ANNEXURE – 10

DEPARTMENT OF MATHEMATICS

Vision:

- To generate and disseminate Mathematical knowledge through humanism and tolerance for reason and for adventure of ideas.

Mission:

- To make the students to achieve academic excellence through classroom teaching, practical, projects and educational tours.
- To encourage students with different learning abilities, by providing the needed support.
- To make education affordable and accessible by providing scholarships to the meritorious and economically weaker students.
- To inspire, prepare and empower students to succeed in the ever-changing world.

Programme Educational Objectives (PEO)

PEO1	Natural navigators and nimble witted in diagnosing problems, in enlisting steps to rectify them and in providing the most effective solutions in the best possible way
PEO2	Moralistic while demonstrating their academiccaliber, in recognizing and acknowledging value systems, in making decisions, accepting responsibilities and while concerned about society and public issues and needs
PEO3	Self-reliant in learning and in real life job situations through which they support their peers and become stable and reliable students, workers and citizens
PEO4	Steadfast in shielding and nurturing environment and stimulate its sustainable growth for a bright future
PEO5	Versatile and vibrant communicators in person and through other media. Vigilant/vital in prolonging the long winding richness and tradition of their mother tongue
PEO6	Neoteric global citizens of our nation, who would take the nation's pride around the world by adapting and adopting the scientific and technological developments
PEO7	Civilized and confident graduates, who believe in lifelong learning with the socio-cultural changes in the generations to come

Programme Outcome (PO) for B.Sc. Mathematics

The objectives of this programme is to equip / prepare the students

PO1	with knowledge of mathematical facts and logical skills which will rack up with a thorough knowledge of the core and the allied papers.
PO2	to develop the knowledge, skills and attitude necessary to pursue higher studies in Mathematics.
PO3	to be competent and socially responsible citizens of India.
PO4	to acquire the reasoning ability and problem solving skills to get through various competitive examinations.
PO5	to develop the managing ability and critical thinking to solve real life problems and takeup career as an entrepreneur.

Programme Specific Outcomes (PSO) for B.Sc.

On the successful completion of B.Sc. Mathematics, the students will be able to

PSO1 :understand the fundamental and the advanced concepts in Mathematics.

PSO2 :exhibit a computational ability and numerical skills in the various areas.

PSO3 : develop basic Mathematical axioms and analyze mathematical problems.

PSO4 : apply mathematical techniques to solve the real life problems.

PSO5 : identify, formulate and analyze mathematical problems in various disciplines and society.

MAPPING OF POs WITH PEOs

	PEO1	PEO2	PEO3	PEO4	PEO5	PEO6	PEO7
PO1	1	3	3	2	2	3	3
PO2	3	2	3	3	3	2	2
PO3	3	2	2	2	2	2	2
PO4	2	2	3	3	3	2	2
PO5	2	3	2	2	2	2	2

3 - Strong 2- Medium – M 1-Low

B.Sc MATHEMATICS

SEM	Part – I	Part – II	Part – III				Part – IV			Part – V (6th Hr)	ACC (6th Hr)			SLC
I Sem.	I Lang (6)	II Lang (6)	Core (5)	Core (5)	Allied Physics (4)	Allied Physics Lab (2)	SBE (2)	–	**Total (30)**	NCC/NSS/PED R.R/ Li.Sc. (3)	Com.Eng (2)	Comp.Lit (1)	–	–
II Sem.	I Lang (6)	II Lang (6)	Core (4)	Core (5)	Allied Physics (4)	Allied Physics Lab (2)	SBE (2)	Elec. EVS (1)	**Total (30)**	NCC/NSS/PED R.R/ Li.Sc. (3)	Com.Eng (2)	Comp.Lit (1)	–	SLC Major
III Sem.	I Lang (6)	II Lang (6)	Core (6)	Core Lab (2)	Allied Physics (4)	Allied Physics Lab (2)	NME (2)	SBE (2)	**Total (30)**	NCC/NSS/PED R.R/ Li.Sc. (3)	Com.Eng (2)	Comp.Lit (1)	–	SLC Major
IV Sem.	I Lang (6)	II Lang (6)	Core (6)	Core Lab (2)	Allied Physics (4)	Allied Physics Lab (2)	NME (2)	SBE (2)	**Total (30)**	NCC/NSS/PED R.R/ Li.Sc. (3)	Com.Eng (2)	Comp.Lit (1)	–	SLC Major
V Sem.	Core (6)	Core (6)	Core (4)	Core. (4)	Core Lab (2)	Elec.-I (5)	SBE Major (2)	Elec. W.S. (1)	**Total (30)**	–	Com.Eng (2)	Comp.Lit (1)	Skill Devt – Career Guidance (3)	SLC Major
VI Sem.	Core (6)	Core (4)	Core (4)	Core Lab (2) (5)	Elec-II. (5)	Elec. -III	SBE Major (2)	Elec. VBE (2)	**Total (30)**	–	Com.Eng (2)	Comp.Lit (1)	Skill Devt – Career Guidance (3)	–
								TOTAL	**180 Hrs**					

I Language – Tamil
II Language – English
SBE – Skill – Based Electives
SLC – Self – Learning Course
EVS – Environmental Studies
W.S. – Women Studies
VBE - Value Based Education

B.Sc MATHEMATICS

CHOICE BASED CREDIT SYSTEM WITH OBE PATTERN

FOR THOSE WHO HAVE JOINED FROM THE ACADEMIC YEAR 2022-23 ONWARDS

Part	Course	Subject	Sub Code	Hrs.	6th Hr.	Cr.	Adl. Cr.	Exam (Hrs)	Marks	
									Int.	Ext.
SEMESTER - I										
I	Lang. – I	Tamil – I	210103101	6		3		3	25	75
II	Lang. – II	English – I	211003101	6		3		3	25	75
III	Core	Calculus	212003101	5		5		3	25	75
	Core	Differential Equations and Laplace Transforms	212003102	5		5		3	25	75
	Al. Phy.	Mechanics, Properties of Matter and Sound	212103121	4		4		3	25	75
	Al. Lab	Physics Practical – I	-	2		-	-	-	-	-
IV	SBE - I	Trigonometry	214403120	2		2		3	25	75
V	Extension activities	NSS / NCC / PED/Rover and Rangers/Library Science and Information	–		3			–	–	–
Additional Credit Courses		Communicative English–I	-	–	2			–	–	–
		Computer Literacy	-	–	1			–	–	–
SEMESTER – II										
I	Lang. – I	Tamil – II	210103201	6		3		3	25	75
II	Lang. – II	English – II	211003201	6		3		3	25	75
III	Core	Sequences and Series	212003201	4		4		3	25	75
	Core	Analytical Geometry of 3D and vector calculus	212003202	5		4		3	25	75
	Al. Phy.	Thermal Physics	212103221	4		4		3	25	75
	Al. Lab	Physics Practical – I	212103222	2		2		3	40	60
IV	SBE - II	Theory of Equations	214403220	2		2		3	25	75
	EVS	Environmental Studies	214103201	1		1		2	–	100
V	Extension activities	NSS / NCC / PED/Rover and Rangers/Library Science and Information	–		3			–	–	–
Additional Credit Courses		Communicative English–I	218003201		2		1	3	25	75
		Computer Literacy		–	1			–	–	–
		SLC - Lattice Theory	218003220				3	3	–	100
SEMESTER – III										
I	Lang. – I	Tamil – III	210103301	6		3		3	25	75
II	Lang. – II	English – III	211003301	6		3		3	25	75
III	Core	Modern Algebra	212003301	6		5		3	25	75
	Core Lab	Applications of Differential Equations Lab	212003302	2		1		3	40	60
	Al. Phy.	Electricity and Electronics	212103321	4		4		3	25	75
	Al. Lab	Physics Practical – II	-	2		-	-	-	-	-
IV	NME - I	Basic Mathematics – I	214603320	2		2		3	25	75
	SBE –III	Statics	214403320	2		2		3	25	75
V	Extension activities	NSS / NCC / PED/Rover and Rangers/Library Science and Information	-		3			–	–	–
Additional Credit Courses		Communicative English–II	-	-	2			–	–	–
		Computer Literacy	-	-	1			–	–	–
		SLC -History of Mathematics	218003320				3	3	–	100

Part	Course	Subject	Sub Code	Hrs.	6thHr.	Cr.	Adl. Cr.	Exam (Hrs)	Marks	
									Int.	Ext.
SEMESTER – IV										
I	Lang. – I	Tamil – IV	210103401	6		3		3	25	75
II	Lang. – II	English – IV	211003401	6		3		3	25	75
III	Core	Programming in C & C++	212003401	6		5		3	25	75
	Core Lab	C & C++ Lab	212003402	2		1		3	40	60
	Al. Phy.	Optics and Modern Physics	212103421	4		4		3	25	75
	Al. Lab	Physics Practical – II	212103423	2		2		3	40	60
IV	NME- II	Basic Mathematics – II	214603420	2		2		2	25	75
	SBE –IV	Dynamics	214403420	2		2		3	25	75
V	Extension activities	NSS / NCC / PED/Rover and Rangers/Library Science and Information	-		3	1		3	25 *40	75 *60
Additional Credit Courses		Communicative English–II	218003401		2		1	3	25	75
		Computer Literacy	-		1			–	–	–
		SLC – Fourier series and Fourier transforms	218003420				4	3	–	100
SEMESTER –V										
III	Core	Real Analysis	212003501	6		5		3	25	75
	Core	Linear Algebra	212003502	6		4		3	25	75
	Core	Discrete Mathematics	212003503	4		4		3	25	75
	Core	Operations Research	212003504	4		2		3	25	75
	Core Lab	Operations Research - Lab	212003505	2		2		3	40	60
	Elective	Elective– I*	-	5		5		3	25	75
IV	SBE - V	Astronomy – I	214403520	2		2		3	25	75
	WS	Women Studies		1		1		2	–	100
Additional Credit Courses		Communicative English–III	-		2			–	–	–
		Computer Literacy	-		1			–	–	–
		Skill Development – Career Guidance	-		3			–	–	–
		SLC – Mathematical Aptitude for Competitive Examinations	218003520				4	3	–	100
SEMESTER - VI										
III	Core	Complex Analysis	212003601	6		5		3	25	75
	Core	Graph theory	212003602	4		4		3	25	75
	Core	Numerical methods	212003603	4		2		3	25	75
	Core Lab	Numerical methods using C and C++ - Lab	212003604	2		2		3	40	60
	Elective	Elective– II*	-	5		5		3	25	75
	Elective	Elective– III: Project *Report;@Viva	212003607	5		5		–	40 [24:16]	60 [36:24]
IV	SBE - VI	Astronomy – II	214403620	2		2		3	25	75
	VBE	Value Based Education	214303601	2		2		2	–	100
Additional Credit Courses		Communicative English–III	218003601		2		1	3	25	75
		Computer Literacy	218003602		1		1	3	–	100
		Skill Development – Career Guidance	218003603		3		2	3	–	100
			Total	**180**	**36**	**140**	**20**			

