Integral University, Lucknow

Effective from Session: 2022-23							
Course Code	B060101T/ MT139	Title of the Course	Descriptive Statistics (Univariate) & Theory of Probability	L	T	P	C
Year	First	Semester	First	4	0	0	4
Pre-Requisite	10+2 with Mathematics	Co-requisite					
Course Objectives			The objective of this course is to introduce the basic elements of descriptive statistics including graphics and also introduce the basic elements of probability and probability distributions.				

Course Outcomes	
CO1	Ability to represent/summarize the data/information using appropriate Graphical methods including Bar chart, histograms and pie chart and also to draw inferences from these graphs.
CO2	Acquire the knowledge to identify the situation to apply appropriate measure of central tendency as per the nature and need of the data and draw meaningful conclusions regarding behavior of the data.
CO3	Acquire the knowledge to identify the situation to apply appropriate measure of dispersion as per the nature and need of the data and draw meaningful conclusions regarding heterogeneity of the data.
CO4	Ability to apply basic probability principles to solve real life problems.
CO5	Ability to understand the concept of random variable (discrete and continuous), concept of probability mass/density function.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1		Introduction to Statistics, Meaning of Statistics, Importance and Scope of Statistics, Concept of Statistical population and sample, Attributes and Variables (Discrete and Continuous), Different types of scales – Nominal, Ordinal, Interval and Ratio, Methods for collecting primary and secondary data; questionnaire and schedule.	6	1
2		Presentation of data: Classification and Tabulation, Frequency and Cumulative frequency distributions. Graphical representations: Bar chart, Histogram, Frequency polygon and Pie chart. Central tendency and its measures: Mean, Median, Mode, Geometric mean and Harmonic mean, properties, Merits and Demerits.	8	2
3		Dispersion and its measures: Range, quartile deviation, mean deviation, standard deviation, variance and their coefficients; properties, Merits and Demerits.	8	3
4		Moments and Factorial moments, Shephard's correction for moments, Measures of Skewness and Kurtosis and their significance, Measures based on quartiles.	8	3
5		Random experiment, Trial, Sample point and Sample space, Events, Operations of events and concept of equally likely, Mutually exclusive and Exhaustive events. Definition of Probability: Classical, Relative frequency and Axiomatic approaches.	8	4
6		Discrete Probability Space, Properties of Probability under Set Theory Approach, Independence of Events, Conditional Probability, Total and Compound Probability theorems, Bayes theorem and its Applications.	8	4
7		Random Variables: Discrete and Continuous, Probability Mass Function (pmf) and Probability density function (pdf), Cumulative distribution function (cdf)	8	4
8		Joint distribution of two random variables, Marginal and Conditional distributions, Independence of random variables. Expectation of a random variable and its properties, Conditional expectation and related problems	8	5

Reference Books:

1. Goon, A.M., Gupta, M.K. and Das gupta, B.; Fundamental of Statistics, Vol I & II World Press, Kolkata

2. Gupta, S.C. and Kapoor, V.K.: Fundamentals of Mathematical Statistics (10th ed.),   Sultan Chand and Sons.

3. Miller, I. and Miller, M.: John E. Freund's Mathematical Statistics with Applications, (7th Edn.), Pearson Education, Asia.

4. Meyer, P.: Introductory Probability and Statistical Applications (2nd ed.), New Delhi, Oxford & IBH Publishing Co. Pvt. Ltd

5. Mukhopadhyay, P.: Mathematical Statistics, New Central Book Agency Pvt. Ltd.

6. Rohatgi, V.K. and Saleh, A.E.: An introduction to Probability Theory and Mathematical Statistics, Wiley Eastern

e-Learning Source:

Suggestive digital platforms web link/platform: NPTEL/SWAYAM/MOOCS

PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO4
Course Articulation Matrix: (Mapping of COs with POs and PSOs)												
CO1	3						3	3	2	3	2	3
CO2	3						1	3	3	2	2	3
CO3	3						3	3	3	3	2	2
CO4	3						1	3	2	2	3	3
CO5	3						1	3	3	3	3	2

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HoD**

Integral University, Lucknow

Effective from Session: 2022-23								
Course Code	MT143/ I030103V	**Title of the Course**	Introduction to LaTeX		**L**	**T**	**P**	**C**
Year	**First**	**Semester**	First		2	0	2	3
Pre-Requisite	Basic usage of a Windows PC or a Mac	**Co-requisite**						
Course Objectives	The course aims to teach the basic features. By attending the course students should acquire all necessary skills to be able to prepare a moderate scientific paper and a short mathematical presentation using LaTeX.							
Course Outcomes								
CO1	Introduction of LaTeX, Basic commands of LaTeX, understanding of different types of fonts.							
CO2	Create sectional units, texts alignment, tiles, mini pages, foot notes, new paragraph.							
CO3	Create and interpret the page layout, page style, running header, page numbering.							
CO4	Find and interpret the listing texts, numbered listing, unnumbered listing, nesting, Tabbing texts.							
CO5	Find and interpret the table environment, adjusting column width in tables, table wrapped by texts, footnotes in tables.							
CO6	Find and interpret the command and environments of inserting simple figure, side by side figures, figures drawing.							

