

ETHIRAJ COLLEGE FOR WOMEN

(AUTONOMOUS)

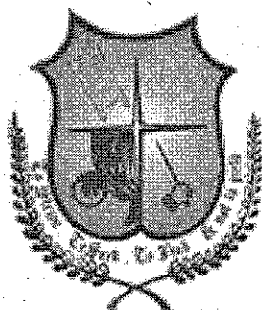
CHENNAI-600 008

COLLEGE WITH POTENTIAL FOR EXCELLENCE

DEPARTMENT OF MATHEMATICS

(Aided & Self Supporting)

SYLLABUS



Choice Based Credit System

Outcome Based Education

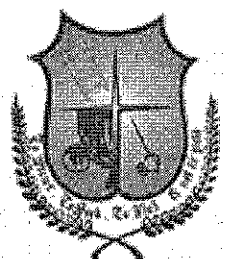
(Offered from the academic year 2018-19)

ETHIRAJ COLLEGE FOR WOMEN

(AUTONOMOUS)

CHENNAI-600 008

COLLEGE WITH POTENTIAL FOR EXCELLENCE



B.Sc., Mathematics

Allied Mathematics

B.Com (Business Mathematics) &

M.Com (Statistics)

SYLLABUS

CHOICE BASED CREDIT SYSTEM

OUTCOME BASED EDUCATION

(Offered from the academic year 2018-19)

CONTENTS

Description		Page No.
Rules and regulations for the Programme		1
Programme Educational Objectives		4
Programme Outcomes		5
Programme Specific Outcomes		6
Programme Profile		7
Evaluation pattern for CA		9
Rubrics for CA Evaluation		9
Evaluation Pattern for End Semester		10
Course Profile - Semester I		12
MA18/1C/TLT	Trigonometry and Laplace Transforms	13
MA18/1C/DCL	Differential Calculus	16
MA18/1A/FD1 (or) PH18/1A/GP1	Calculus of Finite Differences – I (or) Allied General Physics-I	19
Course Profile - Semester II		22
MA18/2C/CLA	Classical Algebra	23
MA18/2C/ICF	Integral Calculus and Fourier Series	26
MA18/2A/FD2 (or) PH18/2A/GP2	Calculus of Finite Differences – II (or) Allied General Physics – II	29
Course profile - Semester III		32
MA18/3C/DEQ	Differential Equations	33
MA18/3C/NTY	Number Theory	36
MA18/3A/MS1	Mathematical Statistics & R Software – I	39
Course profile - Semester IV		42
MA18/4C/ALS	Algebraic Structures	43
MA18/4C/VGF	Vector Calculus, Geometry and Fourier Transforms	46
MA18/4A/MS2	Mathematical Statistics & R Software – II	49
Course Profile - Semester V		52
MA18/5C/LAL	Linear Algebra	53
MA18/5C/RAN	Real Analysis	56
MA18/5C/STT	Statics	59
MA18/5C/OPT	Optimization Techniques	62
MA18/5E/PLC	Programming Language ‘C’	65
MA18/5E/PR1	Programming Language ‘C’ (Practicals)	68
Course Profile - Semester VI		71
MA18/6C/CAN	Complex Analysis	72
MA18/6C/DYN	Dynamics	75
MA18/6C/DIM	Discrete Mathematics	78
MA18/6E/OPR	Operations Research	81
MA18/6E/PCO	Programming Language ‘C’ & Introduction to OOP	84
MA18/6E/PR2	Programming Language ‘C’ & Introduction to OOP (Practicals)	87

UG & PG - Allied Course Profile - Semester I & II (Offered to Other Departments)		90
MA18/1A/AM1	Allied Mathematics- I	91
MA18/2A/AM2	Allied Mathematics- II	94
MA18/1A/BM1	Business Mathematics –I	97
MA18/2A/BM2	Business Mathematics- II	100
MA18/1C/BMM	Business Mathematics	103
MA18/2C/OPT	Optimization Techniques	106
7P18/1C/ST1	Statistical tools for Business Management – I	109
7P18/2C/ST2	Statistical tools for Business Management - II	113
8P18/1C/SFE	Statistical Methods for Economists	116
8P18/2C/SFE	Statistics with Computer Applications	119
UG - Non Major Elective - Course Profile - Semester I & II (Offered to Other Departments)		122
MA18/1N/SUE & MA18/2N/SUE	Statistics using Excel	123
Self Study Papers - Semester V & VI		125
Graph Theory		126
Fundamentals of Fuzzy Set Theory		127

RULES AND REGULATIONS FOR THE PROGRAMME

As per the guidelines given by the University Grants Commission and the Tamil Nadu State Council for Higher Education, the B.Sc. degree programme is designed in such a way to have a foundation in discrete and continuous mathematics; a mathematical attitude towards problem formulation and solving; an analytical skill and desire for correctness; an appreciation of the approaching of mathematical techniques, the programming skill at higher level computer language and research aptitude to mathematics.

Department of Mathematics is revising syllabi with effect from the academic year 2018-19, as specified by the Government of Tamil Nadu. Part IV and Part V components will seek to build the capacity of the students and provide inputs for her social service and social analysis capabilities.

Every academic year is divided into two semester sessions. Each semester will have a minimum of 90 working days and each day will have 5 working hours. Teaching is organized into a modular pattern of credit courses. Credit is normally related to the number of hours a teacher teaches a particular subject. It is also related to the number of hours a student spends learning a subject or carrying out an activity.

1. ELIGIBILITY FOR ADMISSION

Candidates for admission to the first year of the degree of B. Sc course shall be required to have passed the Higher Secondary Examinations conducted by Government of Tamil Nadu or an Examination accepted as equivalent thereto by the Syndicate of the University of Madras.

2. ELIGIBILITY FOR THE AWARD OF DEGREE

The candidate shall be eligible for the award of degree only if she has undergone the prescribed course of study for a period of not less than three academic years, passed the examinations of all the Six Semesters prescribed earning 140 credits - 12 credits from Part I, 12 credits from Part II, 95 credits from Part III, 20 credits from Part IV and 1 credit from Part V.

3. DURATION OF THE PROGRAMME: 3 YEARS

Each academic year shall be divided into two semesters. The first academic year shall comprise of the first and second semesters, the second academic year, the third and fourth semesters and the third academic year, fifth and sixth semesters respectively. The odd semesters shall consist of period from June to November of each year and the even semesters from December to April of each year. There shall not be less than 90 working days for each semester.

COURSE OF STUDY

The main subject of study for Bachelor Degree shall consist of the following:

Part – I : Tamil /Other Language

Part – II : English

Part – III : Core Subjects, Allied Subjects and Project / Electives with three Courses

Part – IV : 1. (a) Those who have not studied Tamil up to XII standard and taken a Non- Tamil Language under part I shall take Tamil Comprising of two Courses (Level will be at 6th Standard).
(b) who have studied Tamil up to XII standard and taken a Non-Tamil language under part I shall take Advanced Tamil Comprising of two courses.
(c) Others who do not come under a & b can choose Non-Major elective.
2. Soft skill paper(offered by English Department)
3. Environmental Studies
4. Value Education

Part V : Extension Activities.

PASSING MINIMUM

A candidate shall be declared to have passed in each paper/ practical of the main subject of study wherever prescribed, if she secured NOT LESS THAN 40% of the marks prescribed for the examination.

1. There shall be no passing minimum for Internal.
2. For External Examination Passing Minimum shall be 40% of the maximum marks prescribed for the paper for each paper / practical and project.
3. In the aggregate (External +Internal) the Passing Minimum shall be of 40%.

4. She shall be declared to have passed the whole examination, if she passes in all the papers and practical where ever prescribed / as per scheme of examinations by earning 140 credits in part I, II, III, IV and V. She shall also fulfill the extension activities prescribed earning a minimum of one credit to qualify for the degree.

CLASSIFICATION OF SUCCESSFUL CANDIDATES:

Part I, II, III & IV

Successful candidates passing the examination and securing the marks (i) 60 percent and above and (ii) 50 percent and above but below 60 percent in the aggregate shall be declared to have passed the examination in the FIRST and SECOND class respectively. All other successful candidates shall be declared to have passed the examination in the THIRD class.

Candidates who pass all the examination (Part I, II, III & IV) prescribed for the course in the FIRST APPEARANCE ITSELF ALONE are eligible for ranking.

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

On obtaining an undergraduate degree the students will be able to:

PEO1: Apply and advance the knowledge and skills acquired, to become a creative professional in their chosen field.

PEO2: Engage in self-directed continuous learning, aimed at global competency, which will promote professional and personal growth

PEO3: Develop management skills and entrepreneurial skills, by harnessing core competencies tempered by values and ethics

PEO4: Work towards achieving economic and social equity for women through application of relevant knowledge

PEO5: Contribute to promoting environmental sustainability and social inclusivity

PROGRAMME OUTCOMES (POs)

On completion of the **Programme**, the learner will be able to:

PO 1- To promote and apply scientific knowledge for finding sustainable solution to solve the issues pertaining to the society/Industry

PO 2- Identify, Analyse and formulate novel ideas to yield, substantial results in the fields of research utilizing the principles of Physical and Biological Science

PO 3- Relate key concepts and scientific principles to various scientific phenomenon and their applications in day-to-day life

PO 4- Cultivate unparalleled comprehension of fundamental concepts relevant to basic sciences leading to an individual progress and career advancement at the National and Global levels

PO 5- To communicate effectively their views and ideas orally/ written in English and in other related languages

PO 6- Design solutions for complex problems and design system components or processes that meet the specific needs with appropriate consideration for public health and safety, cultural, societal and environmental conditions

PROGRAMME SPECIFIC OUTCOME (PSOs)

Upon successful completion of the **B.Sc Mathematics** Program, the students will be able to:

PSO 1- Demonstrate basic manipulative and calculative skills in Trigonometry, geometry and Calculus.

PSO 2 - Solve problems in advanced areas of mathematics like Algebra and Analysis.

PSO 3 - Read, analyse and judge the validity of mathematical arguments.

PSO 4 - Students will be able to communicate mathematical ideas both orally and in writing.

PSO 5 - Display mastery of basic computational skills and recognise the appropriate use of technology to enhance those skills.

PSO 6 - Investigate and apply mathematical models in a variety of contexts related to science, technology, business and industry.

PROGRAMME PROFILE –B.Sc Mathematics

SEM	PART	COURSE CODE	TITLE OF THE PAPER	CREDITS	HOURS / WK	TOTAL HOURS	CA	SE	TOTAL
I	I	Part I	Tamil / Hindi / French / Sanskrit	3	5	75	40	60	100
	II	Part II	English	3	4	60	40	60	100
	III	MA18/1C/TLT	Trigonometry and Laplace Transforms	4	5	75	40	60	100
		MA18/1C/DCL	Differential Calculus	4	5	75	40	60	100
	III	MA18/1A/FD1 (or) PH18/1A/GP1	Calculus of Finite Differences – I (or) Allied General Physics - I	5	6	90	40	60	100
	IV	Part IV	1ab/NME		2	2	30	-	50
Soft Skill (offered by English department)				3	2	30	-	50	50
II	I	Part I	Tamil/Hindi/French/Sanskrit	3	5	75	40	60	100
	II	Part II	English	3	4	60	40	60	100
	III	MA18/2C/CLA	Classical Algebra	4	5	75	40	60	100
		MA18/2C/ICF	Integral Calculus and Fourier Series	4	5	75	40	60	100
		MA18/2A/FD2 (or) PH18/2A/GP2	Calculus of Finite Differences – II (or) Allied General Physics - II	5	6	90	40	60	100
	IV	Part IV	1ab/NME		2	2	30	-	50
Soft Skill (offered by English Department)				3	2	30	-	50	50
III	I	Part I	Tamil/Hindi/French/Sanskrit	3	5	75	40	60	100
	II	Part II	English	3	4	60	40	60	100
	III	MA18/3C/DEQ	Differential Equations	4	5	75	40	60	100
		MA18/3C/NTY	Number Theory	4	5	75	40	60	100
		MA18/3A/MS1	Mathematical Statistics & R Software – I	5	6	90	40	60	100
	IV	Part IV	Soft Skill		3	2	30	-	50
Environmental Studies				2	2	30	-	50	50
IV	I	Part I	Tamil/Hindi/French/	3	5	75	40	60	100

			Sanskrit						
	II	Part II	English	3	4	60	40	60	100
	III	MA18/4C/ALS	Algebraic Structures	4	5	75	40	60	100
	III	MA18/4C/VGF	Vector Calculus , Geometry and Fourier Transforms	4	5	75	40	60	100
	III	MA18/4A/ MS2	Mathematical Statistics & R Software – II	5	6	90	40	60	100
	IV	Part IV	Soft Skill	3	2	30	-	50	50
			Value Education	2	2	30	-	50	50
V	III	MA18/5C/LAL	Linear Algebra	4	5	75	40	60	100
		MA18/5C/RAN	Real Analysis	4	5	75	40	60	100
		MA18/5C/STT	Statics	4	6	90	40	60	100
		MA18/5C/OPT	Optimization Techniques	4	5	75	40	60	100
		MA18/5E/PLC	Programming Language 'C'	3	6	90	40	60	100
		MA18/5E/PR1	Programming Language 'C' (Practicals)	2	3	45	-	100	100
VI	III	MA18/6C/CAN	Complex Analysis	4	5	75	40	60	100
		MA18/6C/DYN	Dynamics	4	6	90	40	60	100
		MA18/6C/DIM	Discrete Mathematics	4	5	75	40	60	100
		MA18/6E/OPR	Operations Research	5	5	75	40	60	100
		MA18/6E/PCO	Programming Language 'C' & Introduction to OOP	3	6	90	40	60	100
		MA18/6E/PR2	Programming Language 'C' & Introduction to OOP (Practicals)	2	3	45	-	100	100

Total minimum credits for B.Sc Mathematics: 140

EVALUATION PATTERN FOR CONTINUOUS ASSESSMENT-UG

INTERNAL VALUATION BY COURSE TEACHER/S

PART I, II AND III-THEORY PAPERS

COMPONENT	TIME	MAX.MARKS	CAMARK
1. *TEST I	2 HOURS	50 MARKS (TO BE CONVERTED)	10
2. *TEST II	2 HOURS	50 MARKS (TO BE CONVERTED)	10
3. ASSIGNMENT/SEMINAR/FIELD VISIT			10
4. PARTICIPATORY LEARNING			10
TOTAL			40

CA QUESTION PAPER PATTERN-UG

Knowledge Level	Section	Word Limit	Marks	Total
K 1	A-5 × 2 marks	50	10	50
K1. K 2	B-3/5 × 8marks	200	24	
K2, K 3	C-1/2 × 16 marks	500	16	

RUBRICS FOR CA EVALUATION

Assignment	Content/originality/Presentation/Schematic Representation and Diagram/Bibliography
Seminar	Organisation/Subject Knowledge/Visual Aids/Confidence level/presentation-Communication and Language
Field Visit	Participation/Preparation/Attitude/Leadership
Participation	Answering Questions/Clearing Doubts/Participating in Group Discussions/Regular Attendance

END SEMESTER EVALUATION PATTERN-UG

THEORY PAPERS

PART III (Major & Allied)

SEMSTER I / II / III / IV / V / VI

Knowledge Level	Section	Word Limit	Marks	Total
K 1	A-5 × 2 marks	50	20	100
K1. K 2	B-3/5 × 8marks	200	35	
K2, K 3	C-1/2 × 16 marks	500	45	

Section A: Short Answer: 10 Questions to be answered without choice, 2 questions from each Unit, each carrying 2 marks

Section B: 5 questions to be answered out of 8 questions, each carrying 7 marks – Atleast one Question from each unit.

Section C: 3 questions to be answered out of 5 questions, each carrying 15 marks – one question from each unit.

DOUBLE VALUATION BY COURSE TEACHER AND EXTERNAL EXAMINER

MAXIMUM MARKS: 100 TO BE CONVERTED TO 60

PASSING MARK: 40

PART IV

SINGLE VALUATION

ORAL TEST/WRITTEN TEST

MAXIMUM MARKS: 50

PASSING MARK:20

PRACTICAL PAPERS

PART III

SEMSTER V/VI

COMPONENT	MARKS
1. Practical Examination	90
2. Record	10

Two **internal examiners** (appointed in consultation with Head of the department / Principal of the college) to be appointed to conduct the practical examination.

There will be three questions with or without subsections to be asked for the practical examination.

Assessment of Computer Practical Examination.

For each question

Programming skill (writing)	- 10 Marks
Technical Skill (Keying)	- 10 Marks
Debugging and generating output	- 10 Marks

MAXIMUM MARKS: 100

PASSING MARKS: 40

SEMESTER I COURSE PROFILE - PROGRAMME OF STUDY

COURSE CODE	TITLE OF THE PAPER	CREDITS	HOURS/ WK	TOTAL HOURS	L-T-P	CA	SA	TOTAL
Part I	Tamil / Hindi / French / Sanskrit	3	5	75		40	60	100
Part II	English	3	4	60	2-1-1	40	60	100
MA18/1C/TLT	Trigonometry and Laplace Transforms	4	5	75	3-2-0	40	60	100
MA18/1C/DCL	Differential Calculus	4	5	75	3-2-0	40	60	100
MA18/1A/FD1 (or) PH18/1A/GP1	Calculus of Finite Differences – I (or) Allied General Physics - I	5	6	90	3-3-0	40	60	100
Part IV	1ab/NME	2	2	30		-	50	50
	Soft Skill (Offered by English department)	3	2	30		-	50	50

SEMESTER – I

TRIGONOMETRY AND LAPLACE TRANSFORMS

TOTAL HOURS: 75 Hours

**COURSE CODE: MA18/1C/TLT//
MC18/1C/TLT**

CREDITS: 4

L – T – P : 3 2 0

COURSE OBJECTIVES:

To enable students to

1. Know the principles and concepts of Trigonometry and Laplace Transforms.
2. Compute logarithm of a complex quantity.
3. Apply Laplace Transform to solve differential equations.

COURSE OUTLINE:

- UNIT I** : Expansion of $\sin nx$, $\cos nx$, $\tan nx$, $\sin^n x$, $\cos^n x$. Expansion of $\sin x$, $\cos x$, $\tan x$ in ascending powers of x
Book 1 Chapter 3 Sec 1,2,4,5 (15 Hours)
- UNIT II** : Hyperbolic Functions: definition, relation between hyperbolic functions and Inverse hyperbolic functions.
Book 1 Chapter 4 Sec 1,2.1,2.2,2.3 (20 Hours)
- UNIT III:** Logarithm of complex quantities
Book 1 Chapter 5 Sec 5 -5.1,5.2. (10 Hours)
- UNIT IV:** Summation of Trigonometric series by using complex quantities: $C+iS$ form, Gregory series (only simple problems in both the cases)
Book 1 Chapter 6 Sec 3 (15 Hours)
- UNIT V:** Laplace Transform: Laplace Transform- Inverse Transform, properties. Application of Laplace Transform to solution of the first and second order linear differential equations (with constant coefficients)
Book 2 Chapter 9 (15 Hours)

BOOKS RECOMMENDED :

1. S. Narayan and T.K. Manicavachagom Pillay, Trigonometry (2012), S.viswanathan Printers & Publishers Pvt. Ltd , Chennai .
2. S. Narayan and T.K. Manicavachagom Pillay, Differential Equations & its Applications (2003) ,S.Viswanathan printers and publishers Pvt. Ltd, Chennai.

REFERENCE BOOKS:

1. A.Singaravelu, Algebra and Trigonometry Volume I (2003), Meenakshi Agency, Chennai.

2. S.L.Loney , Plane Trigonometry – Part II (1982),, Cambridge University Press London.
3. Dr.M.D. Raisinghania, H.C.Saxena, H.K.Dass, Trigonometry (1999), S. Chand & company Pvt Ltd, New Delhi.
4. B.S. Grewal, Higher Engineering Mathematics (2002), Khanna Publishers, New Delhi .
5. Dr.A.Singaravelu , Differential Equations and Laplace Transforms, New Revised Edition (2015), A.R.S Publications, Chennai.

JOURNALS:

1. Mathematics Newsletter Published by Ramanujan Mathematical Society, Chennai.
2. Discrete Mathematical Sciences & Cryptography

E-LEARNING SOURCES:

1. <http://www.mathforum.org>
2. <http://www.opensource.org>
3. <http://www.khanacademy.org>
4. <http://www.in.ixl.com>
5. <http://www.learningwave.com>

COURSE OUTCOMES

Upon successful completion of **Trigonometry and Laplace Transforms**, Students will be able to

CO Number	CO STATEMENT
CO1	Expand sines and cosines of θ in terms of functions of multiples of θ .
CO2	Determine the hyperbolic functions and inverse hyperbolic function and study the relation between them.
CO3	Determine the logarithms of complex numbers.
CO4	Compute the Laplace Transforms and Inverse Laplace Transforms of various basic mathematical functions.
CO5	Investigate the Laplace Transform techniques to solve second order differential equations.

MAPPING-COURSE OUTCOME WITH PROGRAMME SPECIFIC OUTCOME

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	2	3	3	1	3
CO2	3	2	3	3	1	3
CO3	3	2	3	3	1	3
CO4	3	2	3	3	1	3
CO5	3	2	3	3	1	3
AVERAGE	3	2	3	3	1	3

KEY: STRONGLY CORRELATED-3 MODERATELY CORRELATED-2 WEAKLY CORRELATED-1 NO CORRELATION-0

TEACHING METHODOLOGY:

1. Lecture (Chalk and Talk-OHP-LCD)
2. Problem Solving-Group Discussion
3. Quiz-Seminar
4. Peer Learning

QUESTION PAPER PATTERN-UG

Knowledge Level	Section	Word Limit	Marks	Total	Special Instructions if any
K 1	A-10 × 2 marks	50	20	100	Nil
K1, K 2	B-5/8 × 7 marks	200	35		
K2, K 3	C-3/5 × 15 marks	500	45		

All question papers can be framed in the following cognitive levels

- Knowledge Level 1.** Recall
- Knowledge Level 2.** Understanding
- Knowledge Level 3.** Application

SEMESTER – I

DIFFERENTIAL CALCULUS

TOTAL HOURS: 75 Hours
CREDITS: 4

COURSE CODE: MA18/1C/DCL
L – T – P : 3 2 0

COURSE OBJECTIVES:

To enable students to

1. Get exposed to the various concepts of Differential Calculus like n^{th} derivatives, maxima and minima.
2. Apply differentiation to find envelope, curvature and pedal equation of a curve.
3. Develop problem solving skills.

COURSE OUTLINE:

- UNIT I:** Successive Differentiation- n^{th} derivative , standard results – Leibnitz Theorem (without Proof) and its applications
Book 1 Chapter 3 Section 1.1 -1.6 & Section 2.1 -2.2 (18 Hours)
- UNIT II:** Jacobians – Maxima and minima of functions of two independent variables. Necessary and Sufficient conditions (without proof) – Lagrange’s method of undetermined multipliers (without proof)
Book 1 Chapter 8 Section 4, 4.1, 5 (17 Hours)
Book 2 Chapter 3
- UNIT III:** Envelopes: Curvature – Circle , radius and centre of curvature, Cartesian formula for the radius of curvature.
Book 1 Chapter 10 Section 1.1- 1.3, 2.1-2.3 (12 Hours)
- UNIT IV:** Co-ordinates of the centre of curvature – Curvature- radius of curvature in polar Co-ordinates, p-r equations, Pedal equation of a curve
Book 1 Chapter 10 Section 2.4, 2.6 - 2.8 (10 Hours)
- UNIT V:** Definition – Asymptotes parallel to the axis, oblique asymptotes, $F_n + F_{n-2} = 0$ form, Intersection of a curve with its asymptotes (proofs are not included)
Book 1 Chapter 11 Section 1 - 4 & Sections 6 - 7 (18 Hours)

BOOKS RECOMMENDED :

1. S. Narayanan & T.K. Manickavachagom Pillay, Calculus , Volume I (2004) , S. Viswanathan Printers & Publishers Pvt Ltd. Chennai.
2. A.Singaravelu and R.Ramaa, Calculus and Co-ordinate Geometry of two dimension, First edition (2003) Meenakshi Agency, Chennai.

REFERENCE BOOKS :

1. Dr.S.Sudha ,Calculus , First edition (1998) ,Emerald Publishers, Chennai.
2. S.C.Arora & Ramesh Kumar, A Text Book of CALCULUS, First dition (1984), Pitambar Publishing Company-New Delhi.
3. R.K Ghosh, K.C.Maity ,An Introduction to Analysis, Differential Calculus ,Part-I, Tenth edition (1999), Books and Allied (P) Ltd-Calcutta.
4. Shanti Narayanan, P.K.Mittal, Differential Calculus, Tenth Revised Edition(2005),S.Chand & Company Pvt Ltd, New Delhi.
5. Apostal.T.M ,Calculus- Volume I, Second edition , Wiley Publications, New Delhi.