***Elective I, II: Each elective paper has two choices, select any one.**

I.1. Mathematical Statistics - I - 212003506

I.2. Number theory - 212003507

II.1. Mathematical Statistics – II - 212003605

II.2. Fuzzy Sets - 212003606

ALLIED – MATHEMATICS FOR PHYSICS and CHEMISTRY

Sem	Title of the Paper	SUB CODE	Hrs.	Cr.	Exam (Hrs)	Marks Allotted	
						Int.	Ext.
I	Allied Mathematics Paper – I	212003121	6	5	3	25	75
II	Allied Mathematics Paper – II	212003221	6	5	3	25	75
III	Allied Mathematics Paper – III	212003321	6	5	3	25	75
IV	Allied Mathematics Paper – IV	212003421	6	5	3	25	75

ALLIED – MATHEMATICS FOR COMPUTER SCIENCE

Sem	Title of the Paper	SUB CODE	Hrs.	Cr.	Exam (Hrs)	Marks Allotted	
						Int.	Ext.
I	Discrete Mathematics Paper – I	212003122	4	4	3	25	75
II	Discrete Mathematics Paper – II	212003222	4	4	3	25	75
III	Linear Programming	212003322	4	4	3	25	75
IV	Numerical Analysis	212003422	4	4	3	25	75

Core Subject **REAL ANALYSIS** **Code: 212003501**

SEMESTER V **6 Hrs/Week**

Credits 5

PREAMBLE:-

- ***To provide fundamental ideas and properties about metric spaces, convergence, completeness and compactness.***

COURSE OUTCOMES (COs)

On Successful completion of the course, the student will be able to

No.	Course Outcomes	Knowledge Level (According to Bloom's Taxonomy)
CO1	distinguish the countability and uncountability of sets and explain the metric space.	Up to K3
CO2	define open sets, closed sets, closure and interior of a set and dense set.	Up to K3
CO3	describe completeness and related theorems.	Up to K3
CO4	distinguish continuity and uniform continuity and correlate connectedness with continuity.	Up to K3
CO5	Describe compactness of a metric space and compile all equivalent definition.	Up to K3

K1- Knowledge K2 – Understand K3-Apply

UNIT – I: **[18 Hrs]**

Countable sets – Uncountable sets – Inequalities of Holder, Cauchy – Schwartz and Minkowski – Metric space – Definition and examples – Bounded sets in a metric space - Equivalent metrics.

UNIT – II: **[18 Hrs]**

Open ball and open set – Definition and Examples – Subspace – Open set in a subspace – Interior points – Closed ball – Closed set – Closure – Limit point – Dense set.

UNIT – III: **[18 Hrs]**

Complete metric space – Definition and examples – Cantor's intersection theorem – Baire's category theorem.

UNIT – IV: **[18 Hrs]**

Continuity – Uniform continuity – Connected set – Connected subset of R – Connectedness and continuity - Discontinuous functions

UNIT – V: **[18 Hrs]**

Compactness – Heine – Borel Theorem – Finite intersection property – Totally bounded set – Compactness and continuity (sequentially compact is excluded).

TEXT BOOK:

S.Arumugam and Isaac, Modern Analysis, New Gramma Publishing House, Palayamkottai, 2007 Edition.

Chapters:

UNIT – I : 1.2 to 1.4 and 2.1. to 2.2
UNIT – II : 2.3. to 2.10
UNIT – III : 3.1. to 3.2
UNIT – IV : 4.1, 4.3, 4.4, 5.1. to 5.3
UNIT – V : 6.1. to 6.4

REFERENCES:

1. Golds Berg, Methods of Real Analysis, Oxford & IBH Publishing & Co. Delhi, 2013.
2. Sharma J.N. and Vasistha A.R., Real Analysis, Krishna Prakshan Media (P) Limited, 1997.

WEB RESOURCES:

1. https://www.geneseo.edu/~aguilar/public/notes/Real-Analysis-HTML/ch9-metric-spaces.html
2. https://math.hws.edu/eck/math331/guide2020/10-metric-spaces.html
3. https://math.libretexts.org/Bookshelves/Analysis/Introduction_to_Real_Analysis_(Lebl)/08%3A_Metric_Spaces/8.01%3A_Metric_Spaces

PEDAGOGY: Lecture, Black board, LCD projector.

COURSE CONTENTS & TEACHING / LEARNING SCHEDULE

Module No.	Topic	No. of Lectures	Content Delivery Method	Teaching Aids
UNIT – I [18 Hrs]				
1.1	Countable sets, Uncountable sets	4	Lecture	Black Board
1.2	Inequalities of Holder, Cauchy Schwartz and Minkowski	4	Lecture	Black Board
1.3	Metric space definition and examples	4	Lecture	Black Board
1.4	Bounded sets in a metric space	3	Lecture	Black Board
1.5	Equivalent metrics	3	Lecture	Black Board
UNIT – II [18 Hrs]				
2.1	Open ball and open set, definition and Examples	4	Lecture	Black Board
2.2	Subspace, open set in a subspace	4	Lecture	LCD
2.3	Interior points, closed ball, closed set	4	Lecture	Black Board
2.4	Closure, limit point	3	Lecture	Black Board
2.5	Dense set.	3		
UNIT – III [18 Hrs]				
3.1	Complete metric space	5	Lecture	Black Board
3.2	Definition and examples	5	Lecture	Black Board
3.3	Cantor's intersection theorem	4	Lecture	Black Board
3.4	Baire's category theorem.	4	Lecture	Black Board
UNIT – IV [18 Hrs]				
4.1	Continuity, Connected sets	5	Lecture	Black Board
4.2	Uniform continuity	5	Lecture	LCD
4.3	Connected subset of R, Connectedness and continuity	4	Lecture	LCD
4.4	Discontinuous functions	4	Lecture	Black Board
UNIT – V [18 Hrs]				
5.1	Compactness, Finite totally bounded set	4	Lecture	Black Board
5.2	Heine – Borel Theorem	3	Lecture	Black Board
5.3	Finite intersection property	4	Lecture	Black Board
5.4	Bounded set	4	Lecture	LCD
5.5	Compactness and continuity	3	Lecture	Black Board

MAPPING OF COs WITH POs

	PO1	PO2	PO3	PO4	PO5
CO1	3	2	3	2	1
CO2	3	3	1	3	2
CO3	3	2	2	1	3
CO4	2	3	3	2	2
CO5	3	1	3	2	3

3 = Strong 2 = Medium 1= Low

COURSE DESIGNERS: Dr.A.Shakila Jemima & Dr.S.Nagarani

****

Core Subject **LINEAR ALGEBRA** **Code: 212003502**

SEMESTER V **6 Hrs/Week**

Credits 4

PREAMBLE:-

- ***To provide the basic knowledge about the vector spaces, linear transformations and Matrices.***

COURSE OUTCOMES (COs)

On Successful completion of the course, the student will be able to

No.	Course Outcomes	Knowledge Level (According to Bloom's Taxonomy)
CO1	explain the fundamental concepts of vector spaces and linear independency.	Up to K3
CO2	demonstrate the structural intricacy of vector spaces affected by linear transformations.	Up to K3
CO3	illustrate the knowledge of inner product spaces as a special case of vector spaces and its applications.	Up to K3
CO4	use computational techniques essential for the study of matrix algebra.	Up to K3
CO5	apply algebraic skills to solve system of equations and to find eigen values and eigen vetors of a matrix.	Up to K3

K1- Knowledge K2 – Understand K3-Apply

UNIT – I: **[18 Hrs]**

Vector Spaces: Definition and Examples – subspaces – span of a set – Linear Independence.

UNIT – II: **[18 Hrs]**

Linear Transformation – Basis and Dimension – Rank and Nullity – Matrix of a Linear Transformation

UNIT – III: **[18 Hrs]**

Inner product spaces: Definition and Examples – Orthogonality – Orthogonal complement.

UNIT – IV: **[18 Hrs]**

Theory of matrices: Algebra of matrices – Types of Matrices – The inverse of a matrix – Elementary Transformation – Rank of a matrix.

UNIT – V: **[18 Hrs]**

Simultaneous Linear Equations – Characteristic Equation and Cayley Hamilton Theorem – Eigen Values and Eigen vectors.

TEXT BOOK:

01.S.Arumugam, Thangapandi A., Isaac, Modern Algebra, Scitech Publications (India) Private Limited, Reprint 2013.

UNIT – I : Chapters – 5.1, 5.2, 5.4, 5.5
UNIT – II : Chapters – 5.3, 5.6, 5.7, 5.8
UNIT – III : Chapters – 6.1 to 6.3
UNIT – IV : Chapters – 7.1 to 7.5
UNIT – V : Chapters – 7.6 to 7.8

REFERENCES:

01.Vasistha, Modern Algebra, Krishna Publications, 1998.
02.Sharma J.N. and Vashishtha A.R.. Linear Algebra, Krishna Prakasha Mandir, 2002.

WEB RESOURCES:

1. https://byjus.com/maths/linear-algebra/
2. https://www.cuemath.com/algebra/linear-algebra/
3.https://machinelearningmastery.com/gentle-introduction-linear-algebra/

PEDAGOGY: Lecture, Black board, LCD

COURSE CONTENTS & TEACHING / LEARNING SCHEDULE

	Topic	No. of Lectures	Content Delivery Method	Teaching Aids
UNIT – I [18 Hrs]				
1.1	Vector Spaces- Definition and Examples	5	Lecture	Black Board
1.2	subspaces	5	Lecture	Black Board
1.3	span of a set	4	Lecture	Black Board
1.4	Linear Independence.	4	Lecture	Black Board
UNIT – II [18 Hrs]				
2.1	Linear Transformation	4	Lecture	Black Board
2.2	Basis and Dimension	5	Lecture	LCD
2.3	Rank and Nullity	4	Lecture	Black Board
2.4	Matrix of a Linear Transformation	5	Lecture	Black Board
UNIT – III [18 Hrs]				
3.1	Inner product spaces: Definition and Examples	6	Lecture	Black Board
3.2	Orthogonality	6	Lecture	Black Board
3.3	Orthogonal complement.	6	Lecture	Black Board
UNIT – IV [18 Hrs]				
4.1	Theory of matrices: Algebra of matrices Elementary	4	Lecture	Black Board
4.2	Types of Matrices	4	Lecture	LCD
4.3	The inverse of a matrix	4	Lecture	LCD
4.4	Transformation	3	Lecture	Black Board
4.5	Rank of a matrix.	3	Lecture	Black Board
UNIT – V [18 Hrs]				
5.1	Simultaneous Linear Equations	6	Lecture	Black Board
5.2	Characteristic Equation and Cayley Hamilton Theorem	6	Lecture	LCD
5.3	Eigen Values and Eigen vectors.	6	Lecture	LCD

MAPPING OF COs WITH POs

	PO1	PO2	PO3	PO4	PO5
CO1	3	2	1	3	3
CO2	3	3	3	2	2
CO3	3	3	2	1	3
CO4	3	1	3	2	1
CO5	3	3	2	2	2

3 = Strong 2 = Medium 1= Low

COURSE DESIGNERS: Dr.A.Shakila Jemima & Dr. M.Sumathi

****

Core Subject **DISCRETE MATHEMATICS** **Code: 212003503**

SEMESTER V **4 Hrs/Week**

Credits 4

PREAMBLE:

- ***To introduce the essence of mathematical logics and its ramifications.***
- ***To introduce the formulae and estimates which are used in computer algorithms.***

COURSE OUTCOMES (COs)

On Successful completion of the course, the student will be able to

No.	Course Outcomes	Knowledge Level (According to Bloom's Taxonomy)
CO1	identify statements with truth tables.	Up to K3
CO2	write an argument using logical notation and determine if the argument is valid or not.	Up to K3
CO3	examine the validity of the verbal (or) symbolic arguments using rules of inference.	Up to K3
CO4	demonstrate effectively the addition and multiplication principles and use it for counting.	Up to K3
CO5	use generating function to solve combinatorial problems.	Up to K3

K1- Knowledge K2 – Understand K3-Apply

UNIT – I: **[12 Hrs]**

T.F – statements – connectives – atomic and compound statements. Well – formed (statement) formulae – parsing trees – the truth table of a formula – Tautology.

