KONGUNADU ARTS AND SCIENCE COLLEGE (AUTONOMOUS)

COIMBATORE – 641 029

CourseName :M.Sc Mathematics

Curriculum and scheme of Examination under CBCS

(Applicable to the students admitted during the Academic Year 2020-2021 and onwards)

Semester	Subject Code	Title of the Paper	Instruction hours/cycle	Exam. Marks			Duration of Exam (hours)	Credits
				CIA	ESE	TOTAL		
I	20PMA101	Core Paper 1 Algebra	7	25	75	100	3	5
	20PMA102	Core Paper 2 Real Analysis	6	25	75	100	3	4
	20PMA103	Core Paper 3 Ordinary Differential Equations	7	25	75	100	3	5
	20PMA104	Core Paper 4 Numerical Methods	6	25	75	100	3	4
	20PMA1N1	**Non -Major Elective 1**	**4**	**25**	**75**	**100**	**3**	**4**
		Total	**30**	**-**	**-**	**500**	**-**	**22**
II	20PMA205	Core Paper 5 Complex Analysis	7	25	75	100	3	4
	20PMA206	Core Paper 6 Partial Differential Equations	6	25	75	100	3	4
	20PMA207	Core Paper 7 Mechanics	6	25	75	100	3	4
	20PMA208	Core Paper 8– Programming in Python - Theory	5	25	75	100	3	3
	20PMA2CL	Core Practical 1– Programming in Python - Practical	2	40	60	100	3	2

	20PMA2N2	**Non-Major Elective 2**	**4**	**25**	**75**	**100**	**3**	**4**
		Total	**30**	**-**	**-**	**600**	**-**	**21**
III	20PMA309	Core Paper 9 Topology	7	25	75	100	3	5
	20PMA310	Core Paper 10 Functional Analysis	7	25	75	100	3	5
	20PMA311	Core Paper 11 Mathematical Statistics	7	25	75	100	3	5
	20PMA3E1	**Major Elective 1**	**7**	**25**	**75**	**100**	**3**	**5**
	-	**EDC Paper**	**2**	**25**	**75**	**100**	**3**	**2**
		Total	**30**	**-**	**-**	**500**	**-**	**22**
IV	20PMA412	Core Paper 12 Mathematical Methods	8	25	75	100	3	5
	20PMA413	Core Paper 13 Control Theory	8	25	75	100	3	5
	20PMA414	Core Paper 14 Object Oriented Programming with C++ - Theory	5	25	75	100	3	4
	20PMA4CM	Core Practical 2 Object Oriented Programming with C++ - Practical	2	40	60	100	3	2
	20PMA4E2	**Major Elective 2**	**7**	**25**	**75**	**100**	**3**	**5**
	20PMA4Z1	**Project and Viva voce**	**-**	**20**	**80**	**100**	**-**	**4**
		Total	**30**	**-**	**-**	**600**	**-**	**25**
Grand Total				**-**	**-**	**2200**	**-**	**90**

Note :

CBCS – Choice Based Credit system

CIA – Continuous Internal Assessment

ESE – End of Semester Examinations

ADVANCED LEARNER'S COURSE (SELF STUDY)

	20PMA0D1	II Optional	**ALC 1**	Discrete Mathematics and Automata Theory	-	-	100	100	3	2
	20PMA0D2		**ALC 2**	Astronomy	-	-	100	100	3	2
	20PMA0D3		**ALC 3**	Internet and JAVAProgramming	-	-	100	100	3	2

Major Elective Papers

(2 papers are to be chosen from the following 6 papers)

1. Fluid Dynamics
2. Graph Theory
3. Fundamentals of Actuarial Mathematics
4. Cryptography
5. Stochastic Process
6. Mathematical Modelling

Non Major Elective Papers

(2 papers are to be chosen from the following 4 papers)

1. System Analyses and Design
2. Visual Basic and Oracle
3. Fuzzy Logic and Neural networks
4. Measure and Integration

Sub. Code & Title of the Extra Departmental Course (EDC) :

20PMA3X1 – EDC Paper 1 - Research Methodology : Approaches and Techniques

Tally Table:

Subject	No. of Subjects	Total Marks	Credits
Core – Theory / Practical / Project	17	1700	70
Major Elective Papers	2	200	10
EDC Paper	1	100	2
Non Major Elective Papers	2	200	8
Grand Total	**22**	**2200**	**90**

- 25 % CIA is applicable to all subjects except JOC, COP and SWAYAM courses which are considered as extra credit courses.
- The students are advised to complete a **SWAYAM-MOOC** before the completion of the 3rd semester and the course completed certificate should be submitted to the HOD. Two credits will be given to the candidates who have successfully completed.
- A **Field Trip** preferably relevant to the course should be undertaken every year.

Components of Continuous Internal Assessment

Components		Marks	Total
Theory			
CIA I	75	(75+75 = 150/10)	25
CIA II	75	15	
Assignment/Seminar		5	
Attendance		5	
Practical			
CIA Practical		25	40
Observation Notebook		10	
Attendance		5	
Project			

Review	30	40
Regularity	10	

BLOOM'S TAXONOMY BASED ASSESSMENT PATTERN

K1-Remembering;**K2**-Understanding;**K3**-Applying;**K4**-Analyzing;**K5**-Evaluating

1. **Theory Examination**

CIA I & II and ESE: 75 Marks

Knowledge Level	Section	Marks	Description	Total
K1- K2 Q1 to 10	A (Answer all)	10 x 1 = 10	MCQ	75
K2 – K4 Q11 to 15	B (Either or pattern)	5 x 5 = 25	Short Answers	
K2 - K4 Q16 to 20	C (Either or pattern)	5 x 8 = 40	Descriptive / Detailed	

2. **Practical Examination:**

Knowledge Level	Section	Marks	Total
K3	Experiments	50	60
K4	Record Work	10	
K5			

3. Project Viva Voce:

Knowledge Level	Section	Marks	Total
K3	Project Report	60	80
K4	Viva voce	20	
K5			

20PMA101

Programme Code : 02		M.Sc Mathematics		
Course Code : 20PMA101		**Core Paper 1 –**ALGEBRA		
Batch	**Semester**	**Hours / Week**	**Total Hours**	**Credits**
2020-2022	I	7	105	5

Course Objectives

1. To study groups, rings, fields and linear transformations which are widely used in many research fields and the concepts of mappings are applied in the subjects like analysisand topology.
2. To show the needs from which a modern mathematical attitude may grow and it is of great help in any further axiomatic study of mathematics.
3. To study the concept of linear transformations using matrices. Also, Contemporary mathematics and mathematical physics make extensive use of abstract algebra.

