E.M.G. YADAVA WOMEN'S COLLEGE, MADURAI – 625 014.

(*An Autonomous Institution – Affiliated to Madurai Kamaraj University*)

Re-accredited **(3rd Cycle)** with Grade **A+** & **CGPA 3.51** by NAAC

DEPARTMENT OF MATHEMATICS

TANSCHE-CBCS with OBE

MASTER OF SCIENCE

PROGRAMME CODE - PM

COURSE STRUCTURE

(w.e.f. 2023– 2024 Batch onwards)

Annexure-1

E.M.G.YADAVA WOMEN'S COLLEGE, MADURAI-14.

(An Autonomous Institution – Affiliated to Madurai Kamaraj University)

Re-accredited (3rd Cycle) with Grade A+ and CGPA 3.51 by NAAC

DEPARTMENT OF MATHEMATICS- PG

TANSCHE – CBCS WITH OBE

(w.e.f. 2023 – 2024 onwards)

VISION

To mold the students to have strong Mathematical and Analytical skills to meet the challenges open to them.

MISSION

To provide the students with a strong Mathematical Foundation through courses which cater to the needs of Industry, Research and Higher Education

Programme Educational Objectives (PEOs)

M.Sc.,

PEO	On completion of the Programme the student will be able to
PEO1	Apply their knowledge in modern industry or teaching, or secure acceptance in high quality graduate programs in mathematics.
PEO2	Keep on discovering new avenues in the chosen field and exploring areas that remain conducive for research and development.
PEO3	Promote the culture of interdisciplinary research among all disciplines and Applied Mathematics.
PEO4	Handle the problems faced by industry through Mathematical knowledge and scientific computational techniques
PEO5	To develop teaching skills, subject knowledge in the course of their study which will help them to shine in various field including Education ,IT etc.,

Annexure-1

Programme Outcomes (POs) with Graduate Attributes

PO	Graduate Attributes	On completion of the Programme the student will be able to
PO1	**Problem Solving Skill**	Apply knowledge of Management theories and Human Resource practices to solve business problems through research in Global context
PO2	**Decision Making Skill**	Foster analytical and critical thinking abilities for data-based decision-making
PO3	**Ethical Value**	Ability to incorporate quality, ethical and legal value-based perspectives to all organizational activities.
PO4	**Communication Skill**	Ability to develop communication, managerial and interpersonal skills
PO5	**Employability Skill**	Inculcate contemporary business practices to enhance employability skills in the competitive environment
PO6	**Individual and Team Leadership Skill**	Capability to lead themselves and the team to achieve organizational goals. .

Annexure-1

Programme Specific Outcomes (PSOs) with Graduate Attributes

PSO	Graduate Attributes	On completion of the Programme the student will be able to
PSO1	**Placement**	To prepare the students who will demonstrate respectful engagement with others' ideas, behaviors, beliefs and apply diverse frames of reference to decisions and actions
PSO 2	**Entrepreneur**	To create effective entrepreneurs by enhancing their critical thinking, problem solving, decision making and leadership skill that will facilitate startups and high potential organizations.
PSO 3	**Research and Development**	Design and implement HR systems and practices grounded in research that comply with employment laws, leading the organization towards growth and development.
PSO 4	**Contribution to Business World**	To produce employable, ethical and innovative professionals to sustain in the dynamic business world.
PSO 5	**Contribution to the Society**	To contribute to the development of the society by collaborating with stakeholders for mutual benefit.

Eligibility for Admission: Pass in B.Sc., Mathematics

Duration of the Course:
The students shall undergo prescribed courses of study for the period of two academic years under CBCS semester pattern with Outcome Based Education.

Medium of Instruction: English

System: TANSCHE - Choice Based Credit System with Outcome Based Education.

Nature of the Course
Courses are classified according to the following nature
1. Knowledge & Skill
2. Employability Oriented
3. Entrepreneurship Oriented

Annexure-1

Outcome Based Education (OBE) & Assessment

Students understanding must be built on and assessed for wide range of learning activities, which includes different approaches and are classified along several bases, such as

1. Based on purpose:

- Formative (Internal tests, Assignment, Seminar, Quiz, Documentation, Case lets, ICT based Assignment, Mini Projects administered during the learning process)
- Summative (Evaluation of students learning at the end of instructional unit)

2. Based on Domain knowledge: (Post Graduate Up to K5 Levels)

- Assessment through K1, K2,K3, K4 & K5

Evaluation

Continuous Internal Assessment Test (CIA)	: 25 Marks
Summative Examination	: 75 Marks
Total	: 100 Marks

CIA-Continuous Internal Assessment: 25 Marks

Components	Marks
Test (Average of two tests) (Conduct for 120 marks and converted into 12 marks)	12
Application-oriented/Innovation/Creativity Assignment	3
Assignment	5
Seminar	5
Total	**25**

- Centralized system of Internal Assessment Tests
- There will be a two Internal Assessment Tests
- Duration of Internal Assessment Test I and II will be 2 1/2 hours.
- Students shall write retest on the genuine grounds if they are absent in either Test I & Test II with the approval of Head of the Department.

Question Paper Pattern for Continuous Internal Assessment Test I and Test II

Section	Marks
A – Multiple Choice Questions (8x1Mark)	8
B – Short Answer (6 x 2 Marks)	12
C – Either Or type (4/8 x 5 Marks)	20
D – Open Choice type (2/4 x 10 Marks)	20
Total	**60**

Annexure-1

Conducted for 120 marks and converted into 12 marks

Question Paper Pattern for Summative Examination

Section	Marks
A – Multiple Choice Questions without choice (10x 1Mark)	10
B – Short Answer Questions without choice (5 x 2 Marks)	10
C – Either Or type (5/10 X 5Marks)	25
D – Open Choice type(3out of 5 X 10Marks)	30
Total	**75**

- In respect of external examinations passing minimum is **45%** for Post Graduate Courses and in total, aggregate of **50%.**

Latest amendments and revisions as per UGC and TANSCHE Norms are taken into consideration in curriculum preparation.

Distribution of Marks in % with K levels CIAI, II & Externa Assessment

Blooms Taxonomy	Internal Assessment		External Assessment
	I	II	
Knowledge (K1	8 %	8 %	5 %
Understanding (K2)	8 %	8 %	14 %
Apply (K3)	24 %	24 %	27%
Analyze (K4)	30 %	30 %	27%
Evaluate (K5)	30%	30%	27%

Annexure-1

BLUEPRINTFOR INTERNALASSESSMENT–I

Articulation Mapping –K Levels with Course Learning Outcomes(CLOs)

Sl.No	CLOs	K-Level	Section A		Section B		Section C	Section D	Total
			MCQs (No Choice)		Short Answers (No Choice)		(Either or Type)	(Open Choice)	
			No. of Questions	K-Level	No. of Questions	K-Level			
1	CLO1	Upto K5	1 2	K1 K2	1 1	K1 K3	1(K3) 1(K5)	1(K4)	
2	CLO2	Upto K5	2 1	K1 K2	1 1	K1 K2	1(K3) (Each set of questions must be in the same level)	1(K4) 1(K5)	
3.	CLO3	Upto K5	1 1	K1 K2	1 1	K2 K3	1(K4)	1(K5)	
No. of Questions to be asked			8		6		8	4	26
No .of Questions to Be answered			8		6		4	2	20
Marks for each question			1		2		5	10	
Total Marks for each section			8		12		40	40	100

Annexure-1

BLUEPRINT FORINTERNALASSESSMENT– II
Articulation Mapping –K Levels with Course Learning Outcomes (CLOs)

Sl.No	CLOs	K-Level	Section A		Section B		Section C	Section D	Total
			MCQs (No Choice)		Short Answers (No Choice)		(Either or Type)	(Open Choice)	
			No. of Questions	K-Level	No. of Questions	K-Level			
1	CLO3	Upto K5	1 2	K1 K2	1 1	K1 K3	1(K1) 1(K2)	1(K3)	
2	CLO4	Upto K5	2 1	K1 K2	1 1	K1 K2	1(K3) (Each set of questions must be in The same level)	1(K4) 1(K5)	
3.	CLO5	Upto K5	1 1	K1 K2	1 1	K2 K3	1(K4)	1(K5)	
No. of Questions to be asked			8		6		8	4	26
No. of Questions to Be answered			8		6		4	2	20
Marks for each question			1		2		5	10	
Total Marks for each section			8		12		40	40	100

Annexure-1

Distribution of Marks with choice K Levels CIA I – CIA and II-CIA

CIA	K Levels	Section-AMCQ (No choice)	Section –B (Short Answer(No choice)	Section-C(Either or Type)	Section-D (Open Choice)	Total Marks	% of Marks
I	K1	4	4			8	**8**
	K2	4	4			8	**8**
	K3		4	20		24	**24**
	K4			10	20	30	**30**
	K5			10	20	30	**30**
	Marks	**8**	**12**	**40**	**40**	**100**	**100**
II	K1	4	4			8	**8**
	K2	4	4			8	**8**
	K3		4	20		24	**24**
	K4			10	20	30	**30**
	K5			10	20	30	**30**
	Marks	**8**	**12**	**40**	**40**	**100**	**100**

Articulation Mapping –K Levels with Course Learning Outcomes (CLOs) for Internal Assessment (SEC)

Sl.No	CLOs	K-Level	Section A		Section B		Section C	Section D	Total
			MCQs (No choice)		Short Answers (No choice)		(Either/ or Type)	(open choice)	
			No. of Questions	K-Level	No. of Questions	K-Level			
1	CLO1	Upto K4	2	K1			2(K3&K3)	1(K3)	
2	CLO2	Upto K4	2	K1			2(K3&K3	1(K4)	
3	CLO3	Upto K4			2	K2	2(K4&K4)	1(K4)	
4	CLO4	Upto K5			2	K2	2(K5&K5)	1(K5)	
5	CLO5	Upto K5			2	K2		1(K5)	
No. of Questions to be asked			4		3		8	5	20
No. of Questions to be answered			4		3		4	2	13
Marks for each question			1		2		5	10	
Total Marks for each section			4		6		20	20	50 (Marks)

Annexure-1

Distribution of Section-wise Marks with K Levels for Internal Assessment (SEC)

K Levels	Section A (MCQ'S) (No choice)	Section B(Short Answer) (No choice)	Section C(Either or Type)	Section D (Open Choice)	Total Marks	% of Marks
K1	4				**4**	**4**
K2		6			**6**	**6**
K3			20	10	**30**	**30**
K4			10	20	**30**	**30**
K5			10	20	**30**	**30**
Total Marks	**4**	**6**	**40**	**50**	**100**	

K1-Rememberingandrecallingfactswithspecificanswers.
K2- Basic understanding off acts and stating main ideas with general answers.
K3-Application oriented Solving Problems, Justifying the statement and deriving inferences
K4- Examining, analyzing, presentation and make inferences with evidences.
K5-Evaluating, making Judgments based on criteria

Articulation Mapping –K Levels with Course Learning Outcomes(CLOs) for External Assessment

Sl.No	CLOs	K-Level	Section A		Section B		Section C	Section D	Total
			MCQs (No choice)		Short Answers (No choice)		(Either/or Type)	(open choice)	
			No. of Questions	K-Level	No. of Questions	K-Level			
1	CLO1	Upto K4	2	K1&K2	1	K1	2(K2&K2)	1(K3)	
2	CLO2	Upto K4	2	K1&K2	1	K2	2(K3&K3)	1(K4)	
3	CLO3	Upto K4	2	K1&K2	1	K3	2(K3&K3)	1(K4)	
4	CLO4	Upto K5	2	K1&K2	1	K4	2(K4 &K4)	1(K5)	
5	CLO5	Upto K5	2	K1&K2	1	K5	2(K5 &K5)	1(K5)	
No. of Questions to be asked			10		5		10	5	30
No. of Questions to be answered			10		5		5	3	23
Marks for each question			1		2		5	10	
Total Marks for each section			10		10		25	30	75 (Marks)

Annexure-1

Distribution of Section-wise Marks with K Levels for External Assessment

K Levels	SectionA (MCQ'S) (No choice)	Section B(Short Answer) (No choice)	Section C(Either or Type)	Section D(Open Choice)	Total Marks	% of Marks
K1	5	2	-	-	**7**	**5**
K2	5	2	10	-	**17**	**14**
K3	-	2	20	10	**32**	**27**
K4	-	2	10	20	**32**	**27**
K5	-	2	10	20	**32**	**27**
Total Marks	**10**	**10**	**50**	**50**	**120**	**100**

K1-Remembering and recalling facts with specific answers.
K2- Basic understanding of facts and stating main ideas with general answers.
K3-Application oriented Solving Problems, Justifying the statement and deriving inferences
K4- Examining, analyzing, presentation and make inferences with evidences.
K5-Evaluating, making Judgments based on criteria

Annexure-1

E.M.G. YADAVA WOMEN'S COLLEGE, MADURAI-14.