UNIT – II: **[12 Hrs]**

Tautological implications and equivalence of formulae, Replacement process – Functionally complete sets of connectives and duality law. Normal forms – Principal normal forms.

UNIT – III: **[12 Hrs]**

Theory of inference – open statements – quantifiers (Exclude bound and free variables)

UNIT – IV: **[12 Hrs]**

Fundamental principles of counting – The rules of sum and product – Permutations – Combinations with repetition. The principle of inclusion and exclusion – problems.

UNIT – V: **[12 Hrs]**

Generalizations of the principle – problems. Generating functions – Introductory examples – Calculational techniques.

TEXT BOOKS:

01. Discrete Mathematics, Dr. M.K. Venkataraman, Dr. N. Sridharan, Dr. N. Chandrasekaran, the National Publishing company,September 2007.
02. Ralph P. Grimaldi, Ramana B. V., Discrete and Combinatorial Mathematics, 5th Edition, Pearson publications, 2007.

REFERENCES:

01. Discrete and combinatorial Mathematics(An applied Introduction) Ralph P. Grimaldi, B.V. Ramana pearson, 5th Edition, 2014.
02. Discrete Mathematics, Schaum's outline, Seymour Lipschutz, Marc Lars Lipson, Mcgraw-Hill Publishing company Ltd., Revised 3rd Edition, 2013.
03. Discrete Mathematics, with graph theory and combimatorics, T. Veerarajan, Mc Graw Hill Education (India) Pvt.Ltd., 2013.
04. Kenneth H Rosen, Discrete Mathematics and its applications with combinatorics and graph theory, 7th edition, McGraw Hill Education (India) – Private Limited, 2017.
05. Vasudev C., Theory and problems of combinatorics, New age publishers, 1st edition, 2008.
06. Ramaswamy, Discrete Mathematical Structures with Applications to Combinatorics, Univesities Press (India) Pvt., Ltd., 2008.

WEB RESOURCES:

01. https://math.libretexts.org/Bookshelves/Combinatorics_and_Discrete_Mathematics/A_Spiral_Workbook_for_Discrete_Mathematics_(Kwong)/02%3A_Logic/2.01%3A_Propositions
02. https://study.com/academy/lesson/propositions-truth-values-and-truth-tables.html
03. https://www.geeksforgeeks.org/normal-and-principle-forms/
04. https://www.tutorialspoint.com/discrete_mathematics/rules_of_inference.htm
05. https://www.geeksforgeeks.org/mathematical-logic-rules-inference/
06. https://math.mit.edu/~fgotti/docs/Courses/Combinatorial%20Analysis/2.%20Mathematical%20Induction/Mathematical%20Induction.pdf
07. https://brilliant.org/wiki/principle-of-inclusion-and-exclusion-pie/
08. https://math.berkeley.edu/~shiyu/s15math53/generating_functions.pdf
09. https://www.edudose.com/maths/permutation-combination-formulas-tricks/
10. https://www.whitman.edu/mathematics/cgt_online/book/section03.03.html

PEDAGOGY: Lecture, Black board, LCD Projector.

COURSE CONTENTS & TEACHING / LEARNING SCHEDULE

Module No.	Topic	No. of Lectures	Content Delivery Method	Teaching Aids
	UNIT – I	[12 Hrs]		
1.1	T.F – statements	3	Lecture	Black Board
1.2	connectives	2	Lecture	LCD
1.3	atomic and compound statements.	3	Lecture	LCD

1.4	Well – formed (statement) formulae – parsing trees	2	Lecture	Black Board
1.5	The truth table of a formula, Tautology.	2	Lecture	Black Board
	UNIT – II	[12 Hrs]		
2.1	Tautological implications and equivalence of formulae..	3	Lecture	Black Board
2.2	Replacement process	3	Lecture	LCD
2.3	Functionally complete sets of connectives and duality law	3	Lecture	LCD
2.4	Normal forms, Principal normal forms	3	Lecture	Black Board
	UNIT – III	[12 Hrs]		
3.1	Theory of inference	4	Lecture	Black Board
3.2	Open statements	4	Lecture	LCD
3.3	Quantifiers (Exclude bound and free variables)	4	Lecture	LCD
	UNIT – IV	[12 Hrs]		
4.1	Fundamental principles of counting	3	Lecture	Black Board
4.2	The rules of sum and product	3	Lecture	LCD
4.3	Permutations	2	Lecture	LCD
4.4	Combinations with repetition.	2	Lecture	Black Board
4.5	The principle of inclusion and exclusion, problems	2	Lecture	Black Board
	UNIT – V	[12 Hrs]		
5.1	Generalizations of the principle, problems.	3	Lecture	Black Board
5.2	Generating functions	3	Lecture	LCD
5.3	Introductory examples	3	Lecture	LCD
5.4	Calculational techniques.	3	Lecture	Black Board

MAPPING OF COs WITH POs

	PO1	**PO2**	**PO3**	**PO4**	**PO5**
CO1	3	3	2	2	1
CO2	3	1	3	3	2
CO3	3	2	1	2	2
CO4	3	2	3	1	3
CO5	3	3	2	2	2

3 = Strong 2 = Medium 1= Low

COURSE DESIGNERS: Dr.R.Amutha & Dr.S.Karthigai Selvam

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Core Subject **OPERATIONS RESEARCH** **Code: 212003504**

SEMESTER V **4 Hrs/Week**

Credits 2

PREAMBLE:

- ***To introduce a fundamental knowledge of formation of Linear programming problem.***
- ***To motivate the learners to find the solutions.***

COURSE OUTCOMES (COs)

On Successful completion of the course, the student will be able to

No.	**Course Outcomes**	**Knowledge Level (According to Bloom's Taxonomy)**
CO1	formulate Linear Programming Problem and find its solution	Up to K3

CO2	exploit the concept of duality and solve the linear programming problem	Up to K3
CO3	solve transportation problem using MODI method.	Up to K3
CO4	solve assignment and travelling salesman's problem.	Up to K3
CO5	propose the best strategy in a game using different decision making tools.	Up to K3

K1- Knowledge K2 – Understand K3-Apply

UNIT – I: **[12 Hrs]**

Mathematical formulation of the problem – Examples of linear programming problem – Simple examples – Graphical solution method – some exceptional cases – General Linear Programming problem – Canonical and standard forms of L.P.P. – solutions of L.P.P. – Basic solutions – Simplex method – Charne's method of penalties, or Big M– Method.

UNIT – II: **[12 Hrs]**

Introduction – Primal – Dual pair – Formulating a Dual problem – primal – Dual pair in Matrix form – Duality theorems – complementary slackness theorem - Duality and simplex method

UNIT – III: **[12 Hrs]**

Transportation problem – LP formulation of the Transportation problem – Finding an Initial Basic feasible solutions by North West Corner Rule, Matrix minima (least – cost) method and Vogel's approximation method - Optimum solution by the modified distribution method (MODI method)– special cases in transportation problem.

UNIT – IV: **[12 Hrs]**

Assignment problem - mathematical formulation of the problem - solution of Assignment problem - special cases in Assignment problem – the travelling salesman problem.

UNIT – V: **[12 Hrs]**

Game Theory – Two person zero sum games – the maximin and Minimax principle – Solution of Game with Saddle points – Solution of game without saddle points – Mixed strategies – Graphical method – Method of dominance – general solution of (mxn) rectangular games by linear programming method.

TEXT BOOK:

Kanthi Swarap and Others, Operation Research, Sultan Chand and Sons, New Delhi, 14th edition, 2008.

UNIT – I : 2.3, 2.4, 3.2 to 3.5, 4.1, 4.3, 4.4
UNIT – II : 5.1 to 5.7, 5.9
UNIT – III :10.2, 10.8 to 10.10, 10.13, 11.2, 11.3, 11.4, 11.7
UNIT – IV : 17.2, 17.4 to 17.7, 17.9
UNIT – V : 25.1 to 25.7

REFERENCES:

1. Gupta P.K., Operations Research, S. Chand, 2007.
2. Panner Selvam, Operations Research, Prentice Hall of India, New Delhi, 2013.

WEB RESOURCES:

1. https://www.coursera.org/courses?query=operations%20research
2. https://www.classcentral.com/course/swayam-operations-research-14219
3. https://orc.mit.edu/academics/course-offerings

PEDAGOGY: Lecture, Black board, LCD Projector.