JOURNALS:

1. Mathematics Newsletter Published by Ramanujan Mathematical Society, Chennai.
2. Discrete Mathematical Sciences & Cryptography

E-LEARNING SOURCES:

1. <http://www.mathforum.org>
2. <http://www.opensource.org>
3. <http://www.khanacademy.org>
4. <http://in.ixl.com>
5. <http://www.learningwave.com>

COURSE OUTCOMES:

Upon successful completion of **Differential Calculus**, Students will be able to

CO Number	CO STATEMENT
CO 1	Compute n^{th} derivatives of algebraic & trigonometric functions. Evaluate n^{th} derivative of product of two functions using Leibnitz formula
CO 2	Find maxima and minima of functions of two independent variables.Use Lagrange's multiplier method to solve constrained optimization problem. Apply PDE to find Jacobian of a given multiple variable.
CO 3	Demonstrate and compute envelopes, radius and centre of curvature.
CO 4	Discuss Co-ordinates of centre of curvature, p-r equation and pedal equation of a curve.
CO 5	Explain and evaluate the asymptotes.

MAPPING-COURSE OUTCOME WITH PROGRAMME SPECIFIC OUTCOME

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	3	1	2	3	1	-
CO2	3	2	2	2	2	2
CO3	3	1	2	2	2	2
CO4	3	1	2	3	2	2
CO5	3	1	2	2	2	-
AVERAGE	3	1.2	2	2.4	1.8	1.2

KEY: STRONGLY CORRELATED-3 MODERATELY CORRELATED-2 WEAKLY CORRELATED- 1 NO CORRELATION-0

TEACHING METHODOLOGY:

1. Lecture (Chalk and Talk-OHP-LCD)
2. Problem Solving-Group Discussion
3. Quiz-Seminar
4. Peer Learning

QUESTION PAPER PATTERN-UG

Knowledge Level	Section	Word Limit	Marks	Total	Special Instructions if any
K 1	A-10 × 2 marks	50	20	100	Nil
K1,K 2	B-5/8 × 7 marks	200	35		
K2, K 3	C-3/5 × 15 marks	500	45		

All question papers can be framed in the following cognitive levels

Knowledge Level 1. Recall

Knowledge Level 2. Understanding

Knowledge Level 3. Application

SEMESTER – I

CALCULUS OF FINITE DIFFERENCES – I

TOTAL HOURS: 90

COURSE CODE: MA18 / 1A / FD1 //
MC18 / 1A / FD1

CREDITS: 5

L-T-P: 4 2 0

COURSE OBJECTIVES:

To enable students to

1. Solve Mathematical Problem using difference Operator.
2. Compute Numerical Solution of Differentiation and Integration problems.
3. Interpolate an unknown value from a given set of data.

COURSE OUTLINE:

UNIT I : FINITE DIFFERENCES

Forward, Backward, Divided difference and Shift Operators, Relation between operators, representation of polynomials in factorial notations, Successive differences of polynomial- Differences of zero. Simple problems. (Proof of theorems in finite differences excluded) (20 Hours)

UNIT II : INTERPOLATION

Newton's forward and backward formulae for interpolation- Central difference formulae- Gauss forward, Gauss backward, Stirling's and Bessel's formulae (Derivations not included for all the formulae) (20 Hours)

UNIT III : INTERPOLATION (contd)

Lagrange's formula for interpolation – Newton's divided differences formula. Lagrange's inverse formula. (Derivations are not included) (15 Hours)

UNIT IV : NUMERICAL DIFFERENTIATION

Methods of derivatives using interpolation formulae (only first order), maxima and minima using Newton's forward formula – simple problems. (15 Hours)

UNIT V : NUMERICAL INTEGRATION

Quadrature formula for equidistant ordinates based on Newton's Forward formula Trapezoidal rule – Simpson's one third rule – Simpson's three Eighth rule.

(20 Hours)

BOOKS RECOMMENDED:

1. B.D.Gupta, Numerical Analysis (1989), Konark Publication, Ltd, New Delhi.
2. S.G.Venkatachalapathy, Calculus of finite differences and Numerical analysis (2003), Margham publications, Chennai.
3. Dr. M.K. Venkataraman, Numerical Methods in Science & Engineering, Fifth edition (1999), The National Publishing Company, Chennai.

REFERENCE BOOKS:

1. H.C. Saxena, Finite Differences and Numerical Analysis Fifteenth edition (2000) S.Chand &Co, New Delhi.
2. S.Arumugham ,Numerical Methods, Second edition (2008) ,New Gamma Publishing, Palayamkottai.
3. M.K.Jain,S.R.K.Iyengar,R.K.Jain, Numerical methods for scientific and Engineering Computation , Sixth edition (2012) ,New age International Publishers, New Delhi .
4. E.Balagurusamy,Numerical Methods (1999), Tata Mc-Graw Hill, New Delhi.
5. T.K. Manicavachagom Pillay & Prof. S. Narayanan, Numerical Analysis , New edition (2001), S.Viswanathan Printers& Publishers Pvt Ltd ,Chennai.

JOURNALS:

1. Mathematics Newsletter Published by Ramanujan Mathematical Society
2. Discrete Mathematical Sciences & Cryptography

E-LEARNING RESOURCES:

1. <http://www.mathforum.org>
2. <http://www.opensource.org>
3. <http://www.khanacademy.org>
4. <http://in.ixl.com>
5. <http://www.learningwave.com>

COURSE OUTCOMES:

Upon successful completion of **Calculus of Finite Differences- I**, Students will be able to

CO Number	CO STATEMENT
CO 1	Compare accuracy, precision and errors.
CO 2	Applying the Methods of interpolation to compute the missing value in real life problems.
CO 3	Utilize various numerical operators to find the generalized term.
CO 4	Compute the missing values for unequal intervals using Divided difference and Lagrange's Method.
CO 5	Evaluate the approximate values of the first derivative, maximum and Minimum values of the Function using Newton's formula.
CO 6	Compute definite integral for different combinations of integrands using various methods and analyze their accuracy.

MAPPING-COURSE OUTCOME WITH PROGRAMME SPECIFIC OUTCOME

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO 1	3	1	2	3	1	3
CO 2	3	2	2	3	1	3
CO 3	3	2	2	3	1	3
CO 4	3	2	2	3	1	3
CO 5	3	2	2	3	1	3
CO 6	3	2	2	3	1	3
Average	3	1.83	2	3	1	3

KEY: STRONGLY CORRELATED-3 MODERATELY CORRELATED-2 WEAKLY CORRELATED-1 NO CORRELATION-0

TEACHING METHODOLOGY:

1. Lecture (Chalk and Talk-OHP-LCD)
2. Problem Solving-Group Discussion
3. Quiz-Seminar
4. Peer Learning

QUESTION PAPER PATTERN-UG

Knowledge Level	Section	Word Limit	Marks	Total	Special Instructions if any
K 1	A-10 × 2 marks	50	20	100	Nil
K1, K 2	B-5/8 × 7 marks	200	35		
K2, K 3	C-3/5 × 15 marks	500	45		

All question papers can be framed in the following cognitive levels

Knowledge Level 1. Recall

Knowledge Level 2 Understanding

Knowledge Level 3. Application

SEMESTER II COURSE PROFILE

COURSE CODE	TITLE OF THE PAPER	CREDITS	HOURS/ WK	TOTAL HOURS	L-T-P	CA	SA	TOTAL
Part –I	Tamil/Hindi/ French /Sanskrit	3	5	75		40	60	100
Part- II	English	3	5	75	2-1-1	40	60	100
MA18/2C/CLA	Classical Algebra	4	5	75	3-2-0	40	60	100
MA18/2C/ICF	Integral Calculus and Fourier Series	4	5	75	3-2-0	40	60	100
MA18/2A/FD2 (or) PH18/2A/GP2	Calculus of Finite Differences – II (or) Allied General Physics - II	5	6	90	3-3-0	40	60	100
Part- IV	lab/NME	2	2	30		-	50	50
	Soft Skill (Offered by English Department)	3	2	30		-	50	50

SEMESTER – II

CLASSICAL ALGEBRA

TOTAL HOURS: 75 Hours
CREDITS: 4

COURSE CODE: MA18/2C/CLA
L - T - P : 3 2 0

COURSE OBJECTIVES:

To enable students to

1. Sum the Series using Binomial, Exponential and Logarithmic series.
2. Compute the inverse of the matrix using Cayley Hamilton Theorem
3. Understand the basic concepts of Theory of Numbers.

COURSE OUTLINE:

- UNIT I:** Summation of series using Binomial, Exponential and Logarithmic series
Book 1 - Chap 3 Sec 10, Chap 4 Sec 3,9 (12 Hours)
- UNIT II:** Theory of Equations: Polynomial Equations – Relation between roots and Coefficients – symmetric functions of roots, Formation of equation.
Book 1 - Chap 6 Sec 1-12 (18 Hours)
- UNIT III:** Transformation of Equations, Reciprocal equations – Descartes' rules of signs, Approximation of roots of cubic equations by Horner's method .
Book 1-Chap 6 Sec 15-17, 24, 30 (12 Hours)
- UNIT IV:** Matrices: Symmetric – Skew- symmetric- Hermitian, Skew-Hermitian, Orthogonal and Unitary matrices, Cayley- Hamilton theorem (without proof), finding the inverse of a matrix using Cayley-Hamilton theorem. Eigen Values and Eigen vectors – Similar matrices – Diagonalisation.
Book 2 Chap 2 Sec 1-8, 9.1,16 (15 Hours)
- UNIT V:** Theory of numbers: prime and composite numbers, decomposition into prime Factors (without proof), Divisors of a positive integer 'n', Euler function $\phi(n)$, Formula for $\phi(n)$ (without proof), the higher power of a prime contained in $n!$, Congruences, Fermat's and Wilson's theorem (without proof)- simple problems.
Book2 Chap 5 Sec 1,6-8,10-13,16,17. (18 Hours)

BOOKS RECOMMENDED:

1. T.K.Manicavachagam Pillay, T.Natarajan, K.S.Ganapathy, Algebra Volume-I (2008)
S.Viswanathan Printers & Publishers Pvt. Ltd, Chennai.
2. T.K. Manicavachagam Pillay, T.Natarajan, K.S.Ganapathy, Algebra Volume – II (2008)
S.Viswanathan Printers & Publishers Pvt. Ltd, Chennai.

REFERENCE BOOKS:

1. P.R.Vittal and V.Malini, Algebra and Trigonometry (2003), Margam Publishers, Chennai.
2. Dr.A.Singaravelu, Algebra and Trigonometry Vol I & II (2003), Meenakshi Agency, Chennai.
3. Dr.S.Arumugam, Prof. A.Thangapandi Isaac , Classical Algebra (2003), New gamma Publishing House, Palayamakottai.
4. H.K. Dass, H.C.Saxena, M.D.Raisingghania, Matrices (1999), S.Chand & Company Pvt. Ltd , New Delhi.
5. Dr. Sudir K. Pundir, Dr. Rimple Pundir, Theory of numbers , Third Revised edition(2012), Pragati Prakashan , Meerut.

JOURNALS:

1. Mathematics Newsletter Published by Ramanujan Mathematical Society, Chennai.
2. Discrete Mathematical Sciences & Cryptography

E-LEARNING SOURCES:

1. <http://www.mathforum.org>
2. <http://www.opensource.org>
3. <http://www.khanacademy.org>
4. <http://www.in.ixl.com>
5. <http://www.learningwave.com>

COURSE OUTCOMES

Upon successful completion of **Classical Algebra**, Students will be able to

CO Number	CO STATEMENT
CO1	Sum the series using Binomial, Exponential and Logarithmic expansions.
CO2	Analyse the relation between root and coefficients of a polynomial equation. Form the equations using symmetric roots of a given equation
CO3	Find an approximation of roots of cubic equation by Horner's method.
CO4	Compute the inverse of a matrix using Cayley Hamilton Theorem, eigen values and eigen vectors of a matrix.
CO5	Analyse and interpret the concept of numbers, divisibility, Congruence, Euler function, Fermat's and Wilson's theorem.

MAPPING-COURSE OUTCOME WITH PROGRAMME SPECIFIC OUTCOME

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	2	3	3	1	3
CO2	3	2	3	3	1	3
CO3	3	2	3	3	1	3
CO4	3	2	3	3	1	3
CO5	3	2	3	3	1	3
AVERAGE	3	2	3	3	1	3

KEY: STRONGLY CORRELATED-3 MODERATELY CORRELATED-2 WEAKLY CORRELATED-1 NO CORRELATION-0

TEACHING METHODOLOGY:

1. Lecture (Chalk and Talk-OHP-LCD)
2. Problem Solving-Group Discussion
3. Quiz-Seminar
4. Peer Learning

QUESTION PAPER PATTERN-UG

Knowledge Level	Section	Word Limit	Marks	Total	Special Instructions if any
K 1	A-10 × 2 marks	50	20	100	Nil
K1, K 2	B-5/8 × 7 marks	200	35		
K2, K 3	C-3/5 × 15 marks	500	45		

All question papers can be framed in the following cognitive levels

Knowledge Level 1. Recall

Knowledge Level 2. Understanding

Knowledge Level 3. Application

SEMESTER- II

INTEGRAL CALCULUS AND FOURIER SERIES

TOTAL HOURS: 75 HOURS
CREDITS: 4

COURSE CODE: MA18/2C/ICF
L - T - P : 3 2 0

COURSE OBJECTIVES:

To enable students to

1. Get exposed to the concepts of reduction formulae and Fourier Series
2. Apply double and triple integral to find the area and volume.
3. Understand the concepts of Beta and Gamma functions and their applications.

COURSE OUTLINE:

UNIT-I : Integral Calculus:

Reduction formulae, $\int e^{ax} \cos bx \, dx$, $\int e^{ax} \sin bx \, dx$,
 $\int \sin^m x \cos^n x \, dx$ (m, n being positive integers),
 $\int x^m (\log x)^n \, dx$, $\int \cos^m x \cos nx \, dx$, $\int \cos^m x \sin nx \, dx$, Bernoulli's formula
Book 1 Chap 1 Sec 1.3, 13.1 – 13.10, 14,15 (15 Hours)

UNIT-II: Double integrals (Cartesian co-ordinates only), change of order of integration.
Book 1 Chap 5 Sec 2.1, 2.2 (15 Hours)

UNIT-III: Triple integrals, Application of multiple integrals in finding area and volume.
(Cartesian co- ordinates only)
Book 1 Chap 5 Sec 4, 5.1-5.3 (15 Hours)

UNIT-IV: Beta and Gamma functions (applications to simple problems)
Book 1 Chap 7 Sec 2.1-2.3, 3, 4. (15 Hours)

UNIT-V: Fourier Series:

Fourier series of periodic functions, Fourier series of odd and even functions
Book 2 Chap 6 Sec 1-3 (15 Hours)

BOOKS RECOMMENDED :

1. S. Narayan and T.K. Manicavachagom Pillay, Calculus Volume – II (2008), S.Viswanathan Printers & Publishers Pvt. Ltd, Chennai.
2. S. Narayan and T.K. Manicavachagom Pillay, Calculus Volume – III (2008), S.Viswanathan Printers & Publishers Pvt. Ltd, Chennai.

REFERENCE BOOKS:

1. P.Kandasamy and K. Thilagavathi, Mathematics for B.Sc., Volume II (2004) , S.Chand & Company Ltd , New Delhi.
2. Apostol,T.M , Calculus Volume II Fourth edition (1991), John Wiley and Sons, Inc., New York.
3. S.C.Arora & Ramesh Kumar, A Text Book of CALCULUS, First edition (1984), Pitambar Publishing Company,New Delhi.

4. ShantiNarayan,P.K.Mittal ,Integral Calculus, Tenth Revised Edition (2005), S.Chand & Company Ltd.,New Delhi.
5. R.K Ghosh,K.C.Maity , An Introduction to Analysis, Integral Calculus,Part-I, Ninth edition (1999), Books and Allied (P) Ltd-Calcutta.

JOURNALS:

1. Mathematics Newsletter Published by Ramanujan Mathematical Society, Chennai.
2. Discrete Mathematical Sciences & Cryptography

E-LEARNING RESOURCES:

1. <http://www.mathforum.org>
2. <http://www.opensource.org>
3. <http://www.khanacademy.org>
4. <http://in.ixl.com>
5. <http://www.learningwave.com>

COURSE OUTCOMES:

Upon successful completion of **Integral Calculus**, Students will be able to

CO Number	CO STATEMENT
CO 1	Derive reduction formula and thereby evaluate some standard integrals.
CO 2	Apply change of variable method to evaluate double integral
CO 3	Utilize double and triple integral to compute area and volume of the solid
CO 4	Explain the properties of Beta and Gamma function and apply it to compute the integral
CO 5	Identify odd and even function. Use that to determine Fourier series expansion of the given function

MAPPING-COURSE OUTCOME WITH PROGRAMME SPECIFIC OUTCOME

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	3	2	1	3	1	-
CO2	3	2	2	3	2	2
CO3	3	2	2	3	2	3
CO4	3	2	2	3	1	2
CO5	3	2	1	3	1	2
AVERAGE	3	2	1.6	3	1.4	1.8

KEY: STRONGLY CORRELATED-3 MODERATELY CORRELATED-2 WEAKLY CORRELATED-1 NO CORRELATION-0

TEACHING METHODOLOGY:

1. Lecture (Chalk and Talk-OHP-LCD)
2. Problem Solving-Group Discussion
3. Quiz-Seminar
4. Peer Learning

QUESTION PAPER PATTERN-UG

Knowledge Level	Section	Word Limit	Marks	Total	Special Instructions if any
K 1	A-10 × 2 marks	50	20	100	Nil
K1,K 2	B-5/8 × 7 marks	200	35		
K2, K 3	C-3/5 × 15 marks	500	45		

All question papers can be framed in the following cognitive levels

Knowledge Level 1. Recall

Knowledge Level 2. Understanding

Knowledge Level 3. Application

SEMESTER – II

CALCULUS OF FINITE DIFFERENCES – II

TOTAL HOURS: 90

COURSE CODE: MA18 / 2A / FD2//
MC18/2A/FD2

CREDITS: 5

L - T - P: 4 2 0

COURSE OBJECTIVES:

To enable students to

1. Find the numerical solutions of Algebraic, Transcendental & Simultaneous equations.
2. Understand the fundamental concepts of difference equation.
3. Compute the numerical solution of ordinary differential equation.

COURSE OUTLINE:

UNIT I: Summation of series: Use of forward difference operators – Summation using Euler – Maclaurin's formula (20 Hours)

UNIT II: Solution of Algebraic and Transcendental Equations: Numerical solutions of Polynomial and Transcendental equations in one variable. Bisection Method, Method of false position (Regular falsi Method), Newton Raphson Method, Method of iteration. (20 Hours)

UNIT III: Solution of a system of Algebraic Equations: Numerical solution of Simultaneous Linear Equations in three variables by Gauss Elimination Method, Gauss Jordan Method, Jacobi Iteration Method, Gauss Seidel Method. (20 Hours)

UNIT IV: Difference equations: Definition, method of solutions, First order linear difference equation with constant, variable coefficients, second order linear difference equation with constant Coefficients- Particular integrals of type $a^x, x^m, x^m a^x$ – Simple problems. (15 Hours)

UNIT V: Numerical solution of ordinary differential equations of first order: Euler's method, Modified Euler Method, Picard's method of successive approximation, Range- Kutta Method of order four. (15 Hours)

BOOKS RECOMMENDED:

1. B.D.Gupta, Numerical Analysis (1989), Konark Publication, Ltd , New Delhi.
2. S.G.Venkatachalapathy, Calculus of finite differences and Numerical analysis (2003), Margham publications, Chennai.
3. Dr. M.K. Venkataraman, Numerical Methods in Science & Engineering, Fifth edition (1999), The National Publishing Company ,Chennai.

REFERENCE BOOKS:

1. H.C. Saxena, Finite Differences and Numerical Analysis Fifteenth edition (2000) S.Chand &Co, New Delhi.
2. S.Arumugham ,Numerical Methods, Second edition (2008) ,New Gamma Publishing, Palayamkottai.
3. M.K.Jain,S.R.K.Iyengar,R.K.Jain, Numerical methods for scientific and Engineering Computation , Sixth edition (2012) ,New age International Publishers, New Delhi .
4. E.Balagurusamy,Numerical Methods (1999), Tata Mc-Graw Hill, New Delhi.
5. T.K. Manicavachagom Pillay & Prof. S. Narayanan, Numerical Analysis , New edition (2001), S.Viswanathan Printers& Publishers Pvt Ltd ,Chennai.

JOURNALS:

1. Mathematics Newsletter Published by Ramanujan Mathematical Society, Chennai.
2. Discrete Mathematical Sciences & Cryptography

E-LEARNING RESOURCES:

1. <http://www.mathforum.org>
2. <http://www.opensource.org>
3. <http://www.khanacademy.org>
4. <http://in.ixl.com>
5. <http://www.learningwave.com>

COURSE OUTCOMES:

Upon successful completion of **Calculus of Finite Differences- II**, Students will be able to

CO Number	CO STATEMENT
CO 1	Compute the summation of series by applying Numerical Operators and Euler Maclaurin Formula.
CO 2	Apply Numerical Methods to evaluate numerical solution of algebraic and transcendental equations.
CO 3	Solve Simultaneous linear equation in three variables.
CO 4	Formulate difference equation for the given problem and solve the equation.
CO 5	Evaluate the solution of first order differential equation using Euler, Picard's and Runge-Kutta Methods.

MAPPING-COURSE OUTCOME WITH PROGRAMME SPECIFIC OUTCOME

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO 1	3	2	1	3	1	3
CO 2	3	2	-	3	1	3
CO 3	3	2	-	3	1	3
CO 4	3	1	1	3	1	3
CO 5	3	1	1	3	1	3
Average	3	1.6	0.6	3	1	3

KEY: STRONGLY CORRELATED-3 MODERATELY CORRELATED-2 WEAKLY CORRELATED-1 NO CORRELATION-0

TEACHING METHODOLOGY:

1. Lecture (Chalk and Talk-OHP-LCD)
2. Problem Solving-Group Discussion
3. Quiz-Seminar
4. Peer Learning

QUESTION PAPER PATTERN-UG

Knowledge Level	Section	Word Limit	Marks	Total	Special Instructions if any
K 1	A-10 × 2 marks	50	20	100	Nil
K1, K 2	B-5/8 × 7 marks	200	35		
K2, K 3	C-3/5 × 15 marks	500	45		

All question papers can be framed in the following cognitive levels

Knowledge Level 1. Recall

Knowledge Level 2. Understanding

Knowledge Level 3. Application

SEMESTER III COURSE PROFILE

COURSE CODE	TITLE OF THE PAPER	CREDITS	HOURS/ WK	TOTAL HOURS	L-T-P	CA	SA	TOTAL
Part I	Tamil/Hindi/ French/ Sanskrit	3	5	75		40	60	100
Part II	English	3	5	75	2-1-1	40	60	100
MA18/3C/DEQ	Differential Equations	4	5	75	3-2-0	40	60	100
MA18/3C/NTY	Number Theory	4	5	75	3-2-0	40	60	100
MA18/3A/MSI	Mathematical Statistics & R Software – I	5	6	90	4-1-1	40	60	100
Part IV	Soft Skill	3	2	30		-	50	50
	Environmental Studies	2	2	30	2-1-0	-	50	50

SEMESTER III

DIFFERENTIAL EQUATIONS

TOTAL HOURS: 75
CREDITS: 4

COURSE CODE: MA18/3C/DEQ
L-T-P: 3 2 0

COURSE OBJECTIVES:
To enable students to

1. Distinguish ordinary differential equations from partial differential equations.
2. Solve second order differential equations.
3. Determine the solution of exact differential equation using Integrating factor.

COURSE OUTLINE:

UNIT I: Equations of first order and first degree equation; variable separable method, homogeneous equations. (Not for Examination purpose)

Chapter II Sections 1-2

Equations of first order and first degree equation: Bernoulli's equation

Equations of first order but of higher degree – Equations solvable for p – Equations solvable for x – Equations solvable for y – Clairaut's Equation

Chapter II Sections 4-5

Chapter IV Sections 1-3

(20 Hours)

UNIT II :Linear equation with constant coefficients, P.I for e^{ax} , $\cos mx$, $\sin mx$, $e^{ax} V$ where V is x^m , $\cos mx$, $\sin mx$, m being a positive integer.

