तार : विश्वविद्यालय
Gram : UNIVERSITY

टेलीफोन : कार्या0 : 2320496
कुलसचिव : निवास : 2321214
फैक्स : 0510 : 2321667

बुन्देलखण्ड विश्वविद्यालय, झाँसी
BUNDELKHAND UNIVERSITY, JHANSI

झाँसी (उ.प्र.) 284128

संदर्भ B.U/Maths./1897

दिनांक 03/12/2022

The Minutes of Meeting of BOS

In reference to the BOS of department of Mathematical Sciences & Computer Applications Institute of Mathematical Sciences & Computer Applications..... held on 28-06-2022 regarding the revision of syllabus in tune with ~~CBCS~~/NEP-2020 and subsequent approval from Academic Council. This is to certify that the syllabus is 100% revised.

Registrar
Bundelkhand University
JHANSI

HOD/Coordinator
Dr. R. K. Saini
Head
Deptt. of Mathematical Sciences
& Computer Applications

बुन्देलखण्ड विश्वविद्यालय, झाँसी
BUNDELKHAND UNIVERSITY, JHANSI Dated

Department of Mathematical Sciences and Computer Applications

Minutes of BOS Meeting

Today on 28th May 2022 from 12:15 PM onwards, a meeting of BOS (Board of Studies) for the session 2022-2023 as per New Education Policy (NEP-2020) for the courses BCA, B.Sc.(Mathematics/Statistics/Computer Science), M.Sc.(Statistics), MCA (As per AKTU), B.Sc. (CS & IT), M.Sc. (CS & IT) held in the department of Mathematical Science & Computer Applications, Bundelkhand University, Jhansi, UP. The following members present in the meeting:

1. Prof. R.K. Saini, BU Jhansi- HOD, Convener of BOS
2. Prof. Ravindra Patel RGPV, Bhopal- External Expert
3. Prof. Vijay Gupta, RGPV, Bhopal- External Expert
4. Prof. Avnish Kumar, BU Jhansi- Member
5. Dr. Alok Verma, BU Jhansi- Member
6. Dr. Saurabh Srivastava BU Jhansi- Member
7. Dr. Dharmendra Badal, BU Jhansi- Member
8. Dr. Dharmendra Kanchan, BU Jhansi- Member
9. Dr. D. Das Prajapati, BU Jhansi- Member
10. Dr. Anil Kevat, BU Jhansi- Member
11. Dr. Sachin Upadhyay, BU Jhansi- Member
12. Mr. Kamal Gupta, BU Jhansi- Member
13. Dr. Punit Matapurkar, BU Jhansi- Member
14. All Teaching Assistants, BU Jhansi- Member

After a through discussion, the following decisions are adopted:-

1. New Education Policy-2020 is adopted for the courses BCA, B.Sc.(Mathematics/Statistics/Computer Science), M.Sc.(Statistics), MCA(As per AKTU), B.Sc. (CS & IT), and M.Sc. (CS & IT), which will be effective session 2022-2023.
2. Panel of examiners for all courses running through the department are signed by members.
3. The syllabus of all the courses as BCA, B.Sc.(Mathematics/Statistics/Computer Science), M.Sc.(Statistics), MCA(As per AKTU), B.Sc. (CS & IT), and M.Sc. (CS & IT), takes a modification upto 20% form previous one, suggested by students and industry persons.
4. According NEP-2020, some value added courses, entrepreneurships programme and employability skill programme and courses are adopted.
5. Discussion for starting the course M.Sc.(Statistics with soft computing) in place of M.Sc.(Statistics) in the department from next academic session.
6. M.Sc. in Data Science, will be the new course in the deptt from session 2022-23.

(Prof. R. K. Saini)
Head

National Education Policy-2020

Department of Mathematical Science and Computer Application,

Bundelkhand University,Jhansi

THREE YEARS OF HIGHER EDUCATION (UG)

FOR

B.Sc.(H)

(MATHEMATICS/STATISTICS/COMPUTER SCIENCE)

2022

Programme Overview

Bachelor of Science (Mathematics, Statistics, Computer Science)

Programme Overview :

B.Sc (Mathematics, Computer Science, & Statistics) or Bachelor of Science in Mathematics, Computer Science, and Statistics is a three-year undergraduate Mathematics course. The aim of this course is to provide a wide grounding over a range of mathematics and computing science and statistics the regulations are designed to ensure that this is achieved without too much specialization while giving students a good choice of options. Subject areas give you expertise in Mathematical Sciences. Numerical methods for problem-solving, statistical modelling and scientific computing are central. The **Computer Science** curriculum includes relevant studies related to the study of programming concepts and software and their applications. Candidates will be able to gain insights into the structure, function, mechanism, and algorithm that are responsible for the representation, processing, storage, and communication, and access to digital information. The **Mathematics** curriculum focuses on the understanding and solving of numerical problems. Candidates are taught about the science of numbers, quantity, and space through algebra, calculus, geometry, differential equations, and real analysis. The **Statistics** curriculum deals with the collection, organization, calculation, and interpretation of data. Candidates are taught about the principles and applications of Statistics, Probability, Permutations, and Combination. A degree in Mathematics is considered one of the most advanced degrees of study. With mathematical applications traversing multiple disciplines including even literature and languages, it is fair to say that a BSc in Mathematics enables an individual to work in an array of industries. Being a part of popular STEM courses, it also builds a strong foundation in allied fields of Computer Science, Statistics**,** Finance**,** Information Technology**,** Game Theory, and so forth. In addition to that, the course also trains students in computer software such as C+**,** Java, etc. BSc Maths helps you major in any good field, such as statistics, operations management, accounting, actuarial sciences, and many others. After earning a bachelor's degree in mathematics, you can enter academia. As a Mathematics student, you can pursue a career in data analysis, which is in high demand right now. After passing the course applicants can go for further studies and for jobs as well.

Program Outcomes (POs)

Program Outcome (POs) : It is represent the knowledge skills and attitude the students should have end the of B.Sc. program.

PO1	**Domain Knowledge**	**Understand the basic concepts, fundamental principles, and the scientific theories related to various scientific phenomena and their relevancies in the day-to-day life**
PO2	**Problem analysis:**	**Analysed the given scientific data critically and systematically and the ability to draw the objective conclusions.**
PO3	**Design/ Development of solutions**	**Construct and design effective solution by applying existing computation and statistical theory and tool to identify to research**
PO4	**Communication skills**	**Developed various communication skills such as reading, listening, speaking, etc., which we will help in expressing ideas and views clearly and effectively.**
PO5	**Modern tools**	**Develop to ability to apply quantitative and qualitative tools of advanced statistics and computer to analyse disciplinary and cross disciplinary real world issues.**
PO6	**Environment and sustainability:**	**Developed flair by participating in various social and cultural activities voluntarily, in order to spread knowledge, creating awareness about the social evils, blind faith, etc.**

PO7	**Ethics:**	**Imbibed ethical, moral and social values in personal and social life leading to highly cultured and civilized personality.**
PO8	**Life-long learning**	**Developed scientific outlook not only with respect to science subjects but also in all aspects related to life.**

Program Specific Outcomes (PSOs)

Program Specific Outcomes (PSOs): PSOs are statements that describe what the students of B.Sc (Mathematics, Computer Science, & Statistics) should be able to do.

PSO1- Ability to apply knowledge of logical computing relevant and appropriate to the domain.

PSO2- Ability to design, implement and evaluate computer-based system, process, component

PSO3- Focus on statistical science and its application

PSO4- Capability to design and conduct experiments, as well as analyze and interpret data

PSO5- Equip students with analytic and problem solving skills.

PSO6- Ability to develop aptitude skills and apply mathematical methods and ideas in any area of inquiry.

Bundelkhand University, Jhansi
B.Sc. (Mathematics/Statistics/Computer Applications)
Scheme of Examination as per Choice-Based Credit System
(New Education Policy-2020)w.e.f. 2022-23 and onwards

Year	Semester	Course Type& Paper Code	Title	Distribution of marks for the examination			Credits	Minimum/ maximum credits for the year	Cumulative Maximum credits required for award Certificate /Diploma/ Degree
				Internal	External	Total			
FIRST YEAR	I	**Major I (DSC) 10031**	Algebra, Trigonometry & Calculus	25	75	100	4	46	(46) Certificate in Faculty
		Major II (DSC) 10032	Probability & Statistical Methods	25	75	100	4		
		Major III (DSE)	Major-III	25	75	100	4		
		Minor I -Elective (GE)	Minor I -Elective(GE)	25	75	100	4		
		Minor –II (SEC/AEC)	Minor –II (SEC/AEC)	25	75	100	3		
		Minor III (VAC) 11141	Food and Nutrition Minor III (VAC)	Qualifying Nature					
			Practical based on DSC I	25	75	100	2		
		100033	Practical based on DSCII	25	75	100	2		
		100034	Practical based on DSE III	25	75	100	2		
		Total		**200**	**600**	**800**	**25**		
	II	**Major I (DSC) 10036**	Vector Calculus, Linear Algebra & Matrix	25	75	100	6		
		Major II (DCE) 10037	Probability Distribution &Statistical Inference	25	25	100	4		
		Major III (DSE)	Major III (DSE)	25	75	100	4		
		Minor II (SEC/AEC)	Minor II (SEC/AEC)	25	75	100	3		
		Minor III (VAC) 11142	First Aid and Health Minor III (VAC)	Qualifying Nature					
		100038	Practical based on DSC II	15	75	100	2		
		100039	Practical based on DSE III	15	75	100	2		
		Total		**150**	**450**	**600**	**21**		

Year	Semester	Course Type	Title	Distribution of marks for the examination			Credits	Minimum/ maximum credits for the year	Cumulative Maximum credits required for award Certificate /Diploma/ Degree
				Internal	External	Total			
SECOND YEAR	III	**Major I (DSC) 20031**	Differential equation, Fourier Series	25	75	100	6	46	(92) Diploma in Faculty
		Major II (DSC) 20032	Design of Sample Survey	25	75	100	4		
		Major III (DSE)	Major III (DSE)	25	75	100	4		
		Minor I Elective (GE)	Minor I Elective (GE)	25	75	100	4		
		Minor II (SEC/AEC)	Minor II (SEC/AEC)	25	75	100	3		
		Minor III (VAC) 21141	Human values and the Environment Studies Minor III (VAC)	Qualifying Nature					
		200033	Practical based on DCS II	25	75	100	2		
		200034	Practical based on DSE III	25	75	100	2		
		Total		**175**	**525**	**700**	**25**		
	IV	**Major I (DSC) 20036**	Real Analysis & Complex Analysis	25	75	100	6		
		Major II (DSC) 20037	ANOVA & Design of Experiment	25	75	100	4		
		Major III (DSE)	Major III (DSE)	25	75	100	4		
		Minor II (SEC/AEC)	Minor II (SEC/AEC)	25	75	100	3		
		Minor III (VAC) 21142	Physical Education And Yoga Minor III (VAC)	Qualifying Nature					
		200038	Practical based on DSC II	25	75	100	2		
		200039	Practical based on DSE III	25	75	100	2		
		Total		**150**	**450**	**600**	**21**		

Year	Semester	Course Type	Title	Distribution of marks for the examination			Credits	Minimum/ maximum credits for the year	Cumulative Maximum credits required for award Certificate /Diploma/ Degree
				Internal	External	Total			
THIRD YEAR	V	**Major I (DSC) 30031**	Applied Statistics	25	75	100	4	40	{132} Bachelor Degree in Faculty
		Major II (DSC) 30032	Operation Research & Numerical Analysis	25	75	100	4		
		Major III (DSC) 30033	JAVA Programming	25	75	100	4		
		Minor III (VAC) 31141	Analytic Ability & Digital Awareness Minor III (VAC)	Qualifying Nature					
		300034	Practical DSC I	25	75	100	2		
		300035	Practical DSC II	25	75	100	2		
		300036	Practical DSC III	25	75	100	2		
		Total		**150**	**450**	**600**	**18**		
	VI	**Major I (DSC) 30036**	NPM & Regression Analysis	25	75	100	4		
		Major II (DSC) 30037	Integral Transform & Mechanics	25	75	100	6		
		MajorIII (DSC) 30038	Data Warehousing & Data Mining	25	75	100	4		
		Minor III (VAC)	Communication skills and Personality Development Minor III (VAC)	Qualifying Nature					
		Industrial/ Training Program	Valuation of Dissertation 300040	50	150	200	2		
			Final Presentation/ Seminar 300039	25	75	100	1		
			Final Viva-Voce Examination 300041	25	75	100	1		
		300042	Practical DSC I	25	75	100	2		
		300043	Practical DSC III	25	75	100	2		
		Total		**225**	**675**	**900**	**22**		

Semester, Structure and Distribution of credits in undergraduate program

Major- I & II (DSC): Credits 4/5/6	Major- III (DSE): Credits 4/5/6	Minor- I (GE) Credit 4	Minor- II (SEC/AEC) Credits 3	Minor- III (VAC) qualifying	Industrial/ Training	∑ Credits
SEM- 1						
DSC- 1 TH- I DSC- 2 TH- II	DSE-1 TH-1	GE- 1 TH-1	SEC-1 TH-1	VAC-1 TH-1		**25**
SEM- II						
DSC- 3 TH- I DSC- 4 TH- II	DSE-1 TH-1		SEC-2 TH-1	VAC-2 TH-1		**21**
CERTIFICATE in Faculty						**46**
SEM- III						
DSC- 5 TH- I DSC- 6 TH- II	DSE-1 TH-1	GE- 2 TH-1	SEC-3 TH-1	VAC-3 TH-1		**25**
SEM- IV						
DSC- 7 TH- I DSC- 8 TH- II	DSE-1 TH-1		SEC-4 TH-1	VAC-4 TH-1		**21**
DEPLOMA in Faculty						**92**
SEM- V						
DSC- 9 TH- I DSC- 10 TH- II DSC- 11 TH- III				VAC-5 TH-1		**18**
SEM- VI						
DSC- 14 TH- I DSC- 13 TH- II DSC- 10 TH- II				VAC-6 TH-1	Industrial /Training program (4)	**22**
BACHELOR in Degree						**132**

EXPLANATION OF TABLE

DSC	Subject with practical (4+2) = 6 Credits , Subject without practical 6 Credits
DSE	Subject with practical (4+2) = 6 Credits , Subject without practical 6 Credits
GE	4 Credits
SEC/AEC	3 Credits
Industrial Training	4 Credits
VAC	Qualifying

Table 3a

List of Subject of DSE / Major–IIISelect one subject for first year and other subject for second year.