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	Introduction	LaTeX, LaTeX input file, compilation, LaTeX syntax; commands, environment, packages, keyboard characters, Font selection; Text – mode fonts, Math – mode fonts, Emphasized fonts, coloured fonts.	9	1
2	Formatting Texts	Sectional units, labelling and referring numbered items, texts alignment, quoted texts, new lines and paragraph; filling blank spaces, preventing lines break, increasing depth of sectional units, titles, multiple columns, mini pages, foot notes, marginal notes.	7	2
3	Page Layout and Style	Page layout; standard page layout, formatting page layout, increasing the height of a page, page style, running header and footer, page breaking and adjustment, page numbering.	7	2
4	Listing and Tabbing Texts	Listing Texts; numbered listing, unnumbered listing, nesting, Tabbing texts; Adjusting column width, Adjusting alignment of column	7	3
5	Table Preparation	Table through tabular environment, tabular environment, vertical positioning, side ways texts, adjusting column width in tables, marging rows and columns, table wrapped by texts, table with colour background, nested tables, side by side tables, side ways table, long table, footnotes in tables.	9	5
6	Figure Insertion	Command and environments, inserting simple figure, side by side figures, sub – numbering a group of figures, figure wrapped by texts, rotated figures, mathematical notations in figures, figures in table, figures in multi – column documents, figures drawing; circle, circular arcs, straight lines, vector curves and oval boxes, texts in figures, compound figures.	7	6

Reference Books:

1. Stefen Kottwitz, LaTeX – Beginner's Guide, Packt Publishing, Birmingum (2011).

2. H. Kopka and P. W. Daly, A Guide to LaTeX, Addison Wesley Publishing.

3. Dilip Dutta: LaTeX in 24 Hours, Springer.

e-Learning Source:

1. https://www.overleaf.com/learn/latex/Free_online_introduction_to_LaTeX_(part_1)
2. https://spoken-tutorial.org/tutorial-search/?search_foss=LaTeX&search_language=English
3. https://swayam.gov.in/explorer?searchText=LaTeX

Course Articulation Matrix: (Mapping of COs with POs and PSOs)											
PO-PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3						2	3	3	3	3	2
CO2	3						3	3	3	2	2	3
CO3	3						3	3	2	3	3	3
CO4	3						3	3	2	2	3	2
CO5	3						1	2	1	3	2	1
CO6	3						1	2	1	3	2	1

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HoD**

Integral University, Lucknow

Effective from Session:2024-25										
Course Code	B060103T/MT154		**Title of the Course**	Indian Official Statistics			**L**	**T**	**P**	**C**
Year	First		**Semester**	First			4	0	0	4
Pre-Requisite	10+2 with Mathematics		**Co-requisite**							
Course Objectives			**To impart the knowledge of Official Statistics.**							

CourseOutcomes	
CO1	Students will be able to understand the Meaning and sources of official statistics, advantages of present official statistical system in India, Methods of collection of official statistics, their reliability and limitations, Government of India's Principal publications containing data on the topics such as population, agriculture, industry and finance
CO2	Students will be able to understand the Different official agencies responsible for data collection and their main functions, Role of Ministry of Statistics & Program Implementation (MoSPI), concept of Central Statistical Office (CSO), National Sample Survey Office (NSSO), and National Statistical Commission.
CO3	Students will be able to understand the Role, function and activities of central and state statistical organizations, state statistical bureau, organization of large scale sample surveys, general and special data dissemination systems.
CO4	Students will be able to understand the concept of Role, function and activities of Indian statistical institute, Indian agriculture statistics research institute, Indian institute of population studies, Institute of labor research, Statistical and economics departments of Reserve bank of India
CO5	Students will be able to understand the Population growth in developed and developing countries, evaluation and performance of family welfare programs, projections of labor force and manpower, scope and content of population census of India

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1		Meaning and sources of official statistics, advantages of present official statistical system in India, Methods of collection of official statistics, their reliability and limitations.	7	CO1
2		Government of India's Principal publications containing data on the topics such as population, agriculture, industry and finance.	8	CO1
3		Different official agencies responsible for data collection and their main functions, Role of Ministry of Statistics & Program Implementation (MoSPI), concept of Central Statistical Office (CSO), National Sample Survey Office (NSSO), and National Statistical Commission.	8	CO2
4		Role, function and activities of central and state statistical organizations, state statistical bureau.	7	CO3
5		Role, function and activities organization of large scale sample surveys, general and special data dissemination systems	7	CO3
6		Role, function and activities of Indian statistical institute, Indian agriculture statistics research institute.	8	CO4
7		Role, function and activities of Indian institute of population studies, Institute of labor research, Statistical and economics departments of Reserve bank of India.	8	CO4
8		Population growth in developed and developing countries, evaluation and performance of family welfare programs, projections of labor force and manpower, scope and content of population census of India.	7	CO5