Chapter V Sections 1 – 4

(15 Hours)

UNIT III: Linear equation with variable coefficients: $ax^2 \frac{d^2y}{dx^2} + bx \frac{dy}{dx} + cy = Q$.

Method of variation of parameters-simple problems.

Chapter V Section 5

Chapter VIII Section 4

(10 Hours)

UNIT IV: Exact equations : I.F $\frac{1}{Mx+Ny}$, $\frac{1}{Mx-Ny}$, $\frac{\partial M}{\partial y} = \frac{\partial N}{\partial x}$, $\frac{\partial N}{\partial x} = \frac{\partial M}{\partial y}$

Total Differential Equations, Lagrange's equation; $\frac{dx}{P} = \frac{dy}{Q} = \frac{dz}{R}$

Chapter II Section 6

Chapter VI Sections 4, 5

Chapter XI Sections 1.3, 1.4

(15 Hours)

UNIT V :Partial Differential Equations: Formation of P.D.E, Complete integrals, particular integrals, singular integrals. Lagrange's Method of solving linear equation, Non-linear equations of the first order: The four standard forms.

Chapter XII Sections 1- 4, 5.1 – 5.4

(15 Hours)

RECOMMENDED TEXTBOOKS:

S. Narayanan & T.K. Manicavachagam Pillay, Differential Equations and its applications, Revised Ninth Edition (1985), S. Viswanathan Printers & Publishers Pvt. (Ltd.), Chennai.

REFERENCE BOOKS:

1. P.R. Vittal, Differential Equations and Laplace transformations, First edition (2004), Margham Publications, Chennai.
2. Zafar Ahsan, Differential equations and their applications, Second edition (2006), Prentice Hall of India Pvt. Ltd, New Delhi.
3. Richard Bronson, Gabriel B. Costa, Differential Equations, Third edition (2000) Schaum's Outlines, Mc Graw Hill Education, New York.
4. Dr.M.D.Raisinghania, Ordinary and Partial Differential Equations, Revised Ninth edition (2005), S.Chand & Compant Ltd, New Delhi.
5. M.K.Venkataraman, Higher Engineering Mathematics, III-B (1998), National Publishing Co, Chennai.

JOURNALS:

1. Mathematics Newsletter Published by Ramanujan Mathematical Society, Chennai.
2. Discrete Mathematical Sciences & Cryptography

E-LEARNING RESOURCES:

1. <http://www.mathforum.org>
2. <http://www.opensource.org>
3. <http://www.khanacademy.org>
4. <http://in.ixl.com>
5. <http://www.learningwave.com>

COURSE OUTCOMES:

Upon successful completion of **Differential Equations**, Students will be able to

CO Number	CO STATEMENT
CO 1	Analyze and solve the first order differential equation.
CO 2	Compute Complementary function and Particular integral for the Linear equation with constant coefficients.
CO 3	Compute Complementary function and Particular integral for the Linear equation with variable coefficients. Discuss the method of variation of Parameters.
CO 4	Evaluate the solution of exact equations, Total Differential Equations, Lagrange's Equation.
CO 5	Formulate the P.D.E. and find Complete, particular and singular integrals.

MAPPING-COURSE OUTCOME WITH PROGRAMME SPECIFIC OUTCOME

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	3	-	2	3	-	2
CO2	3	-	1	2	-	1
CO3	3	-	1	2	-	1
CO4	3	2	3	2	-	1
CO5	3	2	3	2	-	1
AVERAGE	3	0.8	2	2.2	-	1.2

KEY: STRONGLY CORRELATED-3 MODERATELY CORRELATED-2 WEAKLY CORRELATED-1 NO CORRELATION-0

TEACHING METHODOLOGY:

1. Lecture (Chalk and Talk-OHP-LCD)
2. Problem Solving-Group Discussion
3. Quiz-Seminar
4. Peer Learning

QUESTION PAPER PATTERN-UG

Knowledge Level	Section	Word Limit	Marks	Total	Special Instructions if any
K 1	A-10 × 2 marks	50	20	100	Nil
K1,K 2	B-5/8 × 7 marks	200	35		
K2, K 3	C-3/5 × 15 marks	500	45		

All question papers can be framed in the following cognitive levels

Knowledge Level 1. Recall

Knowledge Level 2. Understanding

Knowledge Level 3. Application

SEMESTER – III
NUMBER THEORY

TOTAL HOURS: 75
CREDITS: 4

COURSE CODE: MA18/3C/NTY
L - T - P: 3 2 0

COURSE OBJECTIVES:

To enable students to

1. Get exposed to the fundamental concepts of Number Theory.
2. Understand the importance of Number Theory in Cryptography.
3. Develop Problem solving skills.

UNIT I: Introduction: Basic Binary Operations on the set of Integers- Ordering of the Integers- Well ordering principle-mathematical Induction.
Chapter 1 Sections 1.3 - 1.6 (7 Hours)

UNIT II: Divisibility Theory: Greatest common Divisor- Relatively Prime integers – Algorithm to Find G.C.D : Investigation of the set of Integers $\{bx+cy\}$ - Least Common Multiple.
Chapter 2 Sections 2.3 - 2.5 and 2.7. (17 Hours)

UNIT III: Linear Diophantine Equations: Linear Diophantine Equations- The Equation $ax+by=c$ - Diophantine Equation in Three or More Unknowns- Diophantine Equation of the Second Degree (Statements of theorems and problems only)
Chapter 3 Sections 3.2 - 3.5

Cryptography: Applications to Cryptography, Data encryption standard, Asymmetric key cryptography.
Chapter 7 Sections 7.8-7.10 (17 Hours)

UNIT IV: Quadratic Residues: Introduction, quadratic residues, Elementary Properties.
Chapter 9 Sections 9.1- 9.3 (17 Hours)

UNIT V: Perfect Numbers : Introduction, Perfect Numbers, Necessary and sufficient Conditions for a positive Integer to be an even Perfect number, Mersenne Numbers, Fermat Numbers.
Chapter 10 Sections 10.1-10.5 (17 Hours)

BOOKS RECOMMENDED:

Pundir & Pundir ,Theory of Numbers, Third revised edition (2012), Pragati Prakashan, Meerut.

REFERENCE BOOKS:

1. Ivan M. Niven and Zuckerman , An Introduction to the theory of numbers, Fifth edition(1991), Wiley Publications, New Delhi.

2. C.Y. Hsiung, Elementary theory of numbers (1995), Allied Publishers Limited, New Delhi.
3. David . M. Burton , Elementary Number Theory (1980.), Allyn and Bacon Inc., Boston.
4. H.E. Rose ,A course in Number Theory , Second Edition , Oxford Science Publications.
5. Tom. M. Apostol, Introduction to Analytic Number Theory (1989), Narosa Publishing House, New Delhi.

JOURNALS:

1. Mathematics Newsletter Published by Ramanujan Mathematical Society, Chennai.
2. Discrete Mathematical Sciences & Cryptography

E-LEARNING RESOURCES:

1. <http://www.mathforum.org>
2. <http://www.opensource.org>
3. <http://www.khanacademy.org>
4. <http://in.ixl.com>
5. <http://www.learningwave.com>

COURSE OUTCOMES:

Upon successful completion of **Number theory**, Students will be able to

CO Number	CO STATEMENT
CO 1	Validate simple mathematical proof by principle of mathematical induction.
CO 2	Analyse the concept of divisibility, congruence, GCD & LCM. Evaluate GCD by Euclid Algorithm.
CO 3	Solve Diophantine equations of two or three variables. Acquire knowledge of Cryptography and data encryption.
CO 4	Apply the law of quadratic reciprocity and their methods to classify numbers as primitive roots, quadratic residues and non-residues.
CO 5	Discuss about perfect numbers, even perfect numbers, Mersenne Numbers, Fermat Numbers.

MAPPING-COURSE OUTCOME WITH PROGRAMME SPECIFIC OUTCOME

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	1	2	3	3	-	-
CO2	1	2	1	3	1	1
CO3	1	1	1	3	3	1
CO4	1	1	-	2	1	2
CO5	1	1	-	2	1	2
AVERAGE	1	1.4	1.25	2.6	1.2	1.2

KEY: STRONGLY CORRELATED-3 MODERATELY CORRELATED-2 WEAKLY CORRELATED-1 NO CORRELATION-0

TEACHING METHODOLOGY:

1. Lecture (Chalk and Talk-OHP-LCD)
2. Problem Solving-Group Discussion
3. Quiz-Seminar
4. Peer learning

QUESTION PAPER PATTERN-UG

Knowledge Level	Section	Word Limit	Marks	Total	Special Instructions if any
K 1	A-10 × 2 marks	50	20	100	Nil
K1,K 2	B-5/8 × 7 marks	200	35		
K2, K 3	C-3/5 × 15 marks	500	45		

All question papers can be framed in the following cognitive levels

Knowledge Level 1.Recall

Knowledge Level 2.Understanding

Knowledge Level 3.Application

SEMESTER – III

MATHEMATICAL STATISTICS & R SOFTWARE –I

TOTAL HOURS: 90 Hours

**COURSE CODE: MA18 /3A/ MS1//
MC18 /3A/MS1**

CREDITS: 5

L- T- P : 4 1 1

COURSE OBJECTIVES:

To enable students to

1. Distinguish between discrete and continuous distribution.
2. Be equipped with the knowledge of R- Programming and apply it to compute statistical measures.
3. Understand the degree of relationship between two variables and to compute the relationship as linear equations.

COURSE OUTLINE:

Concept of probability to be revised (not included for examination purpose)

THEORY COMPONENT

UNIT I: RANDOM VARIABLES

Definition of a random variable, discrete and continuous random variable, mathematical expectation of a discrete and continuous random variable.

Book 1 Chapter 5 Sections 5.1 - 5.4.1

Chapter 6 Sections 6.1 - 6.7

(15 Hours)

UNIT II: DISCRETE DISTRIBUTIONS

Binomial, Poisson distributions - Definitions, mean, median, mode, recurrence formula for moments, moment generating function, additive property, fitting of distributions.

Book 1 Chapter 7

(15 Hours)

UNIT III: CONTINUOUS DISTRIBUTION

Rectangular distribution, Normal distribution - Definition, limiting form of Binomial distribution, (derivation excluded). Chief characteristics of normal distribution. Normal probability curve, mean, mode, median, moment generating functions, moments, Area property, fitting of normal distribution.

Book 1 Chapter 8 Sections 8.1-8.2.14

(15 Hours)

UNIT IV: CORRELATION & REGRESSION

Simple correlation - Rank correlation, product moment correlation for raw and grouped data. Regression lines for X on Y and Y on X, computation of means, variances and correlation coefficient from regression lines.

(Derivation of formulae for correlation and regression lines excluded).

Book 1 Chapter 10 Sections 10.1-10.6.1, 10.7- 10.7.5

(30 Hours)

PRACTICAL COMPONENT

UNIT V: COMPUTATIONAL STATISTICS USING "R" SOFTWARE

Diagrammatic representation of data by subdivided and multiple Bar diagram,

pie chart. Graphical representation of frequency data Rod & Spike graph, frequency polygon. Less than and more than O gives. Correlation and rank correlation between two variables. Regression lines of X on Y and Y on X
(Internal Practical only, No questions for the end semester examination)

Book 2

(15 Hours)

BOOKS RECOMMENDED:

1. S.C. Gupta and V.K. Kapoor, Elements of Mathematical Statistics, Third edition (2015), Sultan Chand & Son Publications, New Delhi.
2. Sudha G.Purohit, Sharad D.Gore and Shailaja R. Deshmukh, Statisites using R , Second Edition (2015), Narosa Publishing House, New Delhi.

REFERENCE BOOKS:

1. P.R. Vittal, Mathematical Statistics (2002), Margham Publications, Chennai.
2. S.C. Gupta and V.K. Kapoor, Fundamentals of Mathematical Statistics Eleventh edition (2002), Sultan Chand & Sons Publications, New Delhi.
3. Robert V. Hogg, Joseph Mckean & Craig A.T ,Introduction to Mathematical Statistics, (2013), Pearson Education India.
4. George W. Snedecor , William G.Cochran, Statistical Methods (1967),Oxford & IBH Publishers,
5. Dr.S.P. Gupta, Statistical Methods ,41st edition (2011) ,Sultan Chand & Sons , New Delhi .

JOURNALS

1. Mathematics Newsletter Published by Ramanujan Mathematical Society, Chennai.
2. Discrete Mathematical Sciences & Cryptography

E- LEARNING RESOURCES:

1. <http://www.mathforum.org>
2. <http://www.opensource.org>
3. <http://www.khanacademy.org>
4. <http://www.in.ixl.com>
5. <http://www.learningwave.com>

COURSE OUTCOMES

Upon successful completion of **Mathematical Statistics & R Software –I** Students will be able to

CO Number	CO STATEMENT
CO1	Differentiate between discrete and continuous random variables and compute the Mathematical expectation of a random variable.
CO2	Compute Mean, Median and Mode of Binomial and Poisson distribution and their moments.
CO3	Analyse rectangular and normal distribution and compute the various parameter of the distribution. Apply Normal distribution properties to solve real life problems.
CO4	Compute Correlation and Rank Correlation and find the relation between two variables using Regression.
CO5	Effectively use ‘R’ software for representation of data, Computation of Correlation and Regression lines.

MAPPING-COURSE OUTCOME WITH PROGRAMME SPECIFIC OUTCOME

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	2	3	3	3	3
CO2	3	2	3	3	3	3
CO3	3	2	3	3	3	3
CO4	3	2	3	3	3	3
CO5	3	2	3	3	3	3
AVERAGE	3	2	3	3	3	3

KEY: STRONGLY CORRELATED-3 MODERATELY CORRELATED-2 WEAKLY CORRELATED-1 NO CORRELATION-0

TEACHING METHODOLOGY:

1. Lecture (Chalk and Talk-OHP-LCD)
2. Problem Solving-Group Discussion
3. Quiz-Seminar
4. Peer Learning

QUESTION PAPER PATTERN-UG

Knowledge Level	Section	Word Limit	Marks	Total	Special Instructions if any
K 1	A-10 × 2 marks	50	20	100	No Questions from Unit- V
K1, K 2	B-5/8 × 7 marks	200	35		
K2, K 3	C-3/5 × 15 marks	500	45		

All question papers can be framed in the following cognitive levels

Knowledge Level 1. Recall

Knowledge Level 2. Understanding

Knowledge Level 3. Application

SEMESTER IV COURSE PROFILE

COURSE CODE	TITLE OF THE PAPER	CREDITS	HOURS/ WK	TOTAL HOURS	L-T-P	CA	SA	TOTAL
Part I	Tamil/Hindi/French/ Sanskrit	3	5	75		40	60	100
Part II	English	3	5	75	2-1-1	40	60	100
MA18/4C/ALS	Algebraic Structures	4	5	75	3-2-0	40	60	100
MA18/4C/VGF	Vector Calculus , Geometry and Fourier Transforms	4	5	75	3-2-0	40	60	100
MA18/4A/MS2	Mathematical Statistics & R Software – II	5	6	90	4-1-1	40	60	100
Part IV	Soft Skill	3	2	30		-	50	50
	Value Education	2	2	30		-	50	50

SEMESTER- IV
ALGEBRAIC STRUCTURES

TOTAL HOURS: 75 Hours
CREDITS : 4

COURSE CODE: MA18/4C/ALS
L – T- P: 3 2 0

COURSE OBJECTIVES:

To enable students to

1. Understand algebraic concepts of groups and rings.
2. Analyze and understand theorems on algebraic concepts.
3. Analyze the similarities and differences between two groups or rings.

COURSE OUTLINE:

- UNIT I : Groups – subgroups.**
Chapter 2 sections 2.1-2.4 (15 Hours)
- UNIT II : Normal subgroups – Quotient groups.**
Chapter 2 sections 2.5, 2.6 (15 Hours)
- UNIT III : Homomorphism – Isomorphism – Automorphism - Cayley's theorem.**
Permutation groups.
Chapter 2 sections 2.7-2.10 (Excluding applications 1 and 2 of section 2.7.
Examples 2.8.1 & 2.8.2 and applications of section 2.9) (15 Hours)
- UNIT IV: Rings: Definitions – Examples - Some Special Classes of rings-**
Homomorphism - Isomorphism.
Chapter 3 sections 3.1-3.3 (15 Hours)
- UNIT V: Ideals and quotient rings - Maximal Ideals, Principle Ideals, Principle Ideal rings –**
Euclidean rings.
Chapter 3 sections 3.4, 3.5, 3.7 (15 Hours)

BOOKS RECOMMENDED:

1. N. Herstein (1989) Topics in Algebra, (2nd edition) Wiley Eastern Ltd. New Delhi.
2. M. Artin, Algebra, Prentice-Hall of India, 2005.

REFERENCE BOOKS:

1. S. Arumugam (2004) Modern algebra, Scitech Publications, Chennai.
2. K. Viswanatha Naik, Modern algebra, Emerald Publishers.
3. Joseph Gallian, Contemporary Algebra, Narosa Publications, Chennai.
4. Schuam's outlines- Group theory, Benjamin baumslag, Bruce chandler, Tata Mc.Graw-Hill Publishing company Ltd.
5. M.L.Santiago (1988) Modern Algebra Arul Publications, Chennai.

JOURNALS

1. Mathematics Newsletter Published by Ramanujan Mathematical Society, Chennai.
2. Discrete Mathematical Sciences & Cryptography

E- LEARNING RESOURCES:

1. <http://www.mathforum.org>
2. <http://www.opensource.org>
3. <http://khanacademy.org>
4. <http://in.ixl.com>
5. <http://www.learningwave.com>

COURSE OUTCOME:

Upon successful completion of **Algebraic Structures**, Students will be able to

CO NUMBER	CO STATEMENT
CO 1	Analyze the properties implied by the definition of groups and rings.
CO 2	Assess the properties of various canonical types of groups and rings like cyclic groups, normal groups, quotient rings, polynomial rings.
CO 3	Analyze and demonstrate examples of subgroups, normal subgroups, quotient group, ideals and quotient rings
CO 4	Use the concepts of isomorphism and homomorphism for groups and rings
CO 5	Produce rigorous proofs of propositions arising in the context of abstract algebra.

MAPPING-COURSE OUTCOME WITH PROGRAMME SPECIFIC OUTCOME

CO /PCO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO 1	3	3	3	3	1	2

CO 2	3	3	3	3	1	2
CO 3	2	3	3	3	1	2
CO 4	1	3	3	3	1	3
CO 5	-	3	3	3	1	-
AVERAGE	1.8	3	3	3	1	1.8

KEY: STRONGLY CORRELATED-3 MODERATELY CORRELATED-2 WEAKLY CORRELATED-1 NO CORRELATION-0

TEACHING METHODOLOGY

1. Lecture (Chalk and Talk-OHP-LCD)
2. Problem Solving-Group Discussion-Role Modelling
3. Quiz-Seminar
4. Peer Learning

QUESTION PAPER PATTERN - UG

Knowledge Level	Section	Word Limit	Marks	Total	Special Instructions if any
K 1	A-10 × 2 marks	50	20	100	Nil
K1, K 2	B-5/8 × 7 marks	200	40		
K2, K 3	C-3/5 × 15 marks	500	40		

All question papers can be framed in the following cognitive levels

Knowledge Level 1.Recall

Knowledge Level 2.Understanding

Knowledge Level 3.Application

SEMESTER IV

VECTOR CALCULUS, GEOMETRY AND FOURIER TRANSFORMS

TOTAL HOURS: 75

COURSE CODE: MA18/4C/VGF

CREDITS: 4

L-T-P: 3 2 0

COURSE OBJECTIVES:

To enable students

1. Understand the fundamental concepts of vector differentiation.
2. Compute line, Surface & volume integral by using Green's, Stokes & Gauss Divergence theorem.
3. Compute the Fourier Transform of a continuous function.

COURSE OUTLINE:

- UNIT I: Vector Differentiation:** Directional Derivative, gradient, unit normal to the surface, equation of tangent plane to a surface, equation of normal to a surface , Divergence, Curl, Laplace operators.
Book1 Chapter 2 Sections 2.1 - 2.13 (15 Hours)
- UNIT II: Evaluation of line integral, surface integral and volume integral**
Book1 Chapter 3 Sections 3.1 - 3.6 (15 Hours)
- UNIT III: Application of Green's theorem, Gauss-Divergence theorem, Stokes' theorem** (proofs of theorems not included), simple problems
Book1 Chapter 4 Sections 4.1 - 4.8 (15 Hours)
- UNIT IV: Planes:** Equation of a plane, Angle between two planes, equation of a plane through line of intersection of two planes , length of perpendicular, To find the equation of the plane which bisects the angle between two given planes, simple problems.
Book 2 Chapter II Sections 1-11 (15 Hours)
- UNIT V: Polar Coordinates :**
Distance between the points, area of triangle – equation of straight line
(Circle - Not included)
Fourier Transforms:
Integral Transforms, Fourier integral theorem (without proof), Fourier sine and cosine integrals (only formulae), Fourier Transforms, Fourier sine transforms and cosine transforms of elementary functions – Simple Problems
(Properties of Fourier Transforms excluded)
Book 3 Chapter 5, Book 4 Chapter 6 (15 Hours)

RECOMMENDED TEXTBOOKS:

1. Duraipandian, P., Kayalal Pachaiyappa, Vector Analysis, First edition (2014), S.Chand & Company Ltd., New Delhi.
2. T.K. Manicavachagam Pillay & T.Natrajan Revised edition (1996) , Analytical Geometry (Part II - Three dimensions), S. Vishwanathan Printers and publishers pvt.ltd, Chennai.
3. Prof. S.G. Venkatachalapathy , Analytical Geometry (Two dimensions & Three dimensions), First edition (2008), Margham Publications, Chennai.
4. A. Singaravelu, Differential Equations, Fourier series and Laplace Transforms, First edition (2002), Meenakshi Traders, Chennai.

REFERENCE BOOKS:

1. M.L.Khanna, Co-ordinate Geometry (2016), Jai Prakash Nath & co.
2. P.R. Vittal, Vector analysis, Analytical solid geometry and sequences and series, Third edition (2003), Margham Publications, Chennai.
3. Dr.K.Venkataraman- Engineering Mathematics – Part B , National Publishing Company , Chennai.
4. B.S.Grewl, Higher Engineering Mathematics (2002), Khanna Publishers, New Delhi.
5. G.B.Thomas and R.L.Finney, Calculus and Analytic Geometry , Ninth Edition (1998), Addison Wesley, New Delhi.

JOURNALS:

1. Mathematics Newsletter Published by Ramanujan Mathematical Society, Chennai., Chennai.
2. Discrete Mathematical Sciences & Cryptography

E-LEARNING RESOURCES:

1. <http://www.mathforum.org>
2. <http://www.opensource.org>
3. <http://khanacademy.org>
4. <http://in.ixl.com>
5. <http://www.learningwave.com>

COURSE OUTCOMES:

Upon successful completion of **Vector Calculus, Geometry and Fourier Transforms**, Students will be able to

CO Number	CO STATEMENT
CO 1	Discuss the Basic concepts of gradient, Scalar Potential, Directional Derivative, Divergence and Curl.
CO 2	Evaluate line integral, surface integral and volume integral.
CO 3	Apply Green's theorem, Gauss-Divergence theorem, Stokes theorem to evaluate Area and Volume.
CO 4	Discuss the Geometrical concepts of Planes.
CO 5	Apply the concept of Polar coordinates to find the Distance between the two Points, Area of a triangle and Solve problems on Straight lines. Determine Fourier Transform for a given function.

MAPPING-COURSE OUTCOME WITH PROGRAMME SPECIFIC OUTCOME

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6

CO1	3	3	3	3	1	2
CO2	3	3	3	3	1	2
CO3	3	3	3	3	1	2
CO4	3	2	3	3	1	3
CO5	3	3	3	3	1	1
AVERAGE	3	2.8	3	3	1	2

KEY: STRONGLY CORRELATED-3 MODERATELY CORRELATED-2 WEAKLY CORRELATED-1 NO CORRELATION-0

TEACHING METHODOLOGY:

1. Lecture (Chalk and Talk-OHP-LCD)
2. Problem Solving-Group Discussion
3. Quiz-Seminar
4. Peer Learning

QUESTION PAPER PATTERN-UG

Knowledge Level	Section	Word Limit	Marks	Total	Special Instructions if any
K 1	A-10 × 2 marks	50	20	100	Nil
K1,K 2	B-5/8 × 7 marks	200	35		
K2, K 3	C-3/5 × 15 marks	500	45		

All question papers can be framed in the following cognitive levels

Knowledge Level 1. Recall

Knowledge Level 2. Understanding

Knowledge Level 3. Application

SEMESTER –IV

MATHEMATICAL STATISTICS & R SOFTWARE – II

TOTAL HOURS: 90 Hours

COURSE CODE: MA18/4A/MS2//

CREDITS: 5

L -T- P: 4 1 1

COURSE OBJECTIVES:**To enable students to**

1. Understand the concepts of sampling, testing of hypothesis, critical region and standard error.
2. Be familiarized with applications of various tests of significance.
3. Be equipped with the knowledge of R-Programming and apply it to compute statistical measures.