S. NO.	Major-III for science (DSE)
1.	Computer Fundamental with Programming in C
2.	Data structure using C
3.	Data Base Management System(DBMS)
4.	Oops With C++
5.	Environmental Science
6.	Forensic science
7.	Earth science
8.	Operating System
9.	Physics
10.	Food technology
11.	Chemistry
12.	Agriculture biotech
13.	Agriculture microbiology

Table 4

Subject Other faculty Minor -I (GE)		
1	Traditional knowledge in Indian medicine and medicinal plants	Interdisciplinary
2	Fruits and vegetables cultivation and management	Interdisciplinary
3	Disaster management	Interdisciplinary
4	Entrepreneurship	Interdisciplinary
5	Business economics	Commerce
6	Political thinkers western and Indian	Arts
7	Indian national movement	Arts
8	Nationalism in India	Arts
9	Ghandhian philosophy	Arts
10	Tribal culture	Arts
11	Social security	Arts
12	Indian arts and culture	Arts
13	Village and Panchayati Raj	Arts
14	Tools and techniques in Bioinformatics	Interdisciplinary
15	Content writing	Arts
16	Cinema and society	Arts
17	Ramayan me Samriksanskriti	Arts
18	Urban development & economic growth	Interdisciplinary
19	Non-conventional energy resource	Interdisciplinary
20	Cyber-crime (cryptography)	Interdisciplinary
21	Drinking water quality assessment	Interdisciplinary
22	Water conservation and river linking	Interdisciplinary
23	Energy and environment	Interdisciplinary
24	Hindi shahityakaitihas	Arts

Distribution ofMinor-I Subjects Year wise (from table 4)

Stream	Semester	Paper / Course
Arts	I	Traditional knowledge in Indian medicine and medicinal plants
		Fruits and vegetables cultivation and management
		Disaster management
		Entrepreneurship
		Business economics
		Tools and techniques in Bioinformatics
	III	Urban development & economic growth
		Nationalism in India
		Indian arts and culture
		Cinema and society
		Cyber-crime (cryptography)
		Drinking water quality assessment
		Energy and environment
		Computational Research
		Mathematical Biology

Stream	Semester	Paper / Course
Commerce	I	Urban development & economic growth
		Traditional knowledge in Indian medicine and medicinal plants
		Fruits and vegetables cultivation and management
		Disaster management
		Entrepreneurship
		Social security
		Ghandhian philosophy
		Tools and techniques in Bioinformatics
	III	Cyber-crime (cryptography)
		Nationalism in India
		Indian arts and culture
		Cinema and society
		Drinking water quality assessment
		Computational Research
		Mathematical Biology
		Energy and environment

Stream	Semester	Paper / Course
Science	I	Traditional knowledge in Indian medicine and medicinal plants
		Fruits and vegetables cultivation and management
		Disaster management
		Entrepreneurship
		Business economics
		Social security
		Ghandhian philosophy
		Urban development & economic growth
		Tools and techniques in Bioinformatics
	III	Cyber-crime (cryptography)
		Nationalism in India
		Indian arts and culture
		Cinema and society
		Drinking water quality assessment
		Energy and environment

Table 5

List of Skill enhancement courses for science, commerce and Arts disciplines. Select one course in each Semester for first two year (Sem –I, II, III and IV only)

(SEC/AEC) or Minor –II	
1	Questioned, documents and Hand writing examination
2	Vedic math
3	Astrology
4	Gen stone and dimensional stone
5	Computer hardware & networking
6	Communication and Soft skill
7	Tour guide and heritage
8	Hospital management
9	Clinical diagnostics
10	Bakery and value-added production
11	Tally
12	Food processing
13	Industrial microbiology
14	photography
15	Chemical sale and marketing management
16	Seed science and technology
17	Rural development
18	Community health
19	Health and hygiene
20	Organic farming
21	Desktop printing
22	Multimedia
23	Soft tissue manipulation: therapeutic massage

Distribution of (SEC/AEC) or Minor-II semester wise

Semester	Paper / Course
I	Questioned, documents and Hand writing examination
	Vedic math
	Community health
	Health and hygiene
	Salesman ship
	Desktop printing
	Soft tissue manipulation: therapeutic massage
II	Computer hardware & networking
	Hospital management
	Tally
	Seed science and technology
	Organic farming
III	Astrology
	Tour guide and heritage
	Bakery and value-added production
	Photography
	Chemical sale and marketing management
	Multimedia
IV	Gen stone and dimensional stone
	Communication and Soft skill
	Clinical diagnostics
	Food processing
	Industrial microbiology
	Entrepreneurship
	Rural development

Table 6

List of Co-curricular courses common for science, commerce and Arts disciplines. Select one course in each Semester for three years (Sem I, II, III, IV, V and VI)

SN	Course paper	Semester
1	Food and Nutrition	(Semester-I
2	First Aid and Health	Semester-II
3	Human Values and Environment Studies	Semester-III
4	Physical Education and Yoga	Semester-IV
5	Analytic Ability and Digital Awareness	Semester-V
6	Communication Skills and Personality Development or Character Building	Semester-VI

Department of mathematical science and computer applications			
Program: B.Sc. (3 year)		**Current AcademicYear:2022-23**	
Branch:(Math/Statistics/C.S.)		**Semester: I**	
1	**Course Code**	11342	
2	**Course Title**	**Algebra, Trigonometry and Calculus**	
3	**Credits**	4	
4	**Contact Hours(L-T-P)**	60-15-15	
	Course Type	Compulsory	
5	**Course Objective**	• To familiarize students with computational techniques and software used in the mathematical arena. • To provide a solid ground in best practices of collating and disseminating information. • To prepare students for undertaking other study. • To teach students to construct practical mathematical models for several processes in the real-world.	
6	**Course Outcomes**	**CO1:** Recognize technical terms and appreciate some of the uses of algebra and collect like terms and simplify expressions term by term. **CO2:** Multiply out brackets, simplify some formulas and solve simple linear equations. **CO3:** Convert between decimal degrees, degree-minute-seconds, andradian measure of an angle, solve triangle (right, acute, obtuse), given various angles and sides. **CO4:** Demonstrate knowledge of several trigonometric identities and usethem to verify other identities, graph trigonometric functions and solve trigonometric equations. **CO5:** Compute limits, derivatives, and integrals. Analyze functions using limits, derivatives, and integrals. Recognize the appropriate tools of calculus to solve applied problems. **CO6:** Definite integrals. Recall integration by substitution. State the Mean – Value Theorem and the Fundamental Theorem of Calculus.	
7	**Course Description**	In today's data-driven world, the application of Algebra, Trigonometry and Calculus in everyday life is an ever-present reality that touches all aspects of society. Though the field of mathematics originated centuries ago, the impact has exploded in recent years as modern mathematics have advanced applications of Algebra, Trigonometry and Calculus through innovative, problem-solving approaches. The application of Algebra, Trigonometry and Calculus most often happens in the background, as mathematicians are continuously at work to discover and implement world-shaping developments. Such as government, health care, finance etc.	
8	**Outline syllabus**		**CO Mapping**
	Unit	**Unit Name**	
	I	**Sequence**	
	I.1	Basic concept of sequence, Cauchy convergence sequence, Bounded sequence, Monotonic sequence, Oscillatory sequence	CO_1, CO_2

	I.2	Convergence of infinite series	CO_1, CO_2
	I.3	Basic concept, Ratio test, Root test, Rabbe's test, Logarithmic test, Cauchy condensation test, Alternating series, Leibnitz test	CO_1, CO_2
	II	**Modulo relation & Equivalence relation**	
	II.1	Congruence modulo relation, Equivalence relation, Partitions, Theorem of uniqueness, Define concept of Identity & theorem	CO_1, CO_2
	III	**Groups & Rings**	
	III.1	Permutation group, odd & even group	CO_1, CO_2
	III.2	Subgroup, Cyclic group,	CO_1, CO_2
	III.3	Lagrange'stheorem	CO_1, CO_2
	III.4	Cayley theorem,	CO_1, CO_2
	III.5	Basic properties of Rings & theorems,	CO_1, CO_2
	III.6	Normal subgroup	CO_1, CO_2
	III.7	Ideals	CO_1, CO_2
	IV	**Trigonometry**	
	IV. 1	Separation into real & imaginary parts	CO_3, CO_4
	IV.2	Exponential function	CO_3, CO_4
	IV. 3	Inverse circular function	CO_3, CO_4
	IV. 4	Hyperbolic function & Euler's theorem	CO_3, CO_4
	IV.5	Exponential logarithmic function & Logarithmic function	CO_3, CO_4
	IV.6	Geogery series	CO_3, CO_4
	IV.7	Summation of series	CO_3, CO_4
	V	**Calculus**	
	V.1	Limit and Continuity, Differentiability Differentiation Successive Differentiation	CO_5, CO_6
	V.2	Expansions of functions Indeterminate forms	CO_5, CO_6
	V.3	Partial Differentiation Jacobians Maxima and Minima	CO_5, CO_6
	V.4	Tangents and Normal	CO_5, CO_6
	V.5	Curvature	CO_5, CO_6
	V.6	Envelopes, Evolutes and Involutes	CO_5, CO_6

	V.7	Asymptotes			CO_5, CO_6
	V.8	Singular Points: Curve Tracing			CO_5, CO_6
	V.9	Reduction Formula (For Trigonometric Functions)			CO_5, CO_6
	V.10	Reduction Formula Continued (For Irregular Algebraic & Transcendental Functions)			CO_5, CO_6
	V.11	Beta and Gamma Functions			CO_5, CO_6
	Mode of examination	Theory and Practical 75+25=100 Marks & 100 Marks			
	Weightage Distribution	CA	MTE	ETE	
		5%	20%	75%	
	Textbook/s*	1. Topics in Algebra; I.N. Herstein, Wiley Eastern Ltd., New Delhi 2. Matrix & Linear Algebra; K.B.Datta, Prentice Hall of India Pvt. Ltd. New Delhi 3. Basic Abstract Algebra; P.B.Bhattacharya, S.K. Jain & Basic Abstract Algebra, Cambridge University Press, Indian Edition. 4. Higher Algebra; H.S.Hall, S.R. Knight, H.M. Publications. 5. Text Book on Algebra & theory of equations; Chandrika Prasad, Pothishala Private Ltd., Allahabad. 6. Plane Trignometry Part II: S.L.Loney, Macmillan & company, London 7. Text Book on Trignometry; R.S.verma & K.S. Shukla, Pothishala Private Ltd., Allahabad 8. Gabriel Kiambauer, Mathematical Analysis, Marcel Dekkar, Inc. New York, 9. Murray R. Spiegel, Theory & Problem of Advanced Calculus, Schaum's outline series, Schaum's Publishing Co., New York 10. N.Piskunov, Differential & Integral Calculus, Peace publishers, Moscow 11. P.K.Jain & S.K. Kaushik, An Introduction to Real Analysis, S.Chand & Co. New Delhi			

Department of mathematical science and computer applications			
Program: B.Sc. (3 year)		**Current Academic Year:2022-23**	
Branch: (Math/Statistics/C.S.)		**Semester: I**	
1	**Course Code**		
2	**Course Title**	**Probability & Statistical Methods**	
3	**Credits**	4	
4	**Contact Hours (L-T-P)**	60-15-15	
	Course Type	Compulsory	
5	**Course Objective**	• To familiarize students with computational techniques and software used in the statistical arena. • To provide a solid ground in best practices of collating and disseminating information. • To prepare students for undertaking other study. • To teach students to construct practical statistical models for several processes in the real-world.	
6	**Course Outcomes**	**CO1:** Set-up the concept of probability concept and its applications with different exercises and real life example. **CO2:** forward one step ahead of probability with random variable concept and working with expectation, variance and law of large number concept. **CO3:** Solve a problem, and work out basic statistical descriptive measures. **CO4:** first step of learning excel for data and use statistical methods.	
7	**Course Description**	In today's data-driven world, the application of statistics in everyday life is an ever-present reality that touches all aspects of society. Though the field of statistics originated centuries ago, the impact has exploded in recent years as modern statisticians have advanced applications of statistics through innovative, problem-solving approaches. The application of statistics most often happens in the background, as statisticians are continuously at work to discover and implement world-shaping developments. Such as government, health care, finance etc.	
8	**Outline syllabus**		**CO Mapping**
	Unit No	**Unit Name**	
	I	**Concept of probability and Bayes theorem**	
	I.1	Basic concept of probability	CO1,CO2
	I.2	Random experiment and events	CO1,CO2
	I.3	Probability by set theory	CO1,CO2

	I.4	Concept of probability through numerical			CO1,CO2
	I.5	Bayes theorem			CO1,CO2
	II	**Random variable**			
	II.1	Concept of Random variable			CO1,CO2
	II.2	Distribution function, PDF & PMF			CO1,CO2
	II.3	Joint random variable, Two-dimension random variable			CO1,CO2
	II.4	Joint random variable, Two-dimension random variable			CO1,CO2
	II.5	Joint random variable, Two-dimension random variable, Concept of conditional, Density functions and Numerical			CO1,CO2
	III	**Law of Large Numbers**			
	III.1	Moment Generating Function and its properties, Cumulants, Characteristic function, Chabychevs inequality, Weak Law Of large number			CO1,CO2
	IV	**Concept of Statistical Population**			
	IV.1	Presentation of data, Graphical Representation of data			CO3,CO4
	V	**Descriptive Statistics**			
	V.1	Measure of central tendency, dispersion, moments			CO3,CO4
	V.2	Skewness, Kurtosis			CO3,CO4
	V.3	Bivariate data: correlation and regression			CO3,CO4
	VI	**Attributes Notions and Terminology**			
	VI.1	Contingency table			CO3,CO4
	VI.2	Association of attributes			CO3,CO4
	VI.3	Measure of Association for 2X2 table			CO3,CO4
	VI.4	Tschprow's coefficient of association			CO3,CO4
	Mode of examination	Theory and Practical 75+25=100 Marks & 100 Marks			
		CA	MTE	ETE	

	Weightage Distribution	5%	20%	75%	
	Textbook/s*	Fundamental of Mathematical Statistics by Kapoor & Gupta			
	OtherReferences	1. Goon Gupta & Das Gupta : An Out Line of Statistical Theory Vol. -- I 2. Spiegel, MA. : Theory and Problems of Probability and Statistical (Schaum's Outline Series) 3. Hogg &Craig : An Introduction to Theory of Statistics 4. Mood and Grabill : An Introduction to Theory of Statistics			

Department of mathematical science and computer applications			
Program: B.Sc. (3 year)		**Current AcademicYear:2022-23**	
Branch:(Math/Statistics/C.S.)		**Semester: I**	
1	**CourseCode**	11342	
2	**CourseTitle**	**Computer Fundamental and Programming in C**	
3	**Credits**	4	
4	**Contact Hours (L-T-P)**	60-15-15	
	CourseType	Major-III	
5	**Course Objective**	1. To understand basics of computer and working with OS. 2. To develop working skills with productivity tools, graphics designing and Internet. 3. To acquire basic programming skills. 4. Though Computer software is utilized, an understanding of underlying Concepts and methods.	
6	**Course Outcomes**	**CO1:** Learn how to organize efficiency in the form of outlines, charts etc. by using appropriate software. **CO2:** Do Academic and Professional Presentation through various IT skills **CO3: :** Solve the problems (programming networking database and web design) in the IT environment **CO4:** Develop IT- oriented security issues and protocols. Design and implement a web page. Improve communication and business management skills	
7	**Course Description**	Computer programming is important today **because so much of our world is automated**. Humans need to be able to control the interaction between people and machines. Since computers and machines are able to do things so efficiently and accurately, we use computer programming to harness that computing power	
8	**Outline syllabus**		**CO Mapping**
	UnitNo	**Unit Name**	
	I	**Introduction to Computers**	
	I.1	Evolution, Generation, Classification of Computers	CO_1, CO_2
	I.2	Characteristics and Block Diagram of a Digital Computer	CO_1, CO_2
	I.3	Concept of Operating System and Types of OS	CO_1, CO_2

