Integral University, Lucknow

Effective from Session: 2023-24							
Course Code	B060101T/MT230	**Title of the Course**	Theory of Estimation & Sampling Survey	**L**	**T**	**P**	**C**
Year	Second	**Semester**	Third	4	0	0	4
Pre-Requisite		**Co-requisite**					
Course Objectives	To introduce the knowledge of estimating the unknown parameters of population and various sampling techniques for obtaining samples from the population						

Course Outcomes	
CO1	Knowledge of the concept of Sampling distributions.
CO2	Ability to understand the difference between parameter & statistic and standard error & standard deviation.
CO3	Knowledge of the sampling distribution of the sum and mean & the concept of Point and Interval Estimation and discuss characteristics of a good estimator. Ability to understand the t, F and chi-square distribution and to identify the main characteristics of these distributions.
CO4	Ability to understand and practice various methods of estimations of parameters & identify the situations where the various sampling techniques shall be used. Knowledge of various probability and non-probability sampling methods along with estimates of population parameters.
CO5	Knowledge of regression and ratio methods of estimation in simple random sampling.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	Introduction to Sampling Distribution	Sampling Distributions: The concept of sampling distribution, Parameter, Statistic and Standard error. The sampling distribution for the sum of independent random variables of Binomial, Poisson and Normal distribution.	7	1
2	Some Sampling Distributions	Central limit theorem, sampling distribution of Z. Sampling distribution of t, F and chi-square without derivations, Simple properties of these distributions and their interrelationship	8	2
3	Point and Interval estimation	Point estimation: Characteristics of a good estimator: Unbiasedness, consistency, sufficiency and efficiency. Problems and examples, Interval estimation.	8	3
4	Estimation Methods	Method of Maximum Likelihood and properties of maximum likelihood estimators (without proof), Method of minimum Chi-square. Method of least squares and methods of moments for estimation of parameters	7	3
5	Introduction to Sampling techniques	Sampling vs. Complete enumeration: Sampling units and Sampling frame, Precision and efficiency of estimators, sampling and non sampling errors, Simple Random sampling with and without replacement, Estimation of population mean and proportion, Derivation of expression for variance of these estimators, Estimation of variances, Sample size determination.	6	4
6	Stratified random sampling	Stratified random sampling, Problem of allocation, proportional allocation, optimum allocation. Derivation of the expressions for the standard error of the usual estimators when these allocations are used, Gain in precision due to Stratification, Role of sampling cost in the sample allocation, Minimization of variance for fixed cost.	8	4
7	Systematic random sampling	Systematic Sampling: Estimation of Population mean and Population total, standard errors of these estimators. Two stage sampling with equal first stage units: Estimation of Population mean and its variance	8	4
8	Regression and ratio methods	Regression and ratio methods of estimation in simple random sampling, Cluster sampling with equal clusters, Estimators of population mean and their mean square errors.	8	5

Reference Books:
1. Ferund J.E (2001) : Mathematical Statistics, Prentice Hall of India.
2. Goon, A.M., Gupta, M.K. & Dasgupta, B.: Fundamentals of Statistics, Vol. I. ,Kolkata, The World Press.
3. Gupta, S.C. and Kapoor, V.K.: Fundamentals of Mathematical Statistics (10th ed.),Sultan Chand and Sons.
4. Hogg, R.V., McKean, J.W. & Craig, A.T: Introduction to Mathematical Statistics, Pearson.
5. Cochran, W.G.: Sampling Techniques. (Third Edition). John Wiley & Sons, New Delhi
6. DesRaj and Chandhok, P. (1998). Sample Survey Theory, Narosa Publishing house.
7. Mukhopadyay, P.: Survey Sampling. Narosa Publisher, New Delhi.
8. Singh, D. and Choudhary, F.S. (1977). Theory and Analysis of Sample Survey Designs.Wiley Eastern Ltd, New Delhi.
e-Learning Source:
Suggestive digital platforms web link/platform: NPTEL/SWAYAM/MOOCS
www.simplilearn.com

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: 2023-24							
Course Code	B060302P/MT231	Title of the Course	Sampling Techniques Lab	L	T	P	C
Year	Second	Semester	Third	0	0	4	2
Pre-Requisite		Co-requisite					
Course Objectives	To introduce the practical approach to estimate the population parameter under various sampling schemes						

Course Outcomes	
CO1	Ability to estimate population means and variance in simple random sampling.
CO2	Ability to deal with problems based on Stratified random sampling for population means (proportional and optimum allocation).
CO3	Ability to deal with problems based on Systematic random sampling and two stage sampling
CO4	Ability to deal with problems based on Ratio and regression estimation of population mean and total
CO5	Ability to deal with problems based on cluster sampling

Experiment No.	Title of the Experiment	Content of Experiment	Contact Hrs.	Mapped CO
1	Simple Random sampling	Problems based on estimation of population mean and variance in simple random sampling.	10	1
2	Stratified random sampling	Problems based on Stratified random sampling for population mean (proportional and optimum allocation).	10	2
3	Systematic random sampling	Problems based on Systematic random sampling	10	3
4	Two stage sampling	Problems based on two stage sampling	10	3
5	Ratio and regression method	Problems based on Ratio and regression estimation of population mean and total.	10	4
6	Cluster sampling	Problems based on cluster sampling	10	5