(An Autonomous Institution – Affiliated to Madurai Kamaraj University)

Re-accredited (3rd Cycle) with Grade A+ and CGPA 3.51 by NAAC

DEPARTMENT OF MATHEMATICS- PG

(w.e.f. 2023 – 2024 Batch onwards)

COURSE STRUCTURE –SEMESTER WISE

TANSCHE-CBCS with OBE

Sem	Part	Course Code	Course Title	Teaching Hours (per Week)	Duration of Exam hrs.	Marks Allotted			
						CIA	SE	Total	Credits
I	III	23OPMA11	**Core I:** Algebraic Structures	7	3	25	75	100	5
		23OPMA12	**Core II:** Real Analysis I	7	3	25	75	100	5
		23OPMA13	**Core III:** Ordinary Differential Equations	6	3	25	75	100	4
			DSEC I :	5	3	25	75	100	3
			DSEC II:	5	3	25	75	100	3
Total				**30**					**20**
II	III	23OPMA21	**Core IV :** Advanced Algebra	6	3	25	75	100	5
		23OPMA22	**Core V:** Real Analysis II	6	3	25	75	100	5
		23OPMA23	**Core VI:** Partial Differential Equations	6	3	25	75	100	4
			DSEC III:	5	3	25	75	100	3
			DSEC IV:	5	3	25	75	100	3
	IV	23OPMASEC2	**SEC :** Office Automation and ICT Tools	2	3	25	75	100	2
Total				**30**					**22**

Annexure-1

DSEC – Discipline Specific Elective Course
SEC - Skill Enhancement Course

DSEC (Discipline Specific Elective Course)

Semester – I (Choose any one)
DSEC - I

1. Number Theory and Cryptography – 23OPMADSE1A
2. Graph theory and its Applications –23OPMADSE1B

DSEC – II (Choose any one)

1. Mathematical Programming – 23OPMADSE1C
2. Fuzzy Sets and their Applications –23OPMADSE1D

Semester – II
DSEC – III (Choose any one)

1. Modelling and Simulation with Excel – 23OPMADSE2A
2. Fluid Dynamics - 23OPMADSE2B

DSEC – IV (Choose any one)

1. Mathematical Statistics – 23OPMADSE2C
2. Stochastic Process - 23OPMADSE2D

Annexure-1

Department of Mathematics						I M.Sc.,		
Sem	Category	Course Code	Course Title	Credits	Contact Hours/week	CIA	SE	Total
1	Core	23OPMA11	Algebraic Structures	5	7	25	75	100

Nature of the Course		
Knowledge and Skill Oriented	Employability Oriented	Entrepreneurship oriented

Course Objectives

To introduce the concepts and to develop working knowledge on class equation, solvability of groups, finite abelian groups, linear transformations, real quadratic forms.

Course Content

Unit	Course Content	105 Hours	K Level	CLO
I	Another Counting Principle - Sylow's theorems	21	Up to K4	CLO 1
II	Solvable groups - Direct products - Finite abelian groups- Modules.	21	Up to K4	CLO 2
III	Linear Transformations: Canonical forms –Triangular form - Nilpotent transformations	21	Up to K4	CLO 3
IV	Canonical forms – A Decomposition of V - Jordan form - Rational canonical form.	21	Up to K5	CLO 4
V	Trace and transpose - Hermitian, unitary, normal transformations - Real quadratic form.	21	Up to K5	CLO 5

Annexure-1

Book for study:

I.N. Herstein, *Topics in Algebra*, 2nd Edition, John Wiley and Sons, NewYork 1975.

Chapters:

UNIT	CHAPTER(S)	SECTIONS
I	2	2.11 and 2.12 (Omit Lemma 2.12.5)
II	2,4,5	2.13 and 2.14 (Theorem 2.14.1 only), 5.7 (Lemma 5.7.1, Lemma 5.7.2, Theorem 5.7.1), 4.5
III	6	6.4 and 6.5
IV	6	6.6 and 6.7
V	6	6.8, 6.10 and 6.11 (Omit 6.9)

Books for Reference:

1. M.Artin, Algebra, Prentice Hall of India, 1991.
2. P.B.Bhattacharya, S.K.Jain, and S.R.Nagpaul, Basic Abstract Algebra (IIEdition) Cambridge University Press, 1997. (Indian Edition)
3. I.S.Luther and I.B.S.Passi, Algebra, Vol. I –Groups(1996); Vol. II Rings,Narosa Publishing House , New Delhi, 1999
4. D.S.Malik, J.N. Mordeson and M.K.Sen, Fundamental of AbstractAlgebra, McGraw Hill (International Edition), New York. 1997.
5. N.Jacobson, Basic Algebra, Vol. I & II W.H.Freeman (1980); also published by Hindustan Publishing Company, New Delhi.

Web Resources:

1. http://mathforum.org,
2. http://ocw.mit.edu/ocwweb/Mathematics,
3. http://www.opensource.org,
4. www.algebra.com

Pedagogy:

Chalk and Talk, Power point presentations, Group Discussions, Quiz, Assignment and Seminar.

Annexure-1

Rationale for nature of Course:

Knowledge and Skill:

- Acquaintance with the fundamental algebraic structures, namely group, rings and fields, essential for further study of algebra.
- Skill to apply in modern mathematics and other fields.

Activities to be given:

We will be providing students with intellectual problems, theory application problems, group discussion and other practical works and also insist them to check the Books for References and web resources.

Course Learning Outcome (CLOs)

On completion of the course, behind the students would be able to:

CO	Course Outcome	K-level
CO1	Recall basic counting principle, define class equations to solve problems, explain Sylow's theorems and apply the theorem to find number of Sylow subgroups.	Up to K4
CO2	Define Solvable groups, define direct products, examine the properties of finite abelian groups, define modules.	Up to K4
CO3	Define similar Transformations, define invariant subspace, explore the properties of triangular matrix, to find the index of nilpotence to decompose a space into invariantsubspaces, to find invariants of linear transformation, to explore the properties of nilpotent transformation relating nilpotence with invariants.	Up to K4
CO4	Define Jordan, canonical form, Jordan blocks, define rational canonical form, define companion matrix of polynomial, find the elementary devices of transformation,apply the concepts to find characteristic polynomial of linear transformation.	Up to K5
CO5	Define trace, define transpose of a matrix, explain the properties of trace and transpose, to find trace, to find transpose of matrix, to prove Jacobson lemma using the triangular form, define symmetric matrix, skew symmetric matrix, adjoint, to define Hermitian, unitary, normal transformations and to verify whether the transformation in Hermitian, unitary and normal.	Up to K5

K1- Remembering facts with specific answers
K2- Basic understanding of facts.
K3- Application oriented -Solving Problems
K4- Analyzing, examining and making presentations with evidence
K5- Evaluating, making Judgments based on criteria

Annexure-1

Mapping of Course Learning Outcomes (CLOs) with Programme Outcomes (POs)

	PO1	PO2	PO3	PO4	PO5	PO6
CLO1	3	3	1	2	1	3
CLO2	3	2	2	2	1	3
CLO3	3	2	2	2	2	3
CLO4	3	2	2	2	2	3
CLO5	3	3	1	2	2	3

1-Basic Level 2- Intermediate Level 3.AdvancedLevel

Lesson Plan

Unit	Description	Hours	Total Hours	Mode
I	Another Counting Principle	10	21	Chalk & Talk
	Sylow's theorems	11		Chalk & Talk
II	Solvable groups - Direct products	10	21	Chalk & Talk
	Finite abelian groups- Modules	11		Chalk & Talk
III	Linear Transformations: Canonical forms	10	21	PPT, Chalk & Talk
	Triangular form - Nilpotent transformations	11		Seminar
IV	Jordan form	10	21	Chalk & Talk Seminar
	Rational canonical form	11		Chalk & Talk Seminar
V	Trace and transpose - Hermitian, unitary	10	21	Chalk & Talk Seminar
	Normal transformations, real quadratic form	11		Lecture, Quiz
Total			**105**	

Annexure-1

Department of Mathematics						I M.Sc.,		
Sem	Category	Course Code	Course Title	Credits	Contact Hours/week	CIA	SE	Total
1	Core	23OPMA12	Real Analysis I	5	7	25	75	100

Nature of the Course		
Knowledge and Skill Oriented	Employability Oriented	Entrepreneurship oriented

Course Objectives

1. To learn about advanced topics in Riemann's Stieltjes Integrals.
2. To understand the concepts of infinite series and products.

Course Content

Unit	Course Content	105 Hours	K Level	CLO
I	**Functions of bounded variation** - Introduction - Properties of monotonic functions - Functions of bounded variation - Total variation - Additive property of total variation - Total variation on [a, x] as a function of x - Functions of bounded variation expressed as the difference of two increasing functions - Continuous functions of bounded variation. **Infinite Series:** Absolute and conditional convergence - Dirichlet's testand Abel's test - Rearrangement of series - Riemann's theorem on conditionally convergent series.	21	Up toK3	CLO1
II	**The Riemann - Stieltjes Integral** - Introduction - Notation - The definition of the Riemann - Stieltjes integral - Linear Properties - Integration by parts- Change of variable in a Riemann - Stieltjes integral - Reduction to a Riemann Integral – Euler's summation formula - Monotonically increasing integrators, Upper and lower integrals - Additive and linearity properties of upper, lower integrals - Riemann's condition - Comparison theorems.	21	Up toK4	CLO2
III	**The Riemann-Stieltjes Integral** - Sufficient conditions for the existence of Riemann-Stieltjes integrals- Necessary conditions for the existence of RS integrals- Mean value theorems -integrals as a function of the interval – Second fundamental theorem of integral calculus-Change of variable -Second Mean Value Theorem for Riemann integral	21	Up toK4	CLO3
IV	**Sequences of Functions** – Pointwise convergence of sequences of functions - Examples of sequences of real - valued functions – Definition of Uniform Convergence- Uniform convergence and continuity - Cauchy condition for uniform convergence - Uniform convergence of infinite	21	Up toK5	CLO5

	series of functions - Riemann - Stieltjes integration – Sufficient condition for uniform convergence of a series - Mean convergence.			
V	**Power series-**Multiplication of power series-The Substitution Theorem-Reciprocal of a Power series-The Bernstein's Theorem-Abels Limit Theorem-Tauber's Theorem	21	Up toK5	CLO5

Book for study:

Tom M. Apostol : *Mathematical Analysis*, 2nd Edition, Addison-Wesley Publishing Company Inc. New York, 1974.

Chapters:

UNIT	CHAPTER(S)	SECTIONS
I	6,8	6.1 to 6.8 8.8, 8.15, 8.17, 8.18
II	7	7.1 to 7.7 & 7.10 to 7.14
III	7	7.16 to 7.22
IV	9	9.1 to 9.6,9.8,9.11,9.13
V	9	9.14 to 9.17,9.20,9.22,9.23

Books for Reference:

1. Bartle, R.G. *Real Analysis*, John Wiley and Sons Inc., 1976.
2. Rudin,W. *Principles of Mathematical Analysis*, 3rd Edition.McGraw Hill Company, New York, 1976.
3. Malik,S.C. and Savita Arora. *Mathematical Anslysis*, WileyEastern Limited.New Delhi, 1991.
4. Sanjay Arora and Bansi Lal, *Introduction to Real Analysis*, SatyaPrakashan, New Delhi, 1991.
5. Gelbaum, B.R. and J. Olmsted, *Counter Examples in Analysis*,Holden day, San Francisco, 1964.

Web Resources:

1. http://mathforum.org,
2. http://ocw.mit.edu/ocwweb/Mathematics,
3. http://www.opensource.org

Annexure-1

Pedagogy:

- Chalk and Talk, Powerpoint presentations, Group Discussions, Quiz, Assignment and Seminar

Rationale for nature of Course:

Knowledge and Skill:

Demonstrate capacity for mathematical reasoning through analyzing , proving and explaining concepts from Real Analysis and skill to apply for other field in mathematics.

Activities to be given:

We will be providing students with intellectual problems, theory application problems, group discussion and other practical works and also insist them to check the books for references and web resources.