	I.4	Input / Output Devices, Computer Viruses			CO_1, CO_2
	I.5	Programming Concepts: Types of Programming Languages			CO_1, CO_2, CO_3
	I.6	Classification of Software, Structured Programming Concepts, Algorithms and Flowcharts with Examples			CO_1, CO_2, CO_3
	II	**Introduction to C Programming**			
	II.1	History and Structure of a C program. The C character set, Constants, Variables and keywords, Data type			CO_2, CO_3
	II.2	Type conversion, Operators in C, Hierarchy of operators, control instructions, Input Output statements In C			CO_2, CO_3
	II.3	Control Structures: Decision control structures			CO_3, CO_4
	II.4	Loop control structures–while, do-while, for loop			CO_3, CO_4
	II.5	Break and Continue statement, switch case control structure, goto statement			CO_3, CO_4
	III	**Arrays, Functions, Pointers**			
	III. 1	One dimensional and multidimensional array, declaration, initialization and array Manipulations			CO_3, CO_4
	III. 2	Sorting (Bubble sort), Strings – Basic Concepts, Library Functions. Functions: Definition, function definition and prototyping			CO_3, CO_4
	III. 3	Recursion, Storage Classes in C			CO_3, CO_4
	III. 4	Pointers: Definition, notation, pointers and arrays, array of pointers and functions– call by value and Call by reference, Pointers to pointers,			CO_3, CO_4
	III. 5	Structure and Union, Array of Structure, pointer and structure			CO_3, CO_4
	III. 6	Type def, Enum			CO_3, CO_4
	III. 7	C pre-processor directives, Macros, data file handling, file opening modes, Text and Binary files			CO_3, CO_4
	Mode of examination	Theory		Practical	
	Marks Distribution	Internal	External	100 marks	
		25 marks	75 marks		

	References Books	1. 'Let us C' by Yeshwant Kanitker , BPB Publications. 2. 'Programming in C' by E Balaguruswami , TMH Publications. 3. The C programming Lang., Person Ecl – Dennis Ritchie 4. Structured programming approach using C-Forouzah & Ceilberg Thomson learning publication 5. Fundamental of Computers – By V.Rajaraman B.P.B. Publications 6. Fundamental of Computers – By P.K. Sinha

Department of Mathematical Science and Computer Application			
Program: B.Sc.(H)		**Current Academic Year:2022-23**	
Branch: (M/S/Cs)		**Semester: I**	
1	**Course Code**	11342	**Paper Code :**
2	**Course Title**	**Desktop Printing**	
3	**Credits**	4	
4	**Contact Hours(L-T-P)**	2-2-2	
	Course Type	Compulsory	
5	**Course Objective**	1. This course is designed to introduce the participant to the Desktop printing,. 2. It therefore focus on Desktop Publishing standards, guidelines and procedures as well as the implementation and governance of these activities. 3. The present course provides participants with an understanding of the new and advanced Desktop publishing Printing techniques for system..	
6	**Course Outcomes**	CO1: MS Paint introduction limits of Ms Paint, file types Display Options. CO2: Resize image , Drawing tools Color selection ,Color inversion ,Photoshop, introduction tools, brush & selections settings. CO3:Filling and stroking , adobe Bridge ,basic photo corrections retouching and repairing. CO4: Page Maker, introduction Managing Document layer creating and editing text, working with graphics, working withs layers PDF document with PageMaker CO5: Corel Draw. Introduction, features, interface, Moving from Adobe to coral Draw, Drawing and coloring, project work, design process.	
7	**Course Description**	The purpose of this course is to present a broad overview of desktop and printing issues, including a basic understanding of computer technology, the history of computer printing, types of computer publishing, printing aspects of desktop, , During this course, students will learn how to identify Photoshop printing, , they will learn how desktop publishing Printing evolved from the early use of systems to personal computers to the MS paint, and how modern Desktop printing is evolving to include personal digital systems.	
8	**Outline syllabus**		CO Mapping
	Unit 1	**MS Paint Introduction**	
	A	Introduction to MS Paint, Types of files ,(JPG,TIFF, ICO, PNG, GIF)	CO1
	B	Limits of MS Paint, file Types of Desktop printing,	CO1

	C	Resize image ,Brush & selections settings	C02
	D	Display option, Photoshop, introduction tools	CO2
	E	Drawing tools Color selection, Color inversion	CO2
	Unit 2	**PageMaker**	
	A	Brush & selections settings, Introduction of adobe Bridge	CO2
	B	Filling and stroking Desktop publishing printing	CO2
	C	basic photo corrections, retouching and repairing	CO2
	D	Page Maker, introduction Managing Document layer,	CO3
	E	creating and editing text, working with graphics	CO3
	F	working with layers PDF document with PageMaker	CO3
	Unit 3	**Corel Draw**	
	A	Corel Draw. introduction, features, interface, project work, design process.	CO4
	B	Moving from Adobe to coral Draw	CO4
	C	Drawing and coloring	CO5
	D	project work, design process.	CO5
	Mode of examination	Theory	
	Text book/s*	**Reference Books:** 1. Adobe Photoshop CC classroom in a book- Adobe creative team, adobe press. 2. Adobe PageMaker 7.0 classroom in a book-. Adobe creative team, adobe press. 3. CorelDraw X8: the official guide –Gary David Bouton	

Department of mathematical science and computer applications				
Program: BSc(H)		**Current Academic Year:2022-23**		
Branch: Computer Application		**Semester: I**		
1	**Course Code**	11332	**Paper Code :**	
2	**Course Title**	**Tools and techniques in Bioinformatics (B.Sc.(H)) (Running)**		
3	**Credits**	4		
4	**Contact Hours (L-T-P)**	2-2-2		
	Course Type	Compulsory		
5	**Course Objective**	**1.** Objective of this course and main goals of Bioinformatics are (1) to manage data in such a way that it allows easy access to the existing information and to submit new entries as they are produced **2.** After successful completion of tools and techniques in bioinformatics **3.** To develop technological tools that help analyze biological data **4.** To use these tools to analyze the data and interpret the results		
6	**Course Outcomes**	**CO1:** students understand basic of computer and bioinformatics in modern biological sciences **CO2:** students will get used to the biological database , types of databases Organization **CO3:** Students will become familiar with a variety of currently available genomic and proteomic databases. **CO4:** Students will be able to search and retrieve information from genomic and proteomic databases **CO5:** Students will be able to locate consensus sequences, genes and open reading frames within biological sequences.		
7	**Course Description**	BLAST is one of the most widely used tools to gain sequence information. Finding similarity between DNA and protein sequences against a database is one of the first things people do when trying to get immediate information about a sequence of interest. Search results give a list of hits; where the most similar result appears at the start of the list. These hits can also be known as alignments. Each alignment is assigned a statistical value known as an "e-value". The e-value is the number of times that alignment as good as or better than the one found on BLAST would be expected to occur given the size of the database that was searched. The smaller the e-value the better the match.		
8	**Outline syllabus**			CO Mapping
	Unit 1	**Basic of computer and Bioinformatics**		
	A	Basic of computer structure , input and output devices, memory devices,		CO1

	B	Internet-IP address, TCP/IP, DNS, URL and Email	CO1
	Unit 2	**Introduction to Bioinformatics**	
	A	Bioinformatics definition , what is Bioinformatics and its relation with molecular biology	CO2
	B	History , Aim, Scope, and Applications	CO2
	Unit 3	**Biological Databases**	
	A	DNA Databases –GenBank, EMBL, DDBJ, Understanding structure of DNA databases	CO3
	B	Protein Databases- UniprotKB, Swiss Prot , TrEMBL Understanding structure these databases	CO3
	C	Structure Databases- PBD and understanding its structure	CO3
	D	Literature Databases - PubMED	CO3
	UNIT 4	**Sequence Alignment**	
	A	Pairwise and multiple sequence alignment, Global and local alignment.	CO4
	B	Dot plot method, BLAST and FASTA tools for sequence similarity search, basics of phylogenetics , online tools for sequence alignment	CO4
	UNIT 5	**Amino Acid and protein structure**	
	A	Primary, secondary , tertiary and quaternary, basic of secondary and tertiary structure prediction method	CO5
	B	Ramachandran Plot , Homology Modeling, bioinformatics companies and research institutes –INDIA & International	CO5
	Mode of Examination	Theory and Practical	
	Text book/s*	**Reference Books:** 1. Bioinformatics. Baxevanis, A.D. and Quelette, B.F.F. 2. Bio informatics. Des Higgins & Willie Taylor 3. Bioinformatics. Methods and protocols. Macsewer, S. 4. Bioinformatics. Sequence and genome analysis. Mount, D.W. 5. Computer fundamentals. Nagpal, D.P.	

Department of mathematical science and computer applications			
Program: B.Sc. (3 year)		**Current Academic Year:2022-23**	
Branch: (Math/Statistics/C.S.)		**Semester: I**	
1	**Course Code**		
2	**Course Title**	**Food, Nutrition and Hygiene**	
3	**Credits**	Qualifying Nature	
4	**Contact Hours (L-T-P)**	30-15-15	
	Course Type	Compulsory	
5	**Course Objective**	The course provides students with the learning of the importance of nutrition in our food. It teaches them the skills and knowledge to preserve the nutritious elements in our diet with an aim to having a healthy diet.	
6	**Course Outcomes**	**CO1:** To learn the basic concept of the Food and Nutrition **CO2:** To study the nutritive requirement during special conditions like pregnancy and lactation To learn meal planning **CO3:** To learn 100 days Nutrition Concept To study common health issues in the society **CO4:** To learn the special requirement of food during common illness	
7	**Course Description**	A food and nutrition course is a learning process that will enable you with the skills required to research, process, and preserve the nutritional components in our food. The nutritional components are protein, carbohydrates, vitamins, fiber, minerals, and fat. The scope in food and nutrition courses is broad	
8	**Outline syllabus**		**CO Mapping**
	Unit No	**Unit Name**	
	I	**Concept of Food and Nutrition**	
	I.1	Definition of Food, Nutrients, Nutrition, Health, balanced Diet	CO1,CO2
	I.2	Types of Nutrition- Optimum Nutrition, under Nutrition, Over Nutrition	CO1,CO2
	I.3	Meal planning- Concept and factors affecting Meal Planning	CO1,CO2
	I.4	Food groups and functions of food	CO1,CO2

	II	**Nutrients: Macro and Micro RDA, Sources, Functions, Deficiency and excess of**	
	II.1	Carbohydrate	CO1,CO2
	II.2	Fats	CO1,CO2
	II.3	Protein	CO1,CO2
	II.4	Minerals Major: Calcium, Phosphorus, Sodium, Potassium Trace: Iron, Iodine, Fluorine, Zinc	CO1,CO2
	II.5	Vitamins Water soluble vitamins: Vitamin B, C Fat soluble vitamins: Vitamin A, D, E, K	CO1,CO2
	III	**1000 days Nutrition**	
	III.1	Concept, Requirement, Factors affecting growth of child Prenatal Nutrition (0 - 280 days): Additional Nutrients' Requirement and risk factors during pregnancy Breast / Formula Feeding (Birth – 6 months of age) Complementary and Early Diet (6 months – 2 years of age)	CO1,CO2
	IV	**Community Health Concept**	
	IV.1	Causes of common diseases prevalent in the society and Nutrition requirement in the following: Diabetes Hypertension (High Blood Pressure) Obesity Constipation Diarrhea Typhoid	CO3,CO4
	IV.2	National and International Program and Policies for improving Dietary Nutrition	CO3
	IV.3	Immunity Boosting Food	CO3,CO4
	Mode of examination	Theory and Practical 75+25=100 Marks & 100 Marks	

		CA	MTE	ETE	
	Weightage Distribution	5%	20%	75%	
	Textbook/s*	Singh, Anita, "Food and Nutrition", Star Publication, Agra, India, 2018			
	OtherReferences	1000Days-Nutrition_Brief_Brain-Think_Babies_FINAL.pdf 3. https://pediatrics.aappublications.org/content/141/2/e20173716 4. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5750909/			

Department of mathematical sciences and computer applications			
Program: B.Sc. (3 year)		**Current Academic Year:2022-23**	
Branch: (Math/Statistics/C.S.)		**Semester: II**	
1	**Course Code**		
2	**Course Title**	**Vector Calculus, Linear Algebra & Matrix**	
3	**Credits**	4	
4	**Contact Hours (L-T-P)**	2-0-2	
	Course Type	Compulsory	
5	**Course Objective**	Problems in linear algebra arise in a wide variety of scientific and engineering applications including the design of structures, the analysis of electrical networks, and the modelling of chemical processes. This course will cover the analysis and implementation of algorithms used to solve linear algebra problems in practice. This course will enable students to acquire further skills in the techniques of linear algebra, as well as understanding of the principles underlying the subject. This course will prepare students for further courses in mathematics and/or related disciplines (e.g. engineering, economics, actuarial science, etc.).	
6	**Course Outcomes**	**CO1:** understand the basic components of vector calculus, linear algebra and matrix and have the knowledge. **CO2:** find a best estimator with reference the different criteria in case of real-life application questionnaires. **CO3:** The students will be able to think logically and mathematically in any field of engineering. **CO4:** The students will gain an experience in the implementation of Mathematical concepts which are applied in various field of Engineering.	
7	**Course Description**	To present the foundations of many basic Mathematical tools and concepts related Engineering. To provide a coherent development to the students for the courses of various branches of Engineering like Control Theory, Circuits and Networks, Digital Logic design, Fluid Mechanics, Machine Design etc. To enhance the student's ability to think logically and mathematically. To give an experience in the implementation of Mathematical concepts which are applied in various field of Engineering.	
8	**Outline syllabus**		**CO Mapping**
	Unit No.	**Unit Name**	

	I	**Vector calculus**	
	I.1	Vectordifferentiation&Integration	CO1,CO2
	I.2	Gradient, Divergence&curl&theirproperties	CO1,CO2
	I.3	LineIntegral&problems	CO1,CO2
	I.4	Green'stheoremintheplane&problems	CO1,CO2
	I.5	ThedivergencetheoremofGauss&based problems	CO1,CO2
	I.6	Stoke'stheorem&basedproblems	CO1, CO2
	II	**Matrices**	
	II.1	Basicconcept	CO1, CO2
	II.2	Typesofmatrices	CO1, CO2
	II.3	Rankofmatrix	CO1, CO2
	II.4	Definitions	CO1, CO2
	II.5	Rankof matrix	CO1, CO2
	II.6	Echelonformandnormal form	CO1, CO2
	II.7	Linearequation	CO3,CO4
	II.8	L.D.andL.I. ofMatrices	CO3,CO4
	II.9	Solutionsofhomogeneousequations	CO3, CO4
	II.10	Solutionsofnonhomogeneousequation	CO3, CO4
	II.11	Eigenvalueandeigenvector	CO3, CO4
	II.12	CalculationofEigenvalueandeigonvector	CO3, CO4
	II.13	Cayley'shemiltontheorem	CO3, CO4
	II.14	Diagonalisationofsquarematrix-, Quadraticform	CO3, CO4
	III	**Vectorspace**	
	III.1	Vectorspaceandtheirelementaryproperties	CO3, CO4
	III.2	Subspace	CO3, CO4
	III.3	L.I.andL.D.ofvectors	CO3, CO4
	III.4	Basisanddimentionofvectorspaceanddirectsum	CO3, CO4

	III.5	Quotientspace			CO3, CO4
	VI	**Lineartransformation**			
	VI.1	Lineartransformationandtheiralgebra			CO3, CO4
	VI.2	Rangandnullspace			CO3, CO4
	VI.3	Rankandnullity			CO3, CO4
	VI.4	Matrixrepresentationoflineartransformation, Changeofbasis			CO3, CO4
	V	**Linearfunctional**			
	V.1	Dualspaceandbidualspace			CO3, CO4
	V.2	Annihilator			CO3, CO4
	Mode of Examination	Theory			
		CA	MTE	ETE	
	Weightage Distribution	5%	20%	75%	
	Textbook/s*	1. G.Strang, "Linear Algebra and its Applications",4th Edition, Thomson, (2006). 2. K. Hoffman and R. Kunze, "Linear Algebra", Prentice Hall, (2008). 3. H.Anton, "Elementary Linear Algebra with Applications",9th Edition, John Wiley (2004).			
	Other References	1. Loehr, Nicholas, Advanced Linear Algebra, Taylor & Francis Inc, ISBN13 : 9781466559011. 2. Iuliana Iatan, Advanced Lectures on Linear Algebra with Applications, LAP Lambert Academic Publishing, ISBN13 : 9783844324105. 3. Sohail A. Dianat, Eli Saber, Advanced Linear Algebra for Engineers with MATLAB, Taylor Francis Inc, ISBN13 : 9781420095234.			