Reference Books:

1. Basic Statistics Relating to the Indian Economy (CSO), 1990.

2. Guide to Official Statistics (CSO) 1999.
3. Statistical System in India (CSO), 1995
4. Principles and accommodation of National Population Censuses, UNESCO
5. Family Welfare Yearbook, Annual Publication of D/o Family Welfare.
6. Monthly Statistics of Foreign Trade in India, DGCIS, Calcutta and other Govt. Publications.

Suggestive digital platforms web link/platform: NPTEL/SWAYAM/MOOCS

https://www.youtube.com/watch?v=Vs2bzT07GlM

https://www.youtube.com/watch?v=Vs2bzT07GlM

https://www.youtube.com/watch?v=Wxqeyhpsw6A

Course Articulation Matrix: (Mapping of COs with POs and PSOs)

PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO4
CO1	3	1	1	1	1	1	3	3	2	3	3	3
CO2	3	1	1	1	1	1	2	3	2	3	3	2
CO3	3	1	1	1	1	1	3	3	2	2	2	2
CO4	3	1	1	1	1	1	2	3	2	3	3	3
CO5	3	1	1	1	1	1	2	3	3	3	3	3

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	Sign & Seal of HoD

Integral University, Lucknow

Effective from Session: 2024-25								
Course Code	B060104P/ MT155	Title of the Course	Descriptive Statistics Lab (Univariate)	L	T	P	C
Year	First	Semester	First	0	0	4	4
Pre-Requisite	10+2 with Mathematics	Co-requisite					
Course Objectives			**The objective of this course is to introduce the basic elements of descriptive statistics including graphics.**				

Course Outcomes	
CO1	Ability to represent/summarize the data/information using appropriate Graphical methods including Bar chart, histograms and pie chart and also to draw inferences from these graphs.
CO2	Acquire the knowledge to identify the situation to apply appropriate measure of central tendency as per the nature and need of the data and draw meaningful conclusions regarding behavior of the data.
CO3	Acquire the knowledge to identify the situation to apply appropriate measure of dispersion as per the nature and need of the data and draw meaningful conclusions regarding heterogeneity of the data.
CO4	Ability to measure moments of data and define their significance.
CO5	Ability to measure skewness and kurtosis of data and define their significance.

Experiment No.	Title of the Experiment	Content of Experiment	Contact Hrs.	Mapped CO
1		Problems based on graphical representation of data by Bar chart, Histogram, Frequency polygons, pie chart.	8	1
2		Problems based on graphical representation of databyfrequency curves and Ogive curve	8	1
3		Problems based on calculation of Measures of Central Tendency.	10	2
4		Problems based on calculation of Measures of Dispersion	10	3
5		Problems based on calculation of Moments.	8	4
6		Problems based on calculation of Measures of Skewness.	8	5
7		Problems based on calculation of coefficient of Kurtosis.	8	5

Reference Books:

1. Gupta, S.C. and Kapoor, V.K.: Fundamentals of Mathematical Statistics, Sultan Chand and Sons.

2. Goon A.M., Gupta M.K. and Dasgupta B. (2002): Fundamentals of statistics, Vol. I & II, 8th Edn. The World Press, Kolkata

3. Miller, Irwin and Miller, Marylees (2006): John E. Freund's Mathematical Statistics with Applications, (7th Edn.), Pearson Education, Asia

e-Learning Source:

Suggestive digital platforms web link/platform: NPTEL/SWAYAM/MOOCS

Course Articulation Matrix: (Mapping of COs with POs and PSOs)											
PO-PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3						3	3	3	3	3	3
CO2	3						2	3	2	3	3	2
CO3	3						3	3	2	2	2	1
CO4	3						2	3	2	2	3	2
CO5	3						2	3	3	3	3	3

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HoD**

Effective from Session:2024-25							
Course Code	HM101	**Title of the Course**	RASHTRA GAURAV	L	T	P	C
Year	I	**Semester**	I	2	0	0	0
Pre-Requisite	Intermediate (Any Stream)	**Co-requisite**	None				
Course Objectives	The objective of the course on "Rashtra Gaurav" is to explore and critically analyze the multifaceted dimensions of national pride and glory, as depicted in the paper. Participants will delve into the historical, cultural, social, and political aspects that contribute to the concept of "Rashtra Gaurav" (National Pride) in the context of the specific themes and perspectives presented in the paper. Through in-depth discussions, readings, and interactive sessions, participants will gain a comprehensive understanding of the factors that shape and define a nation's sense of pride, and how these factors influence individual and collective identities. The course aims to foster a nuanced appreciation for the significance of "Rashtra Gaurav" in contemporary society, encouraging participants to critically evaluate its implications and applications within diverse global contexts.						