Course Learning Outcome (CLOs)

On completion of the course, behind the students would be able to:

CLO	Course Learning Outcomes	Knowledge Level (According to Bloom's Taxonomy)
CLO1	Know how continuity of derivatives are generalized from real line	Up to K3
CLO2	Determine the Riemann-stieltjes integrability of a function ,prove a selection of theorems and concerning integration.	Up to K4
CLO3	Illustrate the effect of uniform convergence in the limit function with respect to continuity, differentiability and integrability.	Up to K4
CLO4	To be able to understand the concept of integration of differential forms.	Up to K5
CLO5	To be able to differentiate and integrate power series to obtain new ways to represent functions.	Up to K5

K1- Remembering facts with specific answers
K2- Basic understanding of facts.
K3- Application oriented
K4- Analyzing, examining and making presentations with evidence.
K5- Evaluating, making Judgments based on criteria

Annexure-1

Mapping of Course Learning Outcomes (CLOs) with Programme Outcomes (POs)

	PO1	PO2	PO3	PO4	PO5	PO6
CLO1	3	3	1	1	3	3
CLO2	3	3	2	2	1	3
CLO3	3	3	2	2	2	3
CLO4	3	2	2	2	1	3
CLO5	3	3	2	2	1	3

1-Basic Level 2- Intermediate Level 3- Advanced Level

Annexure-1

Lesson Plan

Unit	Description	105 Hours		Mode
I	Introduction - Properties of monotonic functions Functions of bounded variation – Totalvariation - Additive property of total variation – Total variation on [a, x] as afunction of x - Functions of bounded variation expressed as the difference of twoincreasing functions - Continuousfunctions of bounded variation	11	21	Chalk & Talk
	Absolute and conditional convergence Dirichlet's test and Abel's test -Rearrangement of series Riemann's theorem on conditionallyconvergent series	10		Chalk & Talk
II	Linear Properties - Integration by parts-Change of variable in a Riemann - Stieltjes integral -Reduction to a Riemann Integral – Euler's summation formula - Monotonically increasing integrators,Upper and lower integrals	11		Chalk & Talk
	Monotonically increasing integrators,Upper and lower integrals -Additive and linearity properties of upper, lower integrals - Riemann's condition - Comparisontheorems.	10	21	Chalk & Talk
III	Change of variable -Second Mean ValueTheorem for Riemann integral - Lebesgue criteria on for existence of Riemann integrals	10	21	PPT, Chalk & Talk
	Sufficient conditions for the existence of Riemann-Stieltjes integrals- Necessary conditions for the existence of RS Integrals - Mean value theorems -integrals as afunction of the interval – Second fundamental theorem of integral calculus	11		Seminar
IV	Pointwise convergence of sequences of functions - Examples of sequences of real - valued functions Uniform convergence and continuity -Cauchy condition for uniform convergence – Uniform convergence of infinite seriesof functions	10	21	Chalk & Talk Seminar
	Riemann - Stieltjes integration – Non- uniform Convergence and Term-by-term Integration Uniform convergence and differentiation Sufficient condition for uniform convergence of a series - Mean convergence.	11		Chalk & Talk Seminar
V	Multiplication of series – Cesarosummability Infinite products. Multiplication of power series TheTaylor's series generated by a function Bernstein's theorem -	11	21	Chalk & Talk Seminar
	Abel's limit theorem -Tauber's theorem	10		Lecture, Quiz
	Total		**105**	

Annexure-1

Department of Mathematics						I M.Sc.,		
Sem	Category	Course Code	Course Title	Credits	Contact Hours/week	CIA	SE	Total
1	Core	23OPMA13	Ordinary Differential Equations	4	6	25	75	100

Nature of the Course		
Knowledge and Skill Oriented	Employability Oriented	Entrepreneurship oriented

Course Objectives:

- Develop strong background on finding solutions to linear differential equations with constant and variable coefficients and also with singular points.
- Study the existence and uniqueness of the solutions of first orderdifferential equations.
- To solve the second order and *n-th* order Initial value problems.
- Introduce the students to the technique of solving various problems of engineering and science.
- Study the concepts relating to the order and linearity of ODEs,analytic and computational solution methods for ODEs

Course Content:

Unit	Course Content	90 Hours	K Level	CLO
I	**Linear equations with constant coefficients:** Introduction - **The** Second order homogeneous equation -Initial value problems for second order equations -Linear dependence and independence- A formula for the Wronskian - The Non-homogeneous equation of order two.	18	Up toK4	CLO1
II	**Linear equations with constant coefficients:** The Homogeneous equation of order n - Initial value problems for n^{th} order equations – Equations with real constants – The non-homogeneous equation of order n – A special method for solving the non- homogeneous equation - Algebra of constant coefficient operators.	18	Up toK4	CLO2
III	**Linear equation with variable coefficients:** Introduction - Initial value problems for the homogeneous equation.- Solutions of the homogeneous equation.– The Wronskian and linear independence– Reduction of the order of a homogeneous equation – The non-homogeneous equation.- Homogeneous equations with analytic coefficients-The Legendre equation.	18	Up toK4	CLO3
IV	**Linear equation with regular singular points:** Introduction – The Euler equation – Second order equations with regular singular points – an example – Second order equations with regular singular points – the general case – The Bessel Equation – The Bessel Equation (continued) .	18	Up toK5	CLO4

V	**Existence and uniqueness of solutions to first order equations:** Introduction - Equation with variables separated – Exact equations – method of successive approximations – The Lipschitz condition – convergence of the successive approximations.	18	Up toK5	CLO5

Book for study:

E.A.Coddington, *A introduction to ordinary differential equations* (3rdPrinting) Prentice-Hall of India Ltd., New Delhi, 1987.

Chapters:

UNIT	CHAPTER(S)	SECTIONS
I	2	1 to 6
II	2	7 to 12.
III	3	1 to 8
IV	4	1 to 4, 7 & 8
V	5	1 to 6

Books for Reference:

1. Williams E. Boyce and Richard C. DI Prima, *Elementary differential equations and boundary value problems*, John Wiley and sons, New York,1967.
2. George F Simmons, *Differential equations with applications and historical notes*, Tata McGraw Hill, New Delhi, 1974.
3. N.N. Lebedev, *Special functions and their applications*, Prentice Hallof India, New Delhi, 1965.
4. W.T. Reid. *Ordinary Differential Equations*, John Wiley and Sons,New York, 1971
5. M.D.Raisinghania, *Advanced Differential Equations*, S.Chand &Company Ltd. New Delhi 2001
6. B.Rai, D.P.Choudary and H.I. Freedman, *A Course in OrdinaryDifferential Equations*, Narosa Publishing House, New Delhi, 2002.

Web Resources:

1. http://mathforum.org, http://ocw.mit.edu/ocwweb/Mathematics,
2. http://www.opensource.org, www.mathpages.com

Pedagogy:

- Chalk and Talk, Powerpoint presentations, Group Discussions, Quiz, Assignment and Seminar

Annexure-1

Activities to be given:

We will be providing students with intellectual problems, theory application problems, group discussion and other practical works and also insist them to check the books for references and web resources.

Course Learning Outcome (CLOs)

On completion of the course, behind the students would be able to:

CLO	Course Learning Outcomes	Knowledge Level (According to Bloom's Taxonomy)
CLO1	Obtain the solutions of second order homogenous and non-homogenous linear differential equation with constant coefficients and understand the utility of Wronskian, linear independence and linear independence solutions.	Up to K4
CLO2	Understand the concepts regular singular points and solve the Bessel equation.	Up to K4
CLO3	Understand the concept of successive approximation, the Lipchitz condition and prove local and Non-local existence theorems	Up to K4
CLO4	Classify first order partial differential equations and their solutions and solve those using different methods.	Up to K5
CLO5	Solve the first order linear and nonlinear PDE's by using charpits and Jacobi's method respectively.	Up to K5

K1- Remembering facts with specific answers
K2- Basic understanding of facts.
K3- Application oriented
K4- Analyzing, examining and making presentations with evidence.
K5- Evaluating, making Judgments based on criteria

Mapping of Course Learning Outcomes (CLOs) with Programme Outcomes (POs)

	PO1	PO2	PO3	PO4	PO5	PO6
CLO1	3	3	1	1	3	3
CLO2	3	3	2	2	1	3
CLO3	3	3	2	2	2	3
CLO4	3	2	2	2	1	3
CLO5	3	3	2	2	1	3

1-Basic Level 2- Intermediate Level 3- Advanced Level

Annexure-1

Lesson Plan

Units	Description	90 Hours		Mode
I	Introduction	2	18	Lecture
	Second order homogeneous equations	2		Lecture
	Initial value problem for second order equations	2		Lecture & PPT
	Linear dependence and independence	2		Lecture
	Problems on Linear dependence and independence	2		Lecture
	A formula for Wronskian	4		Lecture& Group Discussion
	The Non-Homogeneous equations of order two	4		Lecture
II	The Homogeneous equation of order n.	5	18	Lecture& Seminar
	Initial valueproblems for n^{th} order equations .	2		Lecture
	Equations with real constants .	2		Lecture & PPT
	The non-homogeneous equation of order n.	5		Lecture
	A special methods for solving the non homogeneous equation	2		Lecture& Seminar
	Algebra of constant coefficient operators.	2		Lecture& Seminar
III	Initial value problems for the homogeneous equation.	3	18	Lecture
	Solutions of the homogeneous equation.	3		Lecture & PPT
	The Wronskian and linear independence	3		Lecture
	Reduction of the order of a homogeneous equation	3		Lecture
	The non-homogeneous equation.	3		Lecture & Seminar
	Homogeneous equations with analytic coefficients	3		Lecture & Group Discussion
	The Legendre equations.	2		
IV	The Euler equations	6	18	Lecture
	Second order equations with Regular singular points	2		Lecture
	Exceptional cases	3		Lecture & Seminar
	The Bessel equation	3		Lecture
	The Bessel equation continued.	2		Lecture & PPT
V	Equations with variable separated	2		Lecture
	Exact equations	3	18	Lecture & Seminar
	The method of successive approximation	3		Lecture
	The Lipschitz condition	3		Lecture & PPT
	Convergence of successive approximation	3		Assignment
	Non-local existence of solutions.	3		Lecture & Group Discussion
	Approximations to and uniqueness of solutions.	3		Lecture
	Total		**90**	

Annexure-1

Department of Mathematics						I M.Sc.,		
Sem	Category	Course Code	Course Title	Credits	Contact Hours/week	CIA	SE	Total
1	DSEC	23OPMADSE1A	Number Theory And Cryptography	3	5	25	75	100

Nature of the Course		
Knowledge and Skill Oriented	Employability Oriented	Entrepreneurship oriented

Course Objectives:

To provide an introduction to analytic number theory and recent topics or Cryptography with applications

Course Content:

Unit	Course Content	75 Hours	K Level	CLO
I	Introduction –Conjectures - Well Ordering and Induction – Sigma notation and product notation - Binomial Coefficients – Greatest Integer functions – Divisibility – Greatest Common Divisor (GCD) – Euclid Algorithm.	15	Up toK4	CLO1
II	Introduction – primes counting function – prime number theorem –canonical factorization – fundamental theorem of arithmetic – Seive of Eratosthenes – Determining factorization	15	Up toK4	CLO2
III	Congruence – equivalence relations- linear congruences – linear Diophantine equations and Chinese remainder theorem – Polynomial Congruences – modular arithmetic and Fermat's theorem – Wilson's theorem and Fermat number	15	Up toK4	CLO3
IV	Arithmetic functions – Sigma function - tau functions – Dirichlet product – quadratic reisdues and Legendre symbols .	15	Up toK5	CLO4
V	Cryptography: Introduction – Character Ciphers – Block Ciphers – One time Pods – Public – Key Cryptography	15	Up toK5	CLO5

Books for study:

Neville Robbins; *Beginning Number Theory*, Second Edition, Narosa, 2006

Annexure-1

Chapters:

UNIT	CHAPTER(S)	SECTIONS
I	1,2	1.1 - 1.6 & 2.2
II	3	3.1- 3.3
III	4	4.2- 4.7
IV	5, 7	5.1-5.2 & 7.2
V	12	12.1 - 12.5

Books for Reference:

1. Tom Apostol, Introduction to Analytic Number theory, Narosa Publications, New Delhi
2. Neal Koblitz, A Course in Number Theory and Cryptography,Springer-Verlag, New York,1987.
3. David M.Burton, Elementary Number Theory, Wm.C.Brown Publishers, Dubuque, Iowa, 1989.

Web Resources:

1. http://mathforum.org,
2. http://ocw.mit.edu/ocwweb/Mathematics,
3. http://www.opensource.org,
4. https://onlinecourses.nptel.ac.in/noc20_ma42/preview

Pedagogy:

- Chalk and Talk, Powerpoint presentations, Group Discussions, Quiz, Assignment and Seminar

Activities to be given:

We will be providing students with intellectual problems, theory application problems, group discussion and other practical works and also insist them to check the books for references and web resources.

Course Learning Outcome (CLOs)

On completion of the course, behind the students would be able to:

Annexure-1

No.	Course Learning Outcomes	Knowledge Level (According to Bloom's Taxonomy)
CLO1	Understand the properties of divisibility and congruence.	Up to K4
CLO2	Use arithmetic functions in area of mathematics	Up to K4
CLO3	Understand and use the theorems ,Chinese reminder theorem and Lagrange's theorem	Up to K4
CLO4	Know the applications of reciprocity law and Diophantine equation	Up to K5
CLO5	Apply elementary number theory concepts in cryptography.	Up to K5

K1- Remembering facts with specific answers
K2- Basic understanding of facts.
K3- Application oriented
K4- Analyzing, examining and making presentations with evidence.
K5- Evaluating, making Judgments based on criteria

Mapping of Course Learning Outcomes (CLOs) with Programme Outcomes (POs)

	PO1	PO2	PO3	PO4	PO5	PO6
CLO1	3	3	1	1	3	3
CLO2	3	3	2	2	1	3
CLO3	3	3	2	2	2	3
CLO4	3	2	2	2	1	3
CLO5	3	3	2	2	1	3

1-Basic Level 2- Intermediate Level 3- Advanced Level

Annexure-1

Lesson Plan:

UNIT	DESCRIPTION	75 Hours		PEDAGOGY
I	Divisibility - Division algorithm	2	15	Chalk and Talk, Problem Solving, Tutorial
	GCD, Euclidean algorithm	2		
	LCM and Properties	2		
	Congruence's - Euler's Theorem	2		
	Fermat's theorem – Wilson's theorem	3		
	Solutions of congruence's – The Chinese Remainder Theorem	4		
II	Quadratic residues – Lemma of Gauss	8	15	Chalk and Talk, Problem Solving, Tutorial
	Gaussian reciprocity law – Jacobi symbol.	7		
III	Greatest integer function	5	15	Chalk and Talk, Problem Solving,quiz
	Arithmetic functions	5		
	The Moebius Inversion formula	5		
IV	Diophantine Equation – The linear equation – Pythagorean Triangle	8	15	Chalk and Talk, Problem Solving
	The equation x^2 y^2 z^2	7		
V	Discrete logarithm– Principles of public key	5	15	Chalk and Talk, Problem Solving
	Cryptosystem – RSA algorithm	5		
	Elliptic curve cryptography.	5		
	Total		**75**	

Annexure-1

I M.Sc.,								
Sem	Category	Course Code	Course Title	Credits	Contact Hours/week	CIA	SE	Total
1	DSEC	23OPMADSE1C	Mathematical Programming	3	5	25	75	100

Nature of the Course		
Knowledge and Skill Oriented	Employability Oriented	Entrepreneurship oriented

Course Objectives:

- To introduce the Revised simplex method and to make them performparametric analysis.
- To make them understand the limitations of simplex method in derivinginteger solution to linear programming problems.
- To illustrate various dynamic programming models and theirapplications in solving a decision-problem.
- To introduce the concept of classical optimization techniques.
- To appreciate the use of some of the non-linear programming techniques such as quadratic and separable programming.