Department of mathematical science and computer applications			
Program: B.Sc. (3 year)		**CurrentAcademicYear:2022-23**	
Branch: (Math/Statistics/C.S.)		**Semester: II**	
1	**Course Code**		
2	**Course Title**	**Probability distribution and statistical inference**	
3	**Credits**	4	
4	**Contact hourss (L-T-P)**	2-0-2	
	Course type	Compulsory	
5	**Course Objective**	• To familiarize students with computational techniques and software used in the statistical arena. • To provide a solid ground in best practices of collating and disseminating information. • To prepare students for undertaking other study. • To teach students to construct practical statistical models for several processes in the real-world.	
6	**Course Outcomes**	**CO1:**- Apply the theoretical discrete probability distribution like binomial , Poisson etc., in the relevant applications . **CO2: :**- Apply the theoretical continuous probability distribution like Normal , exponential etc., in the relevant applications. **CO3:** understand the basic components f sampling and have the knowledge on exact sampling distribution which are essential for estimating and testing hypothetical statement. **CO4:** find a best estimator with reference the different criteria in case of real life application questionnaires.	
7	**Course Description**	In today's data-driven world, the application of statistics in everyday life is an ever-present reality that touches all aspects of society. Though the field of statistics originated centuries ago, the impact has exploded in recent years as modern statisticians have advanced applications of statistics through innovative, problem-solving approaches. The application of statistics most often happens in the background, as statisticians are continuously at work to discover and implement world-shaping developments. Such as government, health care, finance etc.	
8	**Outline syllabus**		**COMapping**
	Unit No	**Unit Name**	

	I	**Probability Distribution**	
	I.1	Uniform distribution, Binomial Distribution, Poisson Distribution, Geometric and NBD, Hyper-geometric	CO1,CO2
	I.2	Normal Distribution, Uniform Distribution	CO1,CO2
	I.3	Gamma Distribution Beta distribution	CO1,CO2
	I.4	Exponential, double Exponential	CO1,CO2
	I.5	Cauchy distribution ,Log normal	CO1,CO2
	II	**Distributions of random variables**	
	II.1	One and two-Dimension transformation	CO1, CO2
	II.2	Chi-Square distribution and its applications	CO1, CO2
	II.3	t-distribution, F-distribution and its applications	CO1, CO2
	II.4	Bivariate Normal distribution	CO1, CO2
	III	**Point estimation**	
	III.1	Basic definition of population and sample, parameter, Characteristics of a good estimator(Unbiasedness, consistency, sufficiency, efficiency & UMVUE)	CO3,CO4
	III.2	Cramer Rao inequality and its use in finding MVU estimators	
	III.3	Method of maximum likelihood, Method of minimum Chi-square. Method of Least squares and method of moments	CO3,CO4
	IV	**Testing Hypothesis**	CO3,CO4
	IV .1	Null hypothesis Alternative hypothesis, Critical region ,two types of errors, Level of significance, power of the test	CO3, CO4
	IV .2	MP test ,UMP test, UMPU test	CO3, CO4
	IV .3	NEYMANJ.ANDPEARSONE.SLEMMA	CO3, CO4
	IV .4	Likelihood ratio tests	CO3, CO4
	IV .5	Interval estimation	CO3, CO4
	Mode of Examination	Theory	

		CA	MTE	ETE	
	Weightage Distribution	5%	20%	75%	
	Textbook/s*	Fundamental of Mathematical Statistics by Kapoor & Gupta			
	Other References	4. Hogg & Craig: Mathematical Statistics. 5. Mood, Graybill and Boes: Introduction to the theory of Statistics. 6. Parzen, E.S.: Modern Probability Theory and Its Applications. 7. Meyer, P.: Introductory Probability and Statistical Applications			

Department of mathematical science and computer applications			
Program: B.Sc. (3 year)		**Current Academic Year:2022-23**	
Branch: (Math/Statistics/C.S.)		**Semester: II**	
1	**Course Code**		
2	**Course Title**	**Data Structure Using C**	
3	**Credits**	4	
4	**Contact Hours (L-T-P)**	2-0-2	
	Course Type	Compulsory	
5	**Course Objective**	**1** To impart the basic concepts of data structures and algorithms **2** To understand concepts about searching and sorting techniques **3** To Understand basic concepts about stacks,queues,lists,trees and graphs **4** To understanding about writing algorithms and step by step approach in s olving problems with the help of fundamental data structures	
6	**Course Outcomes**	**CO1:**- Explain the organization of basic computer , its design and the design of control unit. **CO2: :**- Demonstrate the working of central processing unit and RISC and CISC Architecture. **CO3:** Describe the operations and language f the register transfer, micro operations and input- output organization **CO4:** Understand the organization of memory and memory management hardware. **CO5:** Elaborate advanced concepts of computer architecture, Parallel Processing, interprocessor communication and synchronization.	
7	**Course Description**	Data Structure Using C are used to store data in an organised and efficient manner. The C Programming language has many data structures like an array, stack, queue, linked list, tree, etc. A programmer selects an appropriate data structure and uses it according to their convenience	
8	**Outline syllabus**		**CO Mapping**
	Unit No	**Unit Name**	
	I	**Introduction**	
	I.1	Structure definition and application	CO1,CO2

	I.2	List basic terminology	CO1,CO2
	I.3	Implementation of list	CO1,CO2
	I.4	Pointer implementation of list	CO1,CO2
	I.5	Insertion alist, deletion from list	CO1,CO2
	I.6	Storage of sparse array using linked list	
	I.7	Doubly linked list	CO1, CO2
	I.8	Circular linked list	CO1, CO2
	II	**Defining stack and queue**	CO1, CO2
	II.1	Stack operation and implementation	CO1, CO2
	II.2	Pointer imlpementation	
	II.3	Stack application	CO3,CO4
	II.4	Convert number base by using stack	
	II.5	Infix to post fix conversion	CO3,CO4
	II.6	Queues: operations and implementation	CO3,CO4
	II.7	Queue application and priority queues.	CO3, CO4
	III	**Defining graph**	CO3, CO4
	III.1	Basic terminology	CO3, CO4
	III.2	Graph representation, Graph traversal	CO3, CO4
	III.3	Depths first search (DFS)	CO3, CO4
	III.4	Breadth first search	CO4
	III.5	Short path problem	CO4
	III.6	Minimal spanning tree, Binary tree	CO4
	III.7	In order traversal, post-order traversal, preorder traversal	CO4
	III.8	Binary search tree, Operation on a BST	CO4,CO5
	III.9	Insertion in BST, deletion of node in BST	CO5

	III.10	Search for a key in BST			CO5
	III.11	Searching and sorting technique			CO5
	III.12	Sequential search, Binary search			CO5
	III.13	Internal sort, insertion sort			CO5
	III.14	Bubble sort, Quick sort			CO5
	III.15	Two-way merge sort, Heap sort.			CO5
	Mode of Examination	Theory			
		CA	MTE	ETE	
	Weightage Distribution	5%	20%	75%	
	Textbook/s*	Introduction to Algorithms**, Thomas H. Cormen, Charles E. Leiserson**			
	Other references	• Introduction to Algorithms. Writers: Thomas H. • Data Structures and Algorithms Made Easy. • Algorithms. • Grokking Algorithms. • The Algorithm Design Manual. • Algorithms in a Nutshell. • Introduction to Algorithms: A Creative Approach			

Department of mathematical science and computer applications		
Program: B.Sc.		**Current Academic Year:2022-23**
Subject: Mathematics		**Semester: III**
1	**Course Code**	
2	**Course Title**	**Differential Equations and Fourier Series**
3	**Credits**	
4	**Contact Hours (L-T-P)**	4-2-0
	Course Type	Compulsory
5	**Course Objective**	Familiarise students with basic concepts of ordinary and partial differential equations and learn to solve first-order ordinary and partial differential equations Explore the methods to solve linear differential equation with constant coefficients and variable coefficients. Students will also master in the technique of series solution methods to solve second order differential equations. Students must know the concept of Fourier Series.
6	**Course Outcomes**	CO1: Explain and illustrate how to form the ordinary differential equations and solve the equations of first order and first degree. Differential equations of the first order but not of the first degree Describe and solve the linear differential equation of nth order with constant coefficients, homogeneous and simultaneous equation. Explain Linear differential equations of the second order CO2: Explain and illustrate how to form the partial differential equations and solve the linear and non linear equations of first order. Describe and solve Homogeneous & non homogeneous partial differential equations with constant coefficient Explain Series Solution method to Solve second order Differential Equations CO3: Understand the concept of Fourier Series, Fourier Series for Discontinuous Functions, Fourier Series for even and odd functions, Half range sin & cosine series
:7	**Course Description**	This course aims to provide students with the specialist knowledge necessary for basic concepts of ordinary and partial Differential Equations . More precisely , it strives to enable students to learn basic concepts about series solution method and Fourier Series This course helps to develop abstract mathematical thinking This course is an introduction to the differential equations. After completion of this course, the student will be able to understand and solve the differential equations which helps in appearing various competitive exams
8	**Outline syllabus**	
Unit No.	**Unit Name**	**CO Mapping**
I	**Differential equation**	

I-1	Formation of a differential equation	**CO1**
I-2	Differential equations of the first order first degree	**CO1**
I-3	Separation of variables method, homogeneous equations	**CO1**
I-4	linear equations and exact equations	**CO1**
I-5	Differential equations of the first order but not of the first degree	**CO1**
I-6	Linear differential equations with constant coefficients	**CO1**
I-7	Homogeneous linear differential equations with constant coefficients	**CO1**
I-8	Simultaneous linear differential equations with constant coefficients	**CO1**
I-9	Clairaut's equations and singular solutions	**CO1**
I-10	Linear differential equations of the second order	**CO1**
I-11	Method of variation of parameters	**CO1**
II	**Partial differential equations**	
II-1	Method of forming Partial Differential Equations	**CO2**
II-2	First order Linear Partial Differential Equations	**CO2**
II-3	First order non linear Partial differential equations	**CO2**
II-4	Charpit's method	**CO2**
II-5	Partial differential equations of second & higher orders	**CO2**
II-6	Homogeneous & non homogeneous partial differential equations with constant coefficient	**CO2**
II-7	Series Solution: Power Series Solution of Differential Equations, Ordinary Point, Frobenius Method	**CO2**
III	**Fourier Series**	
III-1	periodic functions, Fourier series, Dirichlet's conditions for a Fourier Series	**CO3**
III-2	Determination of Fourier Coefficients (Euler's formula)	**CO3**
III-3	Fourier Series for Discontinuous Functions	**CO3**
III-4	Even functions & odd functions	**CO3**

III-5	Half range sin & cosine series	**CO3**

References Books:

1. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons Inc., New York.
2. D.A. Murray, Introductory Course on Differential Equations, Orient Longman, (India).
3. A.R. Forsyth, A Treatise on Differential Equations, Macmillan & Co. Ltd., London.
4. Ian N. Sneddon, Elements of Partial Differential Equations, McGraw-Hill Book Company. Ltd., New Delhi.
5. Manish Goyel, engineering Mathematics, Laxmi Publications
6. Ordinary differential Equation by M. D. Rai Singhania
7. Differential Equation by Sharma and Gupta

Department of mathematical science and computer applications			
Program: B.Sc. (3 year)		**CurrentAcademicYear:2022-23**	
Branch: (Math/Statistics/C.S.)		**Semester: III**	
1	**CourseCode**		
2	**CourseTitle**	**Design of Sample Survey**	
3	**Credits**	4	
4	**ContactHours (L-T-P)**	2-0-2	
	CourseType	Compulsory	
5	**CourseObjective**	• To familiarize students with computational techniques and software used in the statistical arena. • To provide a solid ground in best practices of collating and disseminating information. • To prepare students for undertaking other study. • To teach students to construct practical statistical models for several processes in the real-world.	
6	**CourseOutcomes**	**CO1:**- Know the various sampling methodologies and their efficiencies in theoretical and practical aspects. **CO2:** understand and interpret real life survey reports frompublis agencies . **CO3:** understand concepts and techniques in sampling methods . **CO4:** understand solution methodology to estimate population parameters for sampling plans .	
7	**CourseDescription**	In today's data-driven world, the application of statistics in everyday life is an ever-present reality that touches all aspects of society. Though the field of statistics originated centuries ago, the impact has exploded in recent years as modern statisticians have advanced applications of statistics through innovative, problem-solving approaches. The application of statistics most often happens in the background, as statisticians are continuously at work to discover and implement world-shaping developments. Such as government, health care, finance etc.	
8	**Outline syllabus**		**COMapping**
	Unit No	**Unit Name**	

	I	**Sampling vs. complete numeration**			
	I.1	Conceptofpopulationandsample,needforsamplingbasicconceptofsampling,samplingandnon-samplingerrors.			CO1,CO2
	I.2	Samplingunitsandframe.Precisionandefficiencyofestimators.SimplRandom sampling with and without replacement.			CO1,CO2
	I.3	Use of random number tables in selection of simple random sample .Estimation of population mean and proportion.			CO1,CO2
	I.4	Derivationofexpressionforvarianceoftheseestimators.Estimationofvariances.Samplesize determination.			CO1,CO2
	I.5	Sample size determination, questions based on SRS			CO1,CO2
	II	**Stratified random sampling**			
	II.1	Stratified random sampling Problem of allocation ,proportional allocation ,optimum allocation.			CO3,CO4
	II.2	Derivation of the expressions for the standard error soft usual estimators when these allocations are used.			CO3,CO4
	II.3	Gainin precision due to stratification.			CO3,CO4
	II.4	Role of sampling cost in the sample allocation .Minimization o f variance for fixed cost ,and questions based on Stratified random sampling			CO3,CO4
	III	**Regression and ratio estimation**			
	III.1	Regression and ratio methods of estimation in simple random sampling.			CO3,CO4
	III.2	Clustersamplingwithequalclusters.Estimatorsofpopulationmeanandtheir mean square error.			
	III.3	Double sampling in ratio method of estimation .With examples.			CO3,CO4
	III.4	Two stage sampling with equal first stage units			CO3,CO4
	Modeof examination	Theory			
		CA	MTE	ETE	
	Weightage Distribution	5%	20%	75%	
	Textbook/s*	Fundamental of Mathematical Statistics by Kapoor & Gupta			