Course Outcomes (CO)

K1 to K4	CO1	Remembering the concept of rings, fields and extension fields.
	CO2	Understanding the difference between algebraic and transcendental extensions; be able to find the minimal polynomial for algebraic elements over a field and be able to prove whether a polynomial is irreducible over a given field.
	CO3	Applying Sylow's theorems to determine the structure of certain groups of small order and also Gauss lemma, Eisentein criterion for irreducibility of rationals.
	CO4	Analyzing Galois groups in simple cases and to apply the group theoretic information to deduce results about fields and polynomials.

Syllabus

Unit I **(21 Hours)**

Group Theory: Another Counting Principle – Conjugacy* – Normalizer – Cauchy's Theorem - Sylow's Theorem - Direct Products.

Unit II **(21 Hours)**

Ring Theory: **Euclidean Rings*** – Unique Factorization Theorem - A Particular Euclidean Ring – Fermat's Theorem - Polynomial Rings - Polynomials over the Rational Field - Gauss' Lemma - The Eisentein Criterion.

20PMA101

Unit III **(20 Hours)**

Fields: Extension fields - Algebraic Extension – Roots of polynomials – Remainder Theorem Splitting field.

Unit IV **(22 Hours)**

More about roots: Simple Extension. The Elements of Galois Theory – Fixed field of a Group - Normal Extension - The Galois group of a polynomial - Fundamental Theorem of Galois Theory.

Unit V **(21 Hours)**

Linear Transformations: Canonical Forms – Similar Transformation – Triangular Form – Trace and Transpose – Symmetric Matrix – Skew Symmetric Matrix - Hermitian, Unitary and Normal Transformations.

*** Self Study (Questions may be asked from these portions also)**

Teaching Methods

Chalk and Talk / Powerpoint presentation/ Seminar/Quiz/Discussion/Assignment/Smart Class Room

Text Book

I. N.Herstein, Topics in Algebra, 2nd Edition, Wiley Eastern Limited, 2017.

Unit I	Chapter 2	Sections 2.11 to 2.13.
Unit II	Chapter 3	Sections 3.7 to 3.10.
Unit III	Chapter 5	Sections 5.1 and 5.3.
Unit IV	Chapter 5	Sections 5.5 and 5.6.
Unit V	Chapter 6	Sections 6.4, 6.8 and 6.10.

Reference Books

1. John B.Fraleigh, A First Course in abstract Algebra , 3rd Edition, Narosa Publishing House, 1998.
2. P.B.Bhattacharya ,S.K.Jain and S.R.Nagpaul , Basic abstract Algebra, 2nd Edition, Cambridge University Press, 2004.

Mapping

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	H	H	S	M
CO2	S	H	M	S	H
CO3	H	H	S	S	H
CO4	S	H	S	H	S

S - Strong; **H**-High; **M**-Medium; **L**-Low

20PMA102

Programme Code : 02		**M.Sc Mathematics**		
Course Code : 20PMA102		**Core Paper 2 -** REAL ANALYSIS		
Batch	**Semester**	**Hours / Week**	**Total Hours**	**Credits**
2020-2022	I	6	90	4

Course Objectives

1. To learn about advanced topics in Riemann's Stieltjes Integrals.
2. To study the mean value theorem for Riemann and Riemann's Stieltjesintegrals.
3. To study directional derivatives, total derivatives, Jacobian determinant and their applications.

Course Outcomes (CO)

	CO1	Remembering the upper and lower integrals and the Riemann conditions.
	CO2	Understanding the difference between necessary and sufficient conditions for Riemann's Stieltjes Integrals.
	CO3	Identifying the sufficient conditions for differentiability and mixed partial derivatives.
	CO4	Analyzing the Jacobian determinant to understand the Implicit and Inverse function theorems.

Syllabus

UNIT I **(18 Hours)**

The Riemann – Stieltjes Integral: Monotonically increasing integrators. **Upper andlower integrals*** –Additive and Linearity properties of upper and lower integrals –Riemann's condition – Comparison theorems –Integrators of bounded variation.

UNIT II **(18 Hours)**

Sufficient conditions for existence of Riemann - Steiltjes integrals - Necessary conditions for existence of Riemann- Steiltjes integrals –Mean value theorems for R S integrals - The integrals as a function of the interval – Second fundamental theorem of integral calculus – Change of variable in a Riemann integral – Second Mean value theorem for Riemann integral.

20PMA102

UNIT III **(18 Hours)**

Multivariable Differential Calculus - Introduction –The directional derivative -Directional derivatives and continuity –The total derivative – The total derivative expressed in terms of partial derivatives – The matrix of a linear function - **The Jacobian Matrix* -** The chain rule.

UNIT IV **(18 Hours)**

The Mean value Theorem for differentiable functions - A sufficient condition for differentiability – A sufficient condition for equality of mixed partial derivatives – Taylor's formula for functions from R^n to R^1.

UNIT V **(18 Hours)**

Implicit Functions and Extremum Problems: Introduction - Functions with nonzero Jacobian determinant – The inverse function theorem – The implicit function theorem.

*** Self Study (Questions may be asked from these portions also)**

Teaching Methods

Chalk and Talk / Powerpoint presentation/ Seminar/Quiz/Discussion/Assignment/Smart Class Room

TEXT BOOK

1. Tom M.Apostol, Mathematical Analysis, Addition –Wesley, 2002.

Unit I	Chapter 7	Sections 7.11 to 7.15
Unit II	Chapter 7	Sections 7.16 to 7.22
Unit III	Chapter 12	Sections 12.1 to 12.5 , 12.7 to 12.9
Unit IV	Chapter 12	Sections 12.11 to 12.14
Unit V	Chapter 13	Sections 13.1 to 13.4

REFERENCE BOOKS

1. J.V.Deshpande, Mathematical Analysis and applications – An introduction, Narosa Publishing house, New Delhi, 2004.
2. Shanthi Narayan, A course of Mathematical Analysis ,S.Chand and company,1st Edition, New Delhi, 1996.
3. W.Rudin, Real and Complex Analysis, McGraw- Hill company, 3rd Edition, New York, 1986.
4. D.Somasundaram and B.Chaudhary, A first course in Mathematical Analysis , Narosa Publishing house, New Delhi, 1999.