Course Content:

Unit	Course Content	75 Hours	K Level	CLO
I	**Network Models:** Network Definitions – Minimal Spanning tree Algorithm – Shortest Route Problem – Examples of the Shortest Route Applications – Shortest Route Algorithms – Maximal flow Model – Maximum flow algorithm - CPM – PERT – CPM Computations – Construction of the Time Schedule.	15	Up toK3	CLO1
II	**Deterministic Inventory Models:** General Inventory Model - Role of demand in the development of Inventory models - Static Economic order Quantity EOQ Models – Classic EOQ Model – EOQ Problems with Price Breaks – Multiitem EOQ with storage limitation- Dynamic EOQ models – No- Setup model – Set up model	15	Up toK4	CLO2
III	**Queuing Systems:** Elements of Queuing model - Role of Exponential Distribution – Pure Birth and Death Models – Pure Birth models _ Pure Death Model – Generalized poisson Queuing model – Specialized poisson Queues – Steady State Measures of Performance – Single Server Models – Multiple server models – Machine Servicing Model (M/M/R) (GD/K/K); R<K	15	Up toK4	CLO3

Annexure-1

IV	**Classical Optimization Theory:** Unconstrained Problems: Necessaryand Sufficient Conditions – The Newton-Raphson Method – Constrained Problems: Equality Constraints – Inequality Constraints (Karush-Kuhn-Tucker Conditions)	15	Up toK5	CL O4
V	**Nonlinear Programming Algorithms:** Unconstrained Algorithms: Direct search method – Gradient method – Constrained Algorithms: Separable Programming – Quadratic Programming.	15	Up toK5	CL O5

Book for study:

Hamdy A. Taha, *Operations Research*, (Seventh edition) Pearson Prentice Hall of India Private Limited, New Delhi, 1997.

Chapters:

UNIT	CHAPTER(S)	SECTIONS
I	6	6.1,6.2, 6.3 – 6.3.1, 6.3.2, 6.4 – 6.4.2, 6.5 – 6.5.1,6.5.2,6.5.3
II	11	11.1, 11.2, 11.3 – 11.3.1, 11.3.2, 11.3.3 11.4 – 11.4.1, 11.4.2
III	15	15.2, 15.3, 15.4- 15.4.1,15.4.2 15.5,15.6 – 15.6.1, 15.6.2,15.6.3, 15.6.4
IV	18	18.1- 18.1.1, 18.1.2 18.2- 18.2.1, 18.2.2
V	19	19.1 – 19.1.1, 19.1.2 19.2 – 19.2.1, 19.2.2

Books for Reference:

1. J.K.Sharma, *Operations Research Theory and Applications* (Fourth Edition),Macmillan India Ltd, New Delhi, 2009.
2. F.S. Hillier & J.Lieberman *Introduction to Operation Research* (7th Edition)Tata McGraw Hill Company, New Delhi, 2001.
3. Beightler. C, D.Phillips, B. Wilde, *Foundations of Optimization* (2nd Edition)Prentice Hall Pvt Ltd., New York, 1979
4. S.S. Rao, *Optimization Theory and Applications*, Wiley Eastern Ltd. New Delhi. 1990

Web Resources:

1. https://web.mit.edu/15.053/www/AppliedMathematicalProgramming.pdf
2. http://www.dl.behinehyab.com/Ebooks/LP/LP015_800845_www.behinehyab.com.pdf
3. https://coral.ise.lehigh.edu/~ted/teaching/ie406/

Annexure-1

Pedagogy:

- Chalk and Talk, Powerpoint presentations, Group Discussions, Quiz, Assignment and Semina

Activities to be given:

We will be providing students with intellectual problems, theory application problems, group discussion and other practical works and also insist them to check the books for references and web resources.

Course Learning Outcome (CLOs)

On completion of the course, behind the students would be able to:

CLO	Course Learning Outcomes	Knowledge Level (According to Bloom's Taxonomy)
CLO1	Know how Feasibility conditions Parametric changes in ***c***, Parametric changes in b	Up to K3
CLO2	Determine the Then Constraints – Integer Programming Algorithms Traveling Salesperson Problem	Up to K4
CLO3	Illustrate the effect of Dynamic Programming Applications Inventory Model	Up to K4
CLO4	To be able to Unconstrained Problems: Necessary and Sufficient Conditions – The Newton-Raphson Method	Up to K5
CLO5	To be able to understand the concept of Separable Programming – Quadratic Programming	Up to K5

K1- Remembering facts with specific answers
K2- Basic understanding of facts.
K3- Application oriented
K4- Analyzing, examining and making presentations with evidence.
K5- Evaluating, making Judgments based on criteria

Mapping of Course Learning Outcomes (CLOs) with Programme Outcomes (POs)

	PO1	PO2	PO3	PO4	PO5	PO6
CLO1	3	3	1	1	3	3
CLO2	3	3	2	2	1	3
CLO3	3	3	2	2	2	3
CLO4	3	2	2	2	1	3
CLO5	3	3	2	2	1	3

1-Basic Level 2- Intermediate Level 3- Advanced Level

Annexure-1

Lesson Plan

Unit	Description	75 Hours		Mode
I	Network Definitions - Minimal Spanning tree Algorithm – Shortest Route Problem	2	**15**	Lecture, Discussion, Tutorial, Quiz
	Examples of the Shortest Route Applications	5		
	Shortest Route Algorithms – Maximal flow Model – Maximum flow algorithm	4		
	CPM – PERT – CPM Computations – Construction of the Time Schedule.	4		
II	General Inventory Model - Role of demand in the development of Inventory models	4	**15**	Lecture, Quiz Group Discussion, Tutorial
	Static Economic order Quantity EOQ Models	4		
	Classic EOQ Model – EOQ Problems with Price Breaks – Multi item EOQ with storage limitation	4		
	Dynamic EOQ models – No- Setup model – Set up model	3		
III	Elements of Queuing model - Role of Exponential Distribution	2	**15**	PPT, Lecture,Quiz, Tutorial
	Pure Birth and Death Models – Pure Birth models _ Pure Death Model	3		
	Generalized poisson Queuing model – Specialized poisson Queues	2		
	Steady State Measures of Performance – Single Server Models – Multiple server models	5		
	Machine Servicing Model (M/M/R) (GD/K/K); R<K	3		
IV			**15**	PPT, Lecture
	Unconstrained Problems: Necessary and Sufficient Conditions Equality Constraints –	5		
	The Newton-Raphson Method – Constrained Problems:	2		
	Inequality Constraints (Karush-Kuhn-Tucker Conditions)	8		
V	Unconstrained Algorithms: Direct search method –Constrained Algorithms:–	5	**15**	Assignment, Seminar
	Gradient method	3		
	Separable Programming	5		
	Quadratic Programming.	2		
	Total		**75**	

Annexure-1

Department of Mathematics						I M.Sc.,		
Sem	Category	Course Code	Course Title	Credits	Contact Hours/week	CIA	SE	Total
1	DSEC	23OPMADSE1B	Graph Theory and its Applications	3	5	25	75	100

Nature of the Course		
Knowledge and Skill Oriented	Employability Oriented	Entrepreneurship oriented

Course Objectives:

- To enable the students to apply Graph Theritical Techniques in Applications.
- To demonstrate knowledge of Connectivity.
- To study relationship between Euler Tours and Hamilton Cycles.
- To make familiarity with Directed Graphs.
- To assist the students to explore social network analysis software.

Course Content:

Unit	Course Content	75 Hours	K Level	CLO
I	**Graphs and Subgraphs** Definition and Examples of a Graph – Simple Graphs - Graphs Isomorphism- The Incidence and Adjacency Matrices - Subgraphs – Vertex Degrees – Paths and Connection– Cycles - Trees - Cut Edges and Bonds – Cut Vertices – Cayley's Formula(Applications) -The Connector Problem.	15	Up to K4	CLO1
II	**Connectivity** Connectivity – Blocks (Applications) - Construction of Reliable Communication Networks	15	Up to K4	CLO2
III	**Euler Tours and Hamilton Cycles** Euler Tours - Hamilton Cycles (Applications) - The Chinese Postman Problem – The Travelling Salesman Problem.	15	Up to K4	CLO3
IV	**Directed Graphs** Directed Graphs - Directed Paths - Directed Cycles (Applications) – A Job sequencing Problem - Designing an Efficient Computer Drum - Making a Road System One–way - Ranking the Participants in Tournament.	15	Up to K5	CLO4
V	**Networks** Flows-Cuts-The Max-Flow Min-Cut Theorem (Applications)–Menger's Theorems - Feasible Flows	15	Up to K5	CLO5

Annexure-1

Book for study:

J.A. Bondy and U.S.R. Murty.(1982), *Graph Theory with Applications*. 5th print,North Holland .

Chapters:

UNIT	CHAPTER(S)	SECTIONS
I	1and 2	1.1 to 1.7 &2.1 to 2.5
II	3	3.1 to 3.3
III	4	4.1 to 4.4
IV	10	10.1 to 10.7
V	11	11.1 to 11.5

Books for Reference:

1. John Clark. Derek Allan Holton. *Graph Theory*. University of Otago (1995).
2. Frank Harary, (1969), *Graph theory*, Addition-Wesley Publishing Company , First Edition.
3. Murugan.M.,(2003),*Topics in Graph theory and Algorithms*, Muthal Publishing House,
4. S.A. Choudum. *A First Course in Graph Theory*.Macmillan Publishers India Limited (2011).
5. Narasing Deo (2007), *Graph Theory with Applications to Engineering and Computer science*,Pretice .

Web Resources:

1. https://www.shahucollegelatur.org.in/Department/Studymaterial/sci/it/BCS/FY/book.pdf
2. https://www.flowsurfv3.net/c.php?cu=https%253A%252F%252Fwww.shahucollegelatur.org.in%252FDepartment%252FStudymaterial%252Fsci%252Fit%252FBCS%252FFY%252Fbook.pdf&sh=www.shahucollegelatur.org.in%2F...%2Fit%2FBCS%2FFY%2Fbook.pdf&l=IN&po=2&u=mbeh-20210420-ccmnet-flga33&a=3100&tr=1712umd71g10&keyword=Graph%2Btheory%2Bwith%2Bapplication%2Bpdf&aid=61a88bda894f1&t=8&bc=0&rt=1638435802.1301&n=3&loc=normal

E – Books:

1. http://www.freebookcentre.net/maths-books-download/Descriptive-Complexity,-Canonisation and-Definable-Graph-Structure-Theory.html
2. https://www.maths.ed.ac.uk/~v1ranick/papers/wilsongraph.pdf

Pedagogy:

Chalk and Talk, Group Discussions, Quiz, Assignment and Seminar

Rationale for nature of Course: Knowledge and Skill:

Provides a helpful tool to quantity & simplify the many moving parts of dynamic systems

Annexure-1

Activities to be given:

Tocreate social graphs for their own social networks. Group Discussion, Seminar & Project

Course Learning Outcome (CLOs)

On completion of the course, behind the students would be able to:

CLO	Course Learning Outcomes	Knowledge Level (According to Bloom's Taxonomy)
CLO1	Examine the Graphs and Subgraphs .	Up to K4
CLO2	Understand the Connectivity	Up to K4
CLO3	Investigating the relationship between Euler Tours and Hamilton Cycles.	Up to K4
CLO4	Explain the Directed Graphs.	Up to K5
CLO5	Compute the Analysis of Networks.	Up to K5

K1- Remembering facts with specific answers

K2- Basic understanding of facts.

K3- Application oriented

K4- Analyzing, examining and making presentations with evidence.