	OtherReferences	1. Cochran, W.G. : Sampling Techniques 2. Sukhatme , & Asok : Sampling Theory of Surveys with applications. 3. Murthy, M. N. : Sampling theory	

Department of mathematical science and computer applications			
Program: B.Sc. (3 year)		**Current Academic Year:2022-23**	
Branch: (Math/Statistics/C.S.)		**Semester: II**	
1	**Course Code**		
2	**Course Title**	**Object Oriented Programming In C++**	
3	**Credits**	4	
4	**Contact Hours (L-T-P)**	2-0-2	
	Course Type	Major-1(DSC)	
5	**Course Objective**	**1** To impart the basic concepts ofC++ Programming **2** To understand concepts about inheritance and polymorphism 3 To Understand basic concepts about Exception Handling and Templates **4** To understanding about writing programs and step by step approach in solving problems with the help of fundamental and advance level programming.	
6	**Course Outcomes**	**CO1:**- Explain the organization of basic computer Pogramming, its design and the flow of program. **CO2: :**- Demonstrate the working of conditional and control structures. **CO3:** Describe the operations for c++ manipulators **CO4:** Understand the organization of memory management. **CO5:** Elaborate advanced concepts of c++ Programming.	
7	**Course Description**	**1** To understand concepts about inheritance and polymorphism 2 To Understand basic concepts about Exception Handling and Templates **3** To understanding about writing programs and step by step approach in solving problems with the help of fundamental and advance level programming.	
8	**Outline syllabus**		**COMapping**
	Unit No		
	I	Introduction: Introducing Object Oriented Approach,	

	I.1	Relating to other paradigms {Functional, Data decomposition}	CO1,CO2
	I.2	Basic terms and ideas : Abstraction, Encapsulation, Inheritance,	CO1,CO2
	I.3	Polymorphism, Review of C, Difference between C and C++	CO1,CO2
	I.4	cin, cout, new, delete, operators.	CO1,CO2
	I.5	Encapsulation, Information hiding, Abstract data types	CO1,CO2
	I.6	Object & classes, Attributes, Methods	
	II	C++ class declaration, State identity and behaviour of an object	CO1, CO2
	II.1	Constructors and destructors	CO1, CO2
	II.2	Instantiation of objects, Default parameter value	CO1, CO2
	II.3	Object types, C++ garbage collection	CO1, CO2
	II.4	Dynamic memory allocation	
	II.5	Meta class / abstract classes	CO3,CO4
	II.6	Inheritance: Class hierarchy	
	II.7	Derivation – public, private & protected	CO3,CO4
	II.8	**Aggregation: Composition Vs. Classification**	CO3,CO4
	II.9	Categorization of polymorphism techniques	CO3, CO4
	II.10	Method polymorphism	CO3, CO4
	II.11	Operator overloading	CO3, CO4
	II.12	Parametric Polymorphism	CO3, CO4
	II.13	Function name overloading	CO3, CO4
	II.14	Overriding inheritance methods	CO4
	II.15	Run time polymorphism	CO4
	II.16	Multiple Inheritance	CO4
	II.17	Streams and files	CO4
	III	Namespaces	CO4,CO5

	III. 1	Exception handling			CO5
	III. 2	Generic Classes			CO5
	III. 3	Templates			CO5
	III. 4	Virtual function and Pure virtual function			CO5
	III. 5	Abstract class and friend function			CO5
	III. 6	Static function			CO5
	III. 7	Inline function and virtual base class			CO5
	Mode of Examination	Theory			
		CA	MTE	ETE	
	Weightage Distribution	5%	20%	75%	
	Textbook/s*	1 : Introduction to Programming Using C++ 2 : Complete Refrence By HERBERT SCHIELD			
	Other references	• LET US C++ • Thinking in C++			

Department of mathematical science and computer applications		
Program: B.Sc.		**Current Academic Year:2022-23**
Subject: Mathematics		**Semester: III**
1	**Course Code**	
2	**Course Title**	**Differential Equations and Fourier Series**
3	**Credits**	
4	**Contact Hours (L-T-P)**	4-2-0
	Course Type	Compulsory
5	**Course Objective**	Familiarise students with basic concepts of ordinary and partial differential equations and learn to solve first-order ordinary and partial differential equations Explore the methods to solve linear differential equation with constant coefficients and variable coefficients. Students will also master in the technique of series solution methods to solve second order differential equations. Students must know the concept of Fourier Series.
6	**Course Outcomes**	CO1: Explain and illustrate how to form the ordinary differential equations and solve the equations of first order and first degree. Differential equations of the first order but not of the first degree Describe and solve the linear differential equation of nth order with constant coefficients, homogeneous and simultaneous equation. Explain Linear differential equations of the second order CO2: Explain and illustrate how to form the partial differential equations and solve the linear and non linear equations of first order. Describe and solve Homogeneous & non homogeneous partial differential equations with constant coefficient Explain Series Solution method to Solve second order Differential Equations CO3: Understand the concept of Fourier Series, Fourier Series for Discontinuous Functions, Fourier Series for even and odd functions, Half range sin & cosine series
:7	**Course Description**	This course aims to provide students with the specialist knowledge necessary for basic concepts of ordinary and partial Differential Equations . More precisely , it strives to enable students to learn basic concepts about series solution method and Fourier Series This course helps to develop abstract mathematical thinking This course is an introduction to the differential equations. After completion of this course, the student will be able to understand and solve the differential equations which helps in appearing various competitive exams
8	**Outline syllabus**	
Unit No.	**Unit Name**	**CO Mapping**
I	**Differential equation**	

I-1	Formation of a differential equation	**CO1**
I-2	Differential equations of the first order first degree	**CO1**
I-3	Separation of variables method, homogeneous equations	**CO1**
I-4	linear equations and exact equations	**CO1**
I-5	Differential equations of the first order but not of the first degree	**CO1**
I-6	Linear differential equations with constant coefficients	**CO1**
I-7	Homogeneous linear differential equations with constant coefficients	**CO1**
I-8	Simultaneous linear differential equations with constant coefficients	**CO1**
I-9	Clairaut's equations and singular solutions	**CO1**
I-10	Linear differential equations of the second order	**CO1**
I-11	Method of variation of parameters	**CO1**
II	**Partial differential equations**	
II-1	Method of forming Partial Differential Equations	**CO2**
II-2	First order Linear Partial Differential Equations	**CO2**
II-3	First order non linear Partial differential equations	**CO2**
II-4	Charpit's method	**CO2**
II-5	Partial differential equations of second & higher orders	**CO2**
II-6	Homogeneous & non homogeneous partial differential equations with constant coefficient	**CO2**
II-7	Series Solution: Power Series Solution of Differential Equations, Ordinary Point, Frobenius Method	**CO2**
III	**Fourier Series**	
III-1	periodic functions, Fourier series, Dirichlet's conditions for a Fourier Series	**CO3**
III-2	Determination of Fourier Coefficients (Euler's formula)	**CO3**
III-3	Fourier Series for Discontinuous Functions	**CO3**
III-4	Even functions & odd functions	**CO3**

III-5	Half range sin & cosine series	**CO3**

References Books:

1. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons Inc., New York.
2. D.A. Murray, Introductory Course on Differential Equations, Orient Longman, (India).
3. A.R. Forsyth, A Treatise on Differential Equations, Macmillan & Co. Ltd., London.
4. Ian N. Sneddon, Elements of Partial Differential Equations, McGraw-Hill Book Company. Ltd., New Delhi.
5. Manish Goyel, engineering Mathematics, Laxmi Publications
6. Ordinary differential Equation by M. D. Rai Singhania
7. Differential Equation by Sharma and Gupta

Department of mathematical science and computer applications			
Program: B.Sc. (3 year)		**CurrentAcademicYear:2022-23**	
Branch: (Math/Statistics/C.S.)		**Semester: III**	
1	**CourseCode**		
2	**CourseTitle**	**Design of Sample Survey**	
3	**Credits**	4	
4	**ContactHours (L-T-P)**	2-0-2	
	CourseType	Compulsory	
5	**CourseObjective**	• To familiarize students with computational techniques and software used in the statistical arena. • To provide a solid ground in best practices of collating and disseminating information. • To prepare students for undertaking other study. • To teach students to construct practical statistical models for several processes in the real-world.	
6	**CourseOutcomes**	**CO1:**- Know the various sampling methodologies and their efficiencies in theoretical and practical aspects. **CO2:** understand and interpret real life survey reports frompublis agencies . **CO3:** understand concepts and techniques in sampling methods . **CO4:** understand solution methodology to estimate population parameters for sampling plans .	
7	**CourseDescription**	In today's data-driven world, the application of statistics in everyday life is an ever-present reality that touches all aspects of society. Though the field of statistics originated centuries ago, the impact has exploded in recent years as modern statisticians have advanced applications of statistics through innovative, problem-solving approaches. The application of statistics most often happens in the background, as statisticians are continuously at work to discover and implement world-shaping developments. Such as government, health care, finance etc.	
8	**Outline syllabus**		**COMapping**

	Unit No	Unit Name			
	I	**Sampling vs. complete numeration**			
	I.1	Conceptofpopulationandsample,needforsamplingbasicconceptofsampling,samplingandnon-samplingerrors.			CO1,CO2
	I.2	Samplingunitsandframe.Precisionandefficiencyofestimators.SimplRandom sampling with and without replacement.			CO1,CO2
	I.3	Use of random number tables in selection of simple random sample .Estimation of population mean and proportion.			CO1,CO2
	I.4	Derivationofexpressionforvarianceoftheseestimators.Estimationofvariances.Samplesize determination.			CO1,CO2
	I.5	Sample size determination, questions based on SRS			CO1,CO2
	II	**Stratified random sampling**			
	II.1	Stratified random sampling Problem of allocation ,proportional allocation ,optimum allocation.			CO3,CO4
	II.2	Derivation of the expressions for the standard error soft usual estimators when these allocations are used.			CO3,CO4
	II.3	Gainin precision due to stratification.			CO3,CO4
	II.4	Role of sampling cost in the sample allocation .Minimization o f variance for fixed cost ,and questions based on Stratified random sampling			CO3,CO4
	III	**Regression and ratio estimation**			
	III.1	Regression and ratio methods of estimation in simple random sampling.			CO3,CO4
	III.2	Clustersamplingwithequalclusters.Estimatorsofpopulationmeanandtheir mean square error.			
	III.3	Double sampling in ratio method of estimation .With examples.			CO3,CO4
	III.4	Two stage sampling with equal first stage units			CO3,CO4
	Modeof examination	Theory			
		CA	MTE	ETE	
	Weightage Distribution	5%	20%	75%	

	Textbook/s*	Fundamental of Mathematical Statistics by Kapoor & Gupta	
	OtherReferences	4. Cochran, W.G. : Sampling Techniques 5. Sukhatme , & Asok : Sampling Theory of Surveys with applications. 6. Murthy, M. N. : Sampling theory	

Department of mathematical science and computer applications			
Program: B.Sc. (3 year)		**Current Academic Year:2022-23**	
Branch: (Math/Statistics/C.S.)		**Semester: II**	
1	**Course Code**		
2	**Course Title**	**Object Oriented Programming In C++**	
3	**Credits**	4	
4	**Contact Hours (L-T-P)**	2-0-2	
	Course Type	Major-1(DSC)	
5	**Course Objective**	**1** To impart the basic concepts ofC++ Programming **2** To understand concepts about inheritance and polymorphism 3 To Understand basic concepts about Exception Handling and Templates **4** To understanding about writing programs and step by step approach in solving problems with the help of fundamental and advance level programming.	
6	**Course Outcomes**	**CO1:**- Explain the organization of basic computer Pogramming, its design and the flow of program. **CO2: :**- Demonstrate the working of conditional and control structures. **CO3:** Describe the operations for c++ manipulators **CO4:** Understand the organization of memory management. **CO5:** Elaborate advanced concepts of c++ Programming.	
7	**Course Description**	**1** To understand concepts about inheritance and polymorphism 2 To Understand basic concepts about Exception Handling and Templates **3** To understanding about writing programs and step by step approach in solving problems with the help of fundamental and advance level programming.	
8	**Outline syllabus**		**COMapping**
	Unit No		

	I	Introduction: Introducing Object Oriented Approach,	
	I.1	Relating to other paradigms {Functional, Data decomposition}	CO1,CO2
	I.2	Basic terms and ideas : Abstraction, Encapsulation, Inheritance,	CO1,CO2
	I.3	Polymorphism, Review of C, Difference between C and C++	CO1,CO2
	I.4	cin, cout, new, delete, operators.	CO1,CO2
	I.5	Encapsulation, Information hiding, Abstract data types	CO1,CO2
	I.6	Object & classes, Attributes, Methods	
	II	C++ class declaration, State identity and behaviour of an object	CO1, CO2
	II.1	Constructors and destructors	CO1, CO2
	II.2	Instantiation of objects, Default parameter value	CO1, CO2
	II.3	Object types, C++ garbage collection	CO1, CO2
	II.4	Dynamic memory allocation	
	II.5	Meta class / abstract classes	CO3,CO4
	II.6	Inheritance: Class hierarchy	
	II.7	Derivation – public, private & protected	CO3,CO4
	II.8	**Aggregation: Composition Vs. Classification**	CO3,CO4
	II.9	Categorization of polymorphism techniques	CO3, CO4
	II.10	Method polymorphism	CO3, CO4
	II.11	Operator overloading	CO3, CO4
	II.12	Parametric Polymorphism	CO3, CO4
	II.13	Function name overloading	CO3, CO4
	II.14	Overriding inheritance methods	CO4
	II.15	Run time polymorphism	CO4
	II.16	Multiple Inheritance	CO4
	II.17	Streams and files	CO4

	III	Namespaces			CO4,CO5
	III. 1	Exception handling			CO5
	III. 2	Generic Classes			CO5
	III. 3	Templates			CO5
	III. 4	Virtual function and Pure virtual function			CO5
	III. 5	Abstract class and friend function			CO5
	III. 6	Static function			CO5
	III. 7	Inline function and virtual base class			CO5
	Mode of Examination	Theory			
		CA	MTE	ETE	
	Weightage Distribution	5%	20%	75%	
	Textbook/s*	1 : Introduction to Programming Using C++ 2 : Complete Refrence By HERBERT SCHIELD			
	Other references	• LET US C++ • Thinking in C++			