Course Outcomes	
CO1	To understand the basics of Indian Society and culture.
CO2	To understand the literature, science and astrology.
CO3	To understand Indian heritage.
CO4	To examine the philosophical and spiritual developments in India.
CO5	To evaluate the contributions of Major National Characters and Personalities.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	Indian Society & Culture	• Unity in Diversity: Cultural & Religious Harmony • Indian Diaspora • Ancient Indian Civilization. • National and International Awards & Awardees	05	01
2	Literature, Science, Astrology	• Indian Epics: Ramayan & Mahabharata • Prominent litterateur: Shudrak, Kalidas, Amir Khusru, • Kautilya's Arthashastra • Panini's Ashtadhyayi	05	02
3	Indian Heritage	• Cultural Heritage in India: Buddhist Monuments at Sanchi, Ajanta & Ellora Caves, Khajuraho, Taj Mahal • Tourist Places in India: Red Fort, Ambar Palace, Kaziranga National Park	04	03
4	Philosophical and Spiritual Developments	• Sufism & Bhakti Movement:Bulleh Shah, Data Ganj Baksh, Khwaja Moinuddin Chishti, and Nizamuddin Auliya.Tulsidas, Surdas, Meera, Nanak & Kabir • Jainism: Mahavir's Biography and Education • Buddhism: The life of Buddha, Contributions of Buddhism to India's Culture	05	04
5	Major National Characters And Personalities	• Ashoka the Great and His Dhamma • Raja Ram Mohan Roy& Brahmo Samaj • Swami Vivekanand and his philosophies • Mahatma Gandhi: Role of Gandhi in Indian National Movement • Dr. Bhimrao Ambedkar: A Chief architect of the Indian Constitution	06	05

Reference Books:

Jawaharlal Nehru - "The Discovery of India"
B.R. Ambedkar - "Annihilation of Caste"
Ramachandra Guha - "India After Gandhi: The History of the World's Largest Democracy"
Mahatma Gandhi – "My Experiment with Truth"
S C Dubey- "Indian Society"
Nadeem Hasnain –"Indian Society and Culture"
G Shah- "Social Movements in India"

Course Articulation Matrix: (Mapping of COs with POs and PSOs)									
PO-PSO CO	PO1	PO2	PO3	PO4	P05	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	2	1	3	3	2	2	3	2	1	2
CO2	3	2	2	3	1	2	3	1	2	1
CO3	1	2	2	2	2	3	2	3	3	2
CO4	1	3	2	3	2	3	2	3	1	3
CO5	2	3	1	2	2	3	1	3	2	1

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign and seal of HoD**

Integral University, Lucknow

Effective from Session: 2022-23							
Course Code	B060201T/ MT141	**Title of the Course**	Descriptive Statistics (Bivariate) & Probability Distributions	**L**	**T**	**P**	**C**
Year	**First**	**Semester**	Second	4	0	0	4
Pre-Requisite	10+2 with Mathematics	**Co-requisite**					
Course Objectives	The objective of this course is to develop an understanding of descriptive statistics and to introduce the basic elements of probability and probability distributions.						

Course Outcomes	
CO1	Knowledge of the method of least squares for curve fitting to theoretically describe experimental data with a function or equation and to find the parameters associated with the model.
CO2	Knowledge of the concepts of correlation and linear regression.
CO3	Knowledge of the concept of regression analysis and attributes
CO4	Knowledge of discrete distributions. Discuss appropriate distribution negative binomial, Poisson, etc. with their properties and application of discrete distribution models to solve problems.
CO5	Knowledge of continuous distributions. Discuss the appropriate distribution (i.e. uniform, exponential, normal, etc.) with their properties and application of continuous distribution models to solve problems.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1		Bivariate data, Principles of least squares, Most plausible values, Meaning of curve fitting, Fitting of straight line, parabola, logarithmic, power curves and other simple forms by method of least squares.	6	1
2		Bivariate frequency table, Correlation, Types of relationships, Scatter diagram, Karl-Pearson's Correlation Coefficient and its properties. Spearman's Rank correlation and its coefficient.	8	2
3		Regression analysis through both types of regression equations for X and Y variables, Regression coefficients and its properties, coefficient of determination.	8	3
4		Attributes: Notion and Terminology, Contingency table, Class frequencies and Ultimate class frequencies, Consistency, Association of Attributes, Independence, Measures of association for 2X2 table, Chi-square, Karl Pearson's Coefficient of Association.	8	3
5		Discrete Probability Distributions: Binomial distribution, Poisson distribution, Hyper-geometric, Geometric and Negative Binomial distributions, fitting of Binomial, Poisson distributions.	8	4
6		Continuous Probability Distributions: Normal distribution and its properties, Standard Normal variate, Normal distribution as limiting case of Binomial distribution, fitting of Normal distribution Exponential, Uniform, Gamma, Beta distributions.	8	4
7		Moments, Moment generating function (m.g.f) & their properties, Characteristic function, Uniqueness and inversion theorems (without proof) along with applications Continuity theorem for m.g.f. (without proof).	8	5
8		Chebyshev's inequality, Weak law of large numbers for a sequence of independently and identically distributed random variables and their applications (Statement Only). Order Statistics: Discrete & continuous joint and marginal distribution of order statistics, distribution of range, distribution of censored sample.	8	5