Reference Books:
Gupta, S.C. and Kapoor, V.K.: Fundamentals of Applied Statistics (10th ed.), Sultan Chand and Sons.
Cochran, W.G.: Sampling Techniques.
Sukhatme, P.V., Sukhatme, B.V., Sukhatme, S. and Asok, C.: Sampling Theory of Surveys with Applications.

e-Learning Source:
Suggestive digital platforms web link/platform: NPTEL/SWAYAM/MOOCS
www.simplilearn.com
www.qualtrics.com

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	3
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

Integral University, Lucknow

Effective from Session: 2023-24								
Course Code	B030301T/ MT228	**Title of the Course**	Algebra & Mathematical Methods	**L**	**T**	**P**	**C**	
Year	Second	**Semester**	Third					
Pre-Requisite	Knowledge of Sets, Relations and Integrations	**Co-requisite**	None	**6**	**0**	**0**	**6**	
Course Objectives	The objective of the course is to develop the skills to apply the basic knowledge of Abstract Algebra, Integral Transform and Fourier Series. The course will further develop understanding the concepts of Jacobians, Functionals and their applications. The topics introduced will serve as basic tools for specialized studies in science field. After successfully completion of course, the student will able to explore subject knowledge into their respective dimensions.							

Course Outcomes	
CO1	Students will be able to explain the fundamental concept of Group and its well behaved subsets.
CO2	Students will be able to describe fundamental properties of Ring, Integral Domain and their properties.
CO3	Students will be able to learn function of two variables, Jacobians and their related properties which enable them to check the validity of different kind of transformation from one co-ordinate system to other.
CO4	Develop an understanding of Laplace Transforms, Fourier Series and its applications.
CO5	Students will be able to understand functional, strong and weak variations and their applications.

Unit No.	Content of Unit	Contact Hrs.	Mapped CO
I	Equivalence relations and partitions, Congruence modulo n, Definition of a group with examples and simple properties, Subgroups, Generators of a group, Cyclic groups.	12	1
II	Permutation groups, Even and odd permutations, The alternating group, Cayley's theorem, Direct products, Coset decomposition, Lagrange's theorem and its consequences, Fermat and Euler theorems.	11	1
III	Normal subgroups, Quotient groups, Homomorphism and isomorphism, Fundamental theorem of group homomorphism, Theorems on isomorphism.	11	1
IV	Rings, Subrings, Integral domains and fields, Characteristic of a ring, Ideal and quotient rings, Ring homomorphism, Field of quotient of an integral domain.	11	2
V	Limit and Continuity of functions of two variables, Differentiation of function of two variables, Necessary and sufficient condition for differentiability of functions two variables, Schwarz's and Young theorem, Taylor's theorem for functions of two variables with examples, Maxima and minima for functions of two variables, Lagrange multiplier method, Jacobians.	12	3
VI	Existence theorems for Laplace transforms, Linearity of Laplace transform and their properties, Laplace transform of the derivatives and integrals of a function, Convolution theorem, inverse Laplace transforms, Solution of the differential equations using Laplace transforms.	11	4
VII	Fourier series, Fourier expansion of piecewise monotonic functions, Half and full range expansions, Fourier transforms (finite and infinite), Fourier integral.	11	4
VIII	Calculus of variations-Variational problems with fixed boundaries- Euler's equation for functionals containing first order derivative and one independent variable, Extremals, Functionals dependent on higher order derivatives, Functionals dependent on more than one independent variable, Variational problems in parametric form.	11	5

Reference Books: Part-A	
1.	J.B. Fraleigh, A first course in Abstract Algebra, Addison-weley.
2.	I. N. Herstein, Topics in Algebra, John Wiley & Sons.
3.	Suggested digital plateform: NPTEL/SWAYAM/MOOCS.

Reference Books: Part-B	
1.	T.M. Apostal, Mathematical Analysis, Person.
2.	G.F. Simmons, Differential Equations with Application and Historical Notes, Tata -McGrawHill
3.	Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons.
4.	Suggested digital plateform: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	1	1	-	1	1	2	3	2	3	2	3
CO2	1	-	-	-	-	1	3	2	1	1	2	2
CO3	2	-	1	1	-	-	2	1	3	2	3	1
CO4	2	-	-	-	-	-	1	2	1	1	1	1
CO5	3	1	1	1	-	2	3	2	2	2	1	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: 2023-24							
Course Code	B070301T/CS273	**Title of the Course**	Operating System	**L**	**T**	**P**	**C**
Year	Second	**Semester**	Third				
Pre-Requisite	Mathematics subject in class 12th and problem solving using computers in first semester.	**Co-requisite**	None	**4**	**0**	**0**	**4**
Course Objectives	Understanding roles responsibilities of Operating System. Understanding the memory Management and process scheduling algorithms. Applying the concept of file management systems and disk scheduling. To perform shell programming.						