K5- Evaluating, making Judgments based on criteria

Mapping of Course Learning Outcomes (CLOs) with Programme Outcomes (POs)

	PO1	PO2	PO3	PO4	PO5	PO6
CLO1	3	2	3	3	2	3
CLO2	3	3	3	2	3	3
CLO3	3	2	2	3	3	3
CLO4	3	3	2	2	3	3
CLO5	3	2	3	2	2	3

1-Basic Level 2- Intermediate Level 3- Advanced Level

Annexure-1

Lesson Plan

Unit	Course Content	75 Hours		Mode of Teaching
I	Definition and Examples of a Graph – Simple Graphs - Graphs Isomorphism- The Incidence and Adjacency Matrices – Subgraphs.	5	15	Chalk & Talk, Quiz, Exercise
	Vertex Degrees – Paths and Connection–Cycles	5		
	Trees - Cut Edges and Bonds – Cut Vertices – Cayley's Formula (Applications) -The Connector Problem.	5		
II	Connectivity.	5	15	Chalk & Talk, PPTs, Quiz, Exercise
	Blocks (Applications).	5		
	Construction of Reliable Communication Networks.	5		
III	Euler Tours and Hamilton Cycles.	5	15	Chalk & Talk, PPTs, Exercise, Quiz
	The Chinese Postman Problem.	5		
	' The Travelling Salesman Problem.	5		
IV	Directed Graphs - Directed Paths - Directed Cycles (Applications)	5	15	Chalk & Talk, Exercise PPTs, Quiz, seminar
	A Job sequencing Problem-Designing an Efficient Computer Drum	5		
	Making a Road System One–way Ranking the Participants in Tournament..	5		
	Flows-Cuts-The Max-Flow Min-Cut Theorem (Applications).	5	15	Chalk & Talk, Exercise Quiz Assignment PPTs, seminar
	Menger's Theorems	5		
	Feasible Flows.	5		
	Total		**75**	

Annexure-1

Department of Mathematics						I M.Sc.,		
Sem	Category	Course Code	Course Title	Credits	Contact Hours/week	CIA	SE	Total
1	DSEC	23OPMADSE1D	Fuzzy Sets and their Applications	3	5	25	75	100

Nature of the Course		
Knowledge and Skill Oriented	Employability Oriented	Entrepreneurship oriented

Course Objectives:

1. To understand fundamental of fuzzy set.
2. To learn fuzzy set, Arithmetic operation on fuzzy set.
3. To understand fuzzy notation
4. To know about fuzzy relation.
5. To apply fuzzy logic in real world problem.

Course Content:

Unit	Course Content	75Hours	K-Level	CLO
I	Introduction ,Crisp Sets: An Overview, The Notation of Fuzzy Sets, Basic Concepts of Fuzzy Sets, Classical Logic: An Overview, Fuzzy Logic	15	Up to K4	CLO1
II	General Discussion, Fuzzy Complement, Fuzzy Union, Fuzzy Intersection, Combinations of Operations, General Aggregation Operations.	15	Up to K4	CLO2
III	Crisp and Fuzzy Relations, Binary Relations, Binary Relations On a Single Set, Equivalence and Similarity Relations.	15	Up to K4	CLO3
IV	Compatibility or Tolerance Relations, Orderings	15	Up to K5	CLO4
V	Morphisms, Fuzzy Relation Equations	15	Up to K5	CLO5

Book for Study:

Fuzzy Sets, Uncertainty and Information, George J.Klir,Tina A. Folger.

Annexure-1

Chapters:

UNIT	CHAPTER(S)	SECTIONS
I	1	1.1 to 1.6
II	2	2.1 to 2.6
III	3	3.1 to 3.4
IV	3	3.5 & 3.6
V	3	3.7 & 3.8

Books for Reference:

1) Bhargava A.K *Fuzzy Set Theory Fuzzy Logic and Their Applications,* S.Chand& Company Pvt. Ltd.2013.
2) Chennakesava,R.Alavala, *Fuzzy Logic and Neural Network Basic Concepts& Applications,* New Age International Publishers 2008.
3) George J.Klir and Boyuan, *Fuzzy sets Fuzzy Logic, Theory and Applications,* Prentice Hall of India , 2002.
4) George Bojadziev and Maria Bojadziev, *Fuzzy Sets, Fuzzy Logic, Applications*, 1996.
5) Bhargava A.K.*Fuzzy Set Theory Fuzzy Logic and their Applications*, 2013.

Web Resources :

1.https://cours.etsmtl.ca/sys843/REFS/Books/ZimmermannFuzzySetTheory2001.pdf
2. https://link.springer.com/book/10.1007/978-3-642-35221-8
3. https://www.b-farhadinia.ir/bfarhadiadmin/file/stdfile/Klir.pdf

E-books :

1. https://bookauthority.org/books/beginner-fuzzy-logic-ebooks
2. https://www.phindia.com/Books/ShowBooks/NzI/Fuzzy-Sets-and-Fuzzy-Logic
3. https://onlinelibrary.wiley.com/doi/book/10.1002/9781119193210

Pedagogy :

Chalk and Talk, Group Discussion, Student Seminar, Spot Test, Assignments, Quiz.

Rationale for Nature of the Course:

Knowledge and Skill

To understand the concept of fuzzy and its application in various field

Annexure-1

Activities to be given:

We will be providing students with intellectual problems, theory application problems, group discussion and other practical works and also insist them to check the Books for References and web resource

Course Learning Outcomes (CLO):

On successful Completion of the course Students will be able to

CLO	Course Learning Outcomes	Knowledge Level (According to Bloom's Taxonomy)
CLO1	Understand to Examine the Basic Concepts of Crisp sets and Fuzzy sets	Up to K4
CLO2	Describe Fuzzy Operations	Up to K4
CLO3	Understand the concept of Fuzzy Arithmetic	Up to K4
CLO4	Determine the difference between Crisp and Fuzzy Relation	Up to K5
CLO5	Use Fuzzy Relation as tools to Visualize and Simplify	Up to K5

K1- Remembering and recalling facts with specific answers
K2- Basic understanding of facts and stating main ideas with general answers
K3– Application oriented – Solving Problems
K4 –Examining, analyzing, presentation and make inferences with evidences
K5- Evaluating, making Judgments based on criteria

Mapping of Course Learning Outcome(CLOs) with Program Outcomes(Pos)

CLOs	PO1	PO2	PO3	PO4	PO5	PO6
CLO1	2	2	3	2	2	3
CLO2	1	2	3	2	2	3
CLO3	2	3	2	2	2	1
CLO4	2	2	3	2	2	2
CLO5	2	2	3	2	2	3

1 – Basic Level **2 – Intermediate Level** **3- Advance Level**

Annexure-1

Lesson Plan:

Units	Course Contents	75 Hours		Mode of Teaching
I	Introduction , Crisp Sets An Overview: The Notation of Fuzzy Sets. Basic Concepts: Fuzzy Sets, Classical Logic: An Overview, Fuzzy Logic.	5 5 5	15	Chalk & Talk
II	General Discussion, Fuzzy Complement, Fuzzy Union , Fuzzy Intersection Fuzzy Intersection, Combinations of Operations Combinations of Operations, General Aggregation Operations.	5 10	15	Chalk & Talk
III	Crisp and Fuzzy Relations Relations, Binary Relations On a Single Set Equivalence and Similarity Relations	5 5 5	15	Chalk & Talk, Spot Test Group Discussion
IV	Compatibility Tolerance Relations Orderings	5 5 5	15	Chalk & Talk
V	Morphisms Fuzzy Relation and Equation	10 5	15	Chalk & Talk Students Seminar
	Total		**75**	

Annexure-1

Department of Mathematics						I M.Sc.,		
Sem	Category	Course Code	Course Title	Credits	Contact Hours/week	CIA	SE	Total
2	Core	23OPMA21	Advanced Algebra	5	6	25	75	100

Nature of the Course		
Knowledge and Skill Oriented	Employability Oriented	Entrepreneurship oriented

Course Objectives:

- To study field extension, roots of polynomials, Galois Theory, finite fields, division rings, solvability by radicals and to develop computational skill inabstract algebra.

Course Content:

Unit	Course Content	90 Hours	K Level	CLO
I	Extension fields – Transcendence of e.	18	Up toK3	CLO1
II	Roots of Polynomials - More about roots	18	Up toK4	CLO2
III	Elements of Galois theory	18	Up toK4	CLO3
IV	Finite fields - Wedderburn's theorem on finite division rings.	18	Up toK5	CLO4
V	Solvability by radicals - A theorem of Frobenius - Integral Quaternions and the Four - Square theorem.	18	Up toK5	CLO5

Book for study:

I.N. Herstein. Topics in Algebra (II Edition) Wiley Eastern Limited, New Delhi, 1975.

Annexure-1

Chapters:

UNIT	CHAPTER(S)	SECTIONS
I	5	5.1 and 5.2
II	5	5.3 and 5.5
III	5	5.6
IV	7	7.1 and 7.2
V	5, 7	5.7 7.3 and 7.4

Books for Reference:

1. M.Artin, Algebra, Prentice Hall of India, 1991.
2. P.B.Bhattacharya, S.K.Jain, and S.R.Nagpaul, Basic Abstract Algebra (IIEdition) Cambridge University Press, 1997. (Indian Edition)
3. I.S.Luther and I.B.S.Passi, Algebra, Vol. I –Groups(1996); Vol. II Rings,Narosa Publishing House , New Delhi, 1999
4. D.S.Malik, J.N. Mordeson and M.K.Sen, Fundamental of AbstractAlgebra, McGraw Hill (International Edition), New York. 1997.
5. N.Jacobson, Basic Algebra, Vol. I & II Hindustan Publishing Company, New Delhi.

Web Resources:

1. http://mathforum.org,
2. http://ocw.mit.edu/ocwweb/Mathematics,
3. http://www.opensource.org, www.algebra.com

Pedagogy:

- Chalk and Talk, Powerpoint presentations, Group Discussions, Quiz, Assignment and Seminar

Activities to be given:

We will be providing students with intellectual problems, theory application problems, group discussion and other practical works and also insist them to check the books for references and web resources.

Annexure-1

Course Learning Outcome (CLOs)

On completion of the course, behind the students would be able to:

CO	Course Outcome	K-level
CO1	Use the concept of extension fields and prove theorems applying algebraic ways of thinking.	Up to K3
CO2	Examine splitting field in rational fields, extension fields, splitting fields and understand the idea of roots of polynomials.	Up to K4
CO3	Compose clear and accurate proofs using the concepts of Galois Theory.	Up to K4
CO4	Bring out insight into Abstract Algebra with focus on axiomatic theories.	Up to K5
CO5	Demonstrate knowledge and understanding of fundamental concepts includingextension fields, Algebraic extensions and Finite fields.	Up to K5

K1- Remembering facts with specific answers
K2- Basic understanding of facts.
K3- Application oriented
K4- Analyzing, examining and making presentations with evidence.
K5- Evaluating, making Judgments based on criteria

Mapping of Course Learning Outcomes (CLOs) with Programme Outcomes (POs)

	PO1	PO2	PO3	PO4	PO5	PO6
CLO1	3	3	1	1	3	3
CLO2	3	3	2	2	1	3
CLO3	3	3	2	2	2	3
CLO4	3	2	2	2	1	3
CLO5	3	3	2	2	1	3

1-Basic Level 2- Intermediate Level 3- Advanced Level

Annexure-1

Lesson Plan

Unit	Description	90 Hours		Mode
I	Extension fields	9	18	Lecture, Quiz
	Transcendence of e	9		Lecture, Tutorial
II	Roots of Polynomials	9	18	Lecture, Quiz
	More about roots	9		Lecture, Quiz
III	Elements of Galois theory.	9	18	PPT, Lecture
	Related Theorems	9		Lecture, Quiz
IV	Finite fields	10	18	Lecture, Tutorial
	Wedderburn's theorem on finite division rings.	8		Lecture, Tutorial
V	Solvability by radicals - A theorem of Frobenius	9	18	PPT, Lecture
	Integral Quaternions and the Four - Square theorem.	9		Lecture, Quiz
	Total		**90**	

Annexure-1

Department of Mathematics						I M.Sc.,		
Sem	Category	Course Code	Course Title	Credits	Contact Hours/week	CIA	SE	Total
2	Core	23OPMA22	Real Analysis II	5	6	25	75	100

Nature of the Course		
Knowledge and Skill Oriented	Employability Oriented	Entrepreneurship oriented

Course Objectives:

- To learn about advanced topics in Fourier series and FourierIntegrals.
- To acquire idea to know functions of several variables.
- To obtain the knowledge of the Lebesgue measure &integral.

Course Content:

Unit	Course Content	90 Hours	K Level	CLO
I	**Measure on the Real line** - Lebesgue Outer Measure - Measurable sets - Measurable Functions	18	Up toK3	CLO1
II	**Integration of Functions of a Real variable** - Integrationof Non-negative functions - The General Integral – Integration of series- Riemann and Lebesgue Integrals	18	Up toK4	CLO2
III	**Fourier Series and Fourier Integrals** - Introduction - Orthogonal system of functions - The theorem on best approximation - The Fourier series of a function relative to an orthonormal system - Properties of Fourier Coefficients - The Riesz-Fischer Theorem - The Riemann - Lebesgue Lemma - The Dirichlet Integrals - An integral representation for the partial sums of Fourier series - Riemann'slocalization theore – Cesaro summability of Fourier series- Consequences of Fejer's theorem - The Weierstrassapproximation theorem	18	Up toK4	CLO3
IV	**Multivariable Differential Calculus** - Introduction - The Directional derivative - Directional derivative and continuity - The totalderivative - The total derivative expressed in terms of partialderivatives – An Application of complexed valued functions-The matrix of linear function - The Jacobian matrix - The chain rule - Matrix form of chain rule - The mean - value theorem for differentiable functions - A sufficient condition for differentiability - A sufficient condition for equality of mixed partial derivatives - Taylor's theorem for functions of R^n to R^1	18	Up toK5	CLO4

V	**Implicit Functions and Extremum Problems:** Functions with non-zero Jacobian determinants – The inverse function theorem- The Implicit function theorem-Extrema of real valued functions of one variable and severable variables-Extremum problems with side conditions.	18	Up toK5	CLO5

Book for study:

1. G. de Barra, *Measure Theory and Integration*, Wiley Eastern Ltd.,New Delhi, 1981. (for Units I and II)
2. Tom M.Apostol : *Mathematical Analysis*, 2nd Edition, Addison-Wesley Publishing Company Inc. New York, 1974. (for Units III, IV and V)

Chapters:

UNIT	CHAPTER(S)	SECTIONS
I	2	2.1,2.2,2.4
II	3	3.1 to 3.4
III	11	11.1 to 11.6,11.8 to 11.11, 11.3 to 11.5
IV	12	12.1 to 12.14
V	13	13.1 to 13.7

Books for Reference:

1. Burkill,J.C. *The Lebesgue Integral*, Cambridge University Press,1951.
2. Munroe,M.E. *Measure and Integration*. Addison-Wesley,Mass.1971.
3. Roydon,H.L. *Real Analysis*, Macmillan Pub. Company, New York,1988.
4. Rudin, W. *Principles of Mathematical Analysis*, McGraw HillCompany, New York, 1979.
5. Malik,S.C. and Savita Arora. *Mathematical Analysis*, Wiley EasternLimited. New Delhi, 1991.
6. Sanjay Arora and Bansi Lal, *Introduction to Real Analysis*, Satya Prakashan, New Delhi, 1991

Web Resources:

- http://mathforum.org,
- http://ocw.mit.edu/ocwweb/Mathematics,
- http://www.opensource.org

Pedagogy:

- Chalk and Talk, Powerpoint presentations, Group Discussions, Quiz, Assignment and Seminar

Activities to be given:

We will be providing students with intellectual problems, theory application problems, group discussion and other practical works and also insist them to check the books for references and web resources.