COURSE OUTLINE:**THEORY COMPONENT****UNIT I: SAMPLING THEORY:**

Tests of Hypothesis, Concepts of standard Error, Null Hypothesis, Alternative Hypothesis, Error in Sampling, Critical region and Level of Significance, One tailed and Two tailed tests, degrees of freedom, Simple and composite hypothesis, Size and power of a test.

Book 1 Chapter 12 Sections 12.1 - 12.7

(15 Hours)**UNIT II: TEST OF SIGNIFICANCE FOR LARGE SAMPLES:**

Test of significance of single mean, Test of significance of difference of two means, Difference between two standard deviation, Test for single proportion, test of significance for difference of two proportions, Confidence intervals.

Book 1, Chapter 12, Sections 12.8 -12.9.2, 12.13 – 12.15.

TEST OF SIGNIFICANCE FOR SMALL SAMPLES:

t- Test – Test for single mean, test of significance for difference between two population means, t-Test for paired observations, F- test.

Book 1 Chapter 14 Sections 14.1-14.2.7, 14.3.2

(40 Hours)**UNIT III : CHI-SQUARE TEST:**

Chi-square test for homogeneity, Chi-square test of Goodness of Fit, Test of independence of two attributes.

Book 1 Chapter 11 Sections 11.7 – 11.8

Chapter 13 Sections 13.5.2, 13.5.3

(10 Hours)**UNITIV : ANALYSIS OF VARIANCE:**

ANOVA – One way classification, Two way classification

Chapter 17 Sections 17.1 – 17.3

(10 Hours)**PRACTICAL COMPONENT****UNIT V: COMPUTATIONAL STATISTICS USING “R” SOFTWARE**

Measures of central tendency : Mean ,Median & Mode. Skewness and Kurtosis Fitting of distribution Binomial, Poisson and Normal. Chi-Square test of Goodness of fit Test of Significant difference between two means and two proportions .

Paired t- test, ANOVA one way classification.

(Internal Practical only, No questions for the end semester examination)

Book 2

(15 Hours)

BOOKS RECOMMENDED:

1. S.C. Gupta and V.K Kapoor, Elements of Mathematical Statistics, Third edition (2015), Sultan Chand & Sons , New Delhi .
2. Sudha G.Purohit, Sharad D.Gore and Shailaja R. Deshmukh, Statistics using R , Second edition (2015) ,Narosa Publishing House, New Delhi.

REFERENCE BOOKS:

1. P.R. Vittal, Mathematical Statistics (2002), Margham Publications, Chennai.
2. S.C. Gupta and V.K. Kapoor, Fundamentals of Mathematical Statistics Eleventh edition (2002), Sultan Chand & Sons Publications, New Delhi.
3. Robert V. Hogg, Joseph Mckean & Craig A.T ,Introduction to Mathematical Statistics, (2013), Pearson Education India.
4. George W. Snedecor , William G.Cochran, Statistical Methods (1967),Oxford & IBH Publishers,
5. Dr.S.P. Gupta, Statistical Methods ,41st edition (2011) ,Sultan Chand & Sons , New Delhi .

JOURNALS

1. Mathematics Newsletter Published by Ramanujan Mathematical Society, Chennai., Chennai.
2. Discrete Mathematical Sciences & Cryptography

E- LEARNING RESOURCES:

1. <http://www.mathforum.org>
2. <http://www.opensource.org>
3. <http://www.khanacademy.org>
4. <http://www.in.ixl.com>
5. <http://www.learningwave.com>

COURSE OUTCOMES

Upon successful completion of **Mathematical Statistics & R Software –II** Students will be able to

CO Number	CO STATEMENT
CO1	Determine the basic concepts of sampling, Test statistics and Critical region.
CO2	Understand, apply and compute sample tests of hypothetic problems.
CO3	Apply and examine the Chi-square goodness of fit, test for independence and homogeneity.
CO4	Analyse the principles of Designs of experiments to yield valid conclusions.
CO5	Effectively use ‘R’ software to find averages and derive at statistical inferences from various distributions.

MAPPING-COURSE OUTCOME WITH PROGRAMME SPECIFIC OUTCOME

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
--------	------	------	------	------	------	------

CO1	3	2	3	3	3	3
CO2	3	2	3	3	3	3
CO3	3	2	3	3	3	3
CO4	3	2	3	3	3	3
CO5	3	2	3	3	3	3
AVERAGE	3	2	3	3	3	3

KEY: STRONGLY CORRELATED-3 MODERATELY CORRELATED-2 WEAKLY CORRELATED-1 NO CORRELATION-0

TEACHING METHODOLOGY:

1. Lecture (Chalk and Talk-OHP-LCD)
2. Problem Solving-Group Discussion
3. Quiz-Seminar
4. Peer Learning

QUESTION PAPER PATTERN-UG

Knowledge Level	Section	Word Limit	Marks	Total	Special Instructions if any
K 1	A-10 × 2 marks	50	20	100	No Questions from Unit- V
K1,K 2	B-5/8 × 7 marks	200	35		
K2, K 3	C-3/5 × 15 marks	500	45		

All question papers can be framed in the following cognitive levels

Knowledge Level 1. Recall

Knowledge Level 2. Understanding

Knowledge Level 3. Application

SEMESTER V COURSE PROFILE

COURSE CODE	TITLE OF THE PAPER	CREDITS	HOURS/ WK	TOTAL HOURS	L-T-P	CA	SA	TOTAL
MA18/5C/LAL	Linear Algebra	4	5	75	3-2-0	40	60	100
MA18/5C/RAN	Real Analysis	4	5	75	3-2-0	40	60	100
MA18/5C/STT	Statics	4	6	90	3-3-0	40	60	100
MA18/5C/OPT	Optimization Techniques	4	5	75	3-2-0	40	60	100
MA18/5E/PLC	Programming Language 'C'	3	6	90	2-4-0	40	60	100
MA18/5E/PR1	Programming Language 'C' (Practicals)	2	3	45	0-0-3	-	10 90	100

SEMESTER -V
LINEAR ALGEBRA

TOTAL HOURS: 75 Hours
CREDITS: 4

COURSE CODE: MA18/5C/LAL
L- T- P: 320

COURSE OBJECTIVES:

To enable students to

1. Understand the fundamental concepts of linear algebra.
2. Analyze and understand theorems on Vector space and linear transformation
3. Find the linear span and basis of vector space.

COURSE OUTLINE:

UNIT I: VECTOR SPACES

Basic concepts-Definition-Examples-Homomorphism-Internal Direct Sum-External Direct Sum.

Book 1 Chapter 4 section 4.1

(15 Hours)

UNIT II: VECTOR SPACES (contd.)

Linear dependence and independence of vectors, Linear Span, Bases
Dimensions of Vector Spaces, Inner Product space

Book 1 Chapter 4 section 4.2, 4.4

(15 Hours)

UNIT III: LINEAR TRANSFORMATION

Algebra of Linear transformation, Regular and Singular Linear Transformations
Rank of Linear Transformation.

Book 1 Chapter 6 section 6.1(15Hours)

UNIT IV: LINEAR TRANSFORMATION (contd.)

Characteristic Roots, Characteristic Vectors, Matrices.

Book 1 Chapter 6 sections 6.2, 6.3.

(15 Hours)

UNIT V: APPLICATIONS OF VECTOR SPACES AND LINEAR TRANSFORMATION

Applications based on the concept of

a. linear dependence and independence of vectors, linear Span, bases and dimensions of Vector Spaces.

b. Linear transformation, Characteristic Roots, Characteristic Vectors & Matrices.

Book 2 Chapter 3 Sections 3.1-3.5, chapter 5 sections 5.1 – 5.3 & 5.9 (problems only)

(15 Hours)

BOOKS RECOMMENDED

1. I.N. Herstein, Topics in Algebra, 2nd edition (1989), Wiley Eastern Ltd. New Delhi.
2. N.S. Gopalakrishnan, University Algebra, New Age international (P) Limited, Publishers.

REFERENCE BOOKS:

1. K. Hoffmann and R. Kunze, Linear Algebra, 2nd Edition (2005), Prentice-Hall of India.
2. M. Artin, Algebra (2005), Prentice-Hall of India.

3. S. Axler, Linear Algebra Done Right, 2nd Edition (1999), John-Wiley, New York.
4. S. Lang, Linear Algebra (1997), Springer UTM.
5. S. Kumaresan, Linear algebra: A Geometric Approach (2004), Prentice-Hall of India.

JOURNALS

1. Mathematics Newsletter Published by Ramanujan Mathematical Society, Chennai.
2. Discrete Mathematical Sciences & Cryptography

E- LEARNING RESOURCES:

1. <http://www.mathforum.org>
2. <http://www.opensource.org>
3. <http://khanacademy.org>
4. <http://in.ixl.com>
5. <http://www.learningwave.com>

COURSE OUTCOME:

Upon successful completion of **Linear Algebra**, Students will be able to:

CO NUMBER	CO STATEMENT
CO 1	Assess the properties implied by the definition of vector space.
CO 2	Analyze the concepts of linear span, basis, and dimension of a vector space and apply it to solve problems.
CO 3	Represent a linear transformation in the form of a matrix.
CO 4	Rigorously prove the various propositions arising in the context of linear transformations.
CO 5	Apply the various concepts of linear transformations to compute the matrix representation of a linear transformation, eigen values and eigen vectors of a matrix.

MAPPING-COURSE OUTCOME WITH PROGRAMME SPECIFIC OUTCOME

KEY: STRONGLY CORRELATED-3 MODERATELY CORRELATED-2 WEAKLY CORRELATED-1 NO CORRELATION-0

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	3	3	3	1	2
CO2	3	3	3	3	1	2
CO3	2	3	3	3	1	2
CO4	1	3	3	3	1	3
CO5	-	3	3	3	1	-
AVERAGE	1.8	3	3	3	1	1.8

TEACHING METHODOLOGY

1. Lecture (Chalk and Talk-OHP-LCD)
2. Problem Solving-Group Discussion
3. Quiz-Seminar
4. Peer Learning

QUESTION PAPER PATTERN – UG

Knowledge Level	Section	Word Limit	Marks	Total	Special Instructions if any
K 1	A-10 × 2 marks	50	20	100	Nil
K1, K 2	B-5/8 × 7 marks	200	35		
K2, K 3	C-3/5 × 15 marks	500	45		

All question papers can be framed in the following cognitive levels

Knowledge Level 1. Recall

Knowledge Level 2. Understanding

Knowledge Level 3. Application

SEMESTER -V

REAL ANALYSIS

TOTAL HOURS: 75 Hours
CREDITS: 4

COURSE CODE: MA18 / 5C RAN
L-T- P: 3 2 0

COURSEOBJECTIVES:

To enable students to

1. Get acquainted with analytic approach of real numbers.
2. Explore sequence and series, the various limiting processes viz. continuity, differentiability and integrability.
3. Understand the topological properties of a metric space.

COURSE OUTLINE:

UNIT I: Countability, Real numbers, least upper bounds, sequences and sub sequences, limit of a sequence, convergent and divergent sequence, bounded sequences, Monotone sequences, Cauchy sequences.

Chapter 1 sections 1.5 - 1.7

Chapter 2 sections 2.1 - 2.8, 2.10

(15 Hours)

UNIT II: Convergence and divergence of series, series of non-negative terms, alternating Series, conditional and absolute convergence. test for absolute convergence .

Chapter 3 sections 3.1 - 3.4 , 3.6

(15 Hours)

UNIT III: Limit of a function, metric spaces, functions continuous at a point on a real line, Open sets, closed sets.

Chapter 4 sections 4.1 , 4.2

Chapter 5 sections 5.1 - 5.5

(15 Hours)

UNIT IV: Connectedness and Completeness

Connectedness, Bounded sets and totally bounded sets, completeness .

Chapter 6 sections 6.1-6.4

(15 Hours)

UNIT V: Compactness.

Calculus: Sets of measure zero, Definition of Riemann integral, Existence of Riemann integral.

Chapter 6 section 6.5

Chapter 7 sections 7.1 - 7.3

(15 Hours)

BOOKS RECOMMENDED:

1. Richard .R .Goldberg, Methods of Real Analysis, Oxford & IBH Publishing Co., Pvt . Ltd, New Delhi .
2. Tom. M. Apostol , Mathematical Analysis, Narosa Publishing house , 2nd edition (1974), Addison-Wesley publishing company , New Delhi.

REFERENCE BOOKS:

1. Rudin W. Principles of Mathematical Analysis (1976),Tata Mc Graw Hill company, New York.

2. Malik. S. C & Savita Arora, Mathematical Analysis (1991), Wiley eastern Limited, New Delhi.
3. Sanjay Arora & Bansi Lai ,Introduction to Real Analysis (1991), Satya Prakashan , NewDelhi.
4. Gelbaum .B.R & Olmsted, Counter Examples in Analysis (1964) ,Holden Day, San Fransis Co.
5. A. L. Gupta & N. R. Gupta, Principles of Real Analysis (2003), Pearson Education (India Print).

JOURNALS

1. Mathematics Newsletter Published by Ramanujan Mathematical Society, Chennai.,
2. Discrete Mathematical Sciences & Cryptography

E-LEARNING RESOURCES:

1. <http://www.mathforum.org>
2. <http://www.opensource.org>
3. <http://khanacademy.org>
4. <http://in.ixl.com>
5. <http://www.learningwave.com>

COURSE OUTCOME:

Upon successful completion of **Real Analysis**, Students will be able to:

CO NUMBER	CO STATEMENT
CO 1	Determine the basic topological properties of the subsets of the real numbers.
CO 2	Apply the concept of limit to sequences, series and functions.
CO 3	Analyse the topological properties of connectedness, completeness and compactness of a metric space.
CO 4	Produce rigorous proofs of results that arise in the contexts of real analysis.
CO 5	Determine the continuity, differentiability and integrability of functions defined on subsets of real numbers.

MAPPING-COURSE OUTCOME WITH PROGRAMME SPECIFIC OUTCOME

CO /PCO	PCO 1	PCO 2	PCO 3	PCO 4	PCO 5	PCO 6

CO 1	1	3	3	3	-	1
CO 2	2	3	3	3	-	1
CO 3	1	3	3	3	-	-
CO 4	-	3	3	3	-	-
CO 5	2	3	3	3	-	-
AVERAGE	1.2	3	3	3	-	0.4

TEACHING METHODOLOGY

1. Lecture (Chalk and Talk-OHP-LCD)
2. Problem Solving-Group Discussion
3. Quiz-Seminar
4. Peer Learning

QUESTION PAPER PATTERN – UG

Knowledge Level	Section	Word Limit	Marks	Total	Special Instructions if any
K 1	A-10 × 2 marks	50	20	100	Nil
K1, K 2	B-5/8 × 7 marks	200	35		
K2, K 3	C-3/5 × 15 marks	500	45		

All question papers can be framed in the following cognitive levels

Knowledge Level 1. Recall

Knowledge Level 2. Understanding

Knowledge Level 3. Application

SEMESTER - V
STATICS

TOTAL HOURS: 90
CREDITS: 4

COURSE CODE: MA18/5C/STT
L-T-P: 3 3 0

COURSE OBJECTIVES:

To enable students to

1. Understand the basic concepts of forces and friction acting on a static body.
2. Study the equilibrium of a particle and momentum of force acting on a rigid body.
3. Get familiarised with the concepts of couple and evaluate mass centre .

COURSE OUTLINE:

- UNIT I: Forces: Linear Momentum-Friction-Laws of Friction-angle and Cone of Friction-Resultant of two, three and several forces acting on a particle.**
Chapter 2 Section 2.1, 2.2 (15 Hours)
- UNIT II: Equilibrium of a Particle: Triangle Law of forces and its Converse - Lami's Theorem, Equilibrium of a particle under several forces-Limiting Equilibrium of a particle on an Inclined Plane.**
Chapter 3 Section 3.1, 3.2 (15 Hours)
- UNIT III: Forces on a Rigid Body: Moment of a force-General Motion of a Rigid Body - Equation of motion of a rigid body (statement only)-Equivalent Systems of forces- Resultant of Like and Unlike parallel forces- Varignon's theorem-Forces along the sides of a triangle**
Chapter 4 Section 4.1, 4.2, 4.3, 4.4, 4.5 (20 Hours)
- UNIT IV: Couples: Moment of a couple - Arm and axis of a couple - resultant of several coplanar forces - Moment of a certain couple as area - Couples in a parallel plane Resultant of a couple and a force - Equation of the line of action of the resultant.**
Chapter 4 Section 4.6, 4.7, 4.8. (22 Hours)
- UNIT V: Centre of Mass: Centre of Gravity (C.G) - CG of a plane area - CG of an arc of a Circle - segment of a circle - CG of solid and hollow cone - Solid and Hollow hemisphere.**
Chapter 6 Section 6.1, 6.2 (Omit 6.2.3 and 6.2.4) (18 Hours)

RECOMMENDED TEXTBOOKS:

Duraipandian, P., Laxmi Duraipandian, MuthamizhJayapragasam, Mechanics ,6th Revised Edition (2005), S. Chand and Company Ltd, New Delhi.

REFERENCE BOOKS:

1. A.V. Dharmapadam, Statics (2006), S.Viswanathan printers and publishers ltd Chennai.,

2. Viswanath Naik, K & M.S. Kasi ,Statics, First edition (1987), Emerald Publishers Chennai.
3. S.G. Venkatachalapathy , Statics ,First edition (2005), Margham Publications, Chennai-17
4. Golden Maths Series , Statics, N.P.Bali, Firewall Media , An Imprint of Ixmi Publications Pvt. Ltd, New Delhi .
5. A.R.Vasishtha & R.K .Gupta, Statics , Krishna’s Educational Publishers, Meerut.

JOURNALS:

1. Mathematics Newsletter Published by Ramanujan Mathematical Society, Chennai.
2. Discrete Mathematical Sciences & Cryptography

E-LEARNING RESOURCES:

1. <http://www.mathforum.org>
2. <http://www.opensource.org>
3. <http://khanacademy.org>
4. <http://in.ixl.com>
5. <http://www.learningwave.com>

COURSE OUTCOMES:

Upon successful completion of **Statics**, Students will be able to:

CO Number	CO STATEMENT
CO 1	Discuss the fundamental concepts of forces and friction and to find the resultant of two or more forces acting on a particle.
CO 2	Apply the concepts of Lami’s Theorem to determine the equilibrium of a particle under three or more forces. Discuss the Limiting Equilibrium of a particle on an Inclined Plane.
CO 3	Explain the concepts of Forces on a Rigid Body. Investigate the Resultant of Like and unlike parallel forces and Varignon’s theorem to find the Moment of a force.
CO 4	Discuss the Basic concepts of Couples , Moment of a Couple, Moment of a Couple as an area and to find equation of the line of action of the resultant .
CO 5	Evaluate the Centre of Mass for the Plane area, Circle, Cone, Hemisphere.

MAPPING-COURSE OUTCOME WITH PROGRAMME SPECIFIC OUTCOME

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6

CO1	3	-	3	3	2	3
CO2	3	-	3	3	2	3
CO3	3	-	3	3	1	3
CO4	3	-	3	3	2	3
CO5	3	-	3	3	1	3
AVERAGE	3	-	3	3	1.6	3

KEY: STRONGLY CORRELATED-3 MODERATELY CORRELATED-2 WEAKLY CORRELATED-1 NO CORRELATION-0

TEACHING METHODOLOGY:

1. Lecture (Chalk and Talk-OHP-LCD)
2. Problem Solving-Group Discussion
3. Quiz-Seminar
4. Peer Learning

QUESTION PAPER PATTERN-UG

Knowledge Level	Section	Word Limit	Marks	Total	Special Instructions if any
K 1	A-10 × 2 marks	50	20	100	Nil
K1,K 2	B-5/8 × 7 marks	200	35		
K2, K 3	C-3/5 × 15 marks	500	45		

All question papers can be framed in the following cognitive levels

Knowledge Level 1. Recall

Knowledge Level 2. Understanding

Knowledge Level 3. Application

SEMESTER - V
OPTIMIZATION TECHNIQUES

TOTAL HOURS: 75
CREDITS: 4

COURSE CODE: MA18/5C/OPT
L-T-P: 3 2 0

COURSE OBJECTIVES:

To enable students to

1. Formulate a real time problem as a classical linear programming model and solve it.
2. Find the optimum allocation of number of jobs to equal number of facilities.
3. Serve the Customers as per the servers available using queuing models.

COURSE OUTLINE:

UNIT I : LINEAR PROGRAMMING

General LPP- Mathematical formulation - Solution for LPP by Graphical Method and Simplex Method (finite optimal solution, unbounded solution, alternative optimal solution) - slack and surplus variables. (15 Hours)

UNIT II : ARTIFICIAL VARIABLE TECHNIQUE

Big-M Method - concept of Duality - Dual theorem (only statement) - Reading solution of the dual from the final simplex table of the primal and vice-versa. (15 Hours)

UNIT III: TRANSPORTATION PROBLEM

Mathematical formulation - North-West corner rule - Least cost Method - Vogel's approximation method - Optimality test. (15 Hours)

UNIT IV: ASSIGNMENT PROBLEM

Hungarian method of solving an assignment problem - Unbalanced assignment problems - Travelling Salesman (routing) problem. (15 Hours)

UNIT V : QUEUING THEORY

General concepts and definitions - classification of queues - Poisson process- properties of Poisson process, Models

- i. (M/M/1) : (∞ / FCFS)
- ii. (M/M/1) : (N/ FCFS)
- iii. (M/M/S) : (∞ / FCFS) (15 Hours)

BOOKS RECOMMENDED:

1. Kanti Swarup, P.K. Gupta, Man Mohan, Operations Research, 18th Edition (2015), Sultan Chand & Sons, New Delhi.
2. S.D. Sharma, Operations Research, 17th edition (2014), Kedhar Nath Ram Nath & co, New Delhi.

REFERENCE BOOKS:

1. R.K. Gupta, Operations Research, 18th edition (2003), Krishna Prakashan Media (P) Ltd, Meerut.
2. Gupta P.K & Hira D.S ,Problems in Operations Research (2000), S. Chand & Co, New Delhi.
3. Hamdy A. Taha, Operations Research: An Introduction, 7th edition (2004), Prentice Hall of India Ltd(P), New Delhi.
4. V. K. Kapoor, Operations Research Techniques for Management, 7th edition (2001), Roopak Printers, New Delhi .

- V.Sundaresan, K.S. Ganapathy Subramanian & K. Ganesan, Resource Management Techniques (Operations Research) Tenth edition (2016), A.R. Publications, Nagapattinam District.

JOURNALS

- Mathematics Newsletter.
- Discrete Mathematical Sciences and Cryptography.