Reference Books:
1. Gupta, S.C. and Kapoor, V.K.: Fundamentals of Mathematical Statistics, Sultan Chand and Sons.
2. Hanagal, D. D.: Introduction to Applied Statistics: A Non-Calculus Based Approach. Narosa Publishing Comp. New Delhi.
3. Miller, I. and Miller, M.: John E. Freund's Mathematical Statistics with Applications, (7th Edn.), Pearson Education, Asia.
4. Mood, A.M. Gray bill, F.A. and Boes, D.C.: Introduction to the Theory of Statistics, 3rd Edn., Tata McGraw-Hill Pub. Co. Ltd.
5. Weather burn, C.E.: A First Course in Mathematical Statistics, the English Lang. Book Society and Cambridge Univ. Press.
6. Mukhopadhyay, P.: Mathematical Statistics, New Central Book Agency Pvt. Ltd.
7. Rohatgi, V.K. and Saleh, A.E.: An Introduction to Probability Theory and Mathematical Statistics, Wiley Eastern
e-Learning Source:
Suggestive digital platforms web link/platform: NPTEL/SWAYAM/MOOCS

Course Articulation Matrix: (Mapping of COs with POs and PSOs)											
PO-PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3						3	3	3	2	3	3
CO2	3						1	3	3	3	3	2
CO3	3						2	3	3	2	2	3
CO4	3						2	3	2	2	3	3
CO5	33						3	3	3	3	3	3

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	Sign & Seal of HoD

Integral University, Lucknow

Effective from Session: 2022-23							
Course Code	B030201T/MT138	Title of the Course	Matrices and Differential Equations & Geometry	L	T	P	C
Year	First	Semester	First	6	0	0	6
Pre-Requisite	10+2 with Mathematics	Co-requisite					
Course Objectives	The purpose of this undergraduate course is to impart details and key knowledge of Matrices and Differential Equations & Geometry. After successfully completion of course, the student will be able to explore subject into their respective dimensions.						

Course Outcomes	
CO1	The students will be able to define types of Matrices, Rank of a Matrix, System of linear homogeneous and non-homogeneous equations, Theorems on consistency of a system of linear equations. Also, students will be able to find Eigen values, Eigen vectors , Cayley-Hamilton theorem, real and imaginary parts, Exponential and Logarithmic functions Inverse trigonometric and hyperbolic functions.
CO2	The student will be able to learn and visualize the fundamental ideas about formation of differential equations, Geometrical meaning of a differential equation
CO3	The students will be to learn and visualize first order higher degree equations solvable for x, y, p, Clairaut's equation and singular solutions, orthogonal trajectories, Linear differential equation of order greater than one with constant coefficients.
CO4	On successful completion of the course students have gained knowledge about to trace of conics, Confocal conics, Polar equation of conics and its properties, Three-Dimensional Coordinates system.
CO5	The student will be able to describe Sphere, Cone and Cylinder, Central conicoids, Paraboloids, lines, Confocal conicoids, Reduction of second degree equations.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1		Types of Matrices, Elementary operations on Matrices, Rank of a Matrix, Echelon form of a Matrix, Normal form of a Matrix, Inverse of a Matrix by elementary operations, System of linear homogeneous and non-homogeneous equations, Theorems on consistency of a system of linear equations.	12	1
2		Eigen values, Eigen vectors and characteristic equation of a matrix, Cayley-Hamilton theorem and its use in finding inverse of a matrix, Complex functions and separation into real and imaginary parts, Exponential and Logarithmic functions Inverse trigonometric and hyperbolic functions.	11	1
3		Formation of differential equations, Geometrical meaning of a differential equation, Equation of first order and first degree, Equation in which the variables are separable, Homogeneous equations, Exact differential equations and equations reducible to the exact form, Linear equations.	11	2
4		First order higher degree equations solvable for x, y, p, Clairaut's equation and singular solutions, orthogonal trajectories, Linear differential equation of order greater than one with constant coefficients, Cauchy- Euler form.	11	3
5		General equation of second degree, System of conics, Tracing of conics, Confocal conics, Polar equation of conics and its properties.	12	4
6		Three-Dimensional Coordinates, Projection and Direction Cosine, Plane (Cartesian and vector form), Straight line in three dimension (Cartesian and vector form).	11	4
7		Sphere, Cone and Cylinder.	11	5
8		Central conicoids, Paraboloids, Plane section of conicoids, Generating lines, Confocal conicoids, Reduction of second degree equations.	11	5