20PMA102

Mapping

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	H	S	M	S
CO2	S	H	M	S	H
CO3	H	M	S	S	S
CO4	S	S	H	M	H

S - Strong; **H**-High; **M**-Medium; **L**-Low

20PMA103

Programme Code : 02		M. Sc Mathematics		
Course Code: 20 PMA103		Core Paper 3 - Ordinary Differential Equations		
Batch	**Semester**	**Hours / Week**	**Total Hours**	**Credits**
2020-2022	I	7	105	5

Course Objectives

1. To understand the concepts of fundamental matrix and successive approximation for finding solution.
2. To enable the students to know the concepts of non-homogeneous linear systems with constant co-efficient and periodic co-efficient.
3. To gain knowledge in the area of linear oscillations and non-linear oscillations.

Course Outcomes (CO)

K1 to K4	CO1	Remembering the different types of differential equations.
	CO2	Understanding the concept of linear oscillations and non-linear oscillations.
	CO3	Applying the notions of fundamental matrix and successive approximations in the system of differential equations.
	CO4	Analyzing the non-homogeneous linear systems with constant co-efficient and periodic co-efficient.

Syllabus

UNIT I **(21 Hours)**

Second order linear equations with ordinary points –Legendre equation and Legendre polynomials -Second order equations with regular singular points –Bessel equation.

UNIT II **(21 Hours)**

Systems of first order equations – Existence and uniqueness theorem - Fundamental matrix.

UNIT III **(21 Hours)**

Non –homogeneous linear systems –Linear systems with constant coefficients - Linear systems with periodic coefficients.

UNIT IV **(21 Hours)**

Successive approximations –Picard's theorem –Some Examples–Continuation and dependence on initial conditions -**Existence of solutions in the large*** -Existence and uniqueness of solutions of systems.

UNIT V **(21 Hours)**

Fundamental results –Strum's comparison theorem –**Elementary linear Oscillations*** - Comparison theorem of Hille-Wintner Oscillations of $x'' + a(t)x = 0$.

20PMA103

*** denotes Self study**

Questions for examinations may be taken from the self study portions also.

Teaching Methods

Chalk and Talk / Powerpoint presentation/ Seminar/Quiz/Discussion/Assignment/Smart Class Room

TEXT BOOK

S.G.Deo, V. Raghavendra, RasmitaKar and V. Lakshmikantham, Ordinary Differential Equations, 3rd Edition, Tata McGrew - Hill Publishing Company Ltd, New Delhi, 2018.

Unit I	Chapter 6	Sections 6.2 to 6.5
Unit II	Chapter 5	Sections 5.2, 5.4, 5.5
Unit III	Chapter 5	Sections 5.6 to 5.8
Unit IV	Chapter 2	Sections 2.3 to2.8
Unit V	Chapter 7	Sections 7.1 to 7.5

REFERENCE BOOKS

1. E.A. Coddington and N. Levinson, Theory of Ordinary Differential Equations, 2nd Edition, Tata McGraw Hill Pvt. Ltd, New Delhi, 2002.
2. V.I. Arnold, Ordinary Differential Equation, Prentice Hall of India Pvt. Ltd, New Delhi, 1998.
3. E.L. Ince, Ordinary Differential Equations, Dover Publications, INC, New York, 1956.
4. Coddington, Theory of Ordinary Differential Equations, S. Chand Pvt., Ltd, 2000.

Mapping

PSO CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	H	S	S	H
CO2	H	H	S	M	S
CO3	H	S	H	H	H
CO4	S	S	M	H	S

S - Strong; **H**-High; **M**-Medium; **L**-Low

20PMA104

Programme Code :02		M. Sc Mathematics		
Course Code:20PMA104		**Core paper 4 -** NUMERICAL METHODS		
Batch	**Semester**	**Hours / Week**	**Total Hours**	**Credits**
2020-2022	I	6	90	4

Course Objectives

1. To solve thelinear equations, non-linearequations and interpolating the values using numerical methods.
2. To obtain the solution of Boundary Value Problems and Characteristic Value Problems using Numerical Methods.
3. To find the Solution of Ordinary Differential Equations and Partial Differential Equations using Numerical methods.

Course Outcomes (CO)

K1 to K4	CO1	Remembering various numerical methods for finding the solution of algebraic and transcendental equations.
	CO2	Demonstrating various numerical algorithms for solving simultaneous linear algebraic equations.
	CO3	Applying various numerical methods to solve differential equations.
	CO4	Analyzing the Boundary Value Problems and Characteristic Value Problems.

Syllabus

UNIT I **(18 Hours)**

Solution of Nonlinear Equations- Newton's method- Convergence of Newton's method – Bairstow Method for quadratic factors. Numerical Differentiation and Integration: Derivatives from difference tables – Higher order derivatives – Divided difference, Central – Difference formulas – Romberg integration – Simpson's rules.

UNIT II **(18 Hours)**

Solution of System of Equations - The Elimination method **-Gauss and Gauss Jordan methods*** – Matrix inversion Gauss – Jordan method – Methods of iteration – Jacobi and Gauss Seidal iteration – Relaxation method.

20PMA104

UNIT III **(18 Hours)**

Solution of Ordinary Differential Equations - Taylor series method – Euler and Modified Euler methods - Runge –Kutta methods – Multistep methods – Milne's method – Adams Moulton method.

UNIT IV **(18 Hours)**

Boundary Value Problems and Characteristic Value Problems: Solution through a set of equations – Derivative boundary conditions – Characteristic value problems – **Eigen values of a matrix*** by iteration – The power method.

UNIT V **(18 Hours)**

Numerical Solution of Partial Differential Equations - Solutions of Elliptic, Parabolic and Hyperbolic partial differential equations : Representation as a difference equation – Laplace's equation on a rectangular region – Iterative methods for Laplace equation – The Poission equation – Derivative Boundary conditions – Solving the equation for time – dependent heat flow (i) The Explicit method (ii) The Crank Nicolson method – Solving the wave equation by finite differences.

***denotes Self Study (Questions for examinations may be taken from this Portions also).**

Teaching Methods

Chalk and Talk / Powerpoint presentation/Seminar/Quiz/Discussion/Assignment/Smart Class Room

Text Book

C.F.Gerald and P.O.Wheatley, Applied Numerical Analysis, 5th Edition, Addition Wesley, 1998.