Course Outcomes	
CO1	Understand role, responsibilities, features, and design of operating system.
CO2	Analyze process management schemes and process scheduling algorithms.
CO3	Apply CPU Scheduling techniques to formulate solution for critical section problems and deadlock detection
CO4	Understanding Memory Management and Demand Paging schemes
CO5	Analyzing I/O Scheduling and Understanding the concept of RAID
CO6	Applying the concept of File system and file organization.
CO7	Introduction to Shell Programming
CO8	Shell Programming Basics and loops

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
I	Introduction	Operating system and functions, Classification of Operating systems: Batch, Interactive, Time sharing, Real Time System, Multiprocessor Systems, Multiuser Systems, Multithreaded Systems, Operating System Structure, System Components, Operating System Services, Kernels, Monolithic and Microkernel Systems.	7	CO1
II	Process Management	Process Concept, Process States, Process Synchronization, Critical Section, Mutual Exclusion, Classical Synchronization Problems, Process Scheduling, Process States, Process Transitions, Scheduling Algorithms Interprocess Communication, Threads and their management, Security Issues.	8	CO2
III	CPU Scheduling	Scheduling Concepts, Techniques of Scheduling, Preemptive and Non-Preemptive Scheduling: First-Come-First-Serve, Shortest Request Next, Highest Response Ration Next, Round Robin, Least Complete Next, Shortest Time to Go, Long, Medium, Short Scheduling, Priority Scheduling. Deadlock: System model, Deadlock characterization, Prevention, Avoidance and detection, Recovery from deadlock.	8	CO3
IV	Memory Management	Memory allocation, Relocation, Protection, Sharing, Paging, Segmentation, Virtual Memory, Demand Paging, Page, Replacement Algorithms, Thrashing.	7	CO4
V	I/O Management and Disk Scheduling	I/O devices, and I/O subsystems, I/O buffering, Disk storage and disk scheduling, RAID.	8	CO5
VI	File System	File concept, File organization and access mechanism, File directories, and File sharing, File system implementation issues, File system protection and security.	7	CO6
VII	Shell introduction and Shell Scripting	What is shell and various type of shell, Various editors present in linux, Different modes of operation in vi editor,	7	CO7
VIII	Shell Programming Loops and system calls	What is shell script, Writing and executing the shell script, Shell variable (user defined and system variables) System calls, Using system calls, Pipes and Filters, Decision making in Shell Scripts (If else, switch), Loops in shell, Functions, Utility programs (cut, paste, join, tr , uniq utilities), Pattern matching utility (grep)	8	CO8

	Reference Books:
1.	Andrew S. Tanenbaum and Herbert Bos,"Modern Operating Systems," Fourth Edition,Pearson, 2014.
2.	Abraham Silberschatz, Greg Gagne, and Peter B. Galvin, "Operating System Concepts,"Tenth Edition, Wiley, 2018.
3.	William Stallings, "Operating Systems: Internals and Design Principles," Seventh Edition,Prentice Hall, 2011.
4.	Dhanjay Dhamdhere, "Operating Systems," First Edition, McGraw-Hill, 2008.
5.	Milan Milankovic "Operating systems, Concepts and Design" McGraw Hill.
6.	Suggested digital plateform: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	1	1	2	1	2	3	3	2	3	3	3
CO2	3	1	2	1	2	2	3	2	3	1	2	2
CO3	3	2	3	3	3	1	3	1	3	2	3	3
CO4	3	2	2	2	3	2	3	3	2	3	1	3
CO5	3	1	3	3	2	2	3	2	2	2	3	2
CO6	3	2	2	1	2	3	2	2	2	3	2	3
CO7	2	3	2	2	1	3	2	1	3	2	1	1
CO8	1	1	2	2	1	3	1	2	3	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: 2023-24							
Course Code	B070302P/CS274	Title of the Course	Operating Systems Lab	L	T	P	C
Year	Second	Semester	Third				
Pre-Requisite	None	Co-requisite	None	0	0	4	2
Course Objectives	To understand the working of Linux OS and implementing Shell Programming						

Course Outcomes	
CO1	Use of Linux operating system and able to write shell programs.
CO2	Simulate and demonstrate the concepts of operating systems.

S. No.	Title of the Experiment	Content of Experiment	Mapped CO
1	Experiment-1	Usage of following commands: Is, pwd, tty, cat, who, who am I, rm, mkdir, rmdir, touch, cd., cal, cat(append), cat(concatenate), mv, cp, man, date., commands: chmod, grep, tput(clear, highlight), bc.	CO1
2	Experiment-2	Write a shell script to check if the number entered at the command line is prime or not.	CO1
3	Experiment-3	Write a shell script to modify "cal" command to display calendars of the specified months/range of months.	CO1
4	Experiment-4	Write a shell script to accept a login name. If not a valid login name display message – "Entered login name is invalid".	CO1
5	Experiment-5	Write a shell script to display date in the mm-dd-yy format/on the screen sorted output of "who" commandalong with the total number of users/multiplication table any number.	CO2
6	Experiment-6	Write a shell script to compare two files and if found equal asks the user to delete the duplicate file.	CO2
7	Experiment-7	Write a shell script to check whether the file have all the permissions or not.	CO2
8	Experiment-8	Simulate FCFS/ SJF/Priority/Round Robin CPU scheduling algorithm in C++.	CO2
9	Experiment-9	Simulate FIFO/ LRU page replacement algorithm in C++.	CO2