Department of Mathematical Science and Computer Application			
Program: B.Sc.(H)		**Current Academic Year:2022-23**	
Branch: (M/S/Cs)		**Semester: III**	
1	**Course Code**	11342	**Paper Code :**
2	**Course Title**	**Cyber-crime (cryptography)**	
3	**Credits**	4	
4	**Contact Hours(L-T-P)**	2-2-2	
	Course Type	Compulsory	
5	**Course Objective**	4. This course is designed to introduce the participant to the cybercrime prevention, detection and incident management processes, policies, procedures and cybercrime governance activities . 5. It therefore focus on cybercrime management standards, guidelines and procedures as well as the implementation and governance of these activities. 6. the present course provides participants with an understanding of the new and advanced digital investigation techniques for machines, systems and networks since new technologies are opening today the door to new criminal approaches.	
6	**Course Outcomes**	CO1: Describe the Computer Network, and type of cyber crime, cyber security. CO2: Phases of Cyber Attacks and Password Sniffing, Cyber Bullying and harassment. CO3: Cyber Laws, Regulatory Framework of Information and Technology Act 2000, IT Act. CO4: Describe Cyber Crime against Person, Cyber Crime against Organization, Risk Management and Financial Fraud Investigation. CO5: Classes or Types of Risk, Risk Management Plan. Implementation, Limitation.	
7	**Course Description**	The purpose of this course is to present a broad overview of cybercrime and cybercriminal issues, including a basic understanding of computer technology, the history of computer crime, types of computer crime, legal aspects of cybercrime, defenses against cybercrime, investigatory techniques, digital forensics, and possible future areas of concern. During this course, students will learn how to identify cyber attacks, distinguish between different types of attacks, and how to protect themselves from attack. In addition, they will learn how cybercrime evolved from the early use of phone systems to personal computers to the internet, and how modern cybercrime is evolving to include personal digital products such as mp3 players and cell phones.	
8	**Outline syllabus**		CO Mapping
	Unit 1	**Introduction**	
	A	Introduction to Computer Network, Cyberspace, Introduction to Cyber Security,	CO1

	C	Cyber Espionage, Cyber Warfare, Cyber Terrorism, Cyber Defamation. Cyber Attacks and its types, Phases of Cyber Attacks	CO1,C02
	D	Vulnerability, Threats, Digital Signature, Spoofing, phishing,	CO2
	E	Spamming, Cyber Bullying and harassment,	CO2
	F	Cyber Stalking, Password Sniffing	CO2
	Unit 2	**Cyber Laws and Standards**	
	A	Intellectual Property Rights, Patent, Copyright, Trademark.	CO2
	B	Regulatory Framework of Information and Technology Act 2000 ,	CO2
	C	Cyber Laws and Standards, IT Act,	CO2
	D	Cyber Crime against Person, Cyber Crime against Organization	CO3
	E	Penalties and Compensation, Objective, Applicability and Jurisdiction	CO3
	Unit 3	**Risk Management and Financial Fraud Investigation**	
	A	Ethical Hacking, Auditing	CO4
	B	, Risk Management and Financial Fraud Investigation	CO4
	C	Classes or Types of Risk	CO5
	D	Process, Mitigation, Potential Risk Treatments.	CO5
	E	Risk Management Plan. Implementation, Limitation.	CO5
	Mode of examination	Theory	
	Text book/s*	**Reference Books:** 4. Dr. M. Dasgupta : Cyber Crime in India. 5. Justice Yatindra Singh: Cyber Laws, Universal Law Publishing Co., New Delhi. 6. Pawan Duggal: Cyber Law- the Indian perspective Universal Law Publishing Co., New Delhi. 7. "Intellectual Property Law in India" by Justice P.S. Narayana. 8. "Cyber Crime and Fraud Management" by Indian Institute of Banking and Finance. 9. "Prevention of Cyber Crime and Fraud Management" by Indian Institute of Banking and Finance; M.K Geeta and Mr. Swapna Raman.	

Department of mathematical science and computer applications			
Program: B.Sc.(H)		**Current Academic Year:2022-23**	
Branch: (M/S/Cs)		**Semester: III**	
1	**Course Code**	11342	**Paper Code :**
2	**Course Title**	**Multimedia**	
3	**Credits**	4	
4	**Contact Hours(L-T-P)**	2-2-2	
	Course Type	Compulsory	
5	**Course Objective**	7. The objective of this subject is to teach the principles of how different types of media can be processed and presented by computers. It introduces how multimedia can be used in various application areas. It provides a solid foundation to the students so that they can identify the proper applications of multimedia, evaluate the appropriate multimedia systems and develop effective multimedia applications. 8. Multimedia is an interactive media and provides multiple ways to represent information to the user in a powerful manner. It provides an interaction between users and digital information. It is a medium of communication.	
6	**Course Outcomes**	**CO1:**Descrive the Components of multimedia technology and application Of multimedia. **CO2:** implement various compression and decompression technology for various file formats. **CO3**: use multimedia application and user interface for effective animation. **CO4:** implement various Video and Animation technology for various file format. **CO5**: Describe Multimedia Authoring of Basics, Some Authoring Tools, Macromedia Director & Flash and object Of multimedia.	
7	**Course Description**	Diploma in Multimedia is an undergraduate professional course that prepares students in concepts of 2D, 3D, Web, Graphic, Web, Visual effects and Cinema 4D Multimedia learning describes learning through the use of pictures and words. Examples of multimedia learning include watching a PowerPoint presentation, watching a pre-recorded lecture or reading a physics textbook.	
8	**Outline syllabus**		CO Mapping
	Unit 1	**Introduction**	
	A	Introduction to Multimedia: What is multimedia,	CO1
	B	Components of multimedia, Web and Internet multimedia applications	CO1

	C	Transition from conventional media to digital media.	C02
	D	Computer Fonts and Presentation: Usage of text in Multimedia	CO2
	E	Families and faces of fonts, outline fonts, bitmap fonts International character sets and hypertext, Digital fonts techniques	CO2
	F	Making effective presentation (using MS PowerPoint, Google Slide etc.) with transitions and animations	CO2
	Unit 2	Audio fundamentals and representations	
	A	Audio fundamentals and representations: Digitization of sound, frequency and bandwidth, decibel system, data rate, audio file format, Sound synthesis	CO2
	B	MIDI, wavetable, Compression and transmission of audio on Internet, Adding sound to your multimedia project, Audio software and hardware.	CO2
	C	Image fundamentals and representations: Color Science , Color, Color Models, Colour palettes, Dithering, 2D Graphics,.	CO1
	D	, Image Compression and File Formats :GIF, JPEG, JPG, PNG, TIFF, EXIF, PS, PDF, BasicImage Processing [Can Use Photoshop],	CO3
	E	Use of image editing software, White balance correction, Dynamic range correction, Gamma correction, Photo Retouching.	CO3
	Unit 3	Video and Animation	
	A	Video Basics , How Video Works, Broadcast Video Standards, Analog video, Digital video,Video Recording and Tape formats,	CO4
	B	Shooting and Editing Video (UsingAdobe Premier, Filmora, DaVinci Resolve), Video Compression and File Formats.	CO4
	C	Video compression based on motioncompensation,	CO5
	D	MPEG-1,2,4,7,21 Animation: CellAnimation, Computer Animation, Morphing.	CO5
	E	Multimedia Authoring: Multimedia Authoring Basics, Some Authoring Tools, Macromedia Director & Flash.	CO5
	Mode of examination	Theory	
	Text book/s*	**Reference Books:** **Reference of Content:** 1. "Multimedia making it work" By Tay Vaughan, Publisher: Tata McGraw-Hill. 2. "Multimedia Systems" By Rajneesh Aggarwal, Publisher: Excel Publication. 3. "Fundamentals of Multimedia" By Li & Drew,Publisher: Pearson Education.	

Department of mathematical science and computer applications		
Program: B.Sc.		**Current Academic Year:2022-23**
Subject: Mathematics		**Semester: IV**
1	**Course Code**	20036
2	**Course Title**	**Real Analysis & Complex Analysis**
3	**Credits**	6
4	**Contact Hours (L-T-P)**	4-2-0
	Course Type	Compulsory
5	**Course Objective**	1.To Understand the basic differences between the rational and the real numbers. 2.To understand concerning uniform convergence of concrete numerical sequences and series. 3. To explain the definition of concepts related to metric spaces, such as continuity, compactness, completeness and connectedness. 4. Give the essence of the proof of Weierstrass' theorem, the contraction theorem as well as the existence of convergent subsequences using continuity 5. To study the techniques of complex variables and functions .together with their derivatives, Contour integration and transformations. 6. To study complex power series, classification of singularities, calculus of residues and its applications 8in the evaluation of integrals, and other concepts and properties. 7.To understand the modulus of a Complex valued function and results regarding that To Understand and develop manipulation skills in the use of Rouche's theorem.
6	**Course Outcomes**	Upon success sful completion, students will have the knowledge and skills to: **CO1** : Concept of extended real numbers, **CO2**:To understant competence with properties of real numbers by finding supremum and infimum of sets and using the completeness property of real numbers. **CO3**:Students will be able to demonstrate competence with elementary properties of sequences by finding limits and proving results involveing sum/difference/product/quiotients of sequences. **CO4**:Define what it means for a function to have a Riemann Integral and describe its properties. **CO5**:Represent complex numbers algebraically and geometrically **CO6**: Cauchy-Riemann equations, analytic functions and various properties of analytic functions **CO7**: Understand Cauchy theorem and Cauchy integral formulas and apply these to evaluate complex contour integrals. **CO8:** Represent functions as Taylor and Laurent series; classify singularities **CO9**: Demonstrate accurate and efficient use of complex analysis techniques
:7	**Course Description**	This course aims to provide students with the specialist knowledge necessary for basic concepts in Real Analysis. More precisely , it strives to enable students to learn basic concepts about functions of bounded variation, grasp basic concepts about the total variation, learn about Riemann integrals , sequences and series of function

		This course is aimed to provide an introduction to the theories of functions of complex variables; analytic functions; contour integrations and to furnish an introduction to their applications.	
8	**Outline syllabus**		CO Mapping
	Unit 1	**Basic Concept of real numbers**	
	A	Axiomatic study of real numbers Completeness property in R, Archimedean property	CO1
	B	Countable and Uncountable sets, Neighborhood, Interior points, Limitpoints, Example	CO2
	C	Open and closed sets, Derived Sets, Denses ets, Perfect Set, Example, Bolzano-Weierstrass theorem	CO3
	Unit 2	**Sequences**	
	A	Sequences of real numbers, subsequences ,Bounded and monotonic sequence, Convergent sequences	CO1, CO2
	B	Cauchy's theorem on limit, Cauchy sequence ,Cauchy general principle of convergence	CO2,CO3
	Unit 3	**Continuity**	
	A	Sequentia continuity, Boundeness and intermediate value properties of continuous functions, Uniform continuity	CO4
	B	Mean of Sign of derivative, Darboux theorem	CO4
	C	Limit and continuity &Taylor's theorem o ffunction of two variables	CO4,CO5
	Unit 4	**Reimann integral**	
	A	Reimann integral	CO6,
	B	Integrability of continuous and monotonic functions	CO6
	C	Fundamenta ltheorem & Mean value theorem of integral calculus	CO6,CO7
	D	Improper integrals and their convergence, Comparision test,μ-test, Abel'stest, Dirichlet test	CO8
	Unit 5	**Funtion of a complex variable**	
	A	Concept o flimit, continuity and differentiability of complex functions	CO9
	B	Analytic fucntions, Cauchy-Riemann equations, Harmonic fucntions, Orthogonal system	CO9,CO10

	Unit 6	**Elementary function**	
	A	Mapping by elementary functions, Linear and bilinear transformations, Fixed points, Cross ratio, Inverse points	CO11
	Unit 7	**Complex integration**	
	A	Line integral, Cauchy fundamental theorem,	CO9,C10
	B	Cauchy integral formula, Morera's theorem Liouville theorem, Maximum modulus theorem	C10
	Unit 8	**Singularities**	
		Basic definition of singularities, Zeros of ananalytic function, Rouches theorem	CO9,C11
	Mode of examination	Theoretical	
	Text book/s*	1. Principles of Mathematical Analysis: Walter Rudin Mc Graw Hill, Singapore. 2. Mathematical Analysis: Tom M Apostol Narosa book distributors pvt Ltd, India 3 . Complex Analysis by Dr. H.K. Pathak 2 021	
	Other References	1. Real analysis: H L Royden: The Macmillan Company, New york. 2. The Real numbers & Real analysis: Ethan D Bloach Springer, New York Complex Analysis: Elias M. Stein,2003	

Department of mathematical science and computer applications			
Program: B.Sc. (3 year)		**CurrentAcademicYear:2022-23**	
Branch: (Math/Statistics/C.S.)		**Semester: IV**	
1	**CourseCode**		
2	**CourseTitle**	**Analysis of Variance & Design of Experiment**	
3	**Credits**	4	
4	**ContactHours (L-T-P)**	2-0-2	
	CourseType	Compulsory	
5	**CourseObjective**	• To familiarize students with computational techniques and software used in the statistical arena. • To provide a solid ground in best practices of collating and disseminating information. • To prepare students for undertaking other study. • To teach students to construct practical statistical models for several processes in the real-world.	
6	**CourseOutcomes**	**CO1:** Understand the differences between various experiment design and when to use them. **CO2:** compute and interpret the results of one way and two way ANOVA . **CO3:** compute and interpret the results of a random block design. **CO4:** Know when and how to use multiple comparison techniques	
7	**CourseDescription**	In today's data-driven world, the application of statistics in everyday life is an ever-present reality that touches all aspects of society. Though the field of statistics originated centuries ago, the impact has exploded in recent years as modern statisticians have advanced applications of statistics through innovative, problem-solving approaches. The application of statistics most often happens in the background, as statisticians are continuously at work to discover and implement world-shaping developments. Such as government, health care, finance etc.	
8	**Outlinesyllabus**		**COMapping**
	UnitNo	**UnitName**	

	I	**Analysis of variance**			
	I.1	Introduction to linear effect model			CO1,CO2
	I.2	One-way analysis			CO1,CO2
	I.3	Two-way Analysis			CO1,CO2
	I.4	Duncans Multiple range test			CO1,CO2
	I.5	Analysis of Covariance			CO1,CO2
	II	**Design of Experiment**			
	II.1	Principles of Design of Experiment			CO1,CO2
	II.2	Complete Block Design			CO1,CO2
	II.3	Randomized Block Design			CO3, CO4
	II.4	Latin Square Design			CO3,CO4
	II.5	Efficiency between CRD ,RBD,LSD			CO3,CO4
	II.6	MissingPlotTechniques:estimationofmissingplotsbyminimizingthesumofsquaresinRBD&LSDwithoneor two missing observations			
	III	**Factorial Experiments**			CO1,CO2
	III.1	2^2 factorial experiment arranged in RBD & LSD ,Definition of main effects and interactions in 2 ^{2}and 2^3 factorial experiments.			
	III.2	2^3 factorial experiment, arranged in RBD & LSD Definition of maineffectsandinteractionsin2^2and2^3factorialexperiments.			CO3,CO4
	III.3	2^nfactorialexperiment			
	III.4	Preparation of ANOVA by Yates Procedure			CO3,CO4
	Modeof examination	Theory			
		CA	MTE	ETE	
	Weightage Distribution	5%	20%	75%	

	Textbook/s*	Fundamental of Mathematical Statistics by Kapoor & Gupta	
	OtherReferences	7. Cochran, W.G. : Sampling Techniques 8. Sukhatme, Sukhatme, Sukhatme & Asok : Sampling Theory of Surveys with applications 9. Cochran and Cox : Experimental Design 10. Kempthorne : Design of Experiments 11. Federer : Experimental Designs	