Unit I	Chapter 1	Sections 1.4, 1.8, 1.11
	Chapter 3	Section 3.3
	Chapter 4	Sections 4.2, 4.3, 4.7
Unit II	Chapter 2	Sections 2.3,2.4,2.7,2.10,2.11
Unit III	Chapter 5	Sections 5.2 to 5.7
Unit IV	Chapter 6	Sections 6.2 to 6.3, 6.6,6.7
Unit V	Chapter 7	Sections 7.3 to 7.7
	Chapter 8	Sections 8.1 to 8.3
	Chapter 9	Section 9.2

20PMA104

Reference Books

1. S.C.Chapra and P.C.Raymond, Numerical Methods for Engineers, Tata McGraw Hill, New Delhi 2000.
2. R.L.Burden and J.DouglasFaries, Numerical Analysis, 4th Edition, PWS Kent Publishing Company, Boston 1989.
3. S.S.Sastry, Introductory methods of Numerical Analysis, Prentice-Hall of India, New Delhi, 1998.
4. P.Kandasamy et al. Numerical Methods, S.Chand& Co., Ltd., New Delhi 2003.

Mapping

PO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	H	S	S	M	S
CO2	S	M	M	S	H
CO3	H	M	S	H	S
CO4	S	S	H	S	H

S-Strong ; H-High; M-Medium ; L-Low

20PMA205

Course Objectives

Programme Code : 02		M. Sc Mathematics		
Course Code : 20PMA205		**Core Paper 5 -** COMPLEX ANALYSIS		
Batch	**Semester**	**Hours / Week**	**Total Hours**	**Credits**
2020-2022	II	7	105	4

1. To study Cauchy's theorem and applying it for a rectangle and a disk.
2. To know various types of singularities and evaluation of definite integrals using residues.
3. To understand the concept of power series expansions and canonical products.

Course Outcomes (CO)

K1 to K4	CO1	Recalling rectifiable arcs and line integrals as functions of arcs.
	CO2	Explaining the concepts of Local mapping theorem, Cauchy residue theorem and its applications.
	CO3	Applying the Residue theorem on definite integrals.
	CO4	Analyzing the Riemann mapping theorem and Schwarz – Christoffel formula.

SYLLABUS

UNIT I **(22 Hours)**

Fundamental Theorems: LineIntegrals – **Rectifiable Arcs - Line Integrals as Functions of Arcs*** – Cauchy's Theorem for a Rectangle – Cauchy's Theorem in a Disk - Cauchy's Integral formula: The index of a point with respect to a closed curve – The Integral formula – Higher derivatives.

UNIT II **(20 Hours)**

Local Properties of Analytic Functions: Removable Singularities - Taylor's theorem – Zeros and poles – The Local Mapping – The Maximum principle.

20PMA205

UNIT III **(20 Hours)**

The Calculus of Residues: The Residue theorem – The Argument Principle – Evaluation of Definite Integrals - Harmonic functions: Definitions and Basic Properties – The Mean - value Property – Poisson's formula – Schwarz's Theorem.

UNIT IV **(21 Hours)**

Power Series Expansions: Weierstrass's Theorem – The Taylor Series – The Laurent Series - Partial fractions and Factorization: Partial Fractions – Infinite Products.

UNIT V **(21 Hours)**

Canonical Products – The Riemann Mapping theorem : Statement and Proof - The Schwarz – Christoffel Formula – A closer look at harmonic functions: Functions with Mean -value Property - Harnack's Principle.

Teaching Methods

Chalk and Talk / Powerpoint presentation/Seminar/Quiz/Discussion/Assignment/Smart Class Room

TEXT BOOK

1.L.V.Ahlfors, Complex Analysis, McGraw Hill Education (India) Pvt. Ltd, 2013.

Unit I	Chapter 4	Sections 1.1 – 1.5
	Chapter 4	Sections 2.1 – 2.3.
Unit II	Chapter 4	Sections 3.1 – 3.4
Unit III	Chapter 4	Sections 5.1 – 5.3, 6.1 – 6.4
Unit IV	Chapter 5	Sections 1.1 – 1.3, 2.1 , 2.2
Unit V	Chapter 5	Section 2.3
	Chapter 6	Sections 1.1, 2.2, 3.1, 3.2.

20PMA205

REFERENCE BOOKS

1. Walter Rudin, Real and Complex Analysis, Tata McGraw Hill Publishing Co.Ltd., New Delhi, 2006.
2. John B.Conway, Functions of one Complex Variable , 2nd Edition, Narosa Publishing House, New Delhi, 2002.
3. S.Ponnusamy, Foundations of Complex Analysis, 2nd Edition, Narosa Publishing House, New Delhi, 2010.

MAPPING

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	H	S	M	S
CO2	S	H	M	S	H
CO3	H	M	S	S	S
CO4	S	S	H	M	H

S - Strong; **H**-High; **M**-Medium; **L**-Low

20PMA206

Programme Code : 02		**M.Sc Mathematics**		
Course Code: 20PMA206		Core Paper 6 - Partial Differential Equations		
Batch	**Semester**	**Hours / Week**	**Total Hours**	**Credits**
2020-2022	II	6	90	4

Course Objectives

1. To studylinear partial differential equations and non-linear partial differential equations.
2. To know the concept of partial differential equations and their role in modern mathematics.
3. To understand the concepts of wave equations and diffusion equations.

Course Outcomes (CO)

K1 to K4	CO1	Finding the solutions of the heat equation, wave equation and the Laplace equation subject to boundary conditions
	CO2	Understanding the method of separation of variables and the method of integral transforms.
	CO3	Applying calculus of variations in finding elementary solutions of diffusion equations.
	CO4	Analyzing the solutions of non-linear partial differential equations by using Charpit's and Jacobi's methods.

Syllabus

Unit I **(18 Hours)**

Non-linear partial differential equations of the first order compatible systems of first order equations- Charpit's Method - **Special types of first order equations*** and Jacobi's Method.

Unit II **(18 Hours)**

Linear partial differential equations with constant co-efficient and Equations with variable Co-efficients.

Unit III **(18 Hours)**

Method of separation of variables and the Method of Integral Transforms.

Unit IV **(18 Hours)**

Elementary solutions of Laplace equations- Families of equi-potential surface-Boundary value problems –Separation of Variables and problems with axial symmetry.

20PMA206

Unit V **(18 Hours)**

Elementary solutions of one dimensional wave equations – Vibrating Membranes: Applications of Calculus of variations – Elementary solutions of Diffusion equations and Separation of variables.