Reference Books:	
1.	Sumitabh Das, "Your Unix/Linux: The Ultimate Guide," McGraw Hill, 2012.
2.	Richard Blum and Christine Bresnahan, "Linux Command Line and Shell Scripting Bible,"Wiley, 2015.
3.	Stroustrup, Bjarne, Programming: Principles and Practice Using C++, Addison Wesley,USA, 2014, 2nd ed.
4.	E Balagurusamy, Object Oriented Programming with C++, McGraw Hill Education (India)Pvt. Ltd., India, 2013, 6th ed.
5.	Suggested digital plateform: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	2	3	3	2	3	2	2	3	3	3
CO2	3	2	3	2	2	3	3	3	3	2	2	3

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

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

IntegralUniversity,Lucknow

Effective from Session: 2023-24

Course Code	I030302V/MT234	Title of the Course	Introduction to R	L	T	P	C
Year	Second	**Semester**	Third	2	0	2	3
Pre-Requisite	Basic usage of a Windows PC or a Mac	**Co-requisite**					
Course Objectives	To make the students understand the basic concept and application of R software used for statistical analysis and better computing abilities.						

Course Outcomes	
CO1	Students will be able to understand the Introduction to R-language and using different operator in R.
CO2	Students will be able to understand the naming an object in R, creating and operating different functions in R
CO3	Students will be able to understand the character vectors, matrices, arrays, data frame and programming fundamentals in R
CO4	Students will be able to understand graphics in R
CO5	Students will be able to understand the descriptive statistics and summary of the data.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	Introduction	Introduction to R-Language, What is R?, Creating a Vector in R-c(), Arithmetic Operations on Vectors , Concept of Recycling	8	1
2	Data Entry	Naming an Object in R, The Functions; Seq() and Rep(),Logical Operators- TRUE(1), FALSE(0), Missing Values- NA	7	2
3	Character Vector	Character Vector- "," and Paste Function, Factor Vector and Ordering of Vectors, Matrices and Arrays.	7	3
4	Programming Fundamentals	Data Frame, Creating functions in R. Programming Fundamentals: Logical operators, conditional statements (if, else, else if statements in R), While loops, For loops, repeat loops.	8	3
5	Graphics	Graphics with R, Dot Chart, Pie Chart, Histogram (Hist()), Scatter Plot (Plot()) and Curve().	8	4
6	Descriptive Statistics	Obtaining Descriptive Statistics from R, Defining New Functions, Defining a Function for Standard Error of Mean, Descriptive Statistics of a Data Vector-describe(), Extension of describe() function for Data Frame	7	5

Reference Books:

1. Sandeep Rakshit, R for Beginner's, McGraw Hill Education-2017

2. Tilman M. Davies: The book of R, A first course in programming in Statistics, William Pollock, No starch Press, Inc

3. Gareth James, An Introduction to Statistical Learning with Application of R, Springer. 2022

4. Mark Gardener, Beginning R: The Statistical Programming Language, Wiley.

5. S. G. Purohit, Statistics Using R, Second Edition, Narosa.

e-Learning Source:

1. https://nptel.ac.in/courses/111104146
2. https://www.digimat.in/nptel/courses/video/111104100/L01.html
3. https://nptel.ac.in/courses/111104147
4. https://www.youtube.com/watch?v=nx-H2xog2d4
5. https://nptel.ac.in/courses/111104100

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					1	2	3	3	3	3	2
CO2	2					1	3	3	3	2	2	3
CO3	3					2	3	3	2	3	3	3
CO4	2					2	3	3	2	2	3	2
CO5	3					1	3	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	B060101T/MT232	Title of the Course	Testing of Hypothesis & Applied Statistics	L	T	P	C
Year	Second	Semester	Fourth	4	0	0	4
Pre-Requisite		Co-requisite					
Course Objectives		**To introduce the concepts of the parametric tests of various measures and interpret the result to predict the future events**					