COURSE CONTENTS & TEACHING / LEARNING SCHEDULE

Module No.	Topic	No. of Lectures	Content Delivery Method	Teaching Aids
UNIT – I [12 Hrs]				
1.1	Mathematical formulation of the problem, Examples of linear programming problem	3	Lecture	Black Board
1.2	Simple examples, Graphical solution method, some exceptional cases	3	Lecture	LCD
1.3	General Linear Programming problem, Canonical and standard forms of L.P.P., solutions of L.P.P.	2	Lecture	LCD
1.4	Basic solutions, Simplex method	2	Lecture	Black Board
1.5	Charne's method of penalties, or Big M–Method and two phase method	2	Lecture	Black Board
UNIT – II [12 Hrs]				
2.1	Introduction, Primal – Dual pair, Formulating a Dual problem	3	Lecture	Black Board
2.2	primal – Dual pair in Matrix form	3	Lecture	LCD
2.3	Duality theorems-complementary slackness theorem	3	Lecture	LCD
2.4	Duality and simplex method	3		
UNIT – III [12 Hrs]				
3.1	Transportation problem – LP formulation of the Transportation problem	3	Lecture	Black Board
3.2	Finding an Initial Basic feasible solutions by North West Corner Rule	3	Lecture	LCD
3.3	Matrix minima (least – cost) method and Vogel's approximation method	2	Lecture	LCD
3.4	Optimum solution by the modified distribution method (MODI method	2	Lecture	Black Board
3.5	special cases in transportation problem.	2	Lecture	Black Board
UNIT – IV [12 Hrs]				
4.1	Assignment problem	2	Lecture	Black Board

4.2	Mathematical formulation of the problem	3	Lecture	LCD
4.3	Solution of Assignment problem	2	Lecture	LCD
4.4	Special cases in Assignment problem	3	Lecture	Black Board
4.5	The travelling salesman problem.	2	Lecture	Black Board
UNIT – V [12 Hrs]				
5.1	Game Theory - Two person zero sum games	3	Lecture	Black Board
5.2	The maximin and Minimax principle	2	Lecture	LCD
5.3	Solution of Game with Saddle points, Solution of game without saddle points	3	Lecture	LCD
5.4	Mixed strategies – Graphical method	2	Lecture	Black Board
5.5	Method of dominance, general solution of (mxn) rectangular games by linear programming method.	2	Lecture	Black Board

MAPPING OF COs WITH POs

	PO1	**PO2**	**PO3**	**PO4**	**PO5**
CO1	3	3	3	3	2
CO2	2	3	1	2	3
CO3	3	3	3	1	2
CO4	3	2	1	3	3
CO5	3	3	2	2	1

3 = Strong 2 = Medium 1= Low

COURSE DESIGNERS: Dr. A.Shakila Jemima & Dr. S.Nagarani

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Core Subject **OPERATIONS RESEARCH LAB** **Code: 212003505**

SEMESTER V **4 Hrs/Week**

Credits 2

PREAMBLE:

- **To motivate the students in tackling different types of problems in operations research**

1. Graphical solution method.
2. Simplex method..
3. Big-M method.
4. Duality and Simplex method
5. Transportation Problem – MODI method
6. Transportation problem – Special cases
7. Assignment problem
8. Travelling salesman problem
9. Solution of game using graphical method
10. Solution of rectangular games by linear programming method

REFERENCES:

1. Kanthi Swarap and Others, Operation Research, Sultan Chand and Sons, New Delhi, 14th edition, 2008.

2. Handy A. Taha, Operations Research, An Introduction, 10th edition, Pearson, 2017.
3. Gupta P.K., Operations Research, S. Chand, 2007.
4. Panner Selvam, Operations Research, Prentice Hall of India, New Delhi, 2013.

WEB RESOURCES:

1. https://www.coursera.org/courses?query=operations%20research
2. https://www.classcentral.com/course/swayam-operations-research-14219
3. https://orc.mit.edu/academics/course-offerings

PEDAGOGY: Lecture, Black board, LCD Projector.

COURSE DESIGNERS: Dr. A.Shakila Jemima & Dr. S. Karthigai Selvam

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Elective -I **1. MATHEMATICAL STATISTICS – I** **Code: 212003506**

SEMESTER V **5 Hrs/Week**

Credits 5

PREAMBALE:-

- ***To provide basic knowledge about statistical tools.***

COURSE OUTCOMES (COs)

On Successful completion of the course, the student will be able to

No.	Course Outcomes	Knowledge Level (According to Bloom's Taxonomy)
CO1	analyze statistical data using measures of central tendency/dispersion.	Up to K3
CO2	calculate moments about mean/any point.	Up to K3
CO3	fit the appropriate curve using the method of least squares	Up to K3
CO4	evaluate the relation between different data	Up to K3
CO5	check the consistency of the data.	Up to K3

K1- Knowledge K2 – Understand K3-Apply

UNIT – I: **[15 Hrs]**

Measures of Dispersion: Introduction – characteristics of an ideal measure of dispersion – measures of Dispersion - Range – inter Quartile difference – Average Deviation – Minimal property of Average deviation – Variance - Standard deviation – coefficient of variation – Relation between standard and Root – mean square deviations – effect of change of origin and scale – mean difference on standard deviation.

UNIT – II: **[15 Hrs]**

Skewness and Kurtosis: Moments – moments about the mean in terms of moments about any point and conversely – Effect of change of origin and scale on moments – symmetrical and Skew distributions – Pearson's β and Υ coefficients – Factorial moments – Absolute moment – moments for a Bivariate distribution.

UNIT – III: **[15 Hrs]**

Principle of least squares and fitting of curves: The Principle of least squares – fitting of curves – fitting of polynomials or parabolic curves - Fitting of the curves of the form $y=ab^x$ $y=ax^b$ and $y=ae^{bx}$.

UNIT – IV: **[15 Hrs]**

Correlation and Regression: Bivariate distribution - Correlation coefficient – Effect of change of origin and scale of reference on correlation coefficient – uncorrelated – limits for the coefficient of correlation – Bivariate frequency distribution – Regression and its analysis – curvilinear regression – Linear Regression – Equations to the lines of regression – Regression coefficients – correlation of ranks.

UNIT – V: **[15 Hrs]**

Theory of Attributes: Attributes – Introduction – Notations – Dictionary – class and class frequencies – order of classes and class frequencies – class symbols as operators – consistence of data – conditions for consistency of data – Independence of attributes – criterions of independence – symbols (AB) and S - association of attributes. Yule's coefficient of Association.

TEXT BOOK:

1. Kapur J.N., Saxena H.C., Mathematical statistics, 2003.
   - UNIT – I : 3.1, 3.1.1, 3.2.1, to 3.2.7
   - UNIT – II : 3.3,3.3.1,3.3.2,3.4, 3.5, 3.6.1, 3.6.2, 3.7
   - UNIT – III : 9.1 to 9.3
   - UNIT – IV : 10.1,10.1.1 to 10.1.3, 10.2, 10.3, 10.3.1, 10.3.2, 10.6
2. Gupta S.P., Kapoor V.K., Fundamentals of Mathematical Statistics, Sultan Chand & Sons.
   - UNIT – V : 11.1, 11.2, 11.3, 11.4, 11.4.1, 11.4.2, 11.5, 11.6, 11.6.1, 11.7, 11.7.1, 11.7.2, 11.8, 11.8.1

REFERENCES:

1. S. Arumugam Issac, Statistics, 2009
2. Gupta S.C., Fundamentals of statistics, 2008.

WEB RESOURCES:

1. https://www.cuemath.com/data/statistics/
2. https://stat.ethz.ch/~geer/mathstat.pdf
3. https://ocw.mit.edu/courses/18-655-mathematical-statistics-spring-2016/

PEDAGOGY: Lecture, Black board, LCD

COURSE CONTENTS & TEACHING / LEARNING SCHEDULE

Module No.	Topic	No. of Lectures	Content Delivery Method	Teaching Aids
UNIT – I [15 Hrs]				
1.1	Measures of Dispersion: Introduction, characteristics of an ideal measure of dispersion	3	Lecture	Black Board
1.2	measures of Dispersion	3	Lecture	LCD

1.3	Range, inter Quartile difference	3	Lecture	LCD
1.4	Average Deviation – Minimal property of Average deviation Variance, Standard deviation, coefficient of variation	3	Lecture	Black Board
1.5	Relation between standard and Root – mean square deviations, effect of change of origin and scale, mean difference on standard deviation.	3	Lecture	Black Board
UNIT – II [15 Hrs]				
2.1	Skewness and Kurtosis: Moments – moments about the mean in terms of moments about any point and conversely	3	Lecture	Black Board
2.2	Effect of change of origin and scale on moments	3	Lecture	LCD
2.3	Symmetrical and Skew distributions	3	Lecture	LCD
2.4	Pearson's β and ϒ coefficients Factorial moments –	3	Lecture	Black Board
2.5	Absolute moment, moments for a Bivariate distribution.	3	Lecture	Black Board
UNIT – III [15 Hrs]				
3.1	Principle of least squares and fitting of curves: The Principle of least squares	4	Lecture	Black Board
3.2	Fitting of curves	3	Lecture	LCD
3.3	Fitting of polynomials or parabolic curves	4	Lecture	LCD
3.4	Fitting of the curves of the form $y=ab^x$ $y=ax^b$ and $y=ae^{bx}$.	3	Lecture	Black Board
5.5				
4.1	Correlation and Regression: Bivariate distribution - Correlation coefficient	2	Lecture	Black Board
4.2	Effect of change of origin and scale of reference on correlation coefficient	2	Lecture	LCD
4.3	uncorrelated – limits for the coefficient of correlation	2	Lecture	LCD
4.4	Bivariate frequency distribution, Regression and its analysis, curvilinear regression	3	Lecture	Black Board
4.5	Linear Regression, Equations to the lines of regression	3	Lecture	Black Board
4.6	Regression coefficients correlation of ranks.	3	Lecture	Black Board
UNIT – V [15 Hrs]				
5.1	Theory of Attributes: Attributes, Introduction, Notations, Dictionary	3	Lecture	Black Board

5.2	Class and class frequencies, order of classes and class frequencies , class symbols as operators	3	Lecture	LCD
5.3	Consistence of data, conditions for consistency of data	3	Lecture	LCD
5.4	Independence of attributes, criterions of independence, symbols (AB)◦ and S association of attributes.	3	Lecture	Black Board
5.5	Yule's coefficient of Association.	3	Lecture	Black Board

MAPPING OF COs WITH POs

	PO1	**PO2**	**PO3**	**PO4**	**PO5**
CO1	3	3	3	3	3
CO2	2	1	3	2	2
CO3	3	2	2	3	1
CO4	3	3	3	2	3
CO5	2	3	2	1	3

3 = Strong 2 = Medium 1= Low

COURSE DESIGNERS: Dr.R.Amutha & Dr.M.Sumathi

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Elective-I **2. NUMBER THEORY** **Code: 212003507**

SEMESTER V **5 Hrs/Week**

Credits 5

PREAMBLE:

- ***To introduce the concept of mathematical induction, prime numbers and congruences.***

COURSE OUTCOMES (COs)

On Successful completion of the course, the student will be able to

No.	**Course Outcomes**	**Knowledge Level (According to Bloom's Taxonomy)**
CO1	recall the basic concepts of divisibility	Up to K3
CO2	analyse various arithmetic functions	Up to K3
CO3	apply divisibility concept to factorial of a number	Up to K3
CO4	discuss on quadratic congruence equations.	Up to K3
CO5	demonstrate renowned theorems in solving congruences.	Up to K3

K1- Knowledge K2 – Understand K3-Apply

UNIT – I: **[15 Hrs]**

Theory of Numbers – prime and composite number – The sieve of Eratosthenes – Divisors of a given number – simple problems

UNIT – II: **[15 Hrs]**

Euler's function – Integral part of a real number – simple problems.