*** Self Study (Questions may be asked from these portions also)**

Teaching Methods

Chalk and Talk / Powerpointpresentation/Seminar/Quiz/Discussion/Assignment/Smart Class Room

Text Book

Ian N. Sneddon, Elements of Partial Differential Equations, Dover Publications, INC-New York, 2006.

Unit I	Chapter 2	Sections 7, 9 – 11, 13
Unit II	Chapter 3	Sections 4, 5
Unit III	Chapter 3	Sections 9, 10
Unit IV	Chapter 4	Sections 2 - 6
Unit V	Chapter 5	Sections 2, 4
	Chapter 6	Sections 3, 4

Reference Books

1. Michael Renardy and Robert C. Rogers, An Introduction to Partial Differential Equations, Second Edition, Springer, 2004.
2. Robert C. Mc Owen, Partial Differential Equations, Methods and Applications, Second Edition, Pearson Education, Inc., 2004.
3. T.Amarnath, An Elementary Course in Partial Differential Equations, Narosa Publishing House, New Delhi, Reprint 2004.
4. TynMyint.U, Loknath and Debnath, Linear Partial Differential Equations for Scientists and Engineers, Brikhauser Boston, Fourth edition, 2006.

20PMA206

Mapping

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	M	H	H
CO2	H	S	H	M	H
CO3	M	S	H	S	H
CO4	S	H	H	S	H

S - Strong; **H**-High; **M**-Medium; **L**-Low

20PMA207

ProgrammeCode :02		M. Sc Mathematics		
Course Code: 20PMA207		Core Paper 7-MECHANICS		
Batch	**Semester**	**Hours / Week**	**Total Hours**	**Credits**
2020-2022	II	6	90	4

Course Objectives

1. To know the basic concepts of the Mechanical system.
2. To understand about the constraints, differential forms and Generating functions
3.To acquire knowledge about mechanical concepts to solve various problems in Mechanics.

Course Outcomes (CO)

K1 to K4	CO1	Remembering the concepts of generalized co-ordinates and constraints.
	CO2	Explaining the derivation of Lagrange's and Hamilton equations.
	CO3	Applying Hamilton Principle for deriving Hamilton Jacobi Equation.
	CO4	Analyzing the Lagrange's and Poisson Brackets.

SYLLABUS

UNIT I **(18 hours)**

Introductory concepts: Mechanical Systems –Generalized Co-ordinates – Constraints

-Virtual work.

UNIT II **(18 hours)**

Lagrange's Equations: Derivation of LaGrange's Equations –**Examples*** –Integrals of motion.

UNIT III **(18 hours)**

Hamilton's Equations: Hamilton's Principle – Hamilton's equations.

UNIT IV **(18 hours)**

Hamilton –Jacobi Theory: Hamilton's Principle function –Hamilton –Jacobi equation –

Separability*.

UNIT V **(18 hours)**

Canonical Transformations: Differential forms and Generating functions –Lagrange and Poisson Brackets.

*** Self Study (Questions may be asked from these portions also)**

20PMA207

Teaching Methods

Chalk and Talk / Power point presentation/ Seminar/Quiz/Discussion/Assignment/ Smart class room

Text Book

D.T.Greenwood, Classical Dynamics, Prentice Hall of India pvt. ltd., New Delhi, 1979.

Unit I	Chapter 1	1.1 – 1.4
Unit II	Chapter 2	2.1 – 2.3
Unit III	Chapter 4	4.1 – 4.2
Unit IV	Chapter 5	5.1 – 5.3
Unit V	Chapter 6	6.1 and 6.3

Reference Books

1. John.L. Synge and Byron.A. Griffth, Principles of Mechanics, 3rd Edition, Mcgrow Hill Kogakygha Ltd, 1970.
2. Goldstin, Classical Mechanics, Prentice Hall of India , New Delhi, 1979.
3. SankaraRao.K, Classical Mechanics, K.K. Publications Prentice Hall of India and the Parkar, 2005.

Mapping

PSO / CO	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	S	M	H	S	M
CO2	M	H	S	M	H
CO3	S	M	M	H	S
CO4	H	S	M	H	M

S - Strong; **H**-High; **M**-Medium; **L**-Low

20PMA208

Programme Code : 02		**M.Sc. Mathematics**		
Course Code: 20PMA208		**Core Paper 8 –** Programming in Python		
Batch 2020-2022	Semester II	Hours / Week 5	Total Hours 75	Credits 3

Course Objectives

1. To introduce the fundamentals of Python Programming.
2. To teach about the concept of Functions in Python.
3. To impart the knowledge of Lists, Tuples, Files and Directories.

Course Outcomes (CO)

K1 – K4	CO1	Remembering the concept of operators, data types, Loops and control statements in Python programming.
	CO2	Understanding the concepts of Input / Output operations in file.
	CO3	Applying the concept of functions and exception handling
	CO4	Analyzing the structures of list, tuples and maintaining dictionaries.

Syllabus

Unit I **(15 Hours)**

Introduction to Python**:** Introduction - Python Overview - Getting Started with Python – ***Comments - ***Python Identifiers** - Reserved Keywords – Variables - Standard Data Types. Operators - Statement and Expression - String Operations - Boolean Expressions - Control Statements - Iteration - While Statement - Input from Keyboard.

Unit II **(15 Hours)**

Functions: Built-in functions - Composition of functions - User defined functions - Parameters and Arguments - Function Calls - The return Statement - Python Recursive Function - The Anonymous Functions – Writing Python Scripts. Strings**:** Compound Data Type - Len Function - String Slices - Strings are Immutable - String Traversal - Escape Characters - String Formatting Operator - String Formatting Functions.

Unit III **(15 Hours)**

Lists: Values and Accessing Elements - Lists are Mutable - Deleting Elements from List- Built-in list Operators - Built-in List Methods. Tuples**:** Creating Tuples - Accessing values in Tuples - Tuples are Immutable - Tuple Assignment - Tuples as Return Values - Variable Length Argument Tuples - Basic Tuple Operations - Built-in Tuple Functions.

20PMA208

Unit IV **(15 Hours)**

Dictionaries: Creating a Dictionary - Accessing values in a Dictionary - Updating Dictionary - Deleting elements from Dictionary - Properties of Dictionary keys - Operations in Dictionary - Built-in Dictionary methods. Classes and Objects: Overview of OOP - Class Definition - Creating Objects - Objects as arguments - Objects as Return Values - Built-in class attribute - Inheritance - Method Overriding - Data Encapsulation - Data Hiding.