Reference Books:

1. Stephen H. Friedberg, A.J Insel & L.E. Spence, Linear Algebra, Person

2. B. Rai, D.P. Choudhary & H. J. Freedman, A Course in Differential Equations, Narosa

3. D.A. Murray, Introductory Course in Differential Equations, Orient Longman

4. Robert J.T Bell, Elementary Treatise on Coordinate Geometry of three dimensions, Macmillan India Ltd.

5. P.R. Vittal, Analytical Geometry 2d & 3D, Pearson.

6. S.L. Loney, The Elements of Coordinate Geometry, McMillan and Company,London.

7. R.J.T. Bill, Elementary Treatise on Coordinate Geometry of Three Dimensions, McMillan India Ltd., 1994.

e-Learning Source:

Suggestive digital platforms web links/platform: NPTEL/SWAYAM/MOOCS

Course Articulation Matrix: (Mapping of COs with POs and PSOs)

PO-PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3						2	3	3	2	3	3
CO2	3						3	3	2	3	3	2
CO3	3						3	2	2	3	3	2
CO4	3						3	3	3	2	3	3
CO5	3						2	3	2	2	2	3

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	Sign & Seal of HoD

Integral University, Lucknow

Effective from Session: 2022-23							
Course Code	MT144/ I030202V	**Title of the Course**	LaTeX – Scientific Writing	**L**	**T**	**P**	**C**
Year	**First**	**Semester**	Second	2	0	2	3
Pre-Requisite	Basic knowledge of LaTeX	**Co-requisite**					
Course Objectives	The course aims to teach the basic features. By attending the course students should acquire all necessary skills to be able to prepare a moderate scientific paper and a short mathematical presentation using LaTeX.						

Course Outcomes	
CO1	Create and interpret the mathematical notations, mathematical operators, mathematical expressions.
CO2	Create and interpret the bibliography, citing bibliographic, BIBTEX, natbib package.
CO3	Create and interpret the list of Contents and Index, rules, dots, hyperlinking, watermarking.
CO4	Create and interpret the letter writing, article preparation, preparation of book, report writing.
CO5	Create and interpret frames in presentation, presentation structure, environments in Beamer class.
CO6	Understand and interpret the Error messages, removal of errors, warning messages, tips for debugging

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	Equation Writing	Basic mathematical notations and delimiters, mathematical operators, mathematical expressions, simple equations, equation numbering, array equations, left aligning, sub – numbering, texts and blank spaces, splitting an equation, vector and matrix, overlining and underlining, stacking terms, side by side equations.	9	1
2	Bibliography	Preparation of bibliography, citing bibliographic reference, bibliography with the BIBTEX program, BIBTEX compatible reference database, standard bibliography styles, natbib package, multiple bibliography.	7	2
3	List of Contents and Index	Lists of contents; Information to the list of contents, formatting list of contents, multiple list of contents, making index, rotated items, rules, dots, hyperlinking, current date and time, highlighted texts, verbatime, watermarking, logo in header and footer, paragraph in different forms.	7	2
4	Letter, Article, Books and Report	Letter writing, Article preparation, list of authors, title and abstract, left aligned title, article in multiple columns, section wise numbering, dividing an article, template of a book, preparation of book, dividing a book into parts, report writing.	8	3
5	Slide Preparation	Frames in presentation, sectional units, presentation structure; title page, appearance of a presentation, themes, frame customization, piece wise presentation, environments in Beamer class, table and figures, dividing frame column wise, repeating slides, jumping to other slides.	8	5
6	Error and Warning Messages	Error messages, removal of errors, warning messages, error without any message, tips for debugging, commonly generated errors, errors due to packages, errors in equation environment.	6	6

Reference Books:

1. Stefen Kottwitz, LaTeX – Beginner's Guide, Packt Publishing, Birmingum (2011).

2. H. Kopka and P. W. Daly, A Guide to LaTeX, Addison Wesley Publishing.

3. Dilip Dutta: LaTeX in 24 Hours, Springer.

e-Learning Source:

1. https://www.overleaf.com/learn/latex/Free_online_introduction_to_LaTeX_(part_1)
2. https://spoken-tutorial.org/tutorial-search/?search_foss=LaTeX&search_language=English
3. https://swayam.gov.in/explorer?searchText=LaTeX

Course Articulation Matrix: (Mapping of COs with POs and PSOs)

PO-PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3						2	3	3	3	3	2
CO2	3						3	3	3	2	2	3
CO3	3						3	3	2	3	3	3
CO4	3						3	3	2	2	3	2
CO5	3						1	2	1	3	2	1
CO6	3						1	2	1	3	2	1

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HoD**

Integral University, Lucknow

Effective from Session: 2023 - 24							
Course Code	B060203T / MT153	**Title of the Course**	Applications of Artificial Intelligence for Mathematical Sciences	**L**	**T**	**P**	**C**
Year	First	**Semester**	Second	2	0	0	0
Pre-Requisite	10+2 with Mathematics	**Co-requisite**					
Course Objectives			This curriculum aims to equip mathematical sciences graduate students with the mathematical foundations necessary to understand and contribute to the rapidly evolving field of artificial intelligence.				