Annexure-1

Course Learning Outcome (CLOs)

On completion of the course, behind the students would be able to:

CO	Course learning outcome	K-level
CO1	Identifying the concept of Lebesgue measure	**Upto K3**
CO2	Analyzing the concept of Lebesgue integral	**Upto K4**
CO3	Understand and describe the basic concepts of Fourier series and Fourier integrals with respect to orthogonal system. Analyze the representation and Convergence problems of Fourier series.	**Upto K4**
CO4	Understand the concept of Multivariable Differential Calculus.	**Upto K5**
CO5	Understand the concept of Implicit functions and Extremum problems.	**Upto K5**

K1- Remembering facts with specific answers
K2- Basic understanding of facts.
K3- Application oriented
K4- Analyzing, examining and making presentations with evidence.
K5- Evaluating, making Judgments based on criteria

Mapping of Course Learning Outcomes (CLOs) with Programme Outcomes (POs)

	PO1	PO2	PO3	PO4	PO5	PO6
CLO1	3	3	1	1	3	3
CLO2	3	3	2	2	1	3
CLO3	3	3	2	2	2	3
CLO4	3	2	2	2	1	3
CLO5	3	3	2	2	1	3

1-Basic Level 2- Intermediate Level 3- Advanced Level

Annexure-1

Lesson Plan

Unit	Topics	90 Hours		Mode
I	Measure on the Real line - Lebesgue Outer Measure	6	18	Lecture Quiz.
	Measurable sets	6		
	Measurable Functions	6		
II	Integration of Functions of a Real variable - Integration of Non- negative functions	6	18	Lecture Quiz.
	The General Integral	6		
	Riemann and Lebesgue Integrals	6		
III	**Fourier Series and Fourier Integrals** - Introduction - Orthogonal system of functions - The theorem on best approximation - The Fourier series of a function relative to an orthonormal system.	6	18	PPT, Lecture, Quiz, GD
	Properties of Fourier Coefficients - The Riesz-Fischer Thorem – The Riemann - Lebesgue Lemma - The Dirichlet Integrals - An integral representation for the partial sums of Fourier series.	6		
	Riemann's localization theorem - Sufficient conditions for convergence of aFourier series at a particular point –Cesaro summability of Fourier series-Consequences of Fejer's theorem - The Weierstrass approximation theorem.	6		
IV	**Multivariable Differential Calculus** - Introduction - The Directional derivative - Directional derivative and continuity - The total derivative - The total derivative expressed in terms of partial derivatives - The matrix of linear function.	6	18	PPT, Lecture ,Quiz.
	The Jacobian matrix - The chain rule - Matrix form of chain rule - The mean -value theorem for differentiable functions - A sufficient condition for differentiability.	6		
	A sufficient condition for equality of mixed partial derivatives - Taylor's theorem for functions of R^n to R^1	6		
V	**Implicit Functions and Extremum Problems:** Functions with non-zero Jacobian determinants.	6	18	Assign ments and Seminar ,GD
	The inverse function theorem-The Implicit function theorem.	6		
	Extrema of real valued functions of severable variables-Extremum problemswith side conditions.	6		
	Total		**90**	

Annexure-1

Department of Mathematics						I M.Sc.,		
Sem	Category	Course Code	Course Title	Credits	Contact Hours/week	CIA	SE	Total
2	Core	23OPMA23	Partial Differential Equations	4	6	25	75	100

Nature of the Course		
Knowledge and Skill Oriented	Employability Oriented	Entrepreneurship oriented

Course Objectives:

- Develop strong background on finding various solutions to firstorder linear and nonlinear Partial Differential Equations (PDE's).
- To solve the nonlinear PDE's by Charpit's method and Jacobi'smethod.
- To focus the formulation of first and second orders PDE's.
- To classify and solving for three basic types namely Hyperbolic,Parabolic and Elliptic PDE's.
- Solving of PDEs which include heat, wave and Laplace's equation that arise in various physical systems.

Course Content:

Unit	Course Content	90 Hours	K Level	CLO
I	**Mathematical Models and Classification of Second-Order Linear Equations:** Classical Equations- The Vibrating String – The Vibrating Membrane –Waves in an Elastic Medium – Conduction of Heat in Solids – The Gravitational Potential – Second-Order Equations in Two Independent Variables –Canonical Forms – Equations with Constant Coefficients – General Solutions	18	Up to K3	CLO1
II	**The Cauchy Problem and Wave Equations:** The Cauchy Problem – The Cauchy-Kowalewskaya Theorem – Homogeneous Wave Equations – Initial Boundary-Value Problems- Equations with Non-Homogeneous Boundary Conditions – Vibration of Finite String with Fixed Ends – Non-Homogeneous Wave Equations – The Riemann Method –Solution of the Goursat Problem – Spherical Wave Equation – Cylindrical Wave Equation	18	Up to K4	CLO2
III	**Method of separation of variables:** Separation of Variable- The Vibrating String Problem – Existence and Uniqueness of Solution of the Vibrating String Problem – The Heat Conduction Problem – Existence and Uniqueness of Solution of the Heat Conduction Problem – The Laplace And Beam Equations	18	Up toK4	CLO3

IV	**Boundary Value Problems and Applications:** Boundary Value Problems – Maximum and Minimum Principles – Uniqueness and Continuity Theorems– Dirichlet Problem for a Circle, A Circular Annulus, a Rectangle – DirichletProblem Involving the Poisson Equation – Neumann Problem for a Rectangle, a Circle.	18	Up toK5	CLO4
V	**Green's Functions and Boundary- Value Problems:** Introduction - The Dirac Delta function – Properties of Green's function – Method of Green's function – Dirichlet's Problem for the Laplace and Helmholtz operators – Method of images and eigen functions – Higher dimensional problem – Neumann Problem.	18	Up toK5	CLO5

Book for study:

TynMyint-U and Lokenath Debnath, *Linear Partial Differential Equations for Scientists and Engineers* (Fourth Edition), Birkhauser Bosten 2007

Chapters:

UNIT	CHAPTER(S)	SECTIONS
I	3,4	3.1 to 3.6, 4.1 to 4.4
II	5	5.1 to 5.11
III	7	7.1 to 7.7
IV	9	9.1 to 9.9
V	11	11.1 to 11.10

Books for Reference:

1. M.M.Smirnov, *Second Order partial Differential Equations*,Leningrad, 1964.
2. I.N.Sneddon, *Elements of Partial Differential Equations,* McGrawHill, New Delhi, 1983.
3. R. Dennemeyer, *Introduction to Partial Differential Equations andBoundary Value Problems,* McGraw Hill, New York, 1968.
4. M.D.Raisinghania, *Advanced Differential Equations,* S.Chand &Company Ltd., New Delhi, 2001.
5. Sankar Rao, *Partial Differential Equations*, 2nd Edition, PrenticeHall of India, New Delhi. 2004

Web Resources:

- http://mathforum.org, http://ocw.mit.edu/ocwweb/Mathematics,
- http://www.opensource.org, www.mathpages.com

Pedagogy:

- Chalk and Talk, Powerpoint presentations, Group Discussions, Quiz, Assignment and Seminar

Annexure-1

Activities to be given:

We will be providing students with intellectual problems, theory application problems, group discussion and other practical works and also insist them to check the books for references and web resources.

Course Learning Outcome (CLOs)

On completion of the course, behind the students would be able to:

CLO	Course Learning outcome	Knowledge level
CLO1	To understand and classify second order equations and find general solutions.	K3
CLO2	To analyse and solve wave equations in different polar coordinates	K4
CLO3	To solve Vibrating string problem, Heat conduction problem, to identify and solve Laplace and beam equations	K4
CLO4	To apply maximum and minimum principle's and solve Dirichlet, Neumann problems for various boundary conditions.	K5
CLO5	To apply Green's function and solve Dirichlet, Laplace problems, toapply Helmholtz operation and to solve Higher dimensional problem.	K5

K1- Remembering facts with specific answers
K2- Basic understanding of facts.
K3- Application oriented
K4- Analyzing, examining and making presentations with evidence.
K5- Evaluating, making Judgments based on criteria

Mapping of Course Learning Outcomes (CLOs) with Programme Outcomes (POs)

	PO1	PO2	PO3	PO4	PO5	PO6
CLO1	3	3	1	1	3	3
CLO2	3	3	2	2	1	3
CLO3	3	3	2	2	2	3
CLO4	3	2	2	2	1	3
CLO5	3	3	2	2	1	3

1-Basic Level **2- Intermediate Level** **3- Advanced Level**

Annexure-1

Lesson Plan

Units	Description	Hours	Total Hours	Pedagogy
I	Classical equations – Introduction, Vibrating String and Vibrating Stringmembrane	5	18	Lecture
	Waves in an elastic medium	2		Lecture
	Conduction of heat in solids, The Gravitational potential	3		Lecture
	Second order equations in two independentvariables Canonical formsand equations withconstant coefficients, General solution of equation with constantcoefficients	8		Lecture & Group Discussion
II	The Cauchy problem. Cauchy -Kowalewskaya theorem	4	18	Lecture
	Homogeneous wave equation initial boundary value problems	2		Lecture
	Non homogeneous boundary conditions, Vibration of finite string with fixed ends	2		Lecture & PPT
	Non homogeneous wave equation. Riemann method and Goursat problem	4		Lecture
	Spherical wave equations, Cyclindrical wave Equatin	6		Lecture
III	Separation of variables and vibrating stringproblem	4	18	Lecture
	Existence and uniqueness of solution ofvibrating string problem	4		Lecture & PPT
	Heat conduction problem	4		Lecture
	Existence and uniqueness of solution ofheat conduction problem,	3		Lecture
	Laplace and beam equations	3		Lecture & Seminar
IV	Boundary value problems	3	18	Lecture
	Maximum and minimum principles	3		Lecture
	Uniqueness and continuity theorems	2		Lecture & PPT
	Dirichlet problem for a circle and a circularannulus and a rectangle	4		Lecture
	Dirichlet problem involving the poisson equation. Neumann problem for a circle and arectante	6		Lecture
V	The Dirac Delta function and Properties of Green's function, Method of Green's function	8	18	Lecture
	Dirichlet Problem for the Laplace and Helmholtz operators	4		Lecture & PPT
	Method of images and eigen functions	3		Assignment
	Higher dimensional problem and Neumannproblem	3		Lecture & Group Discussion
Total			**90**	

Annexure-1

Department of Mathematics						I M.Sc.,		
Sem	Category	Course Code	Course Title	Credits	Contact Hours/week	CIA	SE	Total
2	DSEC	23OPMADSE2A	Modelling And Simulation With Excel	3	5	25	75	100

Nature of the Course		
Knowledge and Skill Oriented	Employability Oriented	Entrepreneurship oriented

Course Objectives:

- To introduce the concepts and to develop working knowledge on Excel, Calculation in Excel, Formatting the Spread sheet, working with tables andCharts.

Course Content:

Unit	Course Content	75 Hours	K Level	CLO
I	**First look at Excel**: The screen and its Elements – Navigating the spreadsheet – Writing the cells – Adaptation of cell size – Selecting Cells.	15	Up toK3	CLO1
II	**Calculations**: Formulas – Formulas with references – Functions –Copying cells: Simple copying – Series – Copying Formulas.	15	Up toK4	CLO2
III	**Formatting**: Text and colours – Number Formats – Date andTime – Formatting Tables – Conditional Formatting – Themes and Styles.	15	Up toK4	CLO3
IV	**Working with Tables**: Create a Table – Filtering – Auto filter –Advanced Filter – Advanced Filter with Formulas – Sorting – Pivot tables – Preserving Results.	15	Up toK5	CLO4
V	**Charts**: Bar Charts – Line Charts – Charts with both Columns andLines – Circle Charts – Scatter Charts – Chart Sheet – Viewing and Printing – Viewing – Adjust Print Range	15	Up toK5	CLO5

Book for study:

Pc Software for Windows 98 made simple, R.K.Taxali, McGraw HillEducation, 2001

Books for Reference:

1. Microsoft Office Excel 2007, Torben Lage Frandsen, Torben LageFrandsen & Ventus Publishing Aps,
2.Guerrero, H. Excel Data Analysis Modelling and Simulation, Springer,London (2010)

Annexure-1

Web Resources:

- http://mathforum.org, http://ocw.mit.edu/ocwweb/Mathematics,
- http://www.opensource.org, www.mathpages.com

Pedagogy:

- Chalk and Talk, Powerpoint presentations, Group Discussions, Quiz, Assignment and Seminar

Activities to be given:

We will be providing students with intellectual problems, theory application problems, group discussion and other practical works and also insist them to check the books for references and web resources.