Department of mathematical science and computer applications			
Program: BSc(M/S/C)		**Current Academic Year:2022-23**	
Branch: Computer Application		**Semester: III**	
1	**Course Code**		**Paper Code**
2	**Course Title**	**Database Management System**	
3	**Credits**	4	
4	**Contact Hours (L-T-P)**	2-2-2	
	Course Type	Compulsory	
5	**Course Objective**	1. The objective of the course is to present an introduction to database management system with an emphasis on how to organize ,maintain and retrieve –efficiently and effectively– information from a DBMS 2. The objective of this lab course is to understand the practical applicability of database management system concept 3. Improve the database design by normalization 4. Familiar with basic database storage structure and access techniques	
6	**Course Outcomes**	**CO1:** Describe the features of a database system and its application and compare various types of data models. **CO2:** Construct an ER Model for a given problem and transform it into a relation database schema. **CO3:** Formulate solution to a query problem using SQL Commands, relational algebra, tuple calculus and domain calculus. **CO4:** Explain the need of normalization and normalize a given relation to the desired normal form. **CO5:** Explain different approaches of transaction processing and concurrency control.	
7	**Course Description**	Database form the back bone of all major application today-tightly or loosely coupled intranet or internet based, financial, social, administrative and so on. Database Management System based on relational and other model have long formed the basis for such databases. Consequently, oracle, Microsoft SQL Server, Sybase etc. have emerged as leading commercial system while MySQL, PostgreSQL etc. lead in open source and free domain. While DBMS Differ in the details they share a Common set of models, design paradigms and a Structured query Language. In this background the course examines data structure file organization concept and principal of DBMS.	
8	**Outline syllabus**		CO Mapping
	Unit 1	**Introduction**	
	A	Characteristics of database approach ,data models, database users database schema	CO1
	B	DBMS architecture, data independence DBMS structure	CO1
	C	*E-R Modeling:* Entity types, Entity set, attribute and key Relationships	C02
	D	relation types roles and structural constraints, weak entities	CO2

	E	enhanced E-R and object modeling enhanced E-R and object modeling Subclasses; Superclasses	CO2
	F	Inheritance,Specialization, Generalization, *EER and ER to relational mapping,* Data base design, relational language	CO2
	Unit 2	***File Organization***	
	A	Indexed sequential access files, implementation using B & B++ trees	CO2
	B	Hashing, hashing functions, collision resolution, extendible hashing, dynamic hashing approach implementation and performance	CO2
	C	*Relational Data Model,* Relational model concepts.	CO1
	D	Relational constraints relational algebra.	CO3
	E	*SQL,* SQL queries, programming using SQL	CO3
	Unit 3	**Normalization**	
	A	Database Normalization Functional Dependencies	CO4
	B	Normal form up to 3rd normal form	CO4
	C	C*oncurrency Control,* Transaction processing, locking techniques	CO5
	D	database recovery, security and authorization	CO5
	E	Database Security, Recovery Techniques	CO5
	Mode of examination	Theory and Practical	
	Text book/s*	**Reference Books:** 1. Korth, Silbertz, Sudarshan," Database Concepts", McGraw Hill. 2. Date C J, "An Introduction to Database Systems", Addision Wesley. 3. Elmasri, Navathe, "Fundamentals of Database Systems", Addision Wesley. 4. O'Neil, "Databases", Elsevier Pub. 5. Ramakrishnan, "Database Management Systems", McGraw Hill. 6. Leon &Leon,"Database Management Systems", Vikas Publishing House. 7. Bipin C. Desai, " An Introduction to Database Systems", Gagotia Publications. 8. Majumdar& Bhattacharya, "Database Management System", McGraw Hill.	

Department of mathematical science and computer applications			
Program: BSc(H)		**Current Academic Year:2022-23**	
Branch: Computer Application		**Semester: IV**	
1	**Course Code**	11332	**Paper Code :20112**
2	**Course Title**	Entrepreneurship	
3	**Credits**	4	
4	**Contact Hours (L-T-P)**	2-2-2	
	Course Type	Compulsory	
5	**Course Objective**	1. The goals of this program are to inspire students and help them imbibe an entrepreneurial mind-set. 2. The students will learn what entrepreneurship is and how it has impacted the world and their country. 3. They will be introduced to key traits and the DNA of an entrepreneur, and be given an opportunity to assess their own strengths and identify gaps that need to be addressed to become a successful entrepreneur. 4. The programmed comprises several short courses, each focusing on a specific entrepreneurial knowledge or skill requirement such as creative thinking, communication, risk taking	
6	**Course Outcomes**	**CO1:** Meaning and concept of entrepreneurship, the history of entrepreneurship development, role of entrepreneurship in economic development, **CO2:** to understand **the** Myths about entrepreneurs, agencies in entrepreneurship **CO3:** management and future of entrepreneurship types of entrepreneurs. **CO4:** Meaning and concept of E-cells, advantages to join E-cell, significance of E-cell, various activities conducted by E-cell **CO5:** Importance of communication, barriers and gateways to communication, listening to people, the power of talk, personal selling, risk taking & resilience, negotiation.	
7	**Course Description**	The entrepreneur is defined as someone who has the ability and desire to establish, administer and succeed in a startup venture along with risk entitled to it, to make profits. The best example of entrepreneurship is the starting of a new business venture. The entrepreneurs are often known as a source of new ideas or innovators, and bring new ideas in the market by replacing old with a new invention. **1**. Small Business Entrepreneurship **2.** Scalable Startup Entrepreneurship **3.** Large Company Entrepreneurship **4.** Social Entrepreneurship. Understand the DNA of an entrepreneur and assess their strengths and weaknesses from an entrepreneurial perspective.	
8	**Outline syllabus**		CO Mapping
	Unit 1	**Introduction to Entrepreneurship**	
	A	Meaning and concept of entrepreneurship, the history of entrepreneurship development.	CO1
	B	Entrepreneurship in economic development, Myths about entrepreneurs. Agencies in entrepreneurship management and	CO1

		future of entrepreneurship types of entrepreneurs.	

	Unit 2	**The Entrepreneur**	
	A	Why to become entrepreneur, the skills/ traits required to be an entrepreneur	CO2
	B	Creative and Design Thinking, the entrepreneurial decision process, skill gap analysis, and role models	CO2
	C	Mentors and support system, entrepreneurial success stories.	CO2
	UNIT 3	**E- CELL**	
	A	Meaning and concept of E-cells, advantages to join E-cell, significance of E-cell, various activities conducted by E-cell	CO3
	B	various activities conducted by E-cell	CO3
	Unit 4	**Communication**	
	A	Importance of communication, barriers and gateways to communication	CO4
	B	Listening to people, the power of talk, personal selling, risk taking & resilience, negotiation.	CO4
	Unit 5	**Introduction to various form of business organization**	
	A	sole proprietorship, partnership, corporations, Limited Liability company	CO5
	B	Mission, vision and strategy formulation.	CO5
	Mode of examination	Theory and Practical	

	Text book/s*	**Reference Books:** 1. **Entrepreneurship** by: Bamford and Bruton 2. **The Intelligent Entrepreneur** by: Bill Murphy Jr. 3. **Zero to One: Notes on Startups, or How to Build the Future** is a 2014 book by Peter Thiel and Blake Masters 4. **Entre Leadership** by Dave Ramsey 5. **The Hard Thing About Hard Thing Ben Horowitz,2014** 6. **Rework** by Jason Fried	

Department of mathematical science and computer applications			
Program: B.Sc. (3 year)		**CurrentAcademicYear:2022-23**	
Branch: (Math/Statistics/C.S.)		**Semester: I**	
1	**CourseCode**		
2	**CourseTitle**	**Probability & Statistical Methods**	
3	**Credits**	4	
4	**ContactHours (L-T-P)**	2-0-2	
	CourseType	Compulsory	
5	**CourseObjective**	• To familiarize students with computational techniques and software used in the statistical arena. • To provide a solid ground in best practices of collating and disseminating information. • To prepare students for undertaking other study. • To teach students to construct practical statistical models for several processes in the real-world.	
6	**CourseOutcomes**	**CO1:** forecasting by using various forecasting models **CO2:** perform entire time series analysis on relevant software. **CO3: :** Apply the statistical tools in business , economics and commercial areas with the help of time series , index number ,etc **CO4:** Analyze such problems and t make better decisions for future in their fields	
7	**CourseDescription**	In today's data-driven world, the application of statistics in everyday life is an ever-present reality that touches all aspects of society. Though the field of statistics originated centuries ago, the impact has exploded in recent years as modern statisticians have advanced applications of statistics through innovative, problem-solving approaches. The application of statistics most often happens in the background, as statisticians are continuously at work to discover and implement world-shaping developments. Such as government, health care, finance etc.	
8	**Outlinesyllabus**		**COMapping**
	UnitNo	**UnitName**	
	I	**Applied Statistics**	

	I.1	Time Series			CO1,CO2
	I.2	Trend			CO1,CO2
	I.3	Seasonal and cyclic variations			CO1,CO2
	I.4	Index Number			CO1,CO2
	I.5	CPI, Educational statistics, Scaling procedure			CO1,CO2
	II	**Vital Statistics & Demography**			
	II.1	Source Demographic data			CO1,CO2
	II.2	Indian Census			CO1,CO2
	II.3	Measurement of Mortality			CO1,CO2
	II.4	Measurement of Fertility			CO3, CO4
	II.5	Life table			CO3, CO4
	II.6	Official statistics			CO3, CO4
	II.7	CSO, NSSO			CO3, CO4
	III	**SQC**			
	III.1	Control Charts for variables and attributes			CO3,CO4
	III.2	Modified Control Charts CUSUM Charts			
	III.3	Sampling Inspection by Attributes			CO3,CO4
	III.4	Consumer risk OC ASN			CO3,CO4
	III.5	ATI function			CO3,CO4
	III.5	AOQL & LTPD of sampling p Sampling by variables			
	Modeof examination	Theory			
		CA	MTE	ETE	
	Weightage Distribution	5%	20%	75%	
	Textbook/s*	Fundamental of Mathematical Statistics by Kapoor & Gupta			
	OtherReferences	1. Montgomery D.C. (1985) : Introduction			

		to Statistical Quality Control (Wiley). 2. Draper & Smith : Applied Regression Analysis 3. Burr: Industrial Quality Control. 4. Wetherill and Brown : Statistical Quality Control 5. Croxton F.E. and Cowden D.J. : Applied General Statistics	

Department of mathematical sciences and computer applications			
Program: B.Sc. (3 year)		**Current Academic Year:2022-23**	
Branch: (Math/Statistics/C.S.)		**Semester: Vth**	
1	**Course Code**		
2	**Course Title**	**Operational Research &Numerical Analysis**	
3	**Credits**	4	
4	**Contact Hours (L-T-P)**	2-0-2	
	Course Type	Compulsory	
5	**Course Objective**	The tools of Operational Research are not from any one discipline; rather Mathematics, Statistics, Information Technology, Economics, Engineering, etc. have contributed to this discipline of knowledge. Today, it has become a professional discipline that deals with the application of scientific methods for decision-making, and especially to the allocation of scare resources. The objective will be to train students to understand why the methods work, what type of errors to expect, and when an application might lead to difficulties.	
6	**Course Outcomes**	**CO-1**: Optimization techniques is a branch of Operations Research. It deals with minimization of cost or maximization of profit. It is used in Production engineering, Mathematics of finance, Networking, etc. **CO-2**: To study linear programming problems. To learn about transportation problems. To know the fundamentals of game theory. **CO-3**: It is used for solving a system of equations. It has application in all branches of engineering. To know how to find the roots of transcendental equations. **CO-4:** To learn how to interpolate the given set of values. To understand the curve fitting for various polynomials. To learn numerical solution of differential equations.	
7	**Course Description**	Operation Research is a relatively new discipline. The contents and the boundaries of the OR are not yet fixed. Therefore, to give a formal definition of the term Operations Research is a difficult task. The OR starts when mathematical and quantitative techniques are used to substantiate the decision being taken. The main activity of a manager is the decision making. In our daily life we make the decisions even without noticing them. The decisions are taken simply by common sense, judgment and expertise without using any mathematical or any other model in simple situations. But the decision we are concerned here with are complex and heavily responsible. Examples are public transportation network planning in a city having its own layout of factories, residential blocks or finding the appropriate product mix when there exists a large number of products with different profit contributions and production requirement etc.	
8	**Outline syllabus**		**CO Mapping**
	Unit No.	**Unit Name**	
	I	**Linearprogrammingproblem**	
	I.1	GeneralLPP andtheirformulation	CO1,CO2
	I.2	MethodsofsolvingLPP--graphicalmethod, Twophasemethod,	CO1,CO2

		MethodofdualityinLPP, Transportationproblem			
	I.3	Replacementtheory- Individualandgroupreplacementpolicy			CO1,CO2
	II	**Queueingtheory**			
	II.1	M/M/1model, M/M/c model, Littlemodel, M/G/1queueingmodel			CO1,CO2
	III	**Networkanalysis**			
	III.1	Minimalspanningtree, Shortestrouteproblem, Maximalflowmodel, CPM/PERT			CO1,CO2
	IV	**Inventorymodel**			CO1, CO2
	IV.1	EOQmodel, EOQmodelwithshortage			CO1, CO2
	V	**Numerical Analysis**			
	V.1	ShiftOperator,ForwardandBackwarddifferenceoperator			CO1, CO2
	V.2	FundamentaltheoremofDifferencecalculus,Interpolation			CO1, CO2
	V.3	PolynomialInterpolation:Newton'sforwardandbackwardformula			CO1, CO2
	V.4	DividedDifferences,NewtonDivideddifferenceformula, Lagrange'sInterpolationforunequalintervals			CO3,CO4
	V.5	CentralDifferenceFormula:Gaussforwardandbackwardformula, Striling'sBessel'sandEverett'sinterpolationformulae			CO3,CO4
	V.6	NumericalDifferentiationIntegration			CO3, CO4
	V.7	Generalquadratureformula			CO3, CO4
	V.8	Trapezoidalrule,Simpson'srule,Cote'sformula,Weddle'sformula			CO3, CO4
	V.9	SimultaneousLinearEq:SolutionsofsystemofLinearEq.			CO3, CO4
	V.10	GaussEliminationdirectmethod			CO3, CO4
	V.11	Solutionofdifferential Eq:Picard'smethod,Euler'smethod			CO3, CO4
	V.12	Taylor'smethod,Runge-Kuttamethods,Milne'smethod			CO3, CO4
	Mode of Examination	Theory			
		CA	MTE	ETE	
	Weightage Distribution	5%	20%	75%	
	Textbook/s*	1. J.K. Sharma, Mathematical Model in Operation Research, Tata McGraw Hill. 2. "Introduction to Numerical Analysis" by C E Froberg			
	Other References	3. H.A. Taha, Operation Research-An introduction, Printice Hall of India. 4. P.K. Gupta and D.S. Hira, Operations Research, S. Chand & Co. 5. S.D. Sharma, Operation Research, Kedar Nath Ram Nath Publications. 6. "Elementary Numerical Analysis – An Algorithmic Approach" by S D Conte and Carl de Boor			