Course Outcomes	
CO1	Understanding of History and evolution of AI
CO2	Students will be able to understand machine learning basics.
CO3	Understanding of some concepts for studying machine learning and AI.
CO4	Students will be able to understand optimization and differential equations in contexts of AI. Time series analysis and Forecasting with AI

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	**Introduction to artificial intelligence & Problem solving through AI**	History and evolution of AI, comparison of human and computer skill, Component of AI, Scope and significance in different domains, Ethical considerations in AI development and deployment, Intelligent Agent, logical agent. Defining problem as a state space search, analyzing the problem, solving problem by searching, informed search and Uninformed Search	8	1
2	**Machine Learning Basics & Natural Language Processing**	Neural networks and deep learning, Supervised and unsupervised learning, feature selection and engineering, learning from observation, knowledge in learning. Brief history of NLP, Text processing, Sentiment analysis, language translation, Early NLP system, ELIZA system, LUNAR system, General NLP system.	7	2
3	**Foundations of AI/ML for Mathematicians**	Introduction to artificial intelligence and its mathematical underpinnings, overview of neural networks and deep learning, Mathematical principles behind machine learning algorithms, Statistical Learning, and Inference: Statistical concepts in machine learning, Inference, and hypothesis testing in the contexts of AI.	7	3
4	**Optimization Techniques in AI**	Mathematical Optimization for machine learning, convex optimization and its applications, Algebraic Structures in AI: Linear Algebra for machine learning, Group theory and its relevance in AI, Differential Equations in AI, Applications of differential equations in machine learning. Time series analysis and Forecasting with AI: Time series modeling using machine learning.	8	4

Reference Books:

1. S. Russel, P. Norvig, Artificial Intelligence: A Modern Approach, Pearson India.

2. N. K. Vishnoi, Algorithms for Convex Optimization, Cambridge University Press.

e-Learning Source:

https://www.youtube.com/watch?v=JMUxmLyrhSk

https://www.youtube.com/watch?v=fpL5fMmJHqk

https://www.youtube.com/watch?v=JO9jNe6BemE&list=PLLy_2iUCG87D1CXFxE-SxCFZUiJzQ3IvE

Course Articulation Matrix: (Mapping of COs with POs and PSOs)												
PO-PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4
CO1	2	1	2	1	2	1	3	2	2	1	2	2
CO2	2	1	2	1	2	1	3	2	2	1	2	2
CO3	3	2	2	1	2	2	3	2	3	3	2	2
CO4	3	2	2	1	2	2	3	2	3	3	2	2

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	Sign & Seal of HoD

Integral University, Lucknow

Effective from Session:2024-25								
Course Code	B060203T/MT156	**Title of the Course**	Actuarial Statistics	**L**	**T**	**P**	**C**	
Year	First	**Semester**	Second	4	0	0	4	
Pre-Requisite	10+2 with Mathematics	**Co-requisite**						
Course Objectives		To impart knowledge on Actuarial Science concepts like basics of Economics, Financial Accounting and Mathematics						

	CourseOutcomes
CO1	Students will be able to understand the concept of Utility theory, insurance and utility theory, models for individual claim and their sums, survival function, curate future life time, force of morality. Life table and its relation with survival function, example, assumptions for fractional ages, some analytic laws of mortality, select and ultimate tables
CO2	Students will be able to understand the distribution of aggregate claims, compound Poisson distribution and its applications, Distribution of aggregate claims, Principles of Compound Interest: nominal and effective rates of interest and discount, force of interest and discount, compound interest, accumulation factor, continuous compounding
CO3	Students will be able to understand the Life insurance: Insurance payable at the moment of death and at the end of the year of death, endowment insurance, deferred insurance and varying annuities, recursions, complete annuities-immediate and apportion able annuities due
CO4	Students will be able to understand the concept of Net premiums: Continuous and discrete premiums, true monthly payment premiums, apportion able premiums, commutation functions, accumulation type benefits. Payment premium, apportion able premiums, commutation functions, accumulation type benefits
CO5	Students will be able to understand the Net Premium reserves: Continuous and discrete net premium reserve, reserves on a semi-continuous basis, reserves based on true monthly premium, reserves on apportion able or discounted continuous basis, reserves at fractional durations