UNIT – III: **[15 Hrs]**

The highest power of a prime ρ contained in n! – simple problems – The product of r consecutive integers is divisible by r! – simple problems.

UNIT – IV: **[15 Hrs]**

Congruence – Criteria of divisibility of a number – simple problems – Numbers in Arithmetic progression – Fermat's theorem.

UNIT – V: **[15 Hrs]**

Generalization of Fermat's theorem – Wilson's theorem – Lagrange's theorem – Simple problems.

TEXT BOOK:

Dr. Arumaugam and Issac, Theory of Equations and Number theory.

REFERENCES:

01. T.K. Manicavasagam Pilli and Narayanan, Algebra I & II, S.V. Publications - 2008.
02. Burton D.M, Elementary Number Theory, Universal book stall, 2012.

WEB RESOURCES:

1.http://discrete.openmathbooks.org/dmoi2/sec_addtops-numbth.html
2. https://www.math.brown.edu/johsilve/frintch1ch6.pdf
3.https://uwaterloo.ca/pure-mathematics/about-pure-math/what-is-pure-math/what-is-number-theory

PEDAGOGY: Lecture, Black board, LCD

COURSE CONTENTS & TEACHING / LEARNING SCHEDULE

Module No.	Topic	No. of Lectures	Content Delivery Method	Teaching Aids
	UNIT – I	[15 Hrs]		
1.1	Theory of Numbers – prime and composite number	4	Lecture	Black Board
1.2	The sieve of Eratosthenes	4	Lecture	LCD
1.3	Divisors of a given number	4	Lecture	LCD
1.4	simple problems	3	Lecture	Black Board
	UNIT – II	[15 Hrs]		
2.1	Euler's function	5	Lecture	Black Board
2.2	Integral part of a real number	5	Lecture	LCD
2.3	simple problems.	5	Lecture	LCD
	UNIT – III	[15 Hrs]		
3.1	The highest power of a prime ρ contained in n!	5	Lecture	Black Board
3.2	simple problems	5	Lecture	LCD
3.3	The product of r consecutive integers is divisible by r!, simple problems	5	Lecture	LCD
	UNIT – IV	[15 Hrs]		
4.1	Congruence —Numbers in arithmetic progression	3	Lecture	Black Board
4.2	Criteria of divisibility of a number	3	Lecture	LCD
4.3	Simple problems	3	Lecture	LCD

4.4	Arithmetic progression	3	Lecture	Black Board
4.5	Fermat's theorem.	2	Lecture	Black Board
	UNIT – V [15 Hrs]			
5.1	Generalization of Fermat's theorem	4	Lecture	Black Board
5.2	Wilson's theorem	4	Lecture	LCD
5.3	Lagrange's theorem	4	Lecture	LCD
5.4	Simple problems	3	Lecture	Black Board

MAPPING OF COs WITH POs

	PO1	**PO2**	**PO3**	**PO4**	**PO5**
CO1	3	3	2	3	2
CO2	3	2	3	1	3
CO3	2	3	1	3	1
CO4	3	3	2	3	3
CO5	2	3	3	2	2

3 = Strong 2 = Medium 1= Low

COURSE DESIGNERS: Dr.R.Amutha & Dr.S.Nagarani

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Part – IV **ASTRONOMY - I** **Code: 214403520**

Skill Based Elective-V **SEMESTER V** **2 Hrs/Week**

Credits 2

PREAMBLE:-

- ***To provide the basic knowledge of the celestial bodies.***
- ***To assess scientific evidence for life on other planets.***

COURSE OUTCOMES (COs)

On Successful completion of the course, the student will be able to

No.	**Course Outcomes**	**Knowledge Level (According to Bloom's Taxonomy)**
CO1	recall the basic concepts on spheres and develop knowledge about spherical triangles	Up to K3
CO2	develop a co-ordinate system and know to measure distances on a sphere	Up to K3
CO3	define the day, month, year, and planetary time periods	Up to K3
CO4	determine the latitude of a place with baseline knowledge of the sun and the stars	Up to K3
CO5	interpret knowledge on dip of horizon in studying about circumpolar stars	Up to K3

K1- Knowledge K2 – Understand K3-Apply

UNIT – I: **[6 Hrs]**

Spherical trigonometry – Spherical triangle – Formulae (without proof) – Simple Problems.

UNIT – II: **[6 Hrs]**

Celestial sphere – Four systems of celestial Co–ordinates – Problems – Simple Problems only.

UNIT – III: **[6 Hrs]**

Sidereal times – West hour angle – Latitude of a place – Duration of day and night time. Azimuth of a star at rising - Simple Problems only.

UNIT – IV: **[6 Hrs]**

The variations in the duration of day and night during a year (Article 88).

UNIT – V: **[6 Hrs]**

Dip of horizon – Circum polar stars. Simple Problems only.

TEXT BOOK:

S.Kumaravelu, Susheela Kumaravelu, Astronomy, Reprinted 2007, S.K.V.Publications, Nagerkoil.

UNIT – I : Chapter I
UNIT – II : Chapter II– pg (41 – 58)
UNIT – III : Chapter II – pg (59 – 74)
UNIT – IV : chapter III– Article 88 only
UNIT – V : Section – 5 & chapter II– pg (77 – 87)

REFERENCES:

1. Ramachandran G.V., Astronomy, S. Chand Publications.
2. Bhupendra Singh, Spherical Astronomy and Space Dynamics, Pragati Prakashan, Meerut, 1st Edition, 2008.

PEDAGOGY : Black Board; Lecture; LCD.

WEB RESOURCES:

1. https://www.astronomytrek.com
2. https://www.space.com
3. https://www.astronomynow.com
4. https://www.astrobites.org

COURSE CONTENTS & TEACHING / LEARNING SCHEDULE

Module No.	Topic	No. of Lectures	Content Delivery Method	Teaching Aids
UNIT – I [6 Hrs]				
1.1	Introduction	1	Lecture	Black Board
1.2	Spherical trigonometry	1	Lecture	Black Board
1.3	Spherical triangle	1	Lecture	Black Board
1.4	Formulae	1	Lecture	Black Board
1.5	Simple Problems	2	Lecture	Black Board
UNIT – II [6 Hrs]				
2.1	Celestial sphere	1	Lecture	LCD Projector
2.2	Four systems of celestial Co–ordinates	2	Lecture	LCD Projector
2.3	Problems	3	Lecture	Black Board
UNIT – III [6 Hrs]				
3.1	Sidereal times, West hour angle	1	Lecture	Black Board
3.2	Latitude of a place	1	Lecture	LCD Projector
3.3	Duration of day and night time - Azimuth of a star at rising	2	Lecture	LCD Projector
3.4	Problems	2	Lecture	Black Board
UNIT – IV [6 Hrs]				
4.1	Variations in the duration of day and night	2	Lecture	LCD Projector
4.2	Problems	4	Lecture	Black Board
UNIT – V [6 Hrs]				
5.1	Dip of horizon	2	Lecture	LCD Projector
5.2	Circum polar stars	2	Lecture	LCD Projector
5.3	Problems	2	Lecture	Black Board

MAPPING OF COs WITH POs

	PO1	PO2	PO3	PO4	PO5
CO1	1	3	3	2	2
CO2	1	3	3	3	2
CO3	1	3	3	2	2
CO4	2	3	3	3	2
CO5	1	3	3	2	2

3 = Strong 2 = Medium 1= Low

COURSE DESIGNERS: Dr. M.Sumathi & Dr. R.Amutha

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MATHEMATICAL APTITUDE FOR COMPETITIVE EXAMINATIONS

Self Learning Course **SEMESTER V** **Code: 218003520**

Addl.Credits 4

PREAMBLE:

- ***To make the students think logically and objectively.***
- ***To develop skills to attend the competitive exams confidently.***
- ***To expose the technique of problem solving on quantitative aptitude.***

UNIT – I:

Average, Ratio and proportion

UNIT – II:

Problems on Numbers, Problems on Ages

UNIT – III:

Time and Work, Time and Distance

UNIT – IV:

Percentage: concept of percentage – problems on population – problems on depreciation, Permutations and combinations

UNIT – V

Profit and loss, Simple interest

TEXT BOOK:

Aggarwal R.S., Quantitative Aptitude, S.Chand & company Ltd, New Delhi, Revised Edition (Reprint 2020)

Unit – I : Chapters 6, 13
Unit – II : Chapters 7, 8
Unit – III : Chapters 17, 18
Unit – IV : Chapters 11, 30
Unit – V : Chapters 12, 22

REFERENCES :

01. Ranganath G.K, Sampangiram C.S, and Rajaram.Y, & text books of business Mathematics, Himalaya Publishing House, New Delhi, Reprint 2006.
02. Ponnien Selvi.M, & Sri Devi.N, Business Mathematics, Yoga Publishing House, Virudhunagar, 2007.

WEB RESOURCES:

1. https://youtu.be/KE7tQf9spPg
2. https://youtu.be/7DJ-lzPnv8I

3. https://youtu.be/vsBpWgNYjtQ
4. https://www.javatpoint.com/aptitude/quantitative
5. https://testbook.com/learn/maths-time-and-work/
6. http://www.practiceaptitudetests.com/

COURSE DESIGNERS: Dr. M.Sumathi & Dr.S.Nagarani

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Core Subject **COMPLEX ANALYSIS** **Code: 212003601**

SEMESTER VI **6 Hrs/Week**

Credits 5

PREAMBLE:

- ***To investigate the functions of complex numbers.***
- ***To motivate the learners to find the integration of complex functions.***

COURSE OUTCOMES (COs)

On Successful completion of the course, the student will be able to

No.	Course Outcomes	Knowledge Level (According to Bloom's Taxonomy)
CO1	differentiate differentiability and analyticity. Charaterize analytic functions with Cauchy Riemann equations.	Up to K3
CO2	demonstrate bilinear transformation as composition of elementary transformations. Compile the relation between bilinear transformation and cross ratio.	Up to K3
CO3	outline the procedure for integration of complex functions. Use Cauchy's integral formula and its consequences to prove most important theorems.	Up to K3
CO4	compute power series expansion in connected region, annular region of an analytic function.	Up to K3
CO5	identify different types of singularities and poles, calculate the residure. Use contour integration to find integrals of real valued functions of certain types.	Up to K3

K1- Knowledge K2 – Understand K3-Apply

UNIT – I: **[18 Hrs]**

Limits – Continuity – Derivatives – Analytic functions .

UNIT – II **[18 Hrs]**

Transformation – Bilinear Transformation – Cross ratio – Special bilinear transformation.

UNIT – III **[18 Hrs]**

Definite Integrals – Properties of Definite Integrals – Contours – Line integrals – Cauchy's Integral theorem – Cauchy – Goursat theorem (Cauchy's theorem) – Extension of Cauchy's Integral theorem - Cauchy's Integral Formula – Derivatives of analytic functions – Morera's theorem - Cauchy's inequality – Liouville's theorem – Fundamental theorem of Algebra - Maximum Modules theorem.