E- LEARNING RESOURCES:

- <http://www.mathforum.org>
- <http://www.opensource.org>
- <http://khanacademy.org>
- <http://in.ixl.com>
- <http://www.learningwave.com>

COURSE OUTCOME:

Upon successful completion of **Optimization Techniques**, Students will be able to:

CO NUMBER	CO STATEMENT
CO 1	Formulate and model the linear programming problem and solve them graphically in two dimensions. Convert the given linear programming problem into standard form and use the Simplex method or Big – M method to solve it.
CO 2	Find the dual, identify and interpret the solution of the Dual problem from the final tableau of the Simplex problem.
CO 3	Formulate the given Transportation problem into a mathematical model and find the optimum solution using North – West Corner rule or least cost method or Vogel's approximation method appropriately.
CO 4	Interpret the Assignment problem as a classical linear programming model su Travelling Salesman Problem using Hungarian method
CO 5	Classify the Queuing problem under the models: (M/M/1) : (∞ /FCFS), (M/M/1) : (N/ FCFS), (M/M/S) : (∞ / FCFS)

MAPPING-COURSE OUTCOME WITH PROGRAMME SPECIFIC OUTCOME

CO /PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
---------	-------	-------	-------	-------	-------	-------

CO 1	3	2	3	3	1	3
CO 2	3	2	3	3	1	3
CO 3	3	2	3	3	1	3
CO 4	3	2	3	3	1	3
CO 5	3	2	3	3	1	3
AVERAGE	3	2	3	3	1	3

KEY: STRONGLY CORRELATED-3 MODERATELY CORRELATED-2 WEAKLY CORRELATED-1 NO CORRELATION-0

TEACHING METHODOLOGY:

1. Lecture (Chalk and Talk-OHP-LCD)
2. Problem Solving - Group Discussion
3. Quiz - Seminar
4. Peer Learning

QUESTION PAPER PATTERN – UG:

Knowledge Level	Section	Word Limit	Marks	Total	Special Instructions if any
K 1	A-10 × 2 marks	50	20	100	Nil
K1, K 2	B-5/8 × 7 marks	200	35		
K2, K 3	C-3/5 × 15 marks	500	45		

All question papers can be framed in the following cognitive levels

Knowledge Level 1. Recall

Knowledge Level 2. Understanding

Knowledge Level 3. Application

SEMESTER – V
PROGRAMMING LANGUAGE ‘C’

TOTAL HOURS: 90
CREDITS: 3

COURSE CODE: MA18/5E/PLC
L-T-P : 2 4 0

COURSE OBJECTIVES:

To enable students to

1. Develop programming skill in 'C' language.
2. Understand the basic concepts of Operators and expressions in C – Language.
3. Get familiarized with the concepts of arrays and functions in C- programming.

COURSE OUTLINE:

- UNIT I : About C – Introduction – Importance – programming structure data types and Variables – character set – C tokens – keywords & identifiers – constants – Variables –Data types – declaration – assigning values to the variables.**
Chapter 1 Sections 1.1-1.4
Chapter 2 Sections 2.1-2.9 (10 Hours)
- UNIT II: Operators and expressions: Arithmetic, Relational, Logical, Assignment, Increment/Decrement, Conditional Bitwise operators, Precedence of Arithmetic Operators – Arithmetic expressions, Evaluation of expressions, Type conversions in expressions, Input/output operations, Reading/Writing a character – formatted Input/output.**
Chapter 3 Sections 3.1-3.14
Chapter 4 Sections 4.1-4.5 (15 Hours)
- UNIT III: Control Statements –Decision making and Looping: While, do-while, for, Nested Loop – jump in Loops.**
Decision Making and branching: if else – switch, break and continue, goto statements.
Chapter 5 & Chapter 6 (20 Hours)
- UNIT IV: Array: One and Two dimensional arrays – initializing two dimensional arrays**
Strings: Handling of character strings – declaring and initializing string variables
Reading strings from the terminal – Writing strings to screen – Arithmetic Operation on characters – Putting strings together – Comparison of strings – String handling functions.
Chapter 7 Sections 7.1-7.4
Chapter 8 Sections 8.1-8 (30 Hours)
- UNIT V: Functions: Defining, Accessing – Passing arguments to functions – Specifying Argument data types – The scope and Life time of variables in functions – Recursion.**
Chapter 9 Sections 9.1-9.15 (Omit 9.14) (15 Hours)

RECOMMENDED TEXT BOOKS:

E.Balaguruswamy ,Programming in ANSI C, Edition 2.1(2002) , Tata Mc-Graw Hill Publishing Company Limited , New Delhi. (Case Study Excluded),

REFERENCE BOOKS:

1. Bryon S. Gottfried , Programming with 'C' ,Schaum's outlines, 3rd edition (1998), Tata Mc-Graw Hill Publishing Company Limited, New Delhi.
2. Yashavant P.Kanetkar, Let us C, 12th edition (2012) BPB Publications, New Delhi.
3. T.Veerarajan,T.Ramachandran ,Numerical Methods With Programs in C,2nd edition(2006) Tata Mc-Graw Hill Publishing Company Limited, New Delhi.
4. Paul Deitel, Harvey Deitel, C How to Program, 8thEdition (2015), Pearson Publication, New Delhi.
5. Anita Goel, Ajay Mittal, Computer Fundamentals and Programming in C (2013), Pearson Education, New Delhi.

JOURNALS:

1. Mathematics Newsletter Published by Ramanujan Mathematical Society
2. Discrete Mathematical Sciences & Cryptography

E-LEARNING RESOURCES:

1. <http://www.mathforum.org>
2. <http://www.opensource.org>
3. <http://www.khanacademy.org>
4. <http://in.ixl.com>
5. <http://www.learningwave.com>

COURSE OUTCOME:

Upon successful completion of **Programming Language 'C'**, Students will be able to:

CO Number	CO STATEMENT
CO 1	Demonstrate the fundamental structures of C programming.
CO 2	Discuss conditional and iterative statements to develop C programs.
CO 3	Critique the arrays of complex objects.
CO 4	Analyze the loops and decision making statements, user defined function to solve the problems.
CO 5	Utilize the concepts of Data types and operators.
CO 6	Formulate C program in Mathematical problems.

MAPPING-COURSE OUTCOME WITH PROGRAMME SPECIFIC OUTCOME

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO 1	3	-	2	3	3	3
CO 2	2	-	2	3	3	3
CO 3	1	-	3	3	3	3
CO 4	-	-	3	3	3	3
CO 5	1	-	2	3	3	3
CO 6	2	-	3	3	3	3
Average	1.5	-	2.5	3	3	3

KEY: STRONGLY CORRELATED-3 MODERATELY CORRELATED-2 WEAKLY CORRELATED-1 NO CORRELATION-0

TEACHING METHODOLOGY:

1. Lecture (Chalk and Talk-OHP-LCD)
2. Group Discussion
3. Quiz-Seminar
4. Peer Learning

QUESTION PAPER PATTERN-UG

Knowledge Level	Section	Word Limit	Marks	Total	Special Instructions if any
K 1	A-10 × 2 marks	50	20	100	Nil
K1, K 2	B-5/8 × 7 marks	200	35		
K2, K 3	C-3/5 × 15 marks	500	45		

All question papers can be framed in the following cognitive levels

Knowledge Level 1. Recall

Knowledge Level 2. Understanding

Knowledge Level 3. Application

SEMESTER – V

PROGRAMMING LANGUAGE C – PRACTICALS

TEACHING HOURS : 45
CREDITS:2

COURSE CODE :MA18 /5E /PR1
L -T- P : 0 0 3

PRACTICAL PROGRAMS

1. Program to find roots of a quadratic equation.
2. Program to reverse the digits of a number and also to find their sum.
3. Program to generate prime numbers between any two given numbers.
4. Program to find the GCD & LCM of two numbers.
5. Program to find integer power of a number.
6. Program to evaluate $1 + x + x^2 + x^3 + \dots + x^n$.
7. Program to read the cost price and selling price and calculate the Profit or loss and also the loss percentage or profit percentage.
8. Program to print election result after checking the eligibility of age.
9. Program to calculate mean and standard deviation of a given set of numbers using arrays.
10. Program to sort a given set of numbers in ascending order by interchange sort.
11. Program to find the transpose and trace of a matrix.
12. Program to find matrix addition and subtraction.
13. Program to find multiplication of matrices.
14. Program to assign grade to the average mark obtained by a student.
15. Program to accept a line of text and to count the number of vowels, consonants and special characters and number of words in the text.
16. Program to get a string and check it for a Palindrome using string handling function and without string handling function.
17. Program to get two strings and concatenate the strings and get the length of the strings.
18. Program using function sub- program, ternary operator and recursive function to find the factorial of a given number.
19. Program using function, to find the binomial co-efficient for a given n and r.
20. Program using function, to generate Fibonacci series.

RECOMMENDED TEXT BOOKS:

E.Balaguruswamy ,Programming in ANSI C, Edition 2.1(2002) , Tata Mc-Graw Hill Publishing Company Limited , New Delhi. (Case Study Excluded)

REFERENCE BOOKS:

1. Bryon S. Gottfried , Programming with 'C' ,Schaum's outlines, 3rd edition (1998), Tata Mc-Graw Hill Publishing Company Limited, New Delhi.
2. Yashavant P.Kanetkar, Let us C, 12th edition (2012) BPB Publications, New Delhi.
3. T.Veerarajan,T.Ramachandran ,Numerical Methods With Programs in C,2nd edition(2006) Tata Mc-Graw Hill Publishing Company Limited, New Delhi.

4. Paul Deitel, Harvey Deitel, C How to Program, 8th Edition (2015), Pearson Publication, New Delhi.
5. Anita Goel, Ajay Mittal, Computer Fundamentals and Programming in C (2013), Pearson Education, New Delhi.

JOURNALS:

1. Mathematics Newsletter Published by Ramanujan Mathematical Society, Chennai.
2. Discrete Mathematical Sciences & Cryptography

E-LEARNING RESOURCES:

1. <http://www.mathforum.org>
2. <http://www.opensource.org>
3. <http://www.khanacademy.org>
4. <http://in.ixl.com>
5. <http://www.learningwave.com>

COURSE OUTCOME:

Upon successful completion of **Programming Language ‘C’ Practical**, Students will be able to:

CO Number	CO Statement
CO 1	Identify algorithm to solve Mathematical problems.
CO 2	Demonstrate coding Techniques.
CO 3	Assess and Debug errors at the time of execution.
CO 4	Develop C programs using operators.
CO 5	Develop C programs using loops, conditional statements, user defined functions.

MAPPING-COURSE OUTCOME WITH PROGRAMME SPECIFIC OUTCOME

CO /PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO 1	2	-	1	2	3	3
CO 2	2	-	1	2	3	3
CO 3	2	-	1	2	3	3
CO 4	2	-	1	2	3	3
CO 5	2	-	1	2	3	3
Average	2	-	1	2	3	3

KEY: STRONGLY CORRELATED-3 MODERATELY CORRELATED-2 WEAKLY CORRELATED-1 NO CORRELATION-0

TEACHING METHODOLOGY:

1. Lecture (Chalk and Talk-OHP-LCD)
2. Group Discussion
3. Peer Learning

Assessment: Computer Practical Examination.

Duration - 3 Hours

Maximum marks 100 (Aggregate of examination and record);

Practical examination – 90 (3 x 30) Marks.

Record -10 Marks

There will be three questions with or without subsections to be asked for the practical examination.

Assessment of Computer Practical Examination.

For each question

Programming skill (writing) - 10 marks

Technical Skill (Keying) - 10 marks

Debugging and generating output - 10 marks

Two **internal examiners** (appointed in consultation with Head of the department / Principal of the college) to be appointed to conduct the practical examination.

SEMESTER VI COURSE PROFILE

COURSE CODE	TITLE OF THE PAPER	CREDITS	HOURS /WK	TOTAL HOURS	L-T-P	CA	SA	TOTAL
MA18/6C/CAN	Complex Analysis	4	5	75	3-2-0	40	60	100
MA18/6C/DYN	Dynamics	4	6	90	3-3-0	40	60	100
MA18/6C/DIM	Discrete Mathematics	4	5	75	3-2-0	40	60	100
MA18/6E/OPR	Operations Research	5	5	75	4-1-0	40	60	100
MA18/6E/PCO	Programming Language 'C' & Introduction to OOP	3	6	90	2-4-0	40	60	100
MA18/6E/PR2	Programming Language 'C' & Introduction to OOP (Practicals)	2	3	45	0-0-3	-	10 90	100

SEMESTER- VI
COMPLEX ANALYSIS

TOTAL HOURS: 75
CREDITS: 4

COURSE CODE: MA18 / 6C / CAN
L-T-P: 3 2 0

COURSE OBJECTIVES:

To enable students to

1. Get introduced to analytic functions.
2. Expand complex function using Taylor & Laurent Series.
3. Evaluate complex integrals using residues.

COURSE OUTLINE:

UNIT I: ANALYTIC FUNCTIONS

Functions of complex variables – Limit, continuity – Uniform Continuity – Analytic function – Cauchy-Riemann equations.

Chapter 2 Sections 12 – 26.

(12 Hours)

UNIT II: TRANSFORMATIONS

Definitions – Definition of Conformal Mapping – Necessary and sufficient conditions for conformal mapping – Bilinear Transformation $w = az+b / (cz+d)$, $w = 1/z$

Chapter 8 Sections 90 – 94, Chapter 9 Section 101.

(15 Hours)

UNIT III: COMPLEX INTEGRATION

Rectifiable arcs, Contours – complex line integration – Cauchy's theorem, Cauchy Goursat theorem (statement only) – Cauchy's Integral formula - Cauchy's integral formula for first order derivative – Extension of Cauchy's integral formula (without proof). Liouville's Theorem, Fundamental Theorem of Algebra, (simple problems)

Chapter 4 Sections 39 – 41, 46, 48 – 53.

(18 Hours)

UNIT IV: Taylor and Laurent Series (statement only), Residue Calculus – Zeros and Poles of a function – Meromorphic function – The Residue at a pole – Residue Theorem Argument principle – Rouché's Theorem, (simple problems)

Chapter 6 Sections 68 – 76 (omit 71) & Chapter 7 Sections 86 – 87.

(15 Hours)

UNIT V: CONTOUR INTEGRATION: Evaluation of

- (i) $\int f(\cos\theta, \sin\theta) d\theta$
- (ii) $\int f(x) dx$ where $f(x)$ is a rational polynomial having no poles on the Real Axis
- (iii) $\int f(x) \sin mx dx$ & (iv) $\int f(x) \cos mx dx$,
where $m > 0$ and $f(x)$ is a rational function having no poles on the Real Axis.

Chapter 7 Sections 78 – 81, 85.

(15 Hours)

BOOKS RECOMMENDED:

1. R.V. Churchill and J.W Brown, Complex variable and application, 5th edition (1990), Mc Graw Hill International Book Co., New York.
2. H.A. Priestley, Introduction to Complex Analysis, 2nd Edition (2006), Oxford Indian).

REFERENCE BOOKS:

1. S. Ponusamy, Foundation of Complex Analysis (2000), Narosa Publishing House, New Delhi.
2. B.S.Tyagi , Functions of a Complex Variable (2018), Kedar Nath and Ram Nath Publishers, Meerut.
3. S.Arumugam , A. Thangapandi Isaac, A. Somasundaram, Complex Variable , Scitech Publications, Chennai.
4. P. Duraipandian and Laxmi Duraipandian , Complex Analysis (1976), Emerald Publishers, Chennai.
5. L.V.Ahlfors, Complex Analysis, 3rd Edition (2000), Mc Graw Hil Publishing Company Pvt. Ltd, New Delhi.

JOURNALS

1. Mathematics Newsletter Published by Ramanujan Mathematical Society, Chennai.
2. Discrete Mathematical Sciences & Cryptography

E- LEARNING RESOURCES:

1. <http://www.mathforum.org>
2. <http://www.opensource.org>
3. <http://www.khanacademy.org>
4. <http://in.ixl.com>
5. <http://www.learningwave.com>

COURSE OUTCOME:

Upon successful completion of **Complex Analysis**, Students will be able to:

CO NUMBER	CO STATEMENT
CO 1	Represent complex numbers algebraically and geometrically, define and analyse the concept of analyticity and apply it to derive Cauchy-Riemann equations.
CO 2	Define conformal mapping and find the mapping that maps three distinct points on the z-plane to three distinct points on the w-plane by applying bilinear transformation.
CO 3	Evaluate complex integrals directly by using Cauchy-Goursat theorem and study the various applications of Cauchy's Integral formula.
CO 4	Represent functions as Taylor and Laurent series, classify singularities and poles, find residues and evaluate complex integrals using Residue theorem.
CO 5	Evaluate complex contour integrals by applying Cauchy –integral formula and its various versions.

MAPPING-COURSE OUTCOME WITH PROGRAMME SPECIFIC OUTCOME

CO /PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO 1	3	3	3	3	1	2
CO 2	3	3	3	3	1	3
CO 3	3	3	3	3	1	2
CO 4	3	3	3	3	1	3
CO 5	3	3	3	3	1	2
AVERAGE	3	3	3	3	1	2.4

KEY: STRONGLY CORRELATED-3 MODERATELY CORRELATED-2 WEAKLY CORRELATED-1 NO CORRELATION-0

TEACHING METHODOLOGY:

1. Lecture (Chalk and Talk-OHP-LCD)
2. Problem Solving-Group Discussion
3. Quiz-Seminar
4. Peer Learning

QUESTION PAPER PATTERN – UG:

Knowledge Level	Section	Word Limit	Marks	Total	Special Instructions if any
K 1	A-10 × 2 marks	50	20	100	Nil
K1, K 2	B-5/8 × 7 marks	200	35		
K2, K 3	C-3/5 × 15 marks	500	45		

SEMESTER VI

DYNAMICS

TOTAL HOURS: 90
CREDITS: 4

COURSE CODE: MA18/6C/DYN
L-T-P: 3 3 0

COURSE OBJECTIVES:

To enable students to

1. Understand the fundamental concepts of velocity and acceleration.
2. Understand the Work done in stretching an elastic string Simple Harmonic motion.
3. Study the motion of Projectiles, Impact of Spheres and Central Orbits.

COURSE OUTLINE:

UNIT-I: Kinematics: Velocity-resultant Velocity- relative velocity-Acceleration-velocity and acceleration in a coplanar motion-Angular Velocity-Relative angular velocity.
Chapter 1 Sections 1.1, 1.2, 1.3, 1.4. (18 Hours)

UNIT-II: Work, Energy and Power: Units of work- work done in stretching an elastic string- Energy- Conservation of Energy-Power. Rectilinear motion under varying force- Simple harmonic motion- composition of two simple harmonic motions.
Chapter 11 & 12 - Sections 11.1, 11.2, 11.3, 12.1 only (Omit 12.2, 12.3, 12.4). (12 Hours)

UNIT-III: Projectiles: Forces on a projectile-Nature of trajectory-Results pertaining to the motion of a projectile-Maximum horizontal range for a given velocity- Two trajectories with a given speed and range- projectile projected horizontally and on an inclined plane-Maximum range on an inclined plane.
Chapter 13 Sections 13.1, 13.2 only (Omit 13.3)

Impact: Impulsive force-Laws of impact- Direct and oblique impact of two smooth Spheres- Impulse loss of kinetic energy due to impact.
Chapter 14 Sections 14.1, 14.2, 14.3, 14.5 (Omit 14.4) (27 Hours)

UNIT-IV: Central Orbits: General Orbits- central force- differential equation of a central orbit- Laws of central force-method to find the central orbit-Conic as a central orbit- Kepler's law of planetary motion.
Chapter 16 Sections 16.1, 16. (15 Hours)

UNIT-V: Moment of Inertia: Moment of two dimensional and solid bodies, Radius of Gyration, Perpendicular and parallel axes theorem.
Chapter 17 Section 17.1 (18 Hours)

RECOMMENDED TEXTBOOKS:

Duraipandian, P., Laxmi Duraipandian, Muthamizh Jayapragasam, Mechanics ,6th Revised Edition (2005), S. Chand and Company Ltd, New Delhi.

REFERENCE BOOKS:

1. A.V Dharmapadam, Dynamics, Fifth edition (1996), S.Viswanathan Printers & Publishers Pvt Ltd.
2. Dr.Viswanath Naik, K & M.S. Kasi ,Dynamics, First edition (1987), Emerald Publishers Chennai.
3. Prof S.G. Venkatachalapathy , Dynamics, First edition (2005) ,Margham Publications, Chennai-17.
4. Golden Maths Series , Dynamics, N.P.Bali, Firewall Media , An Imprint of laxmi Publications Pvt. Ltd, New Delhi .
5. A.R.Vasishtha & R.K .Gupta, Dynamics, Krishna's Educational Publisher, Meerut..

JOURNALS:

1. Mathematics Newsletter Published by Ramanujan Mathematical Society, Chennai.
2. Discrete Mathematical Sciences & Cryptography

E-LEARNING RESOURCES:

1. <http://www.mathforum.org>
2. <http://www.opensource.org>
3. <http://www.khanacademy.org>
4. <http://in.ixl.com>
5. <http://www.learningwave.com>

COURSE OUTCOMES:

Upon successful completion of **Dynamics**, Students will be able to:

CO Number	CO STATEMENT
CO 1	Acquire knowledge about the basic concepts of Kinematics and determine Speed and Shortest distance between the particles.
CO 2	Apply the fundamental concepts of Work, Energy and Power to Calculate Work done, frictional resistance and Kinetic energy. Discuss Simple Harmonic Motion to find period and Amplitude.
CO 3	Analyze the motion of Projectiles and their results. Discuss the Direct Impact and Oblique impact of two Spheres.
CO 4	Critique the Concepts of Central Orbits, Differential equation of a central Orbit and Kepler's law of planetary motion.
CO 5	Determine Moment of Inertia for various geometrical shapes by using Parallel and Perpendicular axis theorem.

MAPPING-COURSE OUTCOME WITH PROGRAMME SPECIFIC OUTCOME

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6

CO1	3	-	3	3	2	3
CO2	3	-	3	3	3	3
CO3	3	-	3	3	2	3
CO4	3	-	3	3	3	3
CO5	3	-	3	3	1	3
AVERAGE	3	-	3	3	2.2	3

KEY: STRONGLY CORRELATED-3 MODERATELY CORRELATED-2 WEAKLY CORRELATED-1 NO CORRELATION-0

1. Lecture (Chalk and Talk-OHP-LCD)
2. Problem Solving-Group Discussion
3. Quiz-Seminar
4. Peer Learning

QUESTION PAPER PATTERN-UG

Knowledge Level	Section	Word Limit	Marks	Total	Special Instructions if any
K 1	A-10 × 2 marks	50	20	100	Nil
K1,K 2	B-5/8 × 7 marks	200	35		
K2, K 3	C-3/5 × 15 marks	500	45		

All question papers can be framed in the following cognitive levels

Knowledge Level 1. Recall

Knowledge Level 2. Understanding

Knowledge Level 3. Application

SEMESTER – VI **DISCRETE MATHEMATICS**

TOATL HOURS: 75 HOURS
CREDITS :4

COURSE CODE : MA18/6C/DIM
L-T-P: 3 2 0

COURSE OBJECTIVES:

To enable students to

1. Develop construction and verification of mathematical Statements.
2. Gain fundamental knowledge about lattices and Boolean Algebra.
3. Learn the basics of Graph Theory and its application.

COURSE OUTLINE :

UNIT I : PROPOSITIONAL CALCULUS

Tautology and contradiction - Equivalence of formulae - Equivalent formulae -duality law – Tautological implications – Functionally complete set of connectives – other connectives- Normal forms – disjunctive normal forms – conjunctive normal forms.

Book 1 Chapter 4

(12 Hours)

UNIT II: RELATIONS and LATTICES

Basic concepts – Binary Relations – Properties of binary relations – Equivalence relations –Partial ordering –partially ordered set – Hasse diagram. Lattices – Introduction- Principle of duality - Properties of Lattices – sub Lattice – distributive lattice, modular lattice – bounded lattice - complemented lattice.

Book 1 Chapter 5, 6 and 7

(15 Hours)

UNIT III:BOOLEAN ALGEBRA

Definition – Other basic laws of Boolean Algebra – Principle of duality for Boolean Algebras – ATOM definition - ATOMIC Boolean algebra – Finite Boolean Algebra. Boolean expression – definition – Boolean function – Literal – minterm and maxterm, Normal forms and Canonical forms – Simplification of Boolean functions by Karnaugh Map method.

Book 1 Chapter 8,9 and 10

(18 Hours)

UNIT IV: GRAPHS, SUBGRAPHS AND CONNECTEDNESS

Introduction – definition and examples – degrees – subgraphs – Isomorphisms – walks, trails and paths – connectedness and components – blocks – connectivity.

Book 2 Chapter 2 section 2.0-2.4

Chapter 4 section 4.0-4.4

(15 Hours)

UNIT V: EULERIAN AND HAMILTONIAN GRAPHS

Introduction - Eulerian graphs – Hamiltonian graphs.

Book 2 Chapter 5

(15 Hours)

BOOKS RECOMMENDED :

1. Dr.S.P. Rajagopalan, Dr.R.Sattanathan, Discrete Mathematics (2007), Margham Publications Chennai -17.
2. S.Arumugam, S.Ramachandran: Invitation to graph theory (2008), Scitech Publications (India) Pvt.ltd , Chennai -17.