Course Outcomes	
CO1	Knowledge of the terms like null and alternative hypotheses, two-tailed and one- tailed alternative hypotheses, significant and insignificant, level of significance and confidence, p value etc.
CO2	Ability to understand the concept of MP, UMP and UMPU tests
CO3	Ability to understand under what situations one would conduct the small sample and large sample tests (in case of one sample and two sample tests) and familiarity with different aspects of Applied Statistics and their use in real life situations.
CO4	Ability to understand the concept of Time series along with its different component & the concept of Index numbers and their applications along with different types of Index numbers. Familiarity with various demographic methods and different measures of mortality and fertility & understand the concept of life table and its construction.
CO5	Knowledge to understand the concept of statistical quality control and different control charts for variables and attributes.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	Statistical Hypothesis	Statistical Hypothesis (Simple and Composite), Testing of hypothesis. Type –I and Type – II errors, Significance level, p-values.	8	1
2	Tests for Statistical Hypothesis	Power of a test, Definitions of Most Powerful (MP), Uniformly Most Powerful (UMP) and Uniformly Most Powerful Unbiased (UMPU) tests.	8	2
3	Large Sample Tests	Test of significance: Large sample tests for (Attributes and Variables) proportions and means (i) for one sample (ii) for two samples Correlation coefficient in case of (a) $p=p_0$ (b) $p_1=p_2$,	8	3
4	Small Sample Test	Small sample test based on t, f and chi-squared distributions.	6	3
5	Time Series	Introduction & Definition of Time Series, its different components, illustrations, additive and multiplicative models. Determination of trend by free hand curve, semi average method, moving average method, method of least squares, Analysis of Seasonal Component by Simple average method, Ratio to moving Average Ratio to Trend, Link relative method.	8	4
6	Index Number	Index number: definition, application of index number, price relative and quantity or volume relatives, link and chain relative, problem involved in computation of index number, use of averages, simple aggregative and weighted average method. Laspeyre's, Paasche's and Fisher's index number, time and factor reversal tests of index numbers, consumer price index.	7	4
7	Vital Statistics	Vital Statistics: Measurement of Fertility– Crude birth rate, general fertility rate, age-specific birth rate, total fertility rate, gross reproduction rate, net reproduction rate, standardized death rates Complete life table, its main features and construction.	8	4
8	Statistical Control Charts	Introduction to Statistical Quality Control, Process control, tools of statistical quality control, $+3\sigma$ control limits, Principle underlying the construction of control charts. Control charts for variables, 'X' and 'R' charts, construction and interpretation, Control charts for attributes 'p' and 'c' charts, construction and interpretation	7	5

Reference Books:

1.	Ferund, J.E.: Mathematical Statistics, Prentice Hall of India.
2.	Freedman, D., Pisani, R. and Purves, R. : Statistics. 4th Edition. Norton & Comp.
3.	Goon, A.M., Gupta, M.K. & Dasgupta, B.: Fundamentals of Statistics, Vol. I,Kolkata, The World Press.
4.	Gupta, S.C. and Kapoor, V. K.: Fundamentals of Mathematical Statistics, Sultan Chand and Sons.
5.	Hogg, R.V., McKean, J.W. & Craig, A.T.; Introduction to Mathematical Statistics, Pearson.
6.	Croxton F.E., Cowden D.J. and Klein, S.: Applied General Statistics, Prentice Hall of India Pvt. Ltd.
7.	Gupta, S.C. and Kapoor, V.K.: Fundamentals of Applied Statistics, SultanChand and Sons.
8.	Montgomery D.C.: Introduction to Statistical Quality Control, Wiley IndiaPvt. Ltd.

e-Learning Source:

Suggestive digital platforms web link/platform: NPTEL/SWAYAM/MOOCS
www.ustat.toronto.edu
ecoursesonline.iaasri.res.in

PO-PSO CO	Course Articulation Matrix: (Mapping of COs with POs and PSOs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO4
CO1	3		1				3	3	2	3	2	3
CO2	3		1				1	3	3	2	2	3
CO3	3		3				3	3	3	3	2	2
CO4	3		3				1	3	2	2	3	3
CO5	3		1				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: 2023-24								
Course Code	B060402P/MT233	Title of the Course	Tests of Significance and Applied Statistics Lab	L	T	P	C
Year	Second	Semester	Fourth	0	0	4	2
Pre-Requisite	Descriptive Statistics	Co-requisite						
Course Objectives	**Practical knowledge to conduct the parametric tests of various measures and interpret the result to predict the future events**							

Course Outcomes	
CO1	Students will be able to conduct test of significance based on t – test and Chi-square test.
CO2	Students will get the knowledge about Fisher's Z-transformation and its use in testing
CO3	Students will be able to deal with problems based on large sample tests.
CO4	Students will be able to deal with problems based on time series and calculation of its different components for forecasting.
CO5	Students will be able to deal with problems based on Index number.
CO6	Students will knowledge about measurement of mortality and fertility.
CO7	Students will be able to deal with problems based on life table.
CO8	Students will be able to understand the control charts for variables and attributes and draw inferences

Experiment No.	Title of the Experiment	Content of Experiment	Contact Hrs.	Mapped CO
1	t-test	Problems based on t-test.	5	1
2	F-test	Problems based on F-test.	5	1
3	Chi-square test	Problems based on Chi-square test..	5	1
4	Fisher's Z-transformation	Problems based on Fisher's Z-transformation and its use in testing	5	2
5	Power curve	Problems based on calculation of power curve.	5	2
6	Large sample tests	Problems based on large sample tests.	5	3
7	Time Series	Problems based on time series and its different components	5	4
8	Index number	Problems based on Index number.	5	5
9	Mortality and Fertility	Problems based on measurement of mortality and fertility.	5	6
10	Logistic curve	Problems based on logistic curve fitting.	5	6
11	Life table	Problems based on life table.	5	7
12	Control Charts	Problems based on control charts for variables and attributes	5	8

Reference Books:

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

Lehmann, E.L.: Elements of Large-sample Theory.