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1		Utility theory, insurance and utility theory, models for individual claim and their sums, survival function, curate future life time, force of morality.	7	CO1
2		Life table and its relation with survival function, example, assumptions for fractional ages, some analytic laws of mortality, select and ultimate tables.	8	CO1
3		Distribution of aggregate claims, compound Poisson distribution and its applications, Distribution of aggregate claims, Principles of Compound Interest: nominal and effective rates of interest and discount, force of interest and discount, compound interest, accumulation factor, continuous compounding	8	CO2
4		Life insurance: Insurance payable at the moment of death and at the end of the year of death, endowment insurance, deferred insurance and varying annuities, recursions, complete annuities-immediate and apportion able annuities due.	7	CO3
5		Net premiums: Continuous and discrete premiums, true monthly payment premiums, apportion able premiums, commutation functions, accumulation type benefits.	7	CO3
6		Net premiums: Continuous and discrete premiums, Payment premium, apportion able premiums, commutation functions, accumulation type benefits	8	CO4
7		Net Premium reserves: Continuous and discrete net premium reserve, reserves on a semi-continuous basis, reserves based on true monthly premium.	8	CO5
8		Net Premium reserves: Continuous and discrete net premium reserve, reserves on apportion able or discounted continuous basis, reserves at fractional durations.	7	CO5

Reference Books:

1. Actuarial Mathematics by N.L. Bower, Gerber, Hickman, D.A. Jones, Nesbit, The society of Actuaries

2. Actuarial Statistics by S.R. Deshmukh, University Press
3. Actuarial Theory by W.A. Robertson and F.A. Ross, Oliver and Boyd, London.
4. Economics by John Solomon, Pearson Education (LPE)
5. Life Insurance Mathematics by Hans U. Gerber, Springer

Suggestive digital platforms web link/platform: NPTEL/SWAYAM/MOOCS

https://www.youtube.com/watch?v=9jyzHr_w5W0

https://www.youtube.com/watch?v=OSDavDUesPM

https://www.youtube.com/watch?v=lVjACrCP1zQ

Course Articulation Matrix: (Mapping of COs with POs and PSOs)

PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO4
CO1	3	1	1	1	1	1	3	3	2	3	3	3
CO2	3	1	1	1	1	1	2	3	2	3	3	2
CO3	3	1	1	1	1	1	3	3	2	2	2	2
CO4	3	1	1	1	1	1	2	3	2	3	3	3
CO5	3	1	1	1	1	1	2	3	3	3	3	3

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HoD**

Integral University, Lucknow

Effective from Session: 2024-25							
Course Code	B060204P/ MT157	**Title of the Course**	Descriptive Statistics Lab (Bivariate)	**L**	**T**	**P**	**C**
Year	**First**	**Semester**	**Second**	0	0	4	4
Pre-Requisite	10+2 with Mathematics	**Co-requisite**					
Course Objectives							

	Course Outcomes
CO1	Ability to deal with the problems based on fitting of curves by Method of least squares e.g., fitting of straight line, second degree polynomial, etc.
CO2	Ability to deal with problems based on determination of Regression lines.
CO3	Ability to deal with problems based on Correlation coefficient for grouped and ungrouped data.
CO4	Ability to deal with the problems based on determination of Rank correlation.
CO5	Ability to fit Binomial and Poisson and Normal distributions for given data.

Experiment No.	Title of the Experiment	Content of Experiment	Contact Hrs.	Mapped CO
1		Problems based on fitting of curves by Method of least squares e.g. fitting of straight line, second degree polynomial, power curve, exponential curve etc.	6	1
2		Problems based on determination of Regression lines.	6	2
3		Calculation of Correlation coefficient for ungrouped data.	8	3
4		Calculation of Correlation coefficient for grouped data.	8	3
5		Problems based on determination of Rank correlation.	8	4
6		Fitting of Binomial distribution	8	5
7		Fitting of Poisson distribution.	8	5
8		Fitting of Normal distribution	8	5

Reference Books:

1. Gupta, S.C. and Kapoor, V.K.: Fundamentals of Mathematical Statistics , Sultan Chand and Sons.

2. Goon A.M., Gupta M.K. and Dasgupta B. (2002): Fundamentals of statistics, Vol. I & II,. The World Press, Kolkata.

3. Miller, Irwin and Miller, Marylees (2006): John E. Freund's Mathematical Statistics with Applications, Pearson Education, Asia

e-Learning Source:

Suggestive digital platforms web link/platform: NPTEL/SWAYAM/MOOCS

Course Articulation Matrix: (Mapping of COs with POs and PSOs)											
PO-PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3						3	3	3	3	3	3
CO2	3						2	3	2	3	3	2
CO3	3						3	3	2	2	2	1
CO4	3						2	3	2	2	3	2
CO5	3						2	3	3	3	3	3

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HoD**