Course Learning Outcome (CLOs)

On completion of the course, behind the students would be able to:

CLO	Course Learning Outcomes	Knowledge Level (According to Bloom's Taxonomy)
CLO1	Illustrate the concepts of excel screen, navigating spreadsheet, Selecting cells	Up to K2
CLO2	Analyze the formulas, functions in excel, copying the cells, series and formulas	Up to K3
CLO3	Determine the text and colours, date and time, formatting tables and themes andstyles	Up to K3
CLO4	Apply to create a table, Filtering, sorting pivot tables and preserving results	Up to K4
CLO5	Enhance the knowledge in creating bar charts, line charts, circle charts, scattercharts and adjust print range	Up to K4

K1- Remembering facts with specific answers
K2- Basic understanding of facts.
K3- Application oriented
K4- Analyzing, examining and making presentations with evidence.
K5- Evaluating, making Judgments based on criteria

Annexure-1

Mapping of Course Learning Outcomes (CLOs) with Programme Outcomes (POs)

	PO1	PO2	PO3	PO4	PO5	PO6
CLO1	3	3	1	1	3	3
CLO2	3	3	2	2	1	3
CLO3	3	3	2	2	2	3
CLO4	3	2	2	2	1	3
CLO5	3	3	2	2	1	3

1-Basic Level 2- Intermediate Level 3- Advanced Level

Lesson Plan

Unit	Description	75 Hours		Pedagogy
I	The screen and its Elements – Navigating the spreadsheet	10	15	Lecture, Chalk and talk
	Writing the cells – Adaptation of cell size – Selecting Cells.	5		Lecture, Assignment
II	Calculations: Formulas – Formulas with references – Functions	10	15	Lecture, Group Discussion
	Copying cells: Simple copying – Series – Copying Formulas.	5		Lecture, Assignment
III	Formatting: Text and colours – Number Formats – Date and Time	5	15	Lecture, Seminar
	Formatting Tables – Conditional Formatting – Themes and Styles.	10		Lecture, Quiz
IV	Working with Tables: Create a Table – Filtering – Auto filter – Advanced Filter	10	15	Lecture, Chalk and talk, Seminar
	Advanced Filter with Formulas – Sorting – Pivot tables – Preserving Results.	5		Lecture, Assignment
V	Charts: Bar Charts – Line Charts – Charts with both Columns and Lines	5	15	Lecture, PPT, Seminar
	Circle Charts – Scatter Charts – Chart Sheet – Viewing and Printing – Viewing – Adjust Print Range.	10		Lecture, Chalk andTalk
	Total		**75**	

Annexure-1

I M.Sc.,								
Sem	Category	Course Code	Course Title	Credits	Contact Hours/week	CIA	SE	Total
2	DSEC	23OPMADSE2B	Fluid Dynamics	3	5	25	75	100

Nature of the Course		
Knowledge and Skill Oriented	Employability Oriented	Entrepreneurship oriented

Course Objectives

1. To develop an application for properties of Newtonian Fluid.
2. To Study analytical solution to variety of simplified problems.
3. To understand the dynamics of fluid flows and governing the non-dimensional parameters.
4. To give fundamental knowledge of fluid, its properties and behavior under various conditions of internal and external flows.

Course Content:

Unit	Course Content	75 Hours	K Level	CLO
I	Real fluids and Ideal fluids- Velocity of a fluid at a point – streamlines path lines- velocity potential –Vorticity Vector – Equation of continuity – acceleration of a fluid	15	Up to K4	CLO1
II	Equation of motion of a fluid: Pressure at a point in a fluid at rest – pressure at a point in a moving fluid-Euler's equations of motion – Bernoulli's Equation, Bernoulli's theorem.	15	Up to K4	CLO2
III	Some two-dimensional flows: meaning of two- dimensional flow –stream function – two dimensional image systems- Milne – Thomson circle theorem –Theorem of Blasius.	15	Up to K4	CLO3
IV	Elements of Thermodynamics: The equation of state of a substance – the first law of thermodynamics- internal energy of a gas – specific heats o f a gas- function of state; Entropy- Maxwell's thermodynamics relation	15	Up to K5	CLO4
V	Shock waves: formation of shock waves – elementary analysis of normal shock waves –elementary analysis of oblique shock waves-the method of characteristics for two – dimensional ,homentropic, irrational flow.	15	Up to K5	CLO5

Annexure-1

Book for study:

F.Chorlton: *Text book of Fluid Dynamics*, CBS publishers and Distributors Pvt.Limited,2004.

Books for Reference:

1. M.D.Raisinghania: *Fluid Dynamics*, S.Chand,2003.
2. Michel Rieutord: *Fluid Dynamics*, Springer International Publishing,2015.
3. Geoffrey K. Vallis *Essentials of Atmospheric and Oceanic Dynamics* 1st dition,2019.
4. Richard W. Johnson *: Handbook of Fluid Dynamics* 2nd Edition.
5. George EmKarniadakis , Spencer J. SherwinSpectral/hp *Element Methods for Computational Fluid Dynamics (Numerical Mathematics and Scientific Computation)* 2nd Edition

Web Resourses:

1.https://www.meteo.physik.unimuenchen.de/lehre/roger/manuskripte/Fluid_Dynamics.pdf

2. http://www.ccpo.odu.edu/~klinck/Reprints/PDF/groschBook2011.pdf

3.https://www.engineerclassroom.com/2019/01/a-textbook-of-fluid-mechanics-and_18.html

E-books:

1.http://www.issp.ac.ru/ebooks/books/open/Advanced_Fluid_Dynamics.pdf

2.https://www.u-cursos.cl/usuario/5d90bc31eadb7b756f4a0d3fd9789c4f/mi_blog/r/1205763481Batchelor.-Introduction-to-Fluid-Dynamics.pdf

Pedagogy:

- Chalk and Talk, Powerpoint presentations, Group Discussions, Quiz, Assignment and Seminar

Rationale for nature of Course:

Knowledge and Skill:

- Students will get the knowledge of basic principles of fluids mechanics
- To get the ability to analyze the fluid flow problems with the application of Bernoulli's theorem.

Activities to be given: We will be providing students with intellectual problems, theory application problems, group discussions and other practical works and also insist them to check the Books for References and web resources.

Annexure-1

Course Learning Outcome (CLOs)

On completion of the course, behind the students would be able to:

No.	Course Learning Outcomes	Knowledge Level (According to Bloom's Taxonomy)
CLO1	Describe the principles of motion for fluids	Up to K4
CLO2	Formulate the motion of fluid element	Up to K4
CLO3	Use the dimensional analysis and derive dimensional numbers	Up to K4
CLO4	Understanding of thermo dynamics properties and processes	Up to K5
CLO5	Be able to analyze shock waves	Up to K5

K1- Remembering facts with specific answers
K2- Basic understanding of facts.
K3- Application oriented
K4- Analyzing, examining and making presentations with evidence.
K5- Evaluating, making Judgments based on criteria

Mapping of Course Learning Outcomes (CLOs) with Programme Outcomes (POs)

	PO1	PO2	PO3	PO4	PO5	PO6
CLO1	2	1	3	2	3	3
CLO2	1	2	2	2	1	3
CLO3	1	1	3	3	1	3
CLO4	2	2	2	2	2	3
CLO5	2	2	3	2	3	3

1-Basic Level 2- Intermediate Level 3- Advanced Level

Annexure-1

Lesson Plan

Unit	Course Content	75 Hours		Mode of Teaching
1	Real fluids and Ideal fluids- Velocity of a fluid at a point	5	15	Chalk and Talk
	streamlines path lines- velocity potential	5		
	Vorticity Vector – Equation of continuity – acceleration of a fluid.	5		
II	Equation of motion of a fluid: Pressure at a point in a fluid at rest	5	15	Chalk and Talk
	pressure at a point in a moving fluid-Euler's equations of motion	5		
	Bernoulli's Equation, Bernoulli's theorem.	5		
III	Some two-dimensional flows: meaning of two-dimensional flow	5	15	Chalk and Talk
	stream function – two dimensional image systems	5		
	Milne – Thomson circle theorem –Theorem of Blasius.	5		
IV	Elements of Thermodynamics: The equation of state of a substance – the first law of thermodynamics	5	15	PowerPoint Presentation &Seminar
	internal energy of a gas – specific heats of a gas-function of state; Entropy	5		
	Maxwell's thermodynamics relation	5		
V	Shock waves: formation of shock waves – elementary analysis of normal shock waves	5	15	PowerPoint Presentation &Seminar
	elementary analysis of oblique shock waves-the method of characteristics for two	5		
	dimensional, homentropic, irrational flow.	5		
	Total		**75**	

Annexure-1

Department of Mathematics						I M.Sc.,		
Sem	Category	Course Code	Course Title	Credits	Contact Hours/week	CIA	SE	Total
2	DSEC	23OPMADSE2C	Mathematical Statistics	3	5	25	75	100

Nature of the Course		
Knowledge and Skill Oriented	Employability Oriented	Entrepreneurship oriented

Course Objectives:

- To know the desirable qualities for an estimator and learn a number oftechniques for finding minimum variance
- To understands the elements of hypothesis test and be able to carry outa number of different hypothesis test.
- To Formulate, test and interpret various hypothesis tests.
- To Characterize, compare, and contrast different nonparametrichypothesis tests.

Unit	Course Content	75 Hours	K Level	CLO
I	**Distribution of Functions of Random Variables:** Sampling Theory – Transformations of Variables of the Discrete Type – Transformations of Variables of the Continuous Type – The t and F Distributions.	15	Up toK3	CLO1
II	**Order Statistics:** Distributions of Order Statistics - The MomentGenerating Function Technique. The Distributions of X and ns^2/σ^2 – Expectations of Functions of Random Variables.	15	Up toK4	CLO2
III	**Estimation Theory:** Point Estimation – Measures of Quality ofEstimators – Confidence Intervals for Means – Confidence Intervals for Differences of Means - Confidence Intervals for Variances – Bayesian Estimates.	15	Up toK4	CLO3
IV	**Statistical Hypothesis**: Some Examples and Definitions – Certain Best Tests – Uniformly Most Powerful Tests – Likelihood Ratio Tests.	15	Up toK5	CLO4
V	**Nonparametric Methods**: Confidence Intervals for Distribution Quantiles – Tolerance Limits for Distributions – The sign Test – A Test of Wilcoxon – The Equality of Two Distributions – The Mann Whitney – Wilcoxon Test.	15	Up toK5	CLO5

Annexure-1

Book for study:

Robert V. Hogg and Allen T. Craig,"Introduction to MathematicalStatistics"(Fourth Edition), Mcmillan publishing Co., Inc., New York.

Chapters

UNIT	CHAPTER(S)	SECTIONS
I	4	4.1 to 4.4
II	4	4.6 to 4.9
III	6	6.1 to 6.6
IV	7	7.1 to 7.4
V	9	9.1 to 9.6

Books for Reference:

1. M. Fisz, Probability theory and Mathematical Statistics, John Wiley &Sons New York, 1963.
2. E.J. Dudewiczn and S.N.Mishra, Modern Mathematical Statistics, JohnWiley & Sons, New York, 1988.
3. V.N. Rohatgi, An Introduction to Probability theory and MathematicalStatistics, Wiley Eastern Limited, New Delhi, 1988.

Web Resources:

- http://mathforum.org,
- http://ocw.mit.edu/ocwweb/Mathematics,
- http://www.opensource.org
- https://stat.ethz.ch/~geer/mathstat.pdf

Pedagogy:

- Chalk and Talk, Powerpoint presentations, Group Discussions, Quiz, Assignment and Seminar

Activities to be given:

We will be providing students with intellectual problems, theory application problems, group discussion and other practical works and also insist them to check the books for references and web resources.