UNIT – IV **[18 Hrs]**

Taylor's series – Laurent's series – Zeros of an Analytic function – Singularities – Riemann's theorem – Weriestrass's theorem.

UNIT – V **[18 Hrs]**

Residues - Cauchy's Residue theorem – Contour integration – Type I – Type II. (excluded Type – III)

TEXT BOOK:

T.K. Manica Vachagam Pillay and others – Complex Analysis, 2007.
Unit 1 – chapter 2
Unit 2 – chapter 3
Unit 3 – chapter 4
Unit 4 – chapter 5 (143 to 172)
Unit 5 – chapter – 6

REFERENCES :

1. S.Arumugam and others – Complex Analysis, 2014.
2. P. Duraipandian, Laxmi Durai Pandian, Complex Analysis, Emerald Publishers, 1999.

WEB RESOURCES:

1. https://complex-analysis.com/
2. https://byjus.com/maths/complex-analysis/
3. https://www.math.ucla.edu/~honda/math520/notes.pdf

PEDAGOGY: Lecture, Black board, LCD.

COURSE CONTENTS & TEACHING / LEARNING SCHEDULE

Module No.	Topic	No. of Lectures	Content Delivery Method	Teaching Aids
UNIT – I [18 Hrs]				
1.1	Limits	4	Lecture	Black board
1.2	Continuity	4	Lecture	Black board
1.3	Derivatives	4	Lecture	Black board
1.4	Analytic functions	6	Lecture	Black board
UNIT – II [18 Hrs]				
2.1	Transformations	4	Lecture	LCD
2.2	Bilinear Transformation	5	Lecture	Black board
2.3	Cross ratio	4	Lecture	Black board
2.4	Special bilinear transformation.	5	Lecture	LCD
UNIT – III [18 Hrs]				
3.1	Definite Integrals, Properties of Definite Integrals	5	Lecture	Black board
3.2	Contours , Line integrals	3	Lecture	Black board
3.3	Cauchy's Integral theorem, Cauchy – Goursat theorem	2	Lecture	Black board
3.4	Extension of Cauchy's Integral theorem, Cauchy's Integral Formula, Derivatives of analytic functions Morera's theorem	5	Lecture	Black board
3.5	Cauchy's inequality Liouville's theorem Fundamental theorem of Algebra, Maximum Modules theorem	3	Lecture	Black board

UNIT – IV [18 Hrs]				
4.1	Taylor's series, Laurent's series, Laurent's series	5	Lecture	LCD
4.2	Zeros of an Analytic function	4	Lecture	Black board
4.3	Singularities	4	Lecture	Black board
4.4	Riemann's theorem, Weriestrass's theorem	5	Lecture	Black board
UNIT – V [18 Hrs]				
5.1	Residues	4	Lecture	Black board
5.2	Cauchy's Residue theorem, Contour integration	5	Lecture	Black board
5.3	Type I	5	Lecture	Black board
5.4	Type II	4	Lecture	Black board

MAPPING OF COs WITH POs

	PO1	**PO2**	**PO3**	**PO4**	**PO5**
CO1	3	3	3	2	3
CO2	3	2	2	1	2
CO3	3	3	1	3	2
CO4	3	1	3	2	3
CO5	3	2	2	1	2

3 = Strong 2 = Medium 1= Low

COURSE DESIGNERS: Dr.A.Shakila Jemima & Dr.S.Nagarani

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Core Subject **GRAPH THEORY** **Code: 212003602**

SEMESTER VI **4 Hrs/Week**

Credits 4

PREAMBLE:

- ***To provide the basic knowledge of graphs.***
- ***To provide the basic notions in graph theory.***

COURSE OUTCOMES (COs)

On Successful completion of the course, the student will be able

No.	**Course Outcomes**	**Knowledge Level (According to Bloom's Taxonomy)**
CO1	to know types of graphs.	Up to K3
CO2	to understand Operation on graphs and Travelling Salesman problem.	Up to K3
CO3	to identify the properties of trees.	Up to K3
CO4	to explore and study more about the nature and properties of Planar graphs.	Up to K3
CO5	to study about Chromatic number and Chromatic polynomial and its applications.	Up to K3

K1- Knowledge K2 – Understand K3-Apply

UNIT – I: **[12 Hrs]**

Graph – Finite and Infinite graphs – Incidence and degree – Isolated vertex – Pendant vertex – Null graph – isomorphism - sub graphs, walks, Paths, Circuits, connected graphs, Disconnected graphs and components, Euler graphs.

UNIT – II: **[12 Hrs]**

Operation on graphs – More on Euler graphs – Hamiltonian paths and circuits – The Travelling salesman problem.

UNIT – III: **[12 Hrs]**

Trees – some properties of trees – pendant vertices in a tree – Distance and centers in a tree.

UNIT – IV: **[12 Hrs]**

Planar graphs – Kuratowskis two graphs – different representations of a planar graph.

UNIT – V: **[12 Hrs]**

Chromatic number – chromatic partitioning – chromatic polynomial - matchings – Four colour problem.

TEXT BOOK:

Narsingh Deo, Graph Theory with Applications to Engineering and Computer Science, Prentice Hall of India Pvt., Ltd., New Delhi, 1994.

UNIT – 1 : 1.1, 1.3, 1.4, 1.5, 2.1, 2.2, 2.4 to 2.6
UNIT – 1I : 2.7, 2.8, 2.9, 2.10
UNIT – 1II : 3.1, 3.2, 3.3, 3.4
UNIT – 1V : 5.2, 5.3, 5.4
UNIT – V : 8.1, 8.2, 8.3, 8.4, 8.6

REFERENCES:

1. S.Arumugam and Ramachandran S., Invitation to Graph Theory, New Gamma Publiations, Palayamkottai, 2007.
2. Choudum S.A., A First Course In Graph Theory, McMillan India Ltd. 1987

WEB RESOURCES:

1.https://www.tutorialspoint.com/graph_theory/graph_theory_fundamentals.htm
2. https://www.geeksforgeeks.org/mathematics-euler-hamiltonian-paths/
3. https://www.skedsoft.com/books/graph-theory/operations-of-graphs
4.https://www.tutorialspoint.com/discrete_mathematics/introduction_to_trees.htm
5.https://www.geeksforgeeks.org/mathematics-planar-graphs-graph-coloring/
6. https://www.tutorialspoint.com/graph_theory/graph_theory_coloring.htm

PEDAGOGY : Black Board; Lecture; LCD.

COURSE CONTENTS & TEACHING / LEARNING SCHEDULE

Module No.	Topic	No. of Lectures	Content Delivery Method	Teaching Aids
	UNIT – I [12 Hrs]			
1.1	Graph, Finite and Infinite graphs, Incidence and degree	2	PPT	LCD Projector
1.2	Isolated vertex – Pendant vertex – Null graph	2	PPT	LCD Projector
1.3	Isomorphism - sub graphs,	2	PPT	LCD Projector
1.4	Walks, Paths, Circuits, connected graphs, Disconnected graphs and components	3	PPT	LCD Projector

1.5	Euler graphs	3	PPT	LCD Projector
	UNIT – II	[12 Hrs]		
2.1	Operation on graphs	3	Lecture	Black Board
2.2	More on Euler graphs	4	PPT	LCD Projector
2.3	Hamiltonian paths and circuits	3	PPT	LCD Projector
2.4	The Travelling salesman problem	2	PPT	LCD Projector
	UNIT – III	[12 Hrs]		
3.1	Trees	1	PPT	LCD Projector
3.2	some properties of trees	3	PPT	LCD Projector
3.3	pendant vertices in a tree	4	PPT	LCD Projector
3.4	Distance and centers in a tree	4	PPT	LCD Projector
	UNIT – IV	[12 Hrs]		
4.1	Planar graphs	2	PPT	LCD Projector
4.2	Kuratowskis two graphs	5	PPT	LCD Projector
4.3	Different representations of a planar graph	5	PPT	LCD Projector
	UNIT – V	[12 Hrs]		
5.1	Chromatic number	2	Lecture	Black Board
5.2	Chromatic partitioning	2	Lecture	Black Board
5.3	Chromatic polynomial	3	Lecture	Black Board
5.4	Matchings	2	Lecture	Black Board
5.5	Four colour problem	3	Lecture	Black Board

MAPPING OF COs WITH POs

	PO1	**PO2**	**PO3**	**PO4**	**PO5**
CO1	3	3	2	2	3
CO2	2	3	2	2	3
CO3	3	2	2	3	2
CO4	2	3	2	3	2
CO5	3	3	2	3	2

3 = Strong 2 = Medium 1= Low

COURSE DESIGNERS: Dr.S.Karthigai Selvam & Dr. M.Sumathi

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Core Subject **NUMERICAL METHODS** **Code: 212003603**

SEMESTER VI **4 Hrs/Week**

Credits 2

PREAMBLE:

- ***To provide the students to solve equations using various Numerical methods.***
- ***To provide the students to apply and compare the viability of different approaches to the numerical solutions.***

COURSE OUTCOMES (COs)

On Successful completion of the course, the student will be able to

No.	Course Outcomes	Knowledge Level (According to Bloom's Taxonomy)
CO1	apply various methods to solve Algebraic and Transcendental equations.	Up to K3
CO2	apply various methods to solve simultaneous equations.	Up to K3
CO3	utilize various finite difference operators.	Up to K3
CO4	compare the viability of different approaches to the numerical solution of problems in differentiation and integration.	Up to K3
CO5	derive numerical methods for approximating the solution of an Ordinary Differential Equations.	Up to K3

K1- Knowledge K2 – Understand K3-Apply

UNIT – I: **[12 Hrs]**

Solution of Numerical, Algebraic and Transcendental equations: Bisection method – Iteration method – Regula falsi method – Newton – Raphson method.

UNIT – II: **[12 Hrs]**

Solution of simultaneous linear Algebraic Equations: Gauss Elimination method – Gauss –Jordan method – Gauss – Jacobi method - Gauss seidel method.

UNIT – III: **[12 Hrs]**

Finite differences: Operators - Newton's Forward and Backward interpolation formula – Divided differences - Newton's Divided Interpolation formula – Lagrange's interpolation formula.

UNIT – IV: **[12 Hrs]**

Numerical Differentiation: Derivatives using – Newton's forward and backward difference formula.

Numerical integration: Trapezoidal rule - Simpson's 1/3 rule – Simpson's 3/8 rule.

UNIT – V: **[12 Hrs]**

Numerical solution of an ordinary differential equations: Taylor series method – Euler's method – Runge kutta method.

TEXT BOOK:

P.Kandasamy and Thilagavathi K., Calculus of Finite Differences and Numerical Analysis, S.Chand & Co. New Delhi, 2013.