Unit V **(15 Hours)**

Files: Text files: Opening a file - Closing a file - The file object attributes - Writing to a file - Reading from a file - Renaming a file - Deleting a file - Files related methods. Directories: mkdir(), chdir(), getcwd(), rmdir(). Exceptions: Built-in exceptions - Handling exceptions - Exception with arguments - User defined exceptions.

* - Self Study and questions for examinations may be taken from the self study portions also.

Teaching Methods:

Chalk and Talk, Smart Class Room, PowerpointPresentation, Seminar, Quiz&Discussion

Text Book:

1. E. Balagurusamy,Problem Solving and Python Programming, First Edition , 2017, McGraw-Hill Education (India) Pvt. Ltd, Chennai.

Reference Books:

1. Ashok NamdevKamthane, Amit Ashok Kamthane, Programming and Problem Solving with Python, McGraw-Hill, First Edition, 2017.
2. Martin Jones, Python for Complete Beginners, Createspace Independent Publisher, First Edition, 2015.
3. S.A. Kulkarni, Problem Solving and Python Programming, Yes Dee Publishing Pvt. Ltd, First Edition, 2017 .

Mapping

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	S	H	M	S	S
CO2	S	S	H	H	H
CO3	H	M	S	S	H
CO4	M	S	M	H	S

S – Strong **H** – High **M** – Medium **L** – Low

20PMA2CL

Programme Code : 02		**M.Sc. Mathematics**		
Course Code: 20PMA2CL		**Core Practical 1–** Programming in Python - Practical		
Batch 2020-2022	Semester II	Hours / Week 2	Total Hours 30	Credits 2

Course Objectives

1. To gain knowledge about the concepts of Python programming.
2. To solve algebraic and non-linear ordinary differential equations using Python programs.
3. To enhance the students to develop the program writing skills for mathematical problems.

Course Outcomes (CO)

K3- K5	CO1	Utilizing Python program for finding the Numerical solutions of Algebraic and Transcendental Equations.
	CO2	Analyzing the GCD, interpolation values and File management using Python programs
	CO3	Applying, compiling and debugging programs with the help of Python.

LIST OF PRACTICAL PROGRAMS

1. Program to determine the Greatest Common Divisor (GCD) of any two integers.
2. Program to accept two complex numbers and find their sum.
3. Program to generate random numbers.
4. Program to display the Pascal's triangle.
5. Program to find the number of instances of different digits in a given number.
6. Program to find the number of vowels and consonants in a text string.
7. Program to find the numerical solution of algebraic and transcendental equations by using
   (i) Bisection Method.
   (ii) Newton Raphson Method.
8. Program to solve an ordinary differential equation by using Fourth order Runge-Kutta Method.
9. Program to find the interpolation value using Lagrange's method.
10. Program to find the inverse of a matrix by Gauss Jordan method.
11. Program to solve the simultaneous equations by
    (i) Gauss Elimination Method
    (ii) Gauss Seidel Method

12. Program to demonstrate File Input and Output operations.

13. Program to demonstrate Classes and their Attributes.

Distribution of Marks in ESE			**CIA**		
Experiment	:	50	CIA Practical Exam	:	25
Record	:	10	Attendance	:	5
			Observation Note Book	:	10
Total		**60**	**Total**		**40**

To be awarded jointly by the internal and external examiners

Teaching Methods

Chalk and Talk / Power point presentation/ Seminar/Quiz/Discussion/Assignment

Mapping

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	H	H	S
CO2	M	M	H	H	M
CO3	H	S	S	S	M

S - Strong; **H**-High; **M**-Medium; **L**-Low

20PMA309

Programme Code : 02		M. Sc Mathematics		
Course Code: 20PMA309		Core Paper 9 TOPOLOGY		
Batch	**Semester**	**Hours / Week**	**Total Hours**	**Credits**
2020-2022	III	7	105	5

Course Objectives

1. To get basic knowledge in topology and topological spaces.
2. To study the concepts of Compactness and Connectedness.
3. To know the concept of countability axioms.

Course Outcomes (CO)

K1 to K4	CO1	Recalling the concept of Basis for a topology.
	CO2	Classifying the ideas of product topology and metric topology.
	CO3	Applying countability and separation axioms in proving Urysohn lemma and UrysohnMetrization theorem.
	CO4	Analyzing the concepts of limit point compactness and local compactness.

Syllabus

UNIT I **(18 Hours)**

Topological Spaces – **Basis for a topology*** – The order topology – The product topology on X x Y – Closed sets and Limit Points.

UNIT II **(18 Hours)**

Continuous functions - The product topology –The metric topology.

UNIT III **(24 Hours)**

Connected spaces* – Connected subspaces of the real line – Components and Local Connectedness.

UNIT IV **(24Hours)** Compact Spaces – Compact subspaces of the real line - Limit Point Compactness- Local compactness.

20PMA309

UNIT V **(21 Hours)**

The countability axioms – The separation axioms –The Urysohn Lemma – UrysohnMetrization Theorem.

*** denotesSelf study(Questions may be taken from these portions also).**

Teaching Methods

Chalk and Talk / Power point presentation/ Seminar/Quiz/Discussion/Assignment/ Smart Class Room

Text Book

James R.Munkers, Topology, Second Edition , Prentice Hall of India Pvt. Ltd., New Delhi, 2011.

Unit I	Chapter 2	Sections 12 to 15, 17
Unit II	Chapter 2	Sections 18, 19, 20
Unit III	Chapter 3	Sections 23,24,25
Unit IV	Chapter 3	Sections 26,27,28,29
Unit V	Chapter 4	Sections 30,31,33,34

Reference Books

1. J.Dugundji, Allyn and Bacon, Topology, Prentice Hall of India Pvt. Ltd, New Delhi 1966.
2. George F.Simmons, Introduction to Topology and Modern Analysis, McGraw Hill Book Company, 1963.
3. Sze-Tsen Hu, Elements of General Topology, Holden – Day, Inc. 1965.

Mapping

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	H	H	H	H	M
CO2	S	M	S	M	H
CO3	M	S	H	H	H
CO4	H	S	S	S	S

S - Strong; **H**-High; **M**-Medium; **L**-Low

20PMA310

ProgrammeCode : 02		M. Sc Mathematics		
Course Code: 20PMA310		Core Paper 10 FUNCTIONAL ANALYSIS		
Batch	**Semester**	**Hours / Week**	**Total Hours**	**Credits**
2020-2022	III	7	105	5

Course Objectives

1. To know the concepts of Normed linear spaces, Banach spaces and Hilbert spaces.

2. To understand the ideas of Uniform boundedness principles, closed graph theorem and Open mapping theorem.
3. To comprehend the notions of spectral radius, the spectral theorem and Operators on Hilbert spaces.