Ferguson, T.S.: A course in Large Sample Theory

Bhende, A.A. and Kanitkar, T.: Principles of Population Studies

e-Learning Source:

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

www.ustat.toronto.edu

ecoursesonline.iaasri.res.in

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: 2023-24								
Course Code	B030401T/MT229		**Title of the Course**	Differential Equations & Mechanics	**L**	**T**	**P**	**C**
Year	Second		**Semester**	Fourth				
Pre-Requisite	Knowledge of Vector Algebra and Integrations		**Co-requisite**	None	**6**	**0**	**0**	**6**
Course Objectives	The purpose of this undergraduate course is to impart basic and key knowledge of analytical solution of ordinary and partial differential equations in closed and infinite series form. The course will further help students to understanding and analysis of motion of a particle in three dimensions under different frame of references. The content of course has various applications. After successfully completion of course, the student will able explore subject into their respective dimensions.							

Course Outcomes

CO1	The students will learn various methods of solving ordinary differential equations of second order and their qualitative applications. They also study some special functions obtained from these equations.
CO2	Students will be able to learn the origin and solution of first order partial differential equations.
CO3	Students will be able to find the solution of second and higher order partial differential equations and their classifications.
CO4	Students will be able to understand forces in three dimensions and their equilibrium. They also study virtual work and develop the ability to know about catenary.
CO5	The students will learn about the motion in two and three dimensions in various mediums. They also understand Kepler's law of motion related to earth rotation.

Unit No.	Content of Unit	Contact Hrs.	Mapped CO
I	Second order linear differential equations with constant and variable coefficients: Use of a known solution to find another, normal form, method of undetermined coefficient, variation of parameters,	12	1
II	Series solutions of differential equations, Power series method, Bessel, Legendre and Hypergeometric functions and their properties, recurrence and generating relations.	11	1
III	Origin of first order partial differential equation, Partial differential equations of the first order and degree one, Lagrange's solution, Partial differential equation of first order and degree greater than one, Charpit's method of solution, Surfaces orthogonal to the given system of surfaces.	11	2
IV	Origin of second order PDE, Solution of partial differential equations of the second and higher order with constant coefficients, Classification of linear partial differential equations of second order, Solution of second order partial differential equations with variable coefficients, Monge's method of solution.	11	3
V	Frame of reference, work energy principle, Forces in three dimensions, Poinsot's central axis, Wrenches, Null lines and planes.	12	4
VI	Virtual work, Stable and Unstable equilibrium, Catenary, Catenary of uniform strength.	11	4
VII	Velocities and accelerations along radial and transverse directions and along tangential and normal directions, Simple Harmonic motion, Motion under other law of forces. Elastic strings, Motion in resisting medium, Constrained motion, Motion on smooth and rough plane curves.	11	5
VIII	Motion of particles of varying mass, Rocket motion, Central orbit, Kepler's laws of motion, Motion of particle in three dimensions, Rotating frame of reference, Rotating earth, Acceleration in terms of different coordinates systems.	11	5

Suggested Readings(Part-A Differential Equations):

1. G.F. Simmons, Differential Equations with Application and Historical Notes, Tata –McGrawHill.
2. B. Rai, D.P. Choudhary & H. J. Freedman, A Course of Ordinary Differential Equations, Narosa
3. Ian N. Snedden, Elements of Partial Differential Equations, Dover Publication
4. L.E. Elsgolts, Differential Equation and Calculus of Variations, University Press of the Pacific.
5. Suggested digital plateform:NPTEL/SWAYAM/MOOCs

Suggested Readings(Part-B Mechanics):

1. R.C. Hibbeler, Engineering Mechanics-Statics, Prentics Hall Publishers
2. R.C. Hibbeler, Engineering Mechanics-Dynamics, Prentics Hall Publishers
3. A. Nelson, Engineering Mechanics Statics and Dynamics, Tata McGraw Hill
4. J.L. Synge & B.A. Griffith, Principles of Mechanics, Tata McGraw Hill
5. Suggested digital plateform:NPTEL/SWAYAM/MOOCs

PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	2	1	-	1	-	-	3	3	2	3	2	1
CO2	1	1	-	-	-	1	1	2	1	1	2	2
CO3	3	-	-	-	1	-	1	1	3	2	3	1
CO4	1	-	-	1	-	1	2	2	2	1	1	2
CO5	2	1	1	-	-	-	3	2	1	2	1	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: 2023-24							
Course Code	B070401T/CS275	**Title of the Course**	Computer System Architecture	**L**	**T**	**P**	**C**
Year	Second	**Semester**	Fourth				
Pre-Requisite	Mathematics in class12th and Operating system.	**Co-requisite**	None	**4**	**0**	**0**	**4**
Course Objectives							