REFERENCE BOOKS:

1. Narsingh Deo, Graph Theory with Applications to Engineering and Computer Science (2004), Prentice-Hall of India.
2. Trembley J.P and Manohar .R , Discrete Mathematical Structures with Applications to Computer Science (2003), Tata Mcgraw – Hill Publication Co., limited, New Delhi.
3. Ralph.P. Grimaldi, Discrete and Combinatorial Mathematics: An Applied Introduction 4th edition (2002), Pearson Education Asia, Delhi.
4. Dr.M.K.Venkataraman , Dr.N.Sridharan, Dr.N.Chandrasekaran, Discrete Mathematics (2003), The National Publishing Company, Chennai.
5. Prof.V.Sundaresan, K.S.Ganapathy Subramanian , K.Ganesan ,Discrete Mathematics , , New Revised edition (2000),A.R.Publications , Tamil Nadu.

JOURNALS:

1. Mathematics Newsletter Published by Ramanujan Mathematical Society, Chennai.
2. Discrete Mathematical Sciences & Cryptography

E-LEARNING RESOURCES:

1. <http://www.mathforum.org>
2. <http://www.opensource.org>
3. <http://www.khanacademy.org>
4. <http://in.ixl.com>
5. <http://www.learningwave.com>

COURSE OUTCOMES:

Upon successful completion of **Discrete Mathematics**, Students will be able to

CO Number	CO STATEMENT
CO 1	Construct truth table for the given proposition. Interpret tautology and contradictions. Demonstrate logical operator.
CO 2	Define and illustrate poset, lattices. Discuss the properties and types of lattices. Demonstrate Hasse diagram.
CO 3	Analyze Boolean functions. Recognize the use of Karnaugh map method to construct the canonical form of Boolean expression.
CO 4	Illustrate different types of graphs. Demonstrate walk, trails, and connectedness.
CO 5	Define and describe Eulerian and Hamiltonian graph.

MAPPING-COURSE OUTCOME WITH PROGRAMME SPECIFIC OUTCOME

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
--------	-------	-------	-------	-------	-------	-------

CO1	1	-	2	3	2	2
CO2	1	1	2	3	1	1
CO3	1	1	1	3	2	2
CO4	1	1	1	1	2	2
CO5	1	1	1	1	2	2
AVERAGE	1	0.8	1.4	2.2	1.8	1.8

KEY: STRONGLY CORRELATED-3 MODERATELY CORRELATED-2 WEAKLY CORRELATED-1 NO CORRELATION-0

TEACHING METHODOLOGY:

1. Lecture (Chalk and Talk-OHP-LCD)
2. Problem Solving-Group Discussion
3. Quiz-Seminar
4. Peer Learning

QUESTION PAPER PATTERN-UG

Knowledge Level	Section	Word Limit	Marks	Total	Special Instructions if any
K 1	A-10 × 2 marks	50	20	100	Nil
K1,K 2	B-5/8 × 7 marks	200	35		
K2, K 3	C-3/5 × 15 marks	500	45		

All question papers can be framed in the following cognitive levels

Knowledge Level 1. Recall

Knowledge Level 2. Understanding

Knowledge Level 3. Application

SEMESTER - VI

OPERATIONS RESEARCH

TOTAL HOURS: 75 HOURS
CREDITS: 5

COURSE CODE: MA18/ 6E/OPR
L-T-P: 4 1 0

COURSE OBJECTIVES:

To enable students to

1. Determine the optimum sequence to complete n jobs through two or three machines in minimum time.
2. Understand the need for inventory and to compute the optimum size of inventory .
3. Represent a real time problem using Network Diagram and find its critical path using CPM & PERT techniques.

COURSE OUTLINE:

UNIT I: SEQUENCING PROBLEMS

Introduction - n jobs to be operated on two machines - n jobs to be operated on three Machines - sequence decision problem for n jobs on m machines - problem involving two jobs and m machines - Graphical method.

(10 Hours)

UNIT II: GAME THEORY

Two persons zero sum games, the maxmin-minmax principle - saddle point and value of games - games without saddle points-pure strategies and mixed strategies - properties of optimal mixed strategies(without proof) - Dominance property - graphical method for $2 \times n$ and $m \times 2$ games.

(10 Hours)

UNIT III: INVENTORY THEORY

Introduction- variables in an inventory problem - Need of inventory- Inventory problems - Advantages and disadvantages of inventory- Classification of inventory Models - Economic lot size models

Model I: Economic lot size model with uniform rate of demand, infinite rate of production and no shortages.

Model II: Economic lot size model with uniform rate of demand, finite rate of replenishment having no shortages.

(20 Hours)

UNIT IV: NETWORK ANALYSIS

Introduction - Network diagram representation - rules for drawing

Network diagram - labelling: Fulkerson's 'I-J' rule - time estimates and critical path in Network analysis - Forward pass, Backward pass computation - Determination of floats and slack times - Determination of critical path.

(20 Hours)

UNIT V: PROJECT EVALUATION AND REVIEW TECHNIQUES (PERT)

Optimistic time - most likely time - Pessimistic time- expected time - variance - Rules for finding variance of events - problems in PERT.

(15 Hours)

BOOKS RECOMMENDED:

1. Kanti Swarup, P.K. Gupta, Man Mohan, Operations Research, 18th Edition (2015), Sultan Chand & Sons, New Delhi.
2. S.D. Sharma, Operations Research, 17th edition (2014), Kedhar Nath Ram Nath & co, New Delhi.

REFERENCE BOOKS:

1. R.K. Gupta, Operations Research, 12th edition, Krishna Prakashan Media (P) Ltd.

2. Gupta P.K & Hira D.S Problems in Operations Research, First edition (2003), S. Chand & Co, Delhi.
3. Hamdy A. Taha, Operations Research: An Introduction, 7th edition, 2004, Prentice Hall of India Ltd(P), New Delhi.
4. V. K. Kapoor, Operations Research Techniques for Management, 7th revised edition (jan 2001), Roopak Printers, Delhi – 32.
5. V. Sundaresan, K.S. Ganapathy Subramanian & K. Ganesan, Resource Management Techniques (Operations Research), Reprint June 2002, A.R. Publications, Nagapattinum District.

JOURNALS

1. Mathematics Newsletter.
2. Discrete Mathematical Sciences and Cryptography.

E- LEARNING RESOURCES:

1. <http://www.mathforum.org>
2. <http://www.opensource.org>
3. <http://khanacademy.org>
4. <http://in.ixl.com>
5. <http://www.learningwave.com>

COURSE OUTCOME:

Upon successful completion of **Optimization Techniques**, Students will be able to:

CO NUMBER	CO STATEMENT
CO 1	Evaluate the given Sequencing problem and classify under the various types and solve them using Graphs.
CO 2	Analyze the given Game problem and solve it using the appropriate models, two person zero sum games, games without saddle points, pure strategies and mixed strategies. Interpret $2 \times n$ and $n \times 2$ games graphically.
CO 3	Analyze the need of Inventory, its advantages and disadvantages and classify them under different Inventory models. Solve the real-time problems using it.
CO 4	Represent the Network problem through Network diagram and label using Fulkerson's 'I-J' rule and determine the critical path.
CO 5	Using PERT model, find the optimistic time, most likely time, pessimistic time, expected time and variance.

MAPPING-COURSE OUTCOME WITH PROGRAMME SPECIFIC OUTCOME

CO /PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6

CREDITS: 3

L-T- P : 2 4 0

COURSE OBJECTIVES:

To enable students to

1. Develop programming skill in C++.
2. Get Familiarised the fundamental concepts of Structures , Pointers & File Management.
3. Acquire knowledge about dynamic memory allocation & linked lists.

COURSE OUTLINE:

UNIT I: Structures: Structure definition giving values to members – structure initialization, Arrays of Structures – Arrays within Structures – Structures within structures
Book 1 Chapter 10 Section 10.1-10.8 (20 Hours)

UNIT II: Pointers: Understanding Pointers – Accessing address of a variable – Declaring and Initializing pointers – Accessing a variable through its pointer – Pointers and Arrays-Pointers and Structures
Book 1 Chapter 11 Section 11.1-11.8 (20 Hours)

UNIT III: File Management: Defining and opening a file – Closing a file – Input / Output, operations on files. Random access to files.
Book 1 Chapter 12 Section 12.1-12.6 (10 Hours)

UNIT IV: Dynamic Memory Allocation and Linked Lists: Introduction –Dynamic Memory allocation, concepts, advantages and types of linked list Representation of Linked Lists in memory. Creation of a linked list. Insertion into Linked List – Deletion from a Linked List.(programs not included)
Book 1 Chapter 13 Section 13.1-13.7 (20 Hours)

UNIT V: Concepts of OOP: Need for object oriented programming, Procedural languages, Object oriented approach, Characteristics of object oriented Languages. Objects, classes, inheritance, reusability, creating new data types, polymorphism and over loading,
Introduction to C++: Name space, Input/output operator , iostream files
Comparison of C with C++, simple programs in C++.
Book 2 Chapter 1& Chapter 2 (20 Hours)

RECOMMENDED TEXT BOOKS:

1. E.Balaguruswamy ,Programming in ANSI C, Edition 2.1(2002) , Tata Mc-Graw Hill Publishing Company Limited , New Delhi. (Case Study Excluded)
2. Object Oriented Programming with C++ , Sixth Edition, E.Balagurusamy, McGraw Hill Education India) Private Limited.

REFERENCE BOOKS:

1. Bryon S. Gottfried , Programming with 'C' ,Schaum's outlines, 3rd edition (1998), Tata Mc-Graw Hill Publishing Company Limited, New Delhi.
2. Yashavant P.Kanetkar, Let us C, 12th edition (2012) BPB Publications, New Delhi.
3. T.Veerarajan,T.Ramachandran ,Numerical Methods With Programs in C,2nd edition(2006) Tata Mc-Graw Hill Publishing Company Limited, New Delhi.
4. Paul Deitel, Harvey Deitel, C How to Program, 8thEdition (2015), Pearson Publication, New Delhi.
5. Anita Goel, Ajay Mittal, Computer Fundamentals and Programming in C (2013), Pearson Education, New Delhi.

JOURNALS:

1. Mathematics Newsletter Published by Ramanujan Mathematical Society, Chennai.
2. Discrete Mathematical Sciences & Cryptography .

E-LEARNING RESOURCES:

1. <http://www.mathforum.org>
2. <http://www.opensource.org>
3. <http://khanacademy.org>
4. <http://in.ixl.com>
5. <http://www.learningwave.com>

COURSE OUTCOME:

Upon successful completion of **Programming Language 'C' & Introduction to OOP** Students will be able to:

CO Number	CO STATEMENT
CO 1	Demonstrate Object oriented features and C++ concepts.
CO 2	Discuss the file operators in C programming
CO 3	Explain structures and Arrays within structures
CO 4	Create C Program using pointers
CO 5	Prepare Linked lists, Insertion and deletion of lists.

MAPPING-COURSE OUTCOME WITH PROGRAMME SPECIFIC OUTCOME

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO 1	3	-	3	3	2	3

CO 2	1	-	3	3	3	3
CO 3	1	-	3	3	2	3
CO 4	1	-	2	3	2	3
CO 5	1	-	3	3	3	3
Average	1.4	-	2.8	3	2.4	3

KEY: STRONGLY CORRELATED-3 MODERATELY CORRELATED-2 WEAKLY CORRELATED-1
NO CORRELATION-0

TEACHING METHODOLOGY:

1. Lecture (Chalk and Talk-OHP-LCD)
2. Group Discussion
3. Quiz-Seminar
4. Peer Learning

QUESTION PAPER PATTERN-UG

Knowledge Level	Section	Word Limit	Marks	Total	Special Instructions if any
K 1	A-10 × 2 marks	50	20	100	Nil
K1, K 2	B-5/8 × 7 marks	200	35		
K2, K 3	C-3/5 × 15 marks	500	45		

All question papers can be framed in the following cognitive levels

Knowledge Level 1. Recall

Knowledge Level 2. Understanding

Knowledge Level 3. Application

SEMESTER – VI
PROGRAMMING LANGUAGE ‘C’ & INTRODUCTION TO OOP
PRACTICALS

TOTAL HOURS: 45 HOURS

COURSE CODE: MA18 /6E/PR2

CREDITS:2

L-T-P:0 0 3

PRACTICAL PROGRAMS:

1. Program to exchange two strings using pointers.
 2. Program using pointers to compute the sum and average of all numbers stored in an array.
 3. Program to read a name, grade and ten test scores into a structure and print them with high, low and average score.
 4. Program to get and print title, author and price of three books, using structures and pointers to structure variables
 5. Program to generate pay bill of an employee using structures and structure element.
 6. Program to generate admission list using structures and structure element.
 7. Program to generate Telephone bill using structures and structure element.
 8. Program to interpolate using Newton – Gregory Forward interpolation formula.
 9. Program to interpolate using Newton – Gregory Backward interpolation formula.
 10. Program to solve a system of Linear Algebraic Equations by Gauss Elimination method.
 11. Program to interpolate using Lagrange Interpolation formula.
 12. Program to evaluate an integral using Simpson one third rule for Numerical Integration.
 13. Program to read the data from the keyboard, write it to a file, called “INPUT”, read the same data from the same file and to display it on the screen.
 14. Program to create a file called DATA containing a series of integer numbers, to read these numbers and then to write all odd numbers to a file to be called ODD and all even numbers to a file to be called EVEN, read the Data stored in ODD and EVEN files and to display them on the screen.
 15. Program to create a file of records of students and to read, update and write the contents of the file.
- Program 16 – 20 Using C++**
16. Program to get two numbers and find the sum. Also check whether the sum is odd or even.
 17. Program to get two numbers and find the quotient & remainder when the greater number is divided by the smaller number.
 18. Program to get the largest of three numbers.
 19. Program to find the sum of natural numbers using for loop.
 20. Program to find factorial of a given number.

RECOMMENDED TEXT BOOKS:

1. E.Balaguruswamy ,Programming in ANSI C, Edition 2.1(2002) , Tata Mc-Graw Hill Publishing Company Limited , New Delhi. (Case Study Excluded)
2. Object Oriented Programming with C++ , Sixth Edition, E.Balagurusamy, McGraw Hill Education India) Private Limited.

REFERENCE BOOKS:

1. Bryon S. Gottfried , Programming with 'C' ,Schaum's outlines, 3rd edition (1998), Tata Mc-Graw Hill Publishing Company Limited, New Delhi.
2. Yashavant P.Kanetkar, Let us C, 12th edition (2012) BPB Publications, New Delhi.
3. T.Veerarajan,T.Ramachandran ,Numerical Methods With Programs in C,2nd edition(2006) Tata Mc-Graw Hill Publishing Company Limited, New Delhi.
4. Paul Deitel, Harvey Deitel, C How to Program, 8thEdition (2015), Pearson Publication, New Delhi.
5. Anita Goel, Ajay Mittal, Computer Fundamentals and Programming in C (2013), Pearson Education, New Delhi.

JOURNALS:

1. Mathematics Newsletter Published by Ramanujan Mathematical Society, Chennai.
2. Discrete Mathematical Sciences & Cryptography

E-LEARNING RESOURCES:

1. <http://www.mathforum.org>
2. <http://www.opensource.org>
3. <http://khanacademy.org>
4. <http://in.ixl.com>
5. <http://www.learningwave.com>

COURSE OUTCOME:

Upon successful completion of Programming Language 'C' & Introduction to OOP Practical Students will be able to:

CO Number	CO STATEMENT
CO 1	Identify algorithm to solve Mathematical problems.
CO 2	Demonstrate coding Techniques.
CO 3	Assess and Debug errors at the time of execution.
CO 4	Develop C programs using Pointers and Structures.
CO 5	Evaluate Numerical Problems using C language.

MAPPING-COURSE OUTCOME WITH PROGRAMME SPECIFIC OUTCOME

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO 1	2	-	1	2	3	3

CO 2	2	-	1	2	3	3
CO 3	2	-	1	2	3	3
CO 4	2	-	1	2	3	3
CO 5	2	-	1	2	3	3
Average	2	-	1	2	3	3

**KEY: STRONGLY CORRELATED-3 MODERATELY CORRELATED-2 WEAKLY CORRELATED-1
NO CORRELATION-0**

TEACHING METHODOLOGY:

3. Lecture (Chalk and Talk-OHP-LCD)
4. Group Discussion
5. Peer Learning

Assessment: Computer Practical Examination.

Duration - 3 Hours

Maximum marks 100 (Aggregate of examination and record);

Practical examination – 90 (3 x 30) Marks.

Record -10 Marks

There will be three questions with or without subsections to be asked for the practical examination.

Assessment of Computer Practical Examination.

For each question

Programming skill (writing) - 10 marks

Technical Skill (Keying) - 10 marks

Debugging and generating output - 10 marks

Two **internal examiners** (appointed in consultation with Head of the department / Principal of the college) to be appointed to conduct the practical examination.

UG & PG - Allied Course Profile
Semester (I & II)
(Offered to Other Departments)

SEMESTER - I

ALLIED MATHEMATICS – I

(for I Year Physics & Chemistry)

TOTAL HOURS: 90

**COURSE CODE: MA18 / 1A / AM1//
MC18 / 1A / AM1**

CREDITS:5

L-T-P: 3 3 0

COURSE OBJECTIVES:

To enable students to

1. Get equip with the knowledge of matrices and its applications.
2. Understand the concept of reduction formula and integral calculus.
3. Know the principle & concepts of Trigonometry

COURSE OUTLINE:

UNIT I: Matrices: Eigen values and Eigen vectors, Cayley Hamilton Theorem (No proof) verification of Cayley Hamilton theorem, Inverse of a Matrix using Cayley Hamilton Theorem. **(17 Hours)**

UNIT II: Theory of equations: Roots of polynomial Equations, Symmetric functions of roots in Terms of coefficients, Transformation of equations, Formation of equations, Reciprocal Equations. **(20 Hours)**

UNIT III: Trigonometry: Expansions of $\cos n\theta$, $\sin n\theta$, Expressions of $\cos \theta$, $\sin \theta$, $\tan \theta$ in powers of θ , Hyperbolic functions and Inverse Hyperbolic functions. Real and imaginary parts of $\sin(\alpha+i\beta)$, $\cos(\alpha+i\beta)$, $\tan(\alpha+i\beta)$, $\tan^{-1}(\alpha + i\beta)$. **(18 Hours)**

UNIT IV: Integral calculus: Bernoulli's formula, Reduction formulae $\int e^{ax} \cos bx \, dx$, $\int e^{ax} \sin bx \, dx$, $\int \sin^m x \cos^n x \, dx$ (m, n being positive integers), $\int x^m (\log x)^n \, dx$, $\int \cos^m x \cos nx \, dx$, $\int \cos^m x \sin nx \, dx$. **(20 Hours)**

UNIT V: Fourier Series: Definition- Finding Fourier coefficients for a given periodic functions with period 2π - odd and even function- Half range series. **(15 Hours)**

BOOKS RECOMMENDED:

1. Narayanan and Manicavachagom Pillay, Ancillary Mathematics Book I (2000), II (2002), and III (1998) , S.Viswanathan Printers and publishers Private limited, Chennai.
2. Dr.A.Singaravelu, Allied Mathematics, 3rd Revised edition (2011), Meenakshi Agency, Chennai.

REFERENCE BOOKS:

1. P.R. Vittal, Allied Mathematics , 4th edition (2009), Margham Publications, Chennai.
2. P. Durairpandian and S. Udayabaskaran, Allied Mathematics , Volume I & II , Second edition (2000) ,Muhil Publishers, Chennai.

3. A.Singaravelu & R.Ramaa , Algebra and Trigonometry ,Volume- I, First edition (2003), Meenakshi Agency, Chennai.
4. P. Kandasamy and K. Thilagavathi, Mathematics for B.Sc ,Volume II, First edition (2004) , S.Chand & Co., New Delhi.
5. T.K Manicavachagam Pillay, T. Natarajan, K.S. Ganapathy ,Algebra vol-I (2003), S. Viswanathan Pvt.Ltd,

JOURNALS

1. Mathematics Newsletter Published by Ramanujan Mathematical Society, Chennai.
2. Discrete Mathematical Sciences & Cryptography

E- LEARNING RESOURCES:

1. <http://www.mathforum.org>
2. <http://www.opensource.org>
3. <http://khanacademy.org>
4. <http://in.ixl.com>
5. <http://www.learningwave.com>

COURSE OUTCOME:

Upon successful completion of **Allied Mathematics-I**, Students will be able to:

CO NUMBER	CO STATEMENT
CO 1	Compute Eigen values and Eigen vector of a square matrix and find inverse of matrix using Cayley -Hamilton theorem.
CO 2	Evaluate the roots of the polynomial equation solving the transformation of equation and Reciprocal equation.
CO 3	Evaluate $\cos n\theta$, $\sin n\theta$, $\cos \theta$, $\sin \theta$, $\tan \theta$ in power of θ . Compute hyperbolic and inverse hyperbolic function.
CO 4	Derive reduction formula and thereby evaluate standard integral
CO 5	Find Fourier series expansion for the given function and evaluate Fourier series for odd and even function.

MAPPING-COURSE OUTCOME WITH PROGRAMME SPECIFIC OUTCOME

CO /PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO 1	3	2	3	2	1	3

CO 2	3	2	3	2	1	3
CO 3	3	2	3	2	1	3
CO 4	3	2	3	2	1	3
CO 5	3	2	3	2	1	3
AVERAGE	3	2	3	2	1	3

KEY: STRONGLY CORRELATED-3 MODERATELY CORRELATED-2 WEAKLY CORRELATED-1 NO CORRELATION-0

TEACHING METHODOLOGY:

1. Lecture (Chalk and Talk-OHP-LCD)
2. Group Discussion
3. Peer Learning

QUESTION PAPER PATTERN – UG

Knowledge Level	Section	Word Limit	Marks	Total	Special Instructions if any
K 1	A-10 × 2 marks	50	20	100	Nil
K1, K 2	B-5/8 × 7 marks	200	35		
K2, K 3	C-3/5 × 15 marks	500	45		

All question papers can be framed in the following cognitive levels

Knowledge Level 1. Recall

Knowledge Level 2. Understanding

Knowledge Level 3. Application

SEMESTER - II

ALLIED MATHEMATICS- II (for I Year Physics & Chemistry)

TOTAL HOURS: 90

COURSE CODE: MA18 / 2A /AM2//
MC18 / 2A /AM2

CREDITS: 5

L-T-P: 3 3 0

COURSE OBJECTIVES:

To enable students to

1. Solve the different types of linear differential equations.
2. Apply Laplace Transform to solve differential equation.
3. Interpolate a value from a given set of data.

COURSE OUTLINE:

- UNIT I : Ordinary Differential Equations:** Linear differential equations with constant co-efficients, particular integral of polynomial and Ve^{mx} , where V is a polynomial or $\sin x$ or $\cos x$. (20 Hours)
- UNIT II : Partial Differential Equations :** Formation, Complete Integral, Four standard types, Lagrange's Equation, simple problems. (20 Hours)
- UNIT III: Laplace Transforms:** Laplace Transforms of Standard functions, Simple theorems. (no proof) Inverse Laplace Transforms, solving first order differential equations with constant coefficients using Laplace transforms. (20 Hours)
- UNIT IV: Vector Analysis:** Introduction, operator ∇ , Gradient, Directional derivative, unit Normal to surface. Divergence and curl of vectors, solenoidal and irrotational vectors, the operator ∇^2 , harmonic functions. (15 Hours)
- UNIT V: Interpolation – Newton's forward and backward formulae for interpolation (no proof) Lagrange's formula for interpolation (No Proof) – Simple problems.** (15 Hours)

BOOKS RECOMMENDED:

1. Narayanan and Manicavachagom Pillay, Ancillary Mathematics Book I (2000), II (2002), and III (1998) , S.Viswanathan Printers and publishers Private limited, Chennai.
2. Dr.A.Singaravelu, Allied Mathematics, 3rd Revised edition (2011), Meenakshi Agency, Chennai.

REFERENCEBOOKS:

1. P.R. Vittal, Allied Mathematics , 4th edition (2009), Margham Publications, Chennai.
2. P. Duraipandian and S. Udayabaskaran, Allied Mathematics ,Volume I & II ,Second edition (2000) ,Muhil Publishers, Chennai.
3. A.Singaravelu & R.Ramaa , Algebra and Trigonometry ,Volume- I, First edition (2003), Meenakshi Agency, Chennai.
4. S. Arumugham, Numeical methods, 2nd edition (2003). New Gamma publishing, Palayamkottai.
5. P.R. Vittal, Differential equation and Laplace Transformations , First edition (2004), Margham Publications, Chennai.