Course Outcomes (CO)

K1 to K4	CO1	Remembering the concepts of semi norms and Quotient spaces.
	CO2	Understanding the ideas of Uniform boundedness principles.
	CO3	Applying the concepts of eigenspectrum on normed linear spaces and spectral radius on Banach spaces.
	CO4	Analyzing the results of Adjoint, Self-Adjoint, Normal and Unitary Operators defined on Hilbert spaces.

Syllabus

UNIT I **(21 Hours)**

Normed Linear spaces: Norm on a Linear Space – Examples of Normed Linear Spaces(Cauchy-Schwarz inequality in K^n, Holder's inequality in $\mathcal{F}(\mathcal{N},\mathcal{K})$, Minkowski's inequality in $\mathcal{F}(\mathcal{N},\mathcal{K})$only). **Semi norms and Quotient Spaces*** – Product Space and Graph Norm – Inner product spaces – Banach Spaces.

UNIT II **(21 Hours)**

Operators on Normed Linear Spaces : Bounded operators – Some basic results and Examples(excluding Fredholm integral operator, Lagrange interpolatory projection) – Norm on $\mathcal{B}(\mathcal{X},\mathcal{Y})$(Definitions only)- Riesz representation theorem. More about Hilbert Spaces : Orthonormal Sets and Orthonormal Bases – Bessel's Inequality. Hahn Banach Theorem and its Consequences : The Extension Theorem.

20PMA310

UNIT III **(21 Hours)**

Uniform BoundednessPrinciple : The Theorem and its Consequences –Closed Graph theorem and its Consequences: ` Closed Graph theorem – Bounded Inverse Theorem – Open Mapping Theorem.

UNIT IV **(21 Hours)**

Spectral Results for Banach Space Operators :Eigenspectrum and Approximate Eigenspectrum (Definitions and theorem statement only) – Spectrum and Resolvent set – Spectral Radius - Spectral Mapping Theorem.

UNIT V **(21 Hours)**

Operators on Hilbert Spaces : Adjoint of an Operator(Definitions and theorem statements only) – Compactness of the Adjoint Operator - SesqilinearFunctionals - Self-Adjoint, Normal and Unitary Operators – Numerical range and Numerical Radius – Some Characterizations.

*** denotesSelf study(Questions may be taken from these portions also).**

Teaching Methods

Chalk and Talk / Power point presentation/ Seminar/Quiz/Discussion/Assignment/ Smart ClassRoom

Text Book

M. Thamban Nair, Functional Analysis – A First Course, Prentice Hall of India Pvt. Ltd., New Delhi, 2010.

Unit I	Chapter 2	Sections 2.1, 2.1.1, 2.1.2, 2.1.4, 2.1.5.
		Sections 2.2,
Unit II	Chapter 3	Section 3.1, 3.1.1, 3.3.
	Chapter 4	Sections 4.1, 4.2.
	Chapter 5	Section 5.1.
Unit III	Chapter 6	Section 6.1.
	Chapter 7	Sections 7.1, 7.2, 7.3.
Unit IV	Chapter 10	Sections 10.1, 10.2, 10.2.1, 10.2.2.
Unit V	Chapter 11	Sections 11.1, 11.1.1, 11.1.2.
		Sections 11.2, 11.2.1, 11.2.2.

20PMA310

Reference Books

1. C.Goffman and G.Pedrick, A First Course in Functional Analysis, Prentice Hill of India, New Delhi, 1987.
2. G.Bachman and L.Narici, Functional Analysis, Academic Press, New York 1966.
3. L.A.Lustenik and V.J.Sobolev, Elements of Functional Analysis, Hindustan Publishing Corporation, New Delhi, 1971.
4. A.E.Taylor, Introduction to Functional Analysis, John Wiley & Sons, New York, 1958.

Mapping

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	**S**	**S**	**S**	**S**	**S**
CO2	**S**	**S**	S	**S**	**S**
CO3	**S**	**S**	H	**S**	**S**
CO4	**S**	**S**	S	**S**	**S**

S - Strong; **H**-High; **M**-Medium; **L**-Low

20PMA311

Programme Code : 02		M. Sc Mathematics		
Course Code: 20PMA311		Core Paper 11 MATHEMATICAL STATISTICS		
Batch	**Semester**	**Hours / Week**	**Total Hours**	**Credits**
2020-2022	III	7	105	5

Course Objectives

1. To study the concepts of random variables and different types of distributions.
2. To determine the moments of the distribution function by using the characteristic functions.
3. To understand the Methods of finding estimates, Sample moments and their functions

Course Outcomes (CO)

K1 to K4	CO1	Remembering the random events and random variables of different distributions.
	CO2	Classifying the properties of characteristic functions of various distributions.
	CO3	Identifying the types of estimates for various probability distribution functions.
	CO4	Analyzing the functions by using various significance tests.

Syllabus

UNIT I **(21 Hours)**

Random Events: Preliminary remarks – **random events and operations performed on them*** – the system of axioms of the theory of probability – conditional probability – Bayes theorem – Independent Events – Random variables : the concept of a random variable – the distribution function – Random variables of the discrete type and the continuous type – functions of random variables – Multidimensional random variables – Marginal distributions – conditional distributions – Independent random variables – Parameters of the distribution of a random variable - Expected values – Moments – The Chebyshev inequality – Absolute moments.

UNIT II **(21 Hours)**

Characteristic functions : **Properties of characteristic functions*** – The characteristic function and moments – Semi - Invariants – The characteristic function of the sum of independent random variables – Determination of the distribution function by the characteristic function – The characteristic function of multidimensional random vectors – Probability generating functions.

Some probability distributions : One point and two point distributions – The Bernoulli scheme: The binomial distribution – The Poisson distribution.

20PMA311

UNIT III **(21 Hours)**

Some probability distributions – The uniform distribution – The normal distribution – the gamma distribution – The beta distribution – The Cauchy and Laplace distributions – Limit theorems : Preliminary remarks – Stochastic convergence – Bernoulli's law of large numbers – The convergence of a sequence of distribution functions – The Levy - Cramer theorem –The de Moivre Laplace theorem – The Lindeberg – Levy theorem.