	Course Outcomes
CO1	The student will be able to understand the basic arithmetic of a Computer System; how the data is represented, how the various operation are performed on the data.
CO2	the basic circuits to perform these operations, how instructions are formatted and how these instructions are executed to accomplish a particular operation.
CO3	Student can also learn the organization of the peripheral d
CO4	The interface between these devices to the system.
CO5	Student can also understand the architecture of a basic computer, its registers, bus system and the interaction flow among them.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
I	Data Representation and basic Computer Arithmetic	Number systems, complements, fixed and floating point representation, character representation, addition, subtraction, magnitude comparison.	7	1
II	Logic gates and circuits	Logic gates, boolean algebra, combinational circuits, circuit simplification, introduction to flip-flops and sequential circuits, decoders, multiplexers, registers, counters.	8	2
III	Basic Computer Organization and Design	Computer registers, bus system, instruction set, timing and control, instruction cycle, memory reference, input-output and interrupt.	7	2
IV	Central Processing Unit	Register organization, arithmetic and logical micro-operations, stack organization, Hardwired vs. micro programmed control. Pipeline control: Instruction pipelines, pipeline performance, super scalar processing,Pipelining, RISC & CISC.	8	3
V	Programming the Basic Computer	Instruction formats, addressing modes, instruction codes, assembly language.	7	2
VI	Memory Organization	Memory device characteristics, random access memories, serial access memories, Multilevel memories, address translation, memory allocation, Main features, address mapping, structure versus performance.	8	4
VII	Input-output Organization	Peripheral devices, I/Ointerface, Modes of data transfer: Programmed, Interrupt Driven and Direct Memory Access.	8	4
VIII	Parallel processing:	Processor-level parallelism, multiprocessor architecture.	7	5

Reference Books:
1. M. Mano, "Computer System Architecture", Pearson Education, New Jersey, 2017,ThirdEdition.
2. W. Stallings, "Computer Organization and Architecture Designing forPerformance",Prentice Hall of India, 2015, Tenth Edition.
3. M. Mano, "Digital Design", Pearson Education, New Jersey, 2018, Sixth Edition.
4. Vranasic and Hamacher, Computer Organization, TMH".
5. Suggested digital plateform:NPTEL/SWAYAM/MOOCs.

PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5
Course Articulation Matrix: (Mapping of COs with POs and PSOs)												
CO1	3	1	2	1	1	2	3	3	2	3	3	3
CO2	3	2	1	2	1	2	3	2	2	2	2	2
CO3	3	1	1	1	2	2	3	1	3	2	3	1
CO4	3	2	1	2	2	2	3	3	3	3	3	3
CO5	3	1	1	1	2	2	3	2	2	2	1	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: 2023-24							
Course Code	B070402P/CS276	Title of the Course	Computer System Architecture Lab	L	T	P	C
Year	Second	Semester	Fourth				
Pre-Requisite	None	Co-requisite	None	0	0	4	2
Course Objectives							

Course Outcomes	
CO1	The functions of various hardware components and their building blocks.
CO2	Boolean algebraic expressions to digital design.
CO3	And implementation of different sequential and Combinational circuits.
CO4	Computer buses and input/output peripherals.
CO5	Memory hierarchy and design of primary memory.

S. No.	Title of the Experiment	Content of Experiment	Mapped CO
1	Experiment-1	Create a machine based on the following architecture: Register Set IR DR AC AR PC FG I FGO S I E 	Symbol	Hex		Symbol	Hex	Symbol	Hex
AND	0xxx		CLA	E800	INP	F800
ADD	2xxx		CLE	E400	OUT	F400
ISZ	Cxxx		INC	E020		| | AND_I	1xxx		SPA	E010
ADD_I	3xxx		SNA	E008
LDA_I	5xxx	Indirect	SZA	E004
STA_I	7xxx	Addressing	SZE	E002
BUN_I	9xxx		HLT	E001
BSA_I	Bxxx			
ISZ_I	Dxxx				 Refer to Chapter-5 of Morris Mano for description of instructions	
2	Experiment-2	Create the micro operations and associate with instructions as given in the chapter (except interrupts). Design the register set, memory and the instruction set. Use this machine for the assignments of this section.	1
3	Experiment-3	Create a Fetch routine of the instruction cycle.	2
4	Experiment-4	Simulate the machine to determine the contents of AC, E, PC, AR and IR registers in hexadecimal after the execution of each of following register reference instructions: a. CLA e. CIR i. SNA b. CLE f. CIL j. SZA c. CMA g. INC k. SZE d. CME h. SPA l. HLT Initialize the contents of AC to $(A937)_{16}$, that of PC to $(022)_{16}$ and E to 1.	2
5	Experiment-5	Simulate the machine for the following memory-reference instructions with I= 0 and address part = 082. The instruction to be stored at address 022 in RAM. Initialize the memory word at address 082 with the operand B8F2 and AC with A937. Determine the contents of AC, DR, PC, AR and IR in hexadecimal after the execution.	3

		a. ADD f. BSA b. AND g. ISZ c. LDA d. STA e. BUN	
6	Experiment-6	Simulate the machine for the memory-reference instructions referred in above question with I= 1 and address part = 082. The instruction to be stored at address 026 in RAM. Initialize the memory word at address 082 with the value 298. Initialize the memory word at address 298 with operand B8F2 and AC with A937. Determine the contents of AC, DR, PC, AR and IR in hexadecimal after the execution.	4