JOURNALS

1. Mathematics Newsletter Published by Ramanujan Mathematical Society, Chennai.
2. Discrete Mathematical Sciences & Cryptography

E- LEARNING RESOURCES:

1. <http://www.mathforum.org>
2. <http://www.opensource.org>
3. <http://khanacademy.org>
4. <http://in.ixl.com>
5. <http://www.learningwave.com>

COURSE OUTCOME:

Upon successful completion of **Allied Mathematics-II**, Students will be able to:

CO NUMBER	CO STATEMENT
CO 1	Solve linear differential equation with constant co-efficient.
CO 2	Recognize the major classification of PDE'S and solve four standard type of PDE.
CO 3	Solve first order differential equation using Laplace and inverse Laplace transform.
CO 4	Determine gradient, divergence and curl of vectors.
CO 5	Analyse and use Newton's forward, backward and Lagrange's formula for interpolation and apply it in real life problems.

MAPPING-COURSE OUTCOME WITH PROGRAMME SPECIFIC OUTCOME

CO /PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO 1	3	2	3	2	1	3

CO 2	3	2	3	2	1	3
CO 3	3	2	3	2	1	3
CO 4	3	2	3	2	1	3
CO 5	3	2	3	2	1	3
AVERAGE	3	2	3	2	1	3

KEY: STRONGLY CORRELATED-3 MODERATELY CORRELATED-2 WEAKLY CORRELATED-1 NO CORRELATION-0

TEACHING METHODOLOGY

1. Lecture (Chalk and Talk-OHP-LCD)
2. Problem Solving-Group Discussion
3. Quiz-Seminar
4. Peer Learning

QUESTION PAPER PATTERN - UG

Knowledge Level	Section	Word Limit	Marks	Total	Special Instructions if any
K 1	A-10 × 2 marks	50	20	100	Nil
K1, K 2	B-5/8 × 7 marks	200	35		
K2, K 3	C-3/5 × 15 marks	500	45		

All question papers can be framed in the following cognitive levels

Knowledge Level 1. Recall

Knowledge Level 2. Understanding

Knowledge Level 3. Application

SEMESTER – I

BUSINESS MATHEMATICS – I (for I B. Com)

TOTAL HOURS: 90

COURSE CODE: MA18/1A/BM1

CREDITS: 5

L-T- P: 3 3 0

COURSE OBJECTIVES:

To enable students to

1. Be equipped with the knowledge of Matrices and its applications.
2. Be acquainted with the various rules of differentiation and integration.
3. Understand the basic concepts of Operations research that can be applied in real life situations with special reference to business.

COURSE OUTLINE:

UNIT I: MATRICES

Introduction, Types of matrices, Cayley Hamilton Theorem (no proof), Inverse of a matrix using Cayley Hamilton Theorem. Solution of simultaneous equations using Gauss Elimination Method.

Book 1 Chapter 2 Sections 1.1, 1.2, 16.3, 16.4

Book 2 Chapter 20 Section 20.24

(18 Hours)

UNIT II: DIFFERENTIATION

First and second order derivative of a function of one variable, derivatives of power function, product of two functions, quotient of two functions, derivative of logarithmic function, logarithmic differentiation. (Trigonometric functions excluded) Maxima and Minima-Application to Business Problems

Book 2 Chapter 17 Sections 17.1 to 17.8, 17.12, 17.19

(20 Hours)

UNIT III: INTEGRATION

Introduction, some standard integrals, integrals reducible to standard form, integration by parts, integration by partial fractions. (Trigonometric functions excluded)

Book 2 Chapter 18 Sections 18.1 to 18.4, 18.6 to 18.8, 18.10

(20 Hours)

UNIT IV: LINEAR PROGRAMMING

General linear programming problem, Mathematical formulation of a LPP, Graphical procedure and Simplex procedure. (Excluding artificial variable).

Book 3 Chapter 6 Sec 6.1 to 6.3, 6.10, 6.11, 6.22

(18 Hours)

UNIT V: GAME THEORY

Two persons zero sum games, the maximin-minimax principle, saddle point and Value of the games, Games without saddle points, mixed strategies, Dominance property.

Book 3 Chap 12 Sec 12.5, 12.9, 12.10, 12.12 to 12.15

(14 Hours)

BOOKS RECOMMENDED:

1. T.K Manicavachagam Pillay, T. Natarajan, K.S. Ganapathy, Algebra vol-II (2004), S. Viswanathan Pvt.Ltd, Chennai.
2. D.C. Sancheti and V.K. Kapoor, Business mathematics, 11th edition (1993), Sultan Chand & Sons, New Delhi.

- R.K. Gupta, Operations Research (2003), Krishna Prakashan Media Pvt Ltd, Meerut.

REFERENCEBOOKS:

- Dr.P.R. Vittal, Business Mathematics, 3rd edition (2005), Margham Publications, Chennai.
- S.P.Rajagopalan , R.Sattanathan , Business Mathematics(2009), Tata Mc Graw Hill Education Pvt Ltd, New Delhi.
- Dr.S.K.Sharma , Dr.Gurmeet Kaur , Business Mathematics, 1st edition (2019), Sultan Chand & Sons ,New Delhi.
- Prof. V. Sundaresan, Prof. K.S. Ganapathy Subramanian, Prof. K. Ganesan, Resource Management Techniques (Operations Research), 10th edition (2016), A.R. Publications, Chennai.
- Kanti Swarup, P.K.Gupta, Man Mohan , Operations Research , 18th edition (2015), Sultan Chand & Sons ,New Delhi.

JOURNALS

- Mathematics Newsletter Published by Ramanujan Mathematical Society, Chennai.
- Discrete Mathematical Sciences & Cryptography

E- LEARNING RESOURCES:

- <http://www.mathforum.org>
- <http://www.opensource.org>
- <http://khanacademy.org>
- <http://in.ixl.com>
- <http://www.learningwave.com>

COURSE OUTCOMES:

Upon successful completion of **Business Mathematics-I**, Students will be able to:

CO Number	CO STATEMENT
CO1	Find the inverse of the matrix and study the various types of matrices
CO2	Apply the derivatives of elementary functions to solve Business, Commerce and Economics problems.
CO3	Analyse the integration problems using basic techniques of integration.
CO4	Formulate a mathematical model of a real life problem and solve it by using Linear Programming Techniques.
CO5	Determine the key concepts and strategies in game theory and apply in certain real life problems.

MAPPING-COURSE OUTCOME WITH PROGRAMME SPECIFIC OUTCOME

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	-	1	3	-	3

CO2	3	-	1	3	-	3
CO3	3	-	1	3	-	3
CO4	3	-	1	3	-	3
CO5	3	-	1	3	-	3
AVERAGE	3	-	1	3	-	3

KEY: STRONGLY CORRELATED-3 MODERATELY CORRELATED-2 WEAKLY CORRELATED-1
NO CORRELATION-0

TEACHING METHODOLOGY:

1. Lecture (Chalk and Talk-OHP-LCD)
2. Problem Solving-Group Discussion
3. Quiz-Seminar
4. Peer Learning

QUESTION PAPER PATTERN-UG

Knowledge Level	Section	Word Limit	Marks	Total	Special Instructions if any
K 1	A-10 × 2 marks	50	20	100	Nil
K1, K 2	B-5/8 × 7 marks	200	35		
K2, K 3	C-3/5 × 15 marks	500	45		

All question papers can be framed in the following cognitive levels

Knowledge Level 1. Recall

Knowledge Level 2. Understanding

Knowledge Level 3. Application

SEMESTER – II

BUSINESS MATHEMATICS – II

(For I B.Com)

TOTAL HOURS: 90 HOURS
CREDITS: 5

COURSE CODE: MA18/2A/BM2
L-T-P: 3 3 0

COURSE OBJECTIVES:

To enable students to

1. Be acquainted with the knowledge of counting principles and its applications.
2. Find an optimum allocation of a number of jobs to equal number of facilities.
3. Select an appropriate order in which, to service, waiting customers.

COURSE OUTLINE:

UNIT I: PERMUTATION AND COMBINATION

Fundamental rule of Counting, Permutations, Factorial notation, Permutation of n different things, Circular Permutations, Permutation of things not all different, Restricted permutations, Combinations- Restricted Combination, Combination of things not all different.

Book1: Chapter 9 – Sections 9.1 to 9.11 (20 Hours)

UNIT II: ARITHMETIC AND GEOMETRIC PROGRESSION

Arithmetic progression, sum of series in AP, arithmetic mean, geometric progression, sum of series in GP, geometric mean.

Book1: Chapter12 – Sections 12.1 to 12.6 (15 Hours)

UNIT III: TRANSPORTATION PROBLEM

Introduction, Transportation problem, initial feasible solution, North-West corner Rule, Lowest cost method, Vogel's method optimality test (only problems) degeneracy excluded.

Book2: Chapter 9 – Sections 9.1,9.2,9.6 (20 Hours)

UNIT IV: ASSIGNMENT PROBLEM

Introduction, Assignment problem-Hungarian method of solving an assignment problem -Unbalanced assignment problems-Travelling Salesman (routing)problem.

Book2: Chapter 8 – Sections 8.1,8.2,8.4,8.5. (15 Hours)

UNIT V: SEQUENCING

Introduction - sequencing problems, general assumptions, sequencing decision problems for n -Jobs on two machines, sequencing decision problems for n -Jobs on three machines.

Book2: Chapter10 – Sections 10.1 to 10.5 (20 Hours)

BOOKS RECOMMENDED:

1. D.C. Sancheti and V.K. Kapoor, Business mathematics, 11th edition (1993), Sultan Chand & Sons , New Delhi.
2. R.K. Gupta, Operations Research (2003), Krishna Prakashan Media (P), Ltd, Meerut.

REFERENCE BOOKS:

1. Narasimhan, Ramachandran , Veeraragavan, Ramana, Business Mathematics and Business statistics, K.C.S. Desikan and Co.
2. P.R. Vittal, Business Mathematics, Margham Publications.

3. D.S. Hira & P.K. Gupta, Operations Research
4. KantiSwarup, P.K. Gupta, Manmohan, S.Chand Publications, Operations Research
5. Prof. V. Sundaresan, Prof. K.S. Ganapathy Subramanian, Prof. K. Ganesan, Resource Management Techniques, Meenakshi Publications.

JOURNALS

1. Mathematics Newsletter Published by Ramanujan Mathematical Society, Chennai.
2. Discrete Mathematical Sciences & Cryptography

E- LEARNING RESOURCES:

1. <http://www.mathforum.org>
2. <http://www.opensource.org>
3. <http://khanacademy.org>
4. <http://in.ixl.com>
5. <http://www.learningwave.com>

COURSE OUTCOMES

Upon successful completion of **Business Mathematics-II**, Students will be able to:

CO Number	CO STATEMENT
CO1	Apply the counting principle of Permutations and Combinations in various problems and solve them.
CO2	Analyse arithmetic and geometric sequences and series to solve problems.
CO3	Evaluate the logistic operations of various resources from one place to another by transportation problems and to apply to Marketing problems.
CO4	Apply the techniques of finding optimal assignment using Hungarian method and apply to real life problems.
CO5	Determine the approximate order of assigning a number of jobs to a number of service facilities by the method of sequencing.

MAPPING-COURSE OUTCOME WITH PROGRAMME SPECIFIC OUTCOME

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	-	1	3	-	3

CO2	3	-	1	3	-	3
CO3	3	-	1	3	-	3
CO4	3	-	1	3	-	3
CO5	3	-	1	3	-	3
AVERAGE	3	-	1	3	-	3

KEY: STRONGLY CORRELATED-3 MODERATELY CORRELATED-2 WEAKLY CORRELATED-1
NO CORRELATION-0

TEACHING METHODOLOGY:

1. Lecture (Chalk and Talk-OHP-LCD)
2. Problem Solving-Group Discussion
3. Quiz-Seminar
4. Peer Learning

QUESTION PAPER PATTERN-UG

Knowledge Level	Section	Word Limit	Marks	Total	Special Instructions if any
K 1	A-10 × 2 marks	50	20	100	Nil
K1, K 2	B-5/8 × 7 marks	200	35		
K2, K 3	C-3/5 × 15 marks	500	45		

All question papers can be framed in the following cognitive levels

Knowledge Level 1. Recall

Knowledge Level 2. Understanding

Knowledge Level 3. Application

SEMESTER –I
BUSINESS MATHEMATICS
(for I B.Com Hons)

TOTAL HOURS: 75 HOURS
CREDITS: 4

COURSE CODE: MA18/1C/BMM
L–T–P: 3 2 0

COURSE OBJECTIVES:

To enable student to

1. Introduce and develop basic concepts of Mathematics.
2. Introduce business applications in Mathematics.
3. Understand the basic integration concepts.
4. Introduce parts of matrices and its applications.
5. Understand the concept of experiment, outcome, event, probability and equally likely.

UNIT – I : DIFFERENTIAL CALCULUS

Differentiation: Meaning, rules and interpretation of first and second order derivatives. Applications of Differentiation: Elasticity of demand, total and marginal revenue, maxima and minima of univariate functions – applications of maxima and minima to economics only. (15 Hours)

UNIT – II : ALGEBRA

Permutation and combination, Arithmetic Progression, Geometric Progression (15 Hours)

UNIT – III: INTEGRATION

Integration : Meaning , Rules of integration . Indefinite and definite integrals . Applications (Integration by substitution and by parts (Trigonometric functions excluded) (15 Hours)

UNIT –IV: MATRICES

Matrices : Meaning and Operations – Matrix inversions – Solutions to linear equations – Payroll wages and Commission. (15 Hours)

UNIT – V: PROBABILITY

Concept of Probability- Independent and mutually exclusive events- Addition rule for two or more mutually exclusive events- Multiplication rule for Probability – Bayes' Rule (Proof excluded). (15 Hours)

RECOMMENDED TEXT:

1. D.C Sancheti and V.K .Kapoor, Business Mathematics (2006) ,Sultan chand & Sons, New Delhi.
2. P.R. Vittal, Business Mathematics (1999), Margham Publications, Chennai.

REFERENCE BOOKS:

1. B.M. Agarwal, Business Mathematics & Statistics(2001), Ane Books Pvt Ltd , New Delhi.
2. R.S.Soni , Business Mathematics(2013) , Ane Books Pvt Ltd ,New Delhi.
3. P.R. Vittal, Mathematical Foundations, Margham Publications, Chennai.
4. P.Mariappan, Business Mathematics, Pearson Publications, New Delhi.
5. Ken Black, Probability and Statistics for Business and Economics (2010), John Wiley and Sons publication, New York.

JOURNALS

1. Mathematics Newsletter Published by Ramanujan Mathematical Society, Chennai.

2. Discrete Mathematical Sciences & Cryptography

E- LEARNING RESOURCES:

1. <http://www.mathforum.org>
2. <http://www.opensource.org>
3. <http://khanacademy.org>
4. <http://in.ixl.com>
5. <http://www.learningwave.com>

COURSE OUTCOMES

Upon successful completion of **Business Mathematics**, Students will be able to:

CO Number	CO STATEMENT
CO 1	Recognize that mathematics permeates the world around us.
CO 2	Formulate and compute general term, sum of sequence and series.
CO 3	Learn to solve problems related to integration.
CO 4	Prepare to improve computation skills
CO 5	Use appropriate mathematical concepts and skills to solve problems including those in real life contexts.

MAPPING-COURSE OUTCOME WITH PROGRAMME SPECIFIC OUTCOME

CO /PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	3	2	1	2	2	2
CO2	1	3	1	2	2	1
CO3	2	3	1	2	1	2
CO4	1	3	2	1	1	1
CO5	1	1	2	1	1	3
Average	1.6	2.4	1.4	1.6	1.4	1.8

KEY: STRONGLY CORRELATED-3 MODERATELY CORRELATED-2 WEAKLY CORRELATED-1
NO CORRELATION-0

TEACHING METHODOLOGY:

1. Lecture (Chalk and Talk-OHP-LCD)
2. Problem Solving-Group Discussion
3. Quiz-Seminar

4. Peer Learning

QUESTION PAPER PATTERN-UG

Knowledge Level	Section	Word Limit	Marks	Total	Special Instructions if any
K 1	A-10 × 2 marks	50	20	100	Nil
K1, K 2	B-5/8 × 7 marks	200	35		
K2, K 3	C-3/5 × 15 marks	500	45		

All question papers can be framed in the following cognitive levels

Knowledge Level 1. Recall

Knowledge Level 2. Understanding

Knowledge Level 3. Application

SEMESTER –II
OPTIMIZATION TECHNIQUES
(for I B.Com Hons)

TOTAL HOURS: 75HOURS
CREDITS: 4

COURSE CODE: MA18/2C/OPT
L –T-P: 3 2 0

COURSE OBJECTIVES:

To enable students to

1. Understand the basic concepts of Operations Research.
2. Know how to apply maxmin-minmax principle in game theory.
3. Understand the special features in transportation problem.
4. Apply assignment techniques in real life situations.
5. Study various concepts in networks

UNIT I: LINEAR PROGRAMMING:

General linear programming problem, Mathematical formulation of a LPP.

Graphical procedure and Simplex procedure.(problems only) **(15 Hours)**

UNIT II: GAME THEORY

Two persons zero sum games, the Maximin-Minimax Principle, Saddle point and Value of the games, Games without saddle points, Mixed Strategies, Dominance property.

(15 Hours)

UNIT III: TRANSPORTATION PROBLEM

Introduction, Transportation problem, Initial feasible solution, North-West Corner Rule, Lowest cost method, Vogel's method, Test for Optimality. (problems only) (Degeneracy excluded)

(15 Hours)

UNIT IV: ASSIGNMENT PROBLEM

Introduction, Assignment problem, Hungarian Assignment for solving minimal assignment problem (problems only)

(15 Hours)

UNIT V: PERT AND CPM

Drawing network diagram, Critical Path Method, Concept of slack and floats on network, Algorithm for PERT and CPM.

(15 Hours)

RECOMMENDED TEXT:

1. Prof. V. Sundaresan, K.S. Ganapathy Subramanian, K. Ganesan: Resource Management Techniques A. R. Publications.
2. S.Kalavathy, Operations Research.

REFERENCE BOOKS:

1. D. C. Sancheti and V.K. Kapoor, Business Mathematics, 11th edition (1993), Sultan Chand & Sons, New Delhi .
2. R. K. Gupta, Operations Research, 12th edition, Krishna Prakashan Media Pvt Ltd., Meerut
3. J.K Sharma, Operations Research, Theory and applications (2003), Macmillan Publishers,
4. Man Mohan, Kanti Swarup, P. K. Gupta, Introduction to Management Science Operations Research, Sultan Chand & Sons, New Delhi.
5. Gupta Prem Kumar, D.S Hira , Problems in Operations Research , Sultan Chand & Co, New Delhi.

JOURNALS

1. Mathematics Newsletter Published by Ramanujan Mathematical Society, Chennai.
2. Discrete Mathematical Sciences & Cryptography

E- LEARNING RESOURCES:

1. <http://www.mathforum.org>
2. <http://www.opensource.org>
3. <http://khanacademy.org>
4. <http://in.ixl.com>
5. <http://www.learningwave.com>

COURSE OUTCOMES

Upon successful completion of **Optimization Techniques**, Students will be able to:

CO Number	CO STATEMENT
CO 1	Formulate and solve industry oriented problems.
CO 2	Analyse the decision making process of interdependent subject.
CO 3	Identify and solve the cases of unequal supply and demand to maximize a transportation problem.
CO 4	Plan to allocate various resources to various activities on one to one basis.
CO 5	Define basic components of Network and find critical path.

MAPPING-COURSE OUTCOME WITH PROGRAMME SPECIFIC OUTCOME

CO /PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	1	1	2	2	3	3
CO2	1	1	3	1	2	3
CO3	1	1	2	1	2	3
CO4	1	1	2	1	2	3
CO5	1	1	2	1	2	2
Average	1	1	2.2	1.2	2.2	2.8

KEY: STRONGLY CORRELATED-3 MODERATELY CORRELATED-2 WEAKLY CORRELATED-1
NO CORRELATION-0

TEACHING METHODOLOGY:

1. Lecture (Chalk and Talk-OHP-LCD)
2. Problem Solving-Group Discussion
3. Quiz-Seminar
4. Peer Learning

QUESTION PAPER PATTERN-UG

Knowledge Level	Section	Word Limit	Marks	Total	Special Instructions if any
K 1	A-10 × 2 marks	50	20	100	Nil
K1. K 2	B-5/8 × 7 marks	200	35		
K2, K 3	C-3/5 × 15 marks	500	45		

All question papers can be framed in the following cognitive levels

Knowledge Level 1. Recall

Knowledge Level 2. Understanding

Knowledge Level 3. Application

SEMESTER I

STATISTICAL TOOLS FOR BUSINESS MANAGEMENT – I (for I M.Com)

TOTAL HOURS: 90 Hours
CREDITS:5

COURSE CODE: 7P18/1C/ST1
L-T-P : 3 3 0

COURSE OBJECTIVES:

To enable students to

1. Classify the random variable as discrete and apply the relevant distribution in problems.
2. Classify the random variable as continuous and apply the relevant distribution in problems.
3. Calculate the degree of relationship between 2 variables.
4. Employ the technique of decision making in the problems.
5. Investigate the data and apply the relevant method for obtaining the missing data.

PROGRAMME SPECIFIC OUTCOMES (PSOs)

On completion of the programme the student will be able to:

- PSO1** - Apply knowledge of Mathematics in different field of science, business studies and technology.
- PSO2**- To acquire knowledge and understanding in advanced areas of mathematics, chosen by the student from the courses.
- PSO3** -To provide students with advanced mathematical and computational skills that prepares them to pursue higher studies and conduct research.
- PSO4** -To train students to deal with the problems faced by software industry through knowledge of mathematics and scientific computational techniques.
- PSO5** - To provide students with knowledge and capability in formulating, analyzing mathematical models of real life applications, to develop abstract mathematical thinking and to crack the competitive examinations.

COURSE OUTLINE:

- UNIT I:** Theoretical discrete distributions – Binomial and Poisson (simple problems only) Fitting of Binomial and Poisson distributions. **(15 Hours)**
- UNIT II:** Theoretical Continuous distributions – Rectangular and Normal distributions. Fitting of Normal Distribution (simple problems only) **(15 Hours)**
- UNIT III:** Partial and multiple correlations. Regression lines of x on y and y on x . (problems only) **(15 Hours)**
- UNIT IV:** Statistical decision theory – Decision Environment – Decision making under Certainty and Uncertainty- Expected Monetary Value, Expected Monetary Loss and Marginal Analysis. Expected Value of Perfect Information. Decision tree analysis. **(25 Hours)**
- UNIT V:** Interpolation and extrapolation – Newton forward, backward, Lagrange's Method for unequally spaced arguments. **(20 Hours)**

RECOMMENDED TEXTBOOKS:

1. S.P. Gupta ,Statistical Methods (2012), Sultan Chand & Sons , New Delhi.
2. D.C. Sancheti & V.K. Kapoor ,Statistics (Theory ,Methods & Application), 7th revised edition (1991), Sultan Chand & Sons , New Delhi.

REFERENCE BOOKS:

1. S.C. Gupta and V.K. Kapoor, Elements of Mathematical Statistics, 3rd edition (2014), Sultan Chand & Sons Publications, New Delhi.
2. P.R. Vittal, Mathematical Statistics (Reprint 2015), Margham Publications,
3. S. C Gupta and V. K Kapoor Fundamentals of Mathematical Statistics (2014), Sultan Chand and Sons , New Delhi.
4. B L Agarwal ,Basic Statistics 6th edition (2013), New Age International Private Limited.
5. Murray R Spiegel and Larry J Stephens, Schaum's Outlines Statistics (2017), Mc Graw Hill Education, New York.

JOURNALS:

1. The Mathematics Intelligencer.
2. Mathematics News Letter
3. Journal of Mathematics and Statistics, Science Publications.
4. International Journal of Mathematics and StatisticsTM

E-LEARNING RESOURCES:

1. www.oxfordmathcenter.com/drupal7/node/297
2. <https://www.analyticsvidhya.com/blog/2017/09/6-probability-distributions-datascience/>
3. <http://www.real-statistics.com/correlation/multiple-correlation/>
4. www.siu.edu/~evailat/decision.htm
5. <https://www.geeksforgeeks.org/newton-forward-backward-interpolation/>

COURSE OUTCOMES:

Upon successful completion of **Statistical Tools for Business Management – I** , Students will be able to:

CO Number	CO STATEMENT
CO 1	To fit a mathematical model or a function of the form $y = p(x)$ to the observed data.
CO 2	To apply the concepts of the appropriate distributions to solve business related problems.

CO 3	To measure the intensity of relationship between two variables and to compute the relationship in the form of linear equations.
CO 4	To apply decision making technique in relevant situations in business and commerce.
CO 5	To analyse and interpolate a missing value in a data and apply the technique to real time problems.