Annexure-1

Course Learning Outcome (CLOs)

On completion of the course, behind the students would be able to:

CO	Course learning outcome	K-level
CO1	To determine transformations of variables of discrete and continuous typesand t and F distributions.	**Upto K3**
CO2	To compute order statistics, moment generating function and expectation of function of random variables	**Upto K4**
CO3	To construct point and interval estimators and evaluate their goodness.	**Upto K4**
CO4	To decide as to which test of significance is to be applied for any given large sample problem.	**Upto K5**
CO5	To analyze the different nonparametric methods in estimation, testing, model fitting, and in analyses.	**Upto K4**

K1- Remembering facts with specific answers
K2- Basic understanding of facts.
K3- Application oriented
K4- Analyzing, examining and making presentations with evidence.
K5- Evaluating, making Judgments based on criteria

Mapping of Course Learning Outcomes (CLOs) with Programme Outcomes (POs)

	PO1	PO2	PO3	PO4	PO5	PO6
CLO1	3	3	1	1	3	3
CLO2	3	3	2	2	1	3
CLO3	3	3	2	2	2	3
CLO4	3	2	2	2	1	3
CLO5	3	3	2	2	1	3

1-Basic Level 2- Intermediate Level 3- Advanced Level

Annexure-1

Lesson Plan

Unit	Topics	75 Hours		Mode
I	Sampling Theory – Transformations of Variables of the Discrete Type	5	15	Lecture, Quiz.
	Transformations of Variables of the Continuous Type	5		
	The t and F Distributions.	5		
II	Distributions of Order Statistics - The Moment Generating Function Technique.	5	15	Lecture, Quiz.
	The Distributions of X and ns^2/σ^2	5		
	Expectations of Functions of Random Variables.	5		
III	Point Estimation – Measures of Quality of Estimators .	5	15	PPT,Lecture, Quiz, GD
	Confidence Intervals for Means – Confidence Intervalsfor Differences of Means	5		
	Confidence Intervals for Variances – Bayesian Estimates.	5		
IV	Some Examples and Definitions – Certain Best Tests –	5	15	PPT Lecture, Quiz.
	Uniformly Most Powerful Tests –.	5		
	Likelihood Ratio Tests.	5		
V	Confidence Intervals for Distribution Quantiles – Tolerance Limits for Distributions.	5	15	Assignment and Seminar.
	The sign Test – A Test of Wilcoxon.	5		
	The Equality of Two Distributions – The MannWhitney – Wilcoxon Test.	5		
	Total hours		**75**	

Annexure-1

Department of Mathematics						I M.Sc.,		
Sem	Category	Course Code	Course Title	Credits	Contact Hours/week	CIA	SE	Total
2	DSEC	23OPMADSE2D	Stochastic Process	3	5	25	75	100

Nature of the Course		
Knowledge and Skill Oriented	Employability Oriented	Entrepreneurship oriented

Course Objectives:

- Acquire intense knowledge on the underlying concepts of Stochastic processes
- Familiarize with Markov chain and system
- Obtain in-depth understanding of birth and death process
- Develop the acquaintance with applications of Markov process
- Comprehend the concept of renewal process

Course Content:

Unit	Course Contents	75 Hours	K Level	CLO
I	Stochastic Processes -Specification of stochastic processes – Stationary processes – Martingales - MarkovChains: Definitions and Examples – Higher transition probabilities – Generalization of independent Bernoulli trials.	15	Up toK3	CLO1
II	Markov Chains: Classification of States andChains – Determination of Higher transitionprobabilities – Stability of Markov system –Graph theoretic approach – Markov chain with denumerable number of states – Reducible chains.	15	Up toK4	CLO2
III	Poisson process: Poisson process and related distributions – Generalizations of Poisson process – Birth and death process – Markov process with discrete state space (Continuous time Markov chain).	15	Up toK4	CLO3
IV	Markov Process with continuous state space – Brownian motion – Weiner process – Differential equations for Weiner Process – Kolmogorov equations.	15	Up toK4	CLO4
V	Renewal process and renewal equation – Stopping time – Wald's equation – Renewal theorems.	15	Up toK4	CLO5

Book for Study:

Medhi.J, "*Stochastic Processes*", New Age International, Cochin, 2nd edition 2017.

UNIT	CHAPTER(S)	SECTIONS
I	2& 3	2.1 to 2.4 & 3.1 to 3.3
II	3	3.4 to 3.9
III	4	4.1 to 4.5
IV	5	5.1 to 5.4
V	6	6.1 to 6.5

Books for Reference:

1) Leo Breiman., *Probability and Stochastic Processes*, Houghton Mifflin,2008
2) Athanasios Papoulis., *Probability Random Variable & Stochastic Process*, McGraw Hill, International, IIEdition, 2004.
3) Peter Watts Jones &Peter Smith "*Stochastic Processes An Introduction*, Third Edition 2018
4) *Stochastic Processes and Applications:* Diffusion Processes, the Fokker-Planck and Langevin Equations(Texts in Applied Mathematics, 60) 2014th Edition
5) Edward P.C Kao " *An Introduction to stochastic processes"* Dover Publication 2019.

Web Resources

1. https://wwwf.imperial.ac.uk/~pavl/PavliotisBook.pdf
2. https://www.mdpi.com/books/pdfdownload/book/1855
3. http://www.ma.ic.ac.uk/~pavl/lecture_notesM4A42.pdf

E-books

1. **https://link.springer.com/chapter/10.1007/978-1-4939-1323-7_1**
2. **https://link.springer.com/content/pdf/10.1007/978-3-030-22297-0.pdf**

Pedagogy:

- Chalk and Talk, Power point presentations, Group Discussions, Quiz, Assignment and Seminar

Rationale for nature of Course
Knowledge and Skill:

Develop a deeper conceptual understanding of the theoretical basis Stability of Markov system – Graph theoretic approach

- Apply stochastic problems

Annexure-1

Activities to be given:

We will be providing students with intellectual problems, theory application problems and other practical works andalso insist them to check the Books for References and web

Course Learning Outcome (CLOs)

On completion of the course, behind the students would be able to:

No.	Course Outcomes	Knowledge Level (According to Bloom's Taxonomy)
CLO1	Correlate the concepts of stochastic processes with illustrations	Up to K3
CLO2	Illustrate Markov chain and its applications	Up to K4
CLO3	Compare the conceptualization of pure birth and deathprocess	Up to K4
CLO4	Apply Markov process in solving problems	Up to K4
CLO5	Summarize the concepts of renewal process and its applications	Up to K4

K1- Remembering facts with specific
K2- Basic understanding of facts.
K3- Application oriented
K4- Analyzing, examining and making presentations with evidences

Mapping of Course Learning Outcomes (CLOs) with Programme Outcomes (POs)

	PO1	PO2	PO3	PO4	PO5	PO6
CL O1	3	2	3	2	3	3
CL O2	3	2	2	2	1	3
CL O3	3	3	2	2	2	3
CL O4	3	3	2	2	1	3
CL O5	3	3	2	2	1	3

1. Basic Level 2- Intermediate Level 3- Advanced Level

Annexure-1

Lesson Plan

Unit	Course Content	Hours	Total Hours	Mode of Teaching
1	Stochastic Processes -Specification of stochastic processes – Stationary processes	5	15	Chalk & Talk
	Martingales - Markov Chains: Definitions and Examples	5		
	Higher transition probabilities – Generalization of independent Bernoullitrials.	5		
II	Markov Chains: Classification of States and Chains – Determination ofHigher transition probabilities	10	15	Chalk & Talk
	Markov chain with denumerable number of states – Reducible chains.	5		
III	Poisson process: Poisson process and related distributions	5	15	Chalk & Talk
	Generalizations of Poisson process – Birth and death process	5		
	Markov process with discrete state space (Continuous time Markov chain).	5		
IV	Markov Process with continuous state space – Brownian motion	5	15	PowerPoint Presentatio n&Seminar
	Weiner process – Differential equations for Weiner Process	5		
	Kolmogorov equations.	5		
V	Renewal process and renewal equation	5	15	PowerPoint Presentation & Seminar
	Stopping time – Wald's equation	5		
	Renewal theorems.	5		
Total hours			**75**	

Annexure-1

Department of Mathematics						I M.Sc.,		
Sem	Category	Course Code	Course Title	Credits	Contact Hours/week	CIA	SE	Total
2	Skill Enhancement Course	23OPMASEC2	Office Automation and ICT Tools	2	2	25	75	100

Nature of the Course		
Knowledge and Skill Oriented	Employability Oriented	Entrepreneurship oriented

Course Objectives:

1. Understand the basics of computer systems and its components.
2. Understand and apply the basic concepts of a word processing package.
3. Understand and apply the basic concepts of electronic spreadsheet software.
4. Understand and apply the basic concepts of database management system.

Course Content:

Unit	Course Content	30 Hours	K Level	CLO
I	**Introductory concepts:** Memory unit– CPU-Input Devices: Key board, Mouse and Scanner. **Output devices:** Monitor, Printer. Introduction to Operating systems &its features: DOS–UNIX–Windows. Introduction to Programming Languages	6	K2	CLO1
II	**Word Processing:** Open, Save and close word document; Editing text – tools, formatting, bullets; Spell Checker - Document formatting – Paragraph alignment, indentation, headers and footers, numbering; printing– Preview, options, merge	6	K2	CLO2
III	**Spreadsheets:** Excel –opening, entering text and data, formatting, navigating; Formulas – entering, handling and copying; Charts – creating, formatting printing, analysis tables, preparation of financial statements, introduction to data analytics.	6	K3	CLO3
IV	**Database Concepts:** The concept of data base management system; Data field, records, and files, Sorting and indexing data; Searching records. Designing queries, and reports; Linking of data files; Understanding Programming environment in DBMS; Developing menu drive applications in query language(MS–Access).	6	K3	CLO4
V	. **Power point:** Introduction to Power point - Features – Understanding slide typecasting & viewing slides – creating slide shows. Applying special object – including objects & pictures – Slide transition– Animation effects, audio inclusion, timers.	6	K4	CLO5

Annexure-1

Book for study:

Vikas Gupta, (2006)," *Comdex Computer Course Kit*", Dream tech Press, New Delhi First Edition.

Chapters:

UNIT	CHAPTER(S)	SECTIONS
I	i	(1)
II	ii	(1 – 7)
III	iii	(1 – 3)
IV	iv	(1 - 3)
V	v	(1)

Books for Reference:

1. Jennifer Ackerman Kettel, Guy Hat-Davis, Curt Simmons, (2003) "*Microsoft Office 2003: The Complete Reference*" , McGraw-Hill Education, 2nd edition.
2. Dr. P. Rizwan Ahmed,(2016),"*Office Automation" Margham Publications*",6 th edition.
3. Dr. Archana Kumar, (2019), "*Computer Basics with Office Automation*" First Edition, Dreamtech Press

Web Resources / E.Books:

1. https://www.ebookbou.edu.bd/Books/Text/SST/DCSA/dcsa_1302/Unit-01.pdf
2. https://www.tndalu.ac.in/econtent/8_Computer_Fundamentals_and_Office_Automation.pdf
3. https://www.ebookbou.edu.bd/Books/Text/SST/DCSA/dcsa_1302/Unit-02.pdf

Pedagogy:

Chalk and Talk, PPT, Group discussion, Quiz.

Rationale for nature of Course:

Knowledge and Skill:

There are three basic activities of an office automation system: storage of information, data exchange, and data management.

Activities to be given:

Students shall be allowed to write program in many concepts.

Annexure-1

Course learning Outcomes (CLO's):

CLO	Course learning Outcomes (CLO's)	Knowledge According to Bloom's Taxonomy (Up to K level)
CLO1	Possess the knowledge on the basics of computers and its components	K1 to K3
CLO2	Gain knowledge on Creating Documents, spreadsheet and presentation.	K1 to K3
CLO3	Learn the concepts of Database and implement the Query in Database.	K1 to K3
CLO4	Demonstrate the understanding of different automation tools.	K1 to K4
CLO5	Utilize the automation tools for documentation, calculation and presentation purpose.	K1 to K4

Mapping of Course Learning Outcomes (CLOs) with Programme Outcomes (POs) (SCIENCE)

	PO1	PO2	PO3	PO4	PO5	PO6
CLO1	2	2	2	3	3	1
CLO2	3	1	2	3	3	3
CLO3	3	2	1	2	1	3
CLO4	3	3	2	2	2	1
CLO5	2	2	1	3	1	3

1-Basic Level 2- Intermediate Level 3- Advanced Level

Annexure-1

Mapping of Course Learning Outcomes (CLOs) with Programme Outcomes (POs) (ARTS)

	PO1	PO2	PO3	PO4	PO5	PO6
CLO1	2	1	1	1	2	1
CLO2	3	2	2	2	3	2
CLO3	2	2	1	2	2	2
CLO4	3	2	3	2	3	2
CLO5	2	2	2	2	3	2

LESSON PLAN

UNIT	DESCRIPTION	30 Hrs	MODE
I	Introductory concepts: Memory unit– CPU-Input Devices: Key board, Mouse and Scanner. Output devices: Monitor, Printer. Introduction to Operating systems &its features: DOS–UNIX–Windows. Introduction to Programming Languages	7	Chalk and Talk, PPT, group discussion, OHP presentations, quiz, on the spot test and Virtual Labs.
II	Word Processing: Open, Save and close word document; Editing text – tools, formatting, bullets; Spell Checker - Document formatting – Paragraph alignment, indentation, headers and footers, numbering; printing– Preview, options, merge.	7	Chalk and Talk, PPT, group discussion, OHP presentations, quiz, on the spot test and Virtual Labs.
III	Spreadsheets: Excel –opening, entering text and data, formatting, navigating; Formulas – entering, handling and copying; Charts – creating, formatting printing, analysis tables, preparation of financial statements, introduction to data analytics.	6	Chalk and Talk, PPT, group discussion, OHP presentations, quiz, on the spot test and Virtual Labs
IV	Database Concepts: The concept of data base management system; Data field, records, and files, Sorting and indexing data; Searching records. Designing queries, and reports; Linking of data files; Understanding Programming environment in DBMS; Developing menu drive applications in query language(MS–Access).	5	Chalk and Talk, PPT, group discussion, OHP presentations, quiz, on the spot test and Virtual Labs
V	Power point: Introduction to Power point - Features – Understanding slide typecasting & viewing slides – creating slide shows. Applying special object – including objects & pictures – Slide transition– Animation effects, audio inclusion, timers	5	Chalk and Talk, PPT, group discussion, OHP presentations, quiz, on the spot test and Virtual Labs
	Total	**30**	