7	Experiment-7	Modify the machine created in Practical 1 according to the following instruction format:
		
		Instruction format
		
		0 2 3 4 15
		
		| Opcode | I | Address |
		
		a. The instruction format contains a 3-bit opcode, a 1-bit addressing mode and a 12-bit address. There are only two addressing modes, I = 0 (direct addressing) and I = 1 (indirect addressing).
		b. Create a new register I of 1 bit.
		c. Create two new microinstructions as follows:
		   i. Check the opcode of instruction to determine type of instruction (Memory Reference/Register Reference/Input-Output) and then jump accordingly
		   ii. Check the I bit to determine the addressing mode and then jump accordingly.
			5

Reference Books:
1.   Sumitabh Das, "Your Unix/Linux: The Ultimate Guide," McGraw Hill, 2012.
2.   Richard Blum and Christine Bresnahan, "Linux Command Line and Shell Scripting Bible,"Wiley, 2015.
3.   Stroustrup, Bjarne, Programming: Principles and Practice Using C++, Addison Wesley,USA, 2014, 2nd ed.
4.   E Balagurusamy, Object Oriented Programming with C++, McGraw Hill Education (India)Pvt. Ltd., India, 2013, 6th ed.
5.   Suggested digital plateform: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	1	2	2	1	3	3	2	2	3	3	3
CO2	3	2	3	3	2	3	3	3	3	2	2	3
CO3	3	3	2	3	3	2	3	3	2	3	2	2
CO4	3	2	2	3	3	2	3	2	2	3	3	3
CO5	3	2	2	3	3	2	3	3	3	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: 2023-24								
Course Code	I030402V/MT235		**Title of the Course**	Introduction to SPSS	**L**	**T**	**P**	**C**
Year	Second		**Semester**	Fourth	2	0	2	3
Pre-Requisite	Basic usage of a Windows PC or a Mac		**Co-requisite**					
Course Objectives	To make the students understand the Statistical Package for Social Sciences (SPSS) software to perform statistics program gives a large amount of basic statistical functionality; some include frequencies, cross-tabulation, bivariate statistics, etc.							

Course Outcomes	
CO1	Students will be able to understand the Basic Statistics: Meaning and Definition and Introduction of primary and secondary source of data and method of their collection.
CO2	Students will be able to understand the Basic of SPSS, entry data file, opening menu and dialogue boxes, creating data file and entering data.
CO3	Students will be able to understand the construction of different graphs in SPSS.
CO4	Students will be able to understand to find the descriptive measures (Univariate and Bivariate) by SPSS.
CO5	Students will be able to understand the hypothesis testing by SPSS.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	Introduction	Basic Statistics: Meaning and definitions of Statistics, data and variables, quantitative and qualitative variables, Scales of Measurements (Nominal, Ordinal, Interval & Ratio), primary and secondary sources of data, methods of data collection, classification of data.	7	1
2	Data Entry	Introduction to SPSS, working with data file, SPSS windows, Menu & Dialogue boxes, creating data file and entering data, defining the variables, modifying data file & import file.	8	2
3	Graphs	Construction of graphs by SPSS: Bar diagram, Histogram, frequency curve, Ogive curve, Pie chart and Box plot.	7	3
4	Univariate Measures	Descriptive (Univariate) measures by SPSS: Mean, Median, Mode & Partition values. Dispersion and its measures: Range, Quartiles deviation, Standard deviation & Variance. Measures of Skewness & Kurtosis	7	4
5	Bivariate Measures	Descriptive (Bivariate) measures by SPSS: Correlation & Scatter diagram, Karl Pearson's Coefficient of correlation, Spearman's Coefficient of Rank correlation, Regression equations and regression coefficients, Coefficient of determination.	8	4
6	Hypothesis Testing	Hypothesis testing by SPSS: Hypothesis, Null & Alternative hypothesis, Level of significance, Confidence level and Degrees of freedom, Normality test, testing of hypothesis based on t-test, Chi-square test, Analysis of variance (ANOVA), Reliability test (Cronbach's alpha), Non parametric test.	8	5

Reference Books:
1. John MacInnes, An Introduction to Secondary Data Analysis with IBM SPSS Statistics, Sage 2017
2. Marija Norusis, The SPSS Guide to Data Analysis, 1991.
3. Stephen A. Sweet, and Karen Grace-Martin, Data Analysis with SPSS: A First Course in Applied Statistics, 4th Edition, Pearson. 2012
4. Pallant, Julie SPSS Survival Manual, 4th Ed, McGraw-Hill, 2010.
5. Cronk, Brian, How to Use SPSS: A Step-By-Step Guide to Analysis and Interpretation, 5th Ed. 2008

e-Learning Source:
1. https://www.youtube.com/watch?v=ZpwZS3XnEZA
2. https://nptel.ac.in/courses/110107113
3. https://www.youtube.com/watch?v=_zFBUfZEBWQ
4. https://www.youtube.com/watch?v=-UF2k0PTw5w
5. https://www.youtube.com/watch?v=6rgwgwv8qdA

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					1	2	3	3	3	3	2
CO2	2					1	3	3	3	2	2	3
CO3	3					2	3	3	2	3	3	3
CO4	2					1	3	3	2	2	3	2
CO5	3					2	3	2	1	3	2	1

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

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