MAPPING-COURSE OUTCOME WITH PROGRAMME SPECIFIC OUTCOME

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	2	2	2	1	2
CO2	3	2	2	1	2
CO3	3	2	2	2	3
CO4	3	3	3	1	2
CO5	2	2	2	3	2
AVERAGE	2.6	2.2	2.2	1.6	2.2

KEY: STRONGLY CORRELATED-3 MODERATELY CORRELATED-2 WEAKLY CORRELATED-1
NO CORRELATION-0

TEACHING METHODOLOGY:

1. Lecture (Chalk and Talk-OHP-LCD)
2. Problem Solving-Group Discussion
3. Quiz-Seminar
4. Peer Learning

QUESTION PAPER PATTERN

Template – End Semester Examination

Knowledge level	Section	Nature of the question	Maximum Marks	
K ₄ , K ₅	A	Analysis, Evaluation, Description/Problems- At least one question from every Unit	5 (out of 8) × 8	40
K ₄ , K ₅	B	Application/ Analysis/ Synthesis/ Evaluation –	3 (out of 5) × 20	60

		One question from every Unit		
			Total	100

Template –Continuous Assessment

Knowledge level	Section	Nature of the question	Maximum Marks	
K ₄ , K ₅	A	Analysis, Evaluation, Description/Problems- At least two question from every Unit	5 (out of 8) × 6	30
K ₄ , K ₅	B	Application/ Analysis/ Synthesis/ Evaluation – At least one question from every Unit	2 (out of 3) × 10	20
			Total	50

All question papers can be framed in the following cognitive levels

Knowledge Level 4. Analysis

Knowledge Level 5. Evaluation

Knowledge Level 6. Creation

SEMESTER II

STATISTICAL TOOLS FOR BUSINESS MANAGEMENT – II
(for I M.Com)

TOTAL HOURS: 75 HOURS
CREDITS:5

COURSE CODE: 7P18/2C/ST2
L-T-P : 4-1-0

COURSE OBJECTIVES:

To enable students to

1. Learn the concept of sampling applied in the problems.
2. Apply the concept of tests of significance in large samples.
3. Apply the concept of tests of significance in small samples
4. Explore on the various methods for finding the association between attributes.
5. Draw valid inferences about the data by carefully analyzing its variance.

COURSE OUTLINE:

UNIT I: Sampling Distribution – Standard errors , errors in sampling , Level of significance, One tailed and Two- tailed test (15 Hours)

UNIT II: Large sample Tests – difference between two means, standard deviations and proportions, Confidence limits. (15 Hours)

UNIT III: Small sample tests – t tests, means, difference between two means, paired t tests for difference of means. F test. (15 Hours)

UNIT IV: Chi square tests – Test of goodness of fit. Test of independence of attributes. Association of two attributes – Comparison method, proportion method, Yule's Co efficient of association. (15 Hours)

UNIT V: Analysis of variance – One way and two way classification. Latin Square Design. (15 Hours)

RECOMMENDED TEXTBOOKS:

1. S.P. Gupta , Statistical Methods (2012), Sultan Chand & Sons, New Delhi.
2. D.C. Sancheti & V.K. Kapoor , Statistics (Theory , Methods & Application) , 11th edition (1993),Sultan Chand & Sons , New Delhi.

REFERENCE BOOKS:

1. S.C. Gupta and V.K. Kapoor, Elements of Mathematical Statistics, 3rd edition (2014), Sultan Chand & Sons Publications, New Delhi.
2. P.R. Vittal, Mathematical Statistics (Reprint 2015), Margham Publications,
3. S. C Gupta and V. K Kapoor Fundamentals of Mathematical Statistics (2014), Sultan Chand and Sons , New Delhi.
4. B L Agarwal ,Basic Statistics 6th edition (2013),New Age International Private Limited.
5. Murray R Spiegel and Larry J Stephens, Schaum's Outlines Statistics (2017), Mc Graw Hill Education, New York.

JOURNALS:

1. The Mathematics Intelligencer.

2. Mathematics News Letter
3. Journal of Mathematics and Statistics, Science Publications.
4. International Journal of Mathematics and Statistics™

E-LEARNING RESOURCES:

1. <https://www.statisticssolutions.com/sample-size-calculation-and-sample-size-justification/sampling/>
2. http://onlinestatbook.com/2/sampling_distributions/samplingdist_diff_means.html
3. <https://www.coursera.org/lecture/six-sigma-define-measure-advanced/t-distribution-f-distribution-MdOjL>
4. <https://www.bmj.com/about-bmj/resources-readers/publications/statistics-square-one/8-chi-squared-tests>
5. <https://www.analyticsvidhya.com/blog/2018/01/anova-analysis-of-variance>

COURSE OUTCOMES:

Upon successful completion of **Statistical Tools for Business Management – II**, Students will be able to:

CO Number	CO STATEMENT
CO 1	To analyze the sample for determining the population characteristics.
CO 2	To apply the tests of significance for the samples whose size is large.
CO 3	To apply the tests of significance for the samples whose size is small.
CO 4	To apply suitable methods for finding the association between the variable and to test the goodness of the distribution fitted to the given data.
CO 5	To apply the techniques of ANOVA to test the difference of means of three or more samples.

MAPPING-COURSE OUTCOME WITH PROGRAMME SPECIFIC OUTCOME

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	3	2	2	1	2
CO2	3	2	3	1	2
CO3	3	2	3	2	2
CO4	3	2	3	3	2
CO5	3	2	3	3	2

AVERAGE	3	2	2.8	2	2
----------------	---	---	-----	---	---

KEY: STRONGLY CORRELATED-3 MODERATELY CORRELATED-2 WEAKLY CORRELATED-1 NO CORRELATION-0

TEACHING METHODOLOGY:

1. Lecture (Chalk and Talk-OHP-LCD)
2. Problem Solving-Group Discussion
3. Quiz-Seminar
4. Peer Learning

QUESTION PAPER PATTERN

Template – End Semester Examination

Knowledge level	Section	Nature of the question	Maximum Marks	
K ₄ , K ₅	A	Analysis, Evaluation, Description/Problems- At least one question from every Unit	5 (out of 8) × 8	40
K ₄ , K ₅	B	Application/ Analysis/ Synthesis/ Evaluation – One question from every Unit	3 (out of 5) × 20	60
Total				100

Template –Continuous Assessment

Knowledge level	Section	Nature of the question	Maximum Marks	
K ₄ , K ₅	A	Analysis, Evaluation, Description/Problems- At least two question from every Unit	5 (out of 8) × 6	30
K ₄ , K ₅	B	Application/ Analysis/ Synthesis/ Evaluation – At least one question from every Unit	2 (out of 3) × 10	20
Total				50

All question papers can be framed in the following cognitive levels

Knowledge Level 4. Analysis

Knowledge Level 5. Evaluation

Knowledge Level 6. Creation

SEMESTER - I

STATISTICAL METHODS FOR ECONOMISTS
(for I M.A. Business Economics)

TOTAL HOURS: 90 Hours

COURSE CODE: 8P18/1C/SFE//
3P18/1C/SFE

CREDITS: 4

L-T-P: 3 3 0

COURSE OBJECTIVES:

1. Provide a strong foundation on statistical concepts
2. Develop skills in handling complex problems in Data analysis and Research
3. Equip the students to calculate vital Statistical indicators.

COURSE OUTLINE:

- UNIT I:** Interpolation and Extrapolation –Newton’s and Lagrange’s Methods. (15 Hours)
- UNIT II:** Probability - Addition and Multiplication Theorems - Conditional -Probability Discrete and Continuous - Random Variables – Mathematical Expectation –Bayes Theorem- Theoretical Distributions - Binomial, Poisson and Normal. (20 Hours)
- UNIT III:** Simple, Partial and Multiple Correlation- Regression- Regression Lines- Multiple Regression. (20 Hours)
- UNIT IV:** Univariate and Multivariate Techniques – Factor Analysis. (15 Hours)
- UNIT V:** Vital Statistics – Sources – Errors in Census and Registration – Measurement of Population rate and Ratio of vital events –Measurement of Mortality – Crude Death Rate (CDR) - Specific Death Rate (SDR)– Infant Mortality Rate (IMR) and Standardized Death Rate (SDR)-Maternal Mortality Rate(MMR) Morbidity Rate. (20Hours)

RECOMMENDED TEXT BOOKS:

1. S.P Gupta, “Statistical Methods ”(2017), Sultan Chand & Sons, New Delhi.
2. Anderson ,Sweeney and Williams, “Statistics for Business and Economics”(2012),Cengage.

REFERENCE BOOKS:

1. Anderson, David Ray, “Statistics for Business and Economics” (2012), South-Western Publication s
2. Dr.T.K.V. Iyengar, Dr.B.Krishna Gandhi S.Ranganatham, Dr.M.V.S.S.N.Prasad , Probability and Statistics (2015), S.Chand & Co., New Delhi.
3. R.S.N. Pillai and V.Bagavathi, Statistics (2010), Sultan & Chand Sons, New Delhi.
4. Sancheti .D.C and V.K. Kapoor,” Statistical Theory-Method and Application (2010) ”, Sultan chand & Sons, New Delhi.
5. SC. Gupta and V.K. Kapoor, Fundamentals of Mathematical Statistics(2014).
6. Dr.S.Sachdeva- Statistics (2014) -Lakshmi Narain Agarwal .

JOURNALS:

1. Journal of Applied Statistics
2. Journal of Statistical Software
3. The STATA Journal
4. Journal of Statistics Education

E-LEARNING RESOURCES

1. <https://guides.library.uoit.ca>
2. <https://www.statista.com>.
3. <https://techjury.net>
4. <https://scholar.harvard.edu/dromney>
5. <https://www.elearningworld.org>

COURSE OUTCOME:

Upon Successful completion of **Statistical Methods for Economists**, the students will be able to:

CO NUMBER	CO STATEMENT
CO1	Estimate the value of unknowns
CO2	Outline the fundamentals and basic rules of probability that help in decision making.
CO3	Calculate and interpret Correlation and regression coefficients
CO4	Apply Univariate and Multivariate techniques.
CO5	Acquire knowledge on vital statistics that would enable students to calculate CDR,SDR,IMR,MMR and other vital indicators

MAPPING- COURSE OUTCOME WITH PROGRAMME SPECIFIC OUTCOME:

CO/PSO	PSO 1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	2	3	3	2	3
CO2	3	2	3	3	2	3
CO3	3	1	3	3	2	3
CO4	2	1	3	3	1	3
CO5	3	3	3	3	2	3
Average	2.8	1.8	3	3	1.8	3

KEY: STRONGLY CORRELATED-3 MODERATLY CORRELATED -2WEAKLY CORRELATED -1
NO CORRELATION -0

QUESTION PAPER PATTERN

Knowledge Level	Section	Word Limit	Marks	Total	Special Instructions if any
K 3	A-5 × 8 marks	500	40	100	Question No.- is compulsory Section B/C- must be have 2
K4, K5	B-3/5 × 20 marks	1500	60		

					theory and 3 Problems
--	--	--	--	--	--------------------------

All question papers can be framed in the following cognitive levels

Knowledge Level 4. Analysis

Knowledge Level 5. Evaluation

Knowledge Level 6. Creation

SEMESTER – II

STATISTICS WITH COMPUTER APPLICATIONS
(for I M.A. Business Economics)

TOTAL HOURS: 75 Hours

**COURSE CODE: 8P18/2C/SCA//
3P18/2C/SCA**

CREDITS: 4

L-T-P : 2 2 1

COURSE OBJECTIVES:

1. Make students familiar with various statistical tools and their Application.
2. Train the students in the application of Computer software in Statistical Data Analysis
3. Deal with economic issues using statistical data.

COURSE OUTLINE:

- UNIT I:** Sampling Theory- Types of Sampling -Sampling Distributions and Standard Error of-Means - Standard Deviation and Proportions - Testing of Hypothesis - Level of Significance - Type I and Type II Error - Large Sample test for Two Means - Two Standard Deviations and Two Proportions. **(15 Hours)**
- UNIT II:** Estimator and Estimate – Point and Interval Estimates – Reliability of an Estimate – Sampling Variance and Mean Square Error – Properties of a good estimator. **(15 Hours)**
- UNIT III:** Small Sample Test – t-test- Paired t- test - Chi-square Test- Test of Goodness of Fit – Test of Homogeneity - Test of Independence of Two Attributes. **(15 hours)**
- UNIT IV:** F test – Analysis of Variance- One Way and Two-Way Classifications **(15 Hours)**
- UNIT V:** Introduction – Statistical Data Files- Statistical Workbook – Installation Data Spreadsheet Toolbar - Scroll Sheet Applications- Diagrams and Graphs - Elementary concepts in Statistics – Application in Computer Correlation, Multiple Correlation - Regression – Multiple Regression ANOVA **(Practical Examination only for this unit. No question for End Semester Examination)** **(15 Hours)**

RECOMMENDED TEXT BOOKS:

1. S.P Gupta, “Statistical Methods (2017)”, Sultan Chand & Sons, New Delhi.
2. Anderson, Sweeney and Williams, “Statistics for Business and Economics(2012)”, Cengage.

REFERENCE BOOKS:

1. Anderson, David Ray, “Statistics for Business and Economics (2001)”, South-Western Publications.
2. Dr.T.K.V. Iyengar, Dr.B.Krishna Gandhi S.Ranganatham, Dr.M.V.S.S.N.Prasad , Probability and Statistics (2015), S.Chand & Co , New Delhi.
3. R.S.N. Pillai and V.Bagavathi, Statistics (2010), Sultan & Chand Sons, New Delhi.

4. Sancheti .D.C and V.K. Kapoor,” Statistical Theory-Method and Application (2010)”, Sultan chand & Sons, New Delhi.
5. S .C. Gupta and V.K. Kapoor, Fundamentals of Mathematical Statistics (2014).
6. Dr.S.Sachdeva- Statistics(2014) -Lakshmi Narain Agarwal.

JOURNALS:

1. Journal of Applied Statistics
2. Journal of Statistical Software
3. The STATA Journal
4. Journal of Statistics Education

E-LEARNING RESOURCES:

1. <https://www.statista.com>.
2. <https://techjury.net>
3. [elearning.ec.unipi.gr>elearning](http://elearning.ec.unipi.gr/elearning)
4. <http://www.coursera.org/learn/economics>
5. <http://www.springboard.com>

COURSE OUTCOME:

On completion of the course the students will be able to

CO NUMBER	CO STATEMENT
CO1	Perform test of Hypothesis and estimate Mean and Proportions using confidence intervals
CO2	Construct Point and Interval estimates and the properties of estimators
CO3	Apply test of Hypotheses and use Non-Parametric test
CO4	Construct and conduct F-test, and Analysis of Variance and interpret the results obtained
CO5	Acquire an In-depth knowledge on Ms-Excel and SPSS packages

MAPPING- COURSE OUTCOME WITH PROGRAMME SPECIFIC OUTCOME:

CO/PSO	PSO 1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	2	1	3	3	2	3
CO2	2	1	3	2	1	3
CO3	2	2	3	3	2	3
CO4	2	2	3	3	2	3
CO5	2	2	3	3	2	3
AVERAGE	2	1.6	3	2.8	1.8	3

KEY: STRONGLY CORRELATED-3 MODERATLY CORRELATED -2WEAKLY CORRELATED -1 NO CORRELATION -0

QUESTION PAPER PATTERN

Knowledge Level	Section	Word Limit	Marks	Total	Special Instructions if any
K 3	A-5 × 8 marks	500	40	100	Question No.- is compulsory Section B/C- must be have 2 theory and 3 problems
K4, K5	B-3/5 × 20 marks	1500	60		

All question papers can be framed in the following cognitive levels

Knowledge Level 4. Analysis

Knowledge Level 5. Evaluation

Knowledge Level 6. Creation

UG - Non Major Elective -Course Profile
Semester I & II
(Offered to Other Departments)

NON-MAJOR ELECTIVE

STATISTICS USING EXCEL

TOTAL HOURS: 30 Hours

**COURSE CODE: MA18 / 1N / SUE
MA18 / 2N / SUE**

CREDITS: 2

L-T-P: 0 0 2

COURSE OBJECTIVES:

To enable students to

1. Understand the basic concepts of collection, classification and tabulation of data.
2. Find the measures of averages and dispersion for given data.
3. Represent the various measures using MS Excel.

COURSE OUTLINE:

UNIT I: DIAGRAMMATIC REPRESENTATION OF DATA

One – dimensional diagrams: – Simple bar diagram, multiple bar diagram, sub-divided bar diagram. Two – dimensional diagram: – Pie diagram. (10 Hours)

UNIT II: MEASURES OF AVERAGES

Simple arithmetic mean, Median, Mode (raw data & Discrete Series only). (10 Hours)

UNIT III: MEASURES OF DISPERSION

Range, Standard deviation, Variance (raw data & Discrete Series only). (10 Hours)

(All the units to be covered through practical sessions)

BOOKS RECOMMENDED:

1. R.S.N. Pillai & V. Bagavathi, Statistics, S.Chand & Company Ltd, New Delhi.

REFERENCE BOOKS:

1. P.R. Vittal, Mathematical Statistics, Margham Publications
2. S.P. Gupta Statistical methods, Sultan Chand & Sons publications.
3. Narasimhan, Veeraraghavan, Ramachandran, Ramana, K. C. S Desikan and Co., Business Mathematics and Business Statistics.

JOURNALS:

1. Mathematics Newsletter Published by Ramanujan Mathematical Society, Chennai.
2. Discrete Mathematical Sciences & Cryptography

E-LEARNING RESOURCES:

1. <http://www.mathforum.org>
2. <http://www.opensource.org>
3. <http://www.khanacademy.org>
4. <http://in.ixl.com>
5. <http://www.learningwave.com>

COURSE OUTCOME:

Upon successful completion of NME- Statistics Using Excel, Students will be able to:

CO NUMBER	CO STATEMENT
CO 1	To open an Excel worksheet, input data and manipulate data in Excel.
CO 2	Represent data using Bar diagrams and pie diagram in Excel spreadsheet
CO 3	Compute various measures of average and dispersion for raw and discrete data using Excel.

MAPPING-COURSE OUTCOME WITH PROGRAMME SPECIFIC OUTCOME

CO / PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO 1	-	-	-	-	3	2
CO 2	-	-	-	-	3	2
CO 3	-	-	-	-	3	2
AVERAGE	-	-	-	-	3	2

TEACHING METHODOLOGY:

1. Problem Solving - Group Discussion
2. Seminar
3. Peer Learning

QUESTION PAPER PATTERN: UG

5 questions (without choice) carrying 10 marks each (Practical)

Self Study Papers
Semester V & VI

GRAPH THEORY

CREDITS: 2

(Prerequisite- Knowledge of :- Graphs and simple graphs - Graph isomorphism - Incidence and adjacency matrices - sub graphs - types of graphs - vertex degrees - Path and connection - Cycles - Trees - Cut vertices and cut edges – connectivity)

COURSE OBJECTIVES:

The student will be able

- To provide structural characterization of graphs with matching, perfect matching and graph coloring.
- To give structural understanding of planar graphs.

UNIT I: INTRODUCTION

Graphs and simple graphs – Graph isomorphism – Incidence and adjacency matrices – Sub graphs – Paths and connection – cycles – Trees – Cut edges and bonds – Cut vertices.

UNIT II: CONNECTIVITY AND TRAVERSIBILITY

Connectivity – Whitney’s theorems – Blocks – Applications of connectivity – Euler’s tour – Hamilton Cycles – The Chinese Postman Problem – The traveling Salesman Problem (only a brief introduction on these problems.)

UNIT III: MATCHING

Matching – Matching and covering of bipartite graph - Perfect matching’s - Covering - Independent sets.

UNIT IV: COLORING

Coloring - Vertex chromatic number - k -critical graphs – Brook’s theorem – Chromatic polynomials - Girth and Chromatic number.

UNIT V: PLANAR GRAPHS

Planar graphs - Euler’s formula - Kurtowski’s theorem - Five colour theorem.

BOOKS RECOMMENDED:

1. Bondy J. A and Murthy U. S. R., “Graph theory with Applications”, Elsevier North – Holland, New York, 1976.
2. Douglas B. West, “Introduction to Graph Theory”, Pearson, Second Edition, New York, 2015.

REFERENCE BOOKS:

1. Balakrishnan R. and Ranganathan K., A Text Book of Graph Theory, Springer – Verlag, New York, 2012.
2. Chartrand G. and Lesneik Foster L., “Graphs and Digraphs”, CRC Press, 4th edition, Boca Raton, 2006.
3. Harary F., “Graph Theory”, Narosa Publishing House, New Delhi, 2001.

JOURNALS:

1. Mathematics Newsletter Published by Ramanujan Mathematical Society, Chennai.
2. Discrete Mathematical Sciences & Cryptography
3. Journal of Discrete Mathematics – Elsevier
4. Journal of Combinatorial Theory Series A & B - Elsevier

E-LEARNING RESOURCES:

1. <http://www.mathforum.org>
2. <http://www.opensource.org>
3. <http://khanacademy.org>
4. <http://in.ixl.com>
5. <http://www.learningwave.com>

Question Paper Pattern – End Semester Examination

Knowledge level	Component	Nature of the question	Maximum marks
K1 K2 K3	Section –A	Understanding Description/Problems Minimum Two Questions from every Unit	10 (out of 12) x 5 = 50

All question papers can be framed in the following cognitive levels

Knowledge Level 1.Recall

Knowledge Level 2.Understanding

Knowledge Level 3.Application

FUNDAMENTALS OF FUZZY SET THEORY

CREDITS: 2

COURSE OBJECTIVES:

The student will be able to

- Understand the fundamentals of fuzzy sets.
- Explore the application of uncertainty through fuzzy mathematics.
- Apply fuzzy concept to physical and social science problems.
- To get knowledge about fuzzy numbers.
- To know how to implement arithmetic operations on intervals.

COURSE OUTLINE:

UNIT I: Introduction

Crisp sets, Basic types of fuzzy sets.

Chapter 1: Sections 1.1, 1.2, 1.3

UNIT II: Fuzzy Sets

Basic Concepts of fuzzy sets.

Chapter 1: Sections 1.4

UNIT III: Fuzzy sets versus Crisp sets

Additional Properties of α - cuts, Representations of fuzzy sets.

Chapter 2: Sections 2.1, 2.2

UNIT IV: Fuzzy Arithmetic

Fuzzy Numbers, Linguistic Variables

Chapter 4 : Sections 4.1 , 4.2

UNIT V: Fuzzy Arithmetic (Continuation)

Arithmetic Operations on Intervals, Arithmetic Operations on Fuzzy Numbers

Chapter 4 : Sections 4.3 , 4.4

BOOKS RECOMMENDED:

1. George J.Klir and Bo Yuan, Fuzzy sets and Fuzzy logic theory and Applications, Prentice Hall of India, New Delhi 2001.

REFERENCE BOOKS:

1. Introduction to Fuzzy Arithmetic by A. Kauffman, Van Nostrand Reinhold, 1991.
2. Fuzzy Set Theory – and its Applications, 4th edition, by L.A. Zadeh.
3. Introduction to Fuzzy Logic by Rajjan Shinghal, Prentice Hall of India.
4. Introduction to Fuzzy Sets and Fuzzy Logic by M. Ganesh, Prentice Hall of India, 2006.
5. Fuzzy Logic with Engineering Applications by Timothy J. Ross, 3rd Edition, 2011.
6. Fuzzy Set Theory, Fuzzy Logic and their Applications by Dr. A.K. Bhargava, S. Chand.

JOURNALS:

1. International Journal of Fuzzy Logic Systems (IJFLS) – Wireilla.
2. Journal of Intelligent & Fuzzy Systems - IOS Press.
3. The Mathematics Intelligencer.
4. Mathematics News letter.

WEBSITES AND e-LEARNING SOURCES:

1. <http://mathforum.org>,
2. <https://cours.etsmtl.ca/sys843/REFS/Books/ZimmermannFuzzySetTheory2001.pdf>
3. <http://OCW.mit.edu/ocwwweb/Mathematics>
4. http://www.iaeng.org/IJCS/issues_v39/issue_1/IJCS_39_1_07.pdf
5. <https://sci2s.ugr.es/fss>

Question Paper Pattern – End Semester Examination

Knowledge level	Component	Nature of the question	Maximum marks
K1 K2 K3	Section –A	Understanding Description/Problems Minimum Two questions from every Unit	10 (out of 12) x 5 = 50

All question papers can be framed in the following cognitive levels

Knowledge Level 1.Recall

Knowledge Level 2.Understanding

Knowledge Level 3.Application