UNIT – I : 1.1to 1.4
UNIT – II : 2.1,2.2, 2.5, 2.6
UNIT – III : 4.2, 4.3, 6.2, 6.5 to 6.7
UNIT – IV : 7.2, 7.3, 7.7, 7.9, 7.13, 7.14
UNIT – V : 9.5, 9.7, 9.10

REFERENCES:

1. S.Arumugam and Issac, A. Somasundaram, Numerical Methods, Scitech Publications, 2010.
2. M.K. Venkataraman, Numerical Methods in Science and Engineering, National Publishing Co., 2001.

WEB RESOURCES:

1. https://www.youtube.com/watch?v=vA7ShWJdfrg
2. https://www.youtube.com/watch?v=nRnoN3xm85A
3. youtube channel - Maths Board Tamil
4. https://www.brainkart.com/article/Numerical-Differentiation-and-Integration_6466/
5. youtube channel - MKS Tutorials by manoj sir

PEDAGOGY : Black Board & Lecture

COURSE CONTENTS & TEACHING / LEARNING SCHEDULE

Module No.	Topic	No. of Lectures	Content Delivery Method	Teaching Aids
	UNIT – I [12 Hrs]			
1.1	Bisection method	3	Lecture	Black Board
1.2	Iteration method	3	Lecture	Black Board
1.3	Regula falsi method	3	Lecture	Black Board
1.4	Newton – Raphson method	3	Lecture	Black Board
	UNIT – II [12 Hrs]			
2.1	Gauss Elimination method	3	Lecture	Black Board
2.2	Gauss-Jordan method	3	Lecture	Black Board
2.3	Gauss-Jacobi method	3	Lecture	Black Board
2.4	Gauss seidel method	3	Lecture	Black Board
	UNIT – III [12 Hrs]			
3.1	Operators	2	Lecture	Black Board
3.2	Newton's Forward and Backward interpolation formula	3	Lecture	Black Board
3.3	Divided differences - Newton's Divided Interpolation formula	4	Lecture	Black Board
3.4	Lagrange's interpolation formula	3	Lecture	Black Board
	UNIT – IV [12 Hrs]			
4.1	Numerical Differentiation: Derivatives using – Newton's forward and backward difference formula.	6	Lecture	Black Board
4.2	Numerical integration: Trapezoidal rule - Simpson's 1/3 rule – Simpson's 3/8 rule	6	Lecture	Black Board
	UNIT – V [12 Hrs]			
5.1	Taylor series method	4	Lecture	Black Board
5.2	Euler's method	4	Lecture	Black Board
5.3	Runge kutta method	4	Lecture	Black Board

MAPPING OF COs WITH POs

	PO1	PO2	PO3	PO4	PO5
CO1	3	3	2	3	3
CO2	3	2	2	3	3

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

3 = Strong 2 = Medium 1= Low

COURSE DESIGNERS: Dr.S.Karthigai Selvam & Dr. S.Nagarani

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Core Lab NUMERICAL METHODS USING C AND C++ LAB

SEMESTER VI **Code: 212003604**

2 Hrs/Week

Credits 2

PREAMBLE:

- ***To motivate the students to develop the skills in writing programs for various iterative methods-***

1. To find the roots of Non-linear equation using Bisection method.
2. To find the roots of Non-linear equation using Newton's method.
3. To solve the system of linear equations using Gauss-Elimination method.
4. To solve the system of linear equations using Gauss-Seidal Iteration Method.
5. To integrate numerically using Trapezoidal rule.
6. To integrate numerically using Simpson's rules.
7. To find numerical solution of ordinary differential equations by Euler's Method.
8. To find numerical solution of ordinary differential equations by Runge-Kutta Method.
9. Newton's forward or backward interpolation formula.
10. Lagrange's interpolation formula.

REFERENCES:

1. Veerarajan T., Numertical Methods with programs in C and C++ Ascent Series, Tata McGrw Hill, 2004.
2. Nita H. Shah., Numerical Methods with C++ Programming, Eastern Economy Edition.
3. B.S. Grewal.,Numerical Methods in Engineering & Science, Khanna Publication.

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Elective- II **1. MATHEMATICAL STATISTICS – II** **Code: 212003605**

SEMESTER VI **5 Hrs/Week**

Credits 5

PREAMBLE:-

- ***To provide the basic knowledge about Research tools.***

COURSE OUTCOMES (COs)

On Successful completion of the course, the student will be able to

No.	Course Outcomes	Knowledge Level (According to Bloom's Taxonomy)
CO1	identify multiple and partial correlations.	Up to K3
CO2	apply the moment generating function to determine moments and the relation to mean, standard deviation and variance.	Up to K3
CO3	identify and apply various distributions to solve problems.	Up to K3
CO4	apply basic principles in sampling also apply testing hypothesis on large samples at appropriate situations.	Up to K3
CO5	apply testing hypothesis on small samples.	Up to K3

K1- Knowledge K2 – Understand K3-Apply

UNIT – I: **[15 Hrs]**

Multiple and partial correlations – Introduction – distribution of three variables – Determination of regression coefficients – properties of the residuals – variance of a residual – Multiple correlation coefficient – properties of multiple correlation coefficient – partial correlation coefficient.

UNIT – II: **[15 Hrs]**

Discrete probability distributions: discrete random variable – probability mass function – probability distribution – distribution function – mathematical expectation – Expectation of a product of independent random variables – moment generating function – effect of change and scale in M.G.F – a property of M.G.F. Univariate continuous probability distributions; Definitions of univariate continuous prob dist – Definitions of moments, etc. M.G.F. – characteristic function.

UNIT – III: **[15 Hrs]**

Bionomial distribution; Introduction – Binomial distribution – Bionomial frequency dist – first four moments of the Binomial distribution – Recurrence relation for probabilities – M.G.F.

Poisson distribution: Poisson distribution – mean and variance – M.G.F. – Reproductive property of poisson distribution.

Normal distribution; Definition – some properties of the normal distribution – A linear combination of independent normal variates – fitting of the normal curve.

UNIT – IV: **[15 Hrs]**

Tests of significance (Large samples): Sampling – Large samples – Testing of significance for difference of properties – Testing the significance of the difference between the means of two large samples – Testing the significance of difference between S.D.'s of two large samples.

UNIT – V: **[15 Hrs]**

Tests of Significance (small samples): Introduction - Test of significance based on t–distribution – Tests based on the F–distribution.

TEXT BOOK:

Kapur J.N., Saxena H.C., Mathematical statistics, 2003.

UNIT – I	:	11.1 to 11.6, 11.6.1, 11.7
UNIT – II	:	7.1, 7.2, 7.3.1, 7.3.2
UNIT – III	:	6.1, 6.2, 6.2.1 to 6.2.4, 6.3, 6.3.1 to 6.3.4, 8.2, 8.2.3, 8.3, 8.3.,
UNIT – IV	:	12.1, 12.3, 12.4, 12.8.1, 12.8.2
UNIT – V	:	15.1, 15.2, 15.3

REFERENCES:

1. S. Arumugam Issac, Statistics, 2009.
2. Kapoor V.K., Gupta S.C., Fundamentals of Statistics, 2008.

WEB RESOURCES:

1. https://stat.ethz.ch/~geer/mathstat.pdf
2. https://link.springer.com/book/10.1007/b97553
3 http://www.ru.ac.bd/wp-content/uploads/sites/25/2019/03/201_04_01_Bijma-An-Introduction-to-Mathematical-Statistics-2017.pdf

PEDAGOGY: Black board, LCD, Lecture.

COURSE CONTENTS & TEACHING / LEARNING SCHEDULE

Module No.	Topic	No. of Lectures	Content Delivery Method	Teaching Aids
UNIT – I [15 Hrs]				
1.1	Multiple and partial correlations, Introduction Distribution of three variables	5	Lecture	Black board
1.2	Determination of regression coefficients, properties of residuals	4	Lecture	Black board
1.3	Variance of a residual, Multiple correlation coefficient	3	Lecture	Black board
1.4	Partial correlation coefficient	3	Lecture	Black board
UNIT – II [15 Hrs]				
2.1	Discrete probability distributions: discrete random variable	4	Lecture	Black board
2.2	Probability mass function, probability distribution, distribution function	3	Lecture	Black board

2.3	Mathematical expectation – Expectation of a product of independent random variables, moment generating function – effect of change and scale in M.G.F, a property of M.G.F.	3	Lecture	Black board
2.4	Definitions of univariate continuous prob dist – Definitions of moments, etc. M.G.F. – characteristic function.	5	Lecture	Black board
	UNIT – III [15 Hrs]			
3.1	Bionomial distribution; Introduction, Binomial distribution, Bionomial frequency distribution, first four moments of the Binomial distribution – Recurrence relation for probabilities – M.G.F.	5	Lecture	Black board
3.2	Poisson distribution: Poisson distribution – mean and variance – M.G.F. – Reproductive property of poisson distribution.	5	Lecture	LCD
3.3	Normal distribution; Definition – some properties of the normal distribution – A linear combination of independent normal variates – fitting of the normal curve	5	Lecture	Black board
	UNIT – IV [15 Hrs]			
4.1	Tests of significance (Large samples): Sampling, Large samples	4	Lecture	LCD
4.2	Testing of significance for difference of properties	4	Lecture	Black board
4.3	Testing the significance of the difference between the means of two large samples –	4	Lecture	Black board
4.4	Testing the significance of difference between S.D.'s of two large samples.	3	Lecture	Black board
	UNIT – V [15 Hrs]			
5.1	Tests of Significance (small samples): Introduction	5	Lecture	Black board
5.2	Test of significance based on t–distribution	5	Lecture	Black board
5.3	Tests based on the F–distribution	5	Lecture	Black board

MAPPING OF COs WITH POs

	PO1	**PO2**	**PO3**	**PO4**	**PO5**
CO1	3	2	3	3	2
CO2	3	2	3	2	1
CO3	3	3	2	2	2
CO4	3	1	3	3	2
CO5	2	3	1	1	3

3 = Strong 2 = Medium 1= Low

COURSE DESIGNERS: Dr.R.Amutha & Dr.S.Nagarani

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Elective-II **2. FUZZY SETS** **Code: 212003606**

SEMESTER V **5 Hrs/Week**

Credits 5

PREAMBLE:-

- ***To introduce the concept of uncertainity and fuzziness in logic and to study fuzzy arithmetic, fuzzy relations and construction of fuzzy sets.***

COURSE OUTCOMES (COs)

On Successful completion of the course, the student will be able to

No.	Course Outcomes	Knowledge Level (According to Bloom's Taxonomy)
CO1	explain the concepts of fuzzy sets.	Up to K3
CO2	extend the binary operations union, intersection, complementation of crisp sets to Fuzzy sets.	Up to K3
CO3	outline the concept of fuzzy numbers and arithmetic operations and to solve fuzzy equations.	Up to K3
CO4	distinguish fuzzy relation from crisp relation and solve fuzzy relation equations.	Up to K3
CO5	apply direct and least squate methods to construct fuzzy sets.	Up to K3

K1- Knowledge K2 – Understand K3-Apply

UNIT – I: **[15 Hrs]**

Fuzzy Set: Introduction - Visual basic types - basic concepts - Fuzzy sets verses crisp sets: - Additional properties of - Cuts - Representation of Fuzzy sets - Extension Principle for fuzzy sets.