Department of mathematical science and computer applications			
Program: B.Sc. (3 year)		**Current Academic Year:2022-23**	
Branch: (Math/Statistics/C.S.)		**Semester: V**	
1	**Course Code**		
2	**Course Title**	**JAVA Programming**	
3	**Credits**	4	
4	**Contact Hours (L-T-P)**	2-0-2	
	Course Type	Compulsory	
5	**Course Objective**	**1** To impart the basic concepts of data structures and algorithms **2** To understand concepts about searching and sorting techniques **3** To Understand basic concepts about stacks,queues,lists,trees and graphs **4** To understanding about writing algorithms and step by step approach in s olving problems with the help of fundamental data structures	
6	**Course Outcomes**	**CO1:**- Explain the organization of basic computer , its design and the design of control unit. **CO2: :**- Demonstrate the working of central processing unit and RISC and CISC Architecture. **CO3:** Describe the operations and language f the register transfer, micro operations and input- output organization **CO4:** Understand the organization of memory and memory management hardware. **CO5:** Elaborate advanced concepts of computer architecture, Parallel Processing, interprocessor communication and synchronization.	
7	**Course Description**	Data Structure Using C are used to store data in an organised and efficient manner. The C Programming language has many data structures like an array, stack, queue, linked list, tree, etc. A programmer selects an appropriate data structure and uses it according to their convenience	
8	**Outline syllabus**		**CO Mapping**
	Unit No	**Unit Name**	
	I	**Internet**	
	I.1	Basic concept of Internet	CO1,CO2

	I.2	Connecting to Internet (Telephone, cables & Satellite)	CO1,CO2
	I.3	Choosing an ISP	CO1,CO2
	I.4	Internet Services	CO1,CO2
	I.5	E-Mail Concepts & Applications	CO1,CO2
	I.6	Voice & Video Conferencing	
	II	**Core Java**	CO1, CO2
	II.1	Introduction of Java + Data Type &Looping	CO1, CO2
	II.2	Methods & Classes + Programming	CO1, CO2
	II.3	Inheritance + Programming	CO1, CO2
	II.4	Packages & Interfaces + Programming	
	II.5	Exception Handling + Programming	CO3,CO4
	II.6	Multithreaded programming	
	II.7	Java Applet	CO3,CO4
	II.8	Networking	CO3,CO4
	II.9	Fundamental concept networking	CO3, CO4
	II.10	Connectivity	CO3, CO4
	II.11	Event handling	CO3, CO4
	II.12	AWT	CO3, CO4
	II.13	Introduction to AWT	CO3, CO4
	II.14	AWT controls	CO4
	II.15	Layout Manager	CO4
	II.16	Menus & Images	CO4
	II.17	Graphics	CO4
	III	**Java Swing**	CO4,CO5
	III. 1	Swing Applet & its application	CO5

	III. 2	Programming Based on different controls like Plugg able look and feel, Label and text fields			CO5
	III. 3	Programming Based on different controls like Panes, Radio Buttons, Scrollbar, Menubars			CO5
	III. 4	Programming Based on different controls like windows, Inner frames			CO5
	III. 5	JDBS			CO5
	III. 6	Introduction			CO5
	III. 7	Connectivity model			CO5
	Mode of Examination	Theory			
		CA	MTE	ETE	
	Weightage Distribution	5%	20%	75%	
	Textbook/s*	Introduction to Programming Using Java			
	Other references	• Spring in Action. • Clean Code. • Test Driven: TDD and Acceptance TDD for Java Developers. • Test-Driven Java Development. • Thinking in Java			

Department of mathematical science and computer applications			
Program: B.Sc. (3 year)		**CurrentAcademicYear:2022-23**	
Branch: (Math/Statistics/C.S.)		**Semester: VI**	
1	**CourseCode**		
2	**CourseTitle**	**NPM and Regression Analysis**	
3	**Credits**	4	
4	**ContactHours (L-T-P)**	2-0-2	
	CourseType	Compulsory	
5	**CourseObjective**	• To familiarize students with computational techniques and software used in the statistical arena. • To provide a solid ground in best practices of collating and disseminating information. • To prepare students for undertaking other study. • To teach students to construct practical statistical models for several processes in the real-world.	
6	**CourseOutcomes**	**CO1:** Summarize data using both graphical and numerical methods for use in nonparametric statistical methods **CO2:** Formulate , test and interpret various hypothesis tests fr location , scale , and independence . Problems **CO3:** Understand how regression helps us make predictions using the least squares concept. **CO4:** Use dummy variables with an understanding of their interpretation .	
7	**CourseDescription**	In today's data-driven world, the application of statistics in everyday life is an ever-present reality that touches all aspects of society. Though the field of statistics originated centuries ago, the impact has exploded in recent years as modern statisticians have advanced applications of statistics through innovative, problem-solving approaches. The application of statistics most often happens in the background, as statisticians are continuously at work to discover and implement world-shaping developments. Such as government, health care, finance etc.	
8	**Outlinesyllabus**		**COMapping**
	UnitNo	**UnitName**	

	I	**Multivariate analysis**			
	I.1	Multivariate normal distribution and its properties			CO1,CO2
	I.2	MGF and Characteristic function			CO1,CO2
	I.3	Covariance and variance matrix and its properties			CO1,CO2
	I.4	MLE of mean vector and covariance matrix			CO1,CO2
	I.5	Linear combination of multivariate analysis			CO1,CO2
	II	**Order Statistics**			
	II.1	Distributions of minimum ,r^{th} and maximum order statistic			CO1,CO2
	II.2	Joint distribution of $r^{th}$and s^{th}order statistics			CO3 , CO4
	II.3	Distribution of sample range for uniform and exponential distributions			CO3 , CO4
	II.4	Distribution of sample median for uniform and exponential distributions			CO3, CO4
	II.5	Confidence interval of quantiles of order p			CO3, CO4
	III	**Non-Parametric Test s and Linear regression analysis**			CO3, CO4
	III.1	Tests for randomness and test for goodness of fit			CO3, CO4
	III.2	Sign test , Wilcoxon signed rank tests			
	III.3	Run test,Kolmogorov–Smirnov's test .Median and Mann- Whitney U test			CO3,CO4
	III.4	Mood tests and Sukhatme test			
	III.5	Concept of linear regression analysis			CO3,CO4
	Modeof examination	Theory			
		CA	MTE	ETE	
	Weightage Distribution	5%	20%	75%	

	Textbook/s*	Fundamental of Mathematical Statistics by Kapoor & Gupta	
	OtherReferences	1. Mood, A.M., Graybill F and Boes D.C.: Introduction to the theory of Statistics. 2. Gibbons, J.D. : Non-parametric statistical inference 3. Conover, W.J. : Practical Non-parametric Statistics 4. David, H.A. : Order Statistics 5. Johnston : Econometric Methods	

Department of mathematical science and computer applications		
Program: B.Sc.		**Current Academic Year:2022-23**
Subject: Mathematics		**Semester: VI**
1	**Course Code**	30037
2	**Course Title**	Integral Transform & Mechanics
3	**Credits**	6
4	**Contact Hours (L-T-P)**	4-2-0
	Course Type	Compulsory
5	**Course Objective**	1. The aim of the course is to offer a gentle introduction to the concepts of Laplace transforms, Inverse Laplace transforms, solution of ordinary differential equations using Laplace transform, Fourier transform and their properties with applications in real life. 2. Appropriate choice of integral transforms helps to convert differential equations and integral equations into terms of an algebraic equation that can be solved easily. 3. Students will be able to generate solutions to unfamiliar problems. 4. The purpose of the course is to expose the students to the basic elements of mechanics in a sufficiently rigorous manner. 5. This course aims to introduce Basic kinematics for a deforming body and various deformation measures and their rates. 6. After attending this course, the students should be able to appreciate a wide variety of advanced courses in solid and fluid mechanics. This course is essential for all future engineers, since all the objects in the world obey these laws, and no machine may be built without their knowledge.
6	**Course Outcomes**	Completion of this course the students will be able to: **CO1** : The focus of this course is to familiarize the students with the concept of Laplace transform and their properties. **CO:2** Use Laplace transform and inverse Laplace transform in solving differential/ integral equation arising in network analysis, control systems and other fields of engineering. **CO:3** Apply transform techniques to analyze continuous-time and discrete-time. **CO4:** To demonstrate knowledge and understanding of the following fundamental concepts in the dynamics of system of particles **CO5:** Students will be able to describe: Relative motion. velocity and acceleration, Central Orbit and Kepler's law, Poinsot's central axis etc. **CO6:** Solve a problem, work out its solution . **CO7:** Problems in which integral transform are encountered include energy transfer and oscillation of a string. **CO8:** Students will have much better and deeper understanding of the

		fundamental concepts of a weak and a strong relative minimum of an integral transform.	
7	**Course Description**	The course is designed as an introduction to the theory and applications of integral transforms to problems in linear differential equations, to boundary and initial value problems in partial differential equations and continuum mechanics. Many new applications in applied mathematics, engineering are included. Topics to be covered include equivalent systems of forces, resultants and distributed forces, equilibrium of rigid bodies, centroids, centers of gravity, fluid statics, moments of inertia, friction and virtual work. This course introduces students to the basic physical laws governing the the interaction of bodies. This course is essential for all future engineers, since all the objects in the world obey these laws, and no machine may be built without their knowledge.	
8	**Outline syllabus**		CO Mapping
	Unit 1	**Laplace Transform**	
	A	Piece-wise continuity, Function of Exponential order Function of class A, Transform Concept, Def. of laplace transform, Properties of laplace transform	CO1, CO2
	B	Some Standard Result Problem based on Standard Result, Existence Theorem of laplace transform	CO2
	C	First Shifting Property, Second Shifting Properties, Change of scale properties Theorms on Derivative, integral form, Multiplication by t, Division by t, Problems	CO3
	Unit 2	**The Inverse laplace transform**	
	A	Definition, Uniqueness of inverse laplace transform, Standard result on inverse laplace transform, Problems	CO2
	B	Partial function, Heaviside expansion formulae ,Problems	CO1,CO2,CO3
	C	Convolution Theorem, Problems	CO3
	Unit 3	**Mechanics**	
	A	velocity and acceleration along radial and transverse directions and along tangential and normal direction, Motion on smooth and rough plane curves, Rocket motion	CO4
	B	Kepler's law, problems, , Motion of a particle in three dimension Common catenary, Force in three dimensions	CO5
	C	Poinsot's central axis, Wrenches, Null Lines and Null Planes	CO6

	Unit 4	**Fourier Transform**	
	A	The Infinite Fourier sine transform, Infinite Fourier Cos Transform Of F(x), Problems	CO7,
	B	Infinite Fourie Transform Of F(x), Problems	CO7,CO8
	C	Relationship between Fourier and laplace transform	CO1,CO8
	Unit 5	**The Finite Fourier sine transform, Problems**	
	A	The Finite Fourier sine transform,	CO7,
	B	The Finite Fourier Cos transform, Problems	CO8,
	C	Z transform and their properties	CO1,CO9

	Mode of examination	Theortical			

	Text book/s*	1. Kreyszig, "Advanced Engineering Mathematics", John Wiley & Sons Publishers, 10th Edition, 2010. 2. Mechanics, Krishna Publication 2021.	
	Other References	1. B. S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, 43rd Edition, 2015. 2. P. P. G. Dyke, An introduction to Laplace transform and Fourier Series, 4th Edition, Springer,2004. 3. Mechanics : Sunil Datta [2016] Eastern Economy edition. 4. Mechanics: Sudhir Pundir[2019] Pragati Publication	

Department of mathematical science and computer applications			
Program: B.Sc. (3 year)		**Current Academic Year:2022-23**	
Branch: (Math/Statistics/C.S.)		**Semester: IV**	
1	**Course Code**	30038	
2	**Course Title**	**DATA WAREHOUSING AND DATA MINING**	
3	**Credits**	4	
4	**Contact Hours (L-T-P)**	2-0-2	
	Course Type	Major-III(DSC)	
5	**Course Objective**	**1** To impart the basic concepts of Data warehousing and Dataminig **2** To understand concepts about arcitenture of Warehouse Server. **3** To Understand basic concepts about Data Cube, Data Preprocessing. **4** To understand basics about Classification Techniques, classsification algorithms such as : supervised and Unsupervised approach in solving problems with the help of fundamental and advance level classification techniques.	
6	**Course Outcomes**	**CO1:**- Explain the organization of basic data warehousing and Data mining. **CO2: :**- Demonstrate the working of Preprocessing of data and Three tier Architecture of DW. **CO3:** Describe the operations for DW and DM. **CO4:** Understand the organization of lassification and Regression. **CO5:** Elaborate advanced concepts of Machine Learning.	
7	**Course Description**	This course aims to provide students with the special knowledge necessary for basic concepts of Data Mining and Data Warehousing . More precisely it enable students to learn basic concepts about Data warehousing and Data minin.g	
8	**Outline syllabus**		**COMapping**
	Unit No	**Unit Name**	
	I	Basic Concepts of Data Warehousing, Introduction, Meaning and characteristics of Data Warehousing	
	I.1	Online Transaction Processing (OLTP)	CO1,CO2

	I.2	Data Warehousing Models,	CO1,CO2
	I.3	Data warehouse architecture	CO1,CO2
	I.4	Principles of Data Warehousing and Data Mining.	CO1,CO2
	I.5	Structure of the Data warehouse, Data warehousing and Operational Systems,	CO1,CO2
	I.6	Organizing for building data warehousing, Benefits of Data warehousing.	
	II	Data mining, Definition and description	CO1, CO2
	II.1	Relationship and Patterns	CO1, CO2
	II.2	KDD vs. Data mining	CO1, CO2
	II.3	DBMS vs. Data mining	CO1, CO2
	II.4	Elements and uses of Data Mining.	
	II.5	Measuring Data Mining Effectiveness: Accuracy, Speed & Cost Data.	CO3,CO4
	II.6	Information and Knowledge, Data Mining vs. Machine Learning,	
	II.7	Data Mining Models. Issues and challenges in DM,	CO3,CO4
	II.8	DM Applications in Various areas	CO3,CO4
	II.9	Techniques of Data Mining Nearest Neighbor	CO3, CO4
	II.10	Clustering Techniques, Decision Tree	CO3, CO4
	II.11	OLAP, Need for OLAP.	CO3, CO4
	II.12	OLAP vs. OLTP	CO3, CO4
	II.13	Multidimensional Data Model Multi-dimensional verses Multi-relational	CO3, CO4
	II.14	OLAP Characteristics of OLAP:	CO4
	II.15	FASMI Test (Fast, Analysis Share, Multidimensional and Information).	CO4
	II.16	Features of OLAP	CO4
	II.17	OLAP Operations	CO4
	III	Categorization of OLAP Tools:	CO4,CO5

	III. 1	MOLAP and ROLAP			CO5
	III. 2	Statical pattern recognition techniques			CO5
	III. 3	Naive Bayes Classification technique			CO5
	III. 4	Decision Tree Classification			CO5
	III. 5	K-NN Classification Technique			CO5
	III. 6	Clustering Techniques			CO5
	III. 7	K-means clustering technique			CO5
	Mode of Examination	Theory			
		CA	MTE	ETE	
	Weightage Distribution	5%	20%	75%	
	Textbook/s*	1 : Data Mining Concepts and Techniques Jiawei Han and Micheline Kamber 2: Data Mining Techniques By Arun K Pujari			
	Other references	• Intro to Data warehousing and Data Mining. • Machine Learning Techniques. • Introduction to classification and Regression			