UNIT – II: **[15 Hrs]**

Operation on Fuzzy sets: Types of Operations - Fuzzy complements - Fuzzy intersections - fuzzy unions - Combination of Operations.

UNIT – III: **[15 Hrs]**

Fuzzy arithmetic - Fuzzy numbers - Linguistic variables - arithmetic operations on intervals - arithmetic operations on Fuzzy numbers - lattice of Fuzzy numbers - Fuzzy equations.

UNIT – IV: **[15 Hrs]**

Fuzzy relations - binary Fuzzy relations - binary relation on a single set - Fuzzy equivalence relation - Fuzzy ordering relation.

UNIT – V: **[15 Hrs]**

Constructing Fuzzy sets - method of construction - direct method with one expert - direct - Lagrange interpolation - least square cure fitting.

TEXT BOOK:

Fuzzy Sets and Fuzzy Logic Theory and Applications - George J. Klir and Bo Yuan, Prentice - Hall of India, 2005.

UNIT – I : chapter 1(1.1 -1.3), 2(2.1 - 2.3)

UNIT – II : chapter 3(3.1 - 3.6)

UNIT – III : chapter 4(4.1 - 4.6)

UNIT – IV : chapter 5(5.3 - 5.5, 5.7)
UNIT – V : chapter 10(10.2 - 10.7)

REFERENCES:

1. Fuzzy Set Theory and its Applications - H.J. Zimmermann Allied Publishers Ltd., 2nd Edition, 1996.
2. A First Course in Fuzzy Logic - Hung T. Nguyen and Elbert A. Walker Chapman and Hall/CRC, 3rd Edition, 2006.

COURSE CONTENTS & TEACHING / LEARNING SCHEDULE

Module No.	Topic	No. of Lectures	Content Delivery Method	Teaching Aids
	UNIT – I	[15 Hrs]		
1.1	Fuzzy Set: Introduction - Visual basic types - basic concepts	3	Lecture	Black board
1.2	Fuzzy sets verses crisp sets:	3	Lecture	Black board
1.3	Additional properties of Cuts	3	Lecture	Black board
1.4	Representation of Fuzzy sets	2	Lecture	Black board
1.5	Extension Principle for fuzzy sets.	4	Lecture	Black board
	UNIT – II	[15 Hrs]		
2.1	Operation on Fuzzy sets: Types of Operations	5	Lecture	Black board
2.2	Fuzzy complements - Fuzzy intersections, fuzzy unions	5	Lecture	Black board
2.3	Combination of Operations.	5	Lecture	Black board
	UNIT – III	[15 Hrs]		
3.1	Fuzzy arithmetic - Fuzzy numbers, Linguistic variables	5	Lecture	Black board
3.2	Arithmetic operations on interval, arithmetic operations on Fuzzy numbers	5	Lecture	Black board
3.3	Lattice of Fuzzy numbers	5	Lecture	Black board
	UNIT – IV	[15 Hrs]		
4.1	Fuzzy relations, binary Fuzzy relations	5	Lecture	Black board
4.2	Binary relation on a single set	5	Lecture	Black board
4.3	Fuzzy equivalence relation	3	Lecture	Black board
4.4	Fuzzy equations	2	Lecture	Black board
	UNIT – V	[15 Hrs]		
5.1	Constructing Fuzzy sets, method of construction	4	Lecture	Black board
5.2	Direct method with one expert	3	Lecture	Black board
5.3	Lagrange interpolation method	4	Lecture	Black board
5.4	Least square cure fitting.	4	Lecture	Black board

MAPPING OF COs WITH POs

	PO1	PO2	PO3	PO4	PO5
CO1	3	3	3	2	3
CO2	3	2	2	3	2
CO3	2	1	2	2	2
CO4	3	3	1	1	1

CO5	3	3	2	3	2

3 = Strong 2 = Medium 1= Low

COURSE DESIGNERS: Dr. A.Shakila Jemima & Dr. M.Sumathi

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Elective -III **PROJECT** **Code: 212003607**

SEMESTER VI **5 Hrs/Week**

Credits 5

Students have to carry out Project works under the guidance of the members of the Mathematics department during VI Semester. Each batch may include 3 students. Project work may be chosen in any field of Mathematics each batch will complete the Project work in the month of February and submit their report in March. It will be duly signed by the Project guide and HOD of Mathematics. The viva on Project work will be conducted at the end of VI Semester. The viva on project work will be conducted by the HOD, BOS and the course teacher.

Internal = 40 Marks	External = 60 Marks
Report = 30	Report = 50
Viva = 10	Viva = 10
Total = 40	Total = 60

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Part – IV **ASTRONOMY-II** **Code: 214403620**

Skill Based Elective- VI –Major **SEMESTER VI**

2 Hrs/Week

Credits 2

PREAMBLE:

- ***To provide the basic knowledge of the moon and Ellipse.***
- ***To study the solar system and to expose the mysteries of the universe.***

COURSE OUTCOMES (COs)

On Successful completion of the course, the student will be able to

No.	Course Outcomes	Knowledge Level (According to Bloom's Taxonomy)
CO1	demonstrate Aberration, its effect and different kinds	Up to K3
CO2	develop knowledge on Procession and Nutation	Up to K3
CO3	provide a comprehensive and clear description of moon and study about its different phases	Up to K3
CO4	understand about eclipses and condition for occurrences of lunar eclipses	Up to K3
CO5	know the condition for occurrences of total solar eclipses and study about ecliptic limits	Up to K3

K1- Knowledge K2 – Understand K3-Apply

UNIT – I: **[7 Hrs]**

Aberration: Effect – constant of aberration – Ecliptic being assumed circular – effect of aberration on the longitude and latitude of a star – apparent position of a star – aberration of a star at a given instant in any given direction – different kind of aberration.

UNIT – II: **[6 Hrs]**

Procession and Nutation; Physical explantation – Nutation – Effect of procession on the R.A. and declination of a star – nutation on the R.A. and declination of a star – combined effect – Independent day numbers – Effect on pole star – length of the season - sidereal day – planetary procession.

UNIT – III: **[7 Hrs]**

Moon: Introduction – sidereal month – synodic month – Relation between sidereal and synodic months - elongation – conjunction – opposition – quadratures – Daily motion of the moon – Age of moon – phase of moon – successive phases of moon – Different phases of moon using the formula.

UNIT – IV: **[5 Hrs]**

Eclipses: Introduction – Umbra and penumbra – lunar eclipse – solar eclipse – angle between a direct common tangent and the line of centres of two circles – angle between a transverse common tangent and the line of centres of two circles – condition for the occurance of a lunar eclipse – condition for the totality of a lunar eclipse.

UNIT – V: **[5 Hrs]**

Condition for the occurrence of a total solar eclipse - Condition for the occurrence of a solar eclipse. Ecliptic limits: calculate major and minor ecliptic limits – synodic period of the nodes of lunar orbit – maximum and minimum number of eclipses in a year.

TEXT BOOK:

S.Kumaravelu, Susheela Kumaravelu, Astronomy, Reprinted 2007, S.K.V.Publications, Nagerkoil.

UNIT – I	:	Chapter IX – Pg – 277 - 291
UNIT – II	:	Chapter X – Pg – 294 - 308
UNIT – III	:	Chapter IX – Pg – 372 - 379
UNIT – IV	:	Chapter IX – Pg – 397 - 404
UNIT – V	:	Chapter IX – Pg – 408 - 417

REFERENCES:

1. Ramachandran G.V., Astronomy, S. Chand, Publications.
2. Bhupendra Singh, Spherical Astronomy and Space Dynamics, Pragati Prakashan, Meerut, 1st Edition, 2008.

WEB RESOURCES:

01.https://www.astronomytrek.com
02.https://www.space.com
03.https://www.astronomynow.com
04.https://www.astrobites.org

PEDAGOGY : Black Board; Lecture; LCD.

COURSE CONTENTS & TEACHING / LEARNING SCHEDULE

Module No.	Topic	No. of Lectures	Content Delivery Method	Teaching Aids
UNIT – I [7 Hrs]				
1.1	Effect – constant of aberration	1	Lecture	Blackboard
1.2	Effect of aberration on the longitude and latitude of a star	2	Lecture	LCD Projector
1.3	Apparent position of a star	1	Lecture	LCD Projector
1.4	Aberration of a star at a given instant	2	Lecture	Blackboard
1.5	Different kind of aberration	1	Lecture	Blackboard
UNIT – II [6 Hrs]				
2.1	Physical explantation procession and Nutation	1	Lecture	Blackboard
2.2	Procession and nutation on the R.A. and declination of a star	2	Lecture	Blackboard
2.3	Independent day numbers	1	Lecture	LCD Projector
2.4	Planetary procession	2	Lecture	LCD Projector
UNIT – III [7 Hrs]				
3.1	Sidereal and synodic months and their relation	1	Lecture	Blackboard
3.2	Elongation, conjunction, opposition and quadratures	1	Lecture	Blackboard
3.3	Daily motion of the moon	1	Lecture	LCD Projector
3.4	Age, phase and successive phases of moon	2	Lecture	LCD Projector
3.5	Different phases of moon using the formula	2	Lecture	LCD Projector
UNIT – IV [5 Hrs]				
4.1	Umbra and penumbra, lunar and solar eclipse	1	Lecture	LCD Projector
4.2	Angle between a direct and transverse common tangent and the line of centres of two circles	1	Lecture	LCD Projector
4.3	Condition for the occurance of a lunar eclipse	1	Lecture	Blackboard
4.4	Condition for the totality of a lunar eclipse	2	Lecture	Blackboard
UNIT – V [5 Hrs]				
5.1	Condition for the occurrence of a total solar eclipse	1	Lecture	Blackboard
5.2	Calculate major and minor ecliptic limits	1	Lecture	Blackboard
5.3	Synodic period of the nodes of lunar orbit	1	Lecture	LCD Projector
5.4	Maximum and minimum number of eclipses in a year.	2	Lecture	LCD Projector

MAPPING OF COs WITH POs

	PO1	PO2	PO3	PO4	PO5
CO1	2	3	3	3	2
CO2	1	3	2	3	2
CO3	2	3	3	2	3

CO4	1	3	2	3	2
CO5	1	3	3	3	3

3 = Strong 2 = Medium 1= Low

COURSE DESIGNERS: Dr. M.Sumathi & Dr. R.Amutha

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