UNIT IV **(21 Hours)**

The theory of Estimation: Preliminary notions – Consistent estimates – Unbiased estimates – The sufficiency of an estimate – The efficiency of an estimate – Asymptotically most efficient estimates – Methods of finding estimates (Method of moments and the method of maximum likelihood estimates only).

UNIT V **(21 Hours)**

Sample moments and their functions : The notion of a sample – The notion of a statistic – The distribution of the arithmetic mean of independent normally distributed random variables – The χ^2 distribution – Student's t- Distribution – Fisher's Z-distribution – Significance tests: The concept of a statistical test – Parametric tests for small samples – The χ^2 test – Independence tests by contingency tables.

*** denotesSelf study(Questions may be taken from these portions also).**

Teaching Methods

Chalk and Talk / Power point presentation/ Seminar/Quiz/Discussion/Assignment/ Smart Class Room

Text Book

MarekFisz, Probability theory and Mathematical Statistics, John Wiley & Sons, Inc, USA, 1980.

Unit I	Chapter 1	1.1 to 1.3, 1.5 to 1.7
	Chapter 2	2.1 to 2.8
	Chapter 3	3.1 to 3.4
Unit II	Chapter 4	4.1 to 4.7
	Chapter 5	5.1, 5.2 and 5.5

20PMA311

Unit III	Chapter 5	5.6 to 5.10
	Chapter 6	6.1 to 6.4, 6.6 to 6.8
Unit IV	Chapter 13	13.1 to 13.7
Unit V	Chapter 9	9.1 to 9.4, 9.6 and 9.7
	Chapter 12	12.1, 12.2, 12.4 and 12.7

References

1. Sheldon M. Ross, Introduction to Probability Models , 8th Edition , Academic Press, USA, 2006.
2. S.K.Gupta and V.K.Kapoor , Fundamentals of Mathematical Statistics, Sultan Chand and Sons, New Delhi, 2006.

Mapping

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	H	H	S	M
CO2	H	H	S	M	H
CO3	M	S	H	H	H
CO4	H	H	H	S	S

S - Strong; **H**-High; **M**-Medium; **L**-Low

Extra Departmental Course (EDC)				
Course Code : **20PMA3X1**		RESEARCH METHODOLOGY: APPROACHES AND TECHNIQUES		
Batch	**Semester**	**Hours / Week**	**Total Hours**	**Credits**
2020-2022	III	2	30	2

Course Objectives

1. To know the basic concepts of research process and its methodologies.

2. Todiscuss the concepts and procedures of sampling, data collection, analysis and reporting.

3. To develop the skills involved in hypothesis testing and its significance.

Course Outcomes (CO)

K1 – K4	CO1	Remembering the research problem and technique and defining a problem are developing a research Plan.
	CO2	Classifying the census and sample survey and different types of sample designs
	CO3	Analyzing the Hypothesis by using various significance tests.
	CO4	Identifying the population variance, Chi – square as a Non- parametric Test.

Syllabus

Unit-I **(6 Hours)**

Defining the Research Problem: What is a Research Problem? - Selecting the Problem -Necessity of Defining the Problem-Technique Involved in Defining a Problem -An illustration-Conclusion-Meaning of Research Design-Need for Research Design - Features of a Good Design- Important Concepts Relating to Research Design - Different Research Designs - ***Developing a Research Plan**.

Unit-II **(6 Hours)**

Sampling Design : Census and Sample Survey – Implication of a Sample Design – Steps in Sampling Design –Criteria of Selecting a Sampling Procedure – ***Characteristics of a Good Sample Design**- Different Types of Sample Designs - Random Sample from an Infinite Universe – Complex Random Sampling Designs.

Unit-III **(6 Hours)**

Testing of Hypothesis – Basic Concepts Concerning Testing of Hypothesis- Procedure for Hypothesis Testing –Tests of Hypotheses-Important Parametric Tests – Hypothesis Testing of Means - Hypothesis Testing for Difference between Means.

Unit-IV **(6 Hours)**

Hypothesis Testing for Comparing a Variance to Some Hypothesized Population Variance -Testing the Equality of Variances of two Normal Populations. Chi – square as a Non- parametric Test - Conditions for the Application of χ^2 Test – Steps Involved in Applying Chi-square Test.

Unit-V **(6 Hours)**

ANOVA – The Basic Principle of ANOVA – ANOVA Technique –Setting up Analysis of Variance Table – Short-cut Method for one-way ANOVA – Coding Method – Two-way ANOVA.

***denotes self study (Questions may be asked from these portions also)**

Teaching Methods

Chalk and Talk/Powerpoint presentation/Seminar/Quiz/Discussion/Assignment/Smart Class Room

Text Book

Dr.C.R.Kothari, Research Methodology: Methods and Application, 2nd Edition, New Age International (P) Limited, Publications, New Delhi, 2012.

Unit I	Chapter 2	Pages 24 to 29
	Chapter 3	Pages 31 to 35, 53
Unit II	Chapters 4	Pages 55 to 58, 61,62.
Unit III	Chapters 9	Pages 185-191, 195-213
Unit IV	Chapters 9	Pages 224-227
	Chapter 10	Pages 236-245
Unit V	Chapters 11	Pages 256-270

Reference Books

1. Panneerselvam.R, Research Methodology, 3rd Edition, Hall of India (Pvt.,),New Delhi, 2006.
2. Yogesh Kumar Singh, Fundamental of Research Methodology and Statistics, Ist Edition, New Age International (P) Ltd, New Delhi, 2006.
3. Santosh Gupta, Research Methodology and Statistical Techniques, Deep &Deep PublicationsPvt.Ltd, New Delhi, 2003.
4. Kenneth S.Bordens Bruce B.Abbott, Research and Design Methods A Process Approach, 6thEdition, Tata Mcgraw- Hill Publication, Company Ltd., New York, 2006.
5. P.Saravanavel, Research Methodology, Reprint, KitabMahal, Allahabad, 2008.
6. Pradeep Rohilla, Research Methodology, APH Publishing Corporation, New Delhi, 2017.

Mapping

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	M	H	S	M
CO2	M	H	S	M	H
CO3	S	M	S	H	S
CO4	H	S	S	H	S

S - Strong; **H**-High; **M**-Medium; **L**-Low

20PMA412

ProgrammeCode :02		M. Sc Mathematics		
Course Code: 20PMA412		Core Paper 12 MATHEMATICAL METHODS		
Batch	**Semester**	**Hours / Week**	**Total Hours**	**Credits**
2020-2022	IV	8	120	5

Course Objectives

1. To study the concept of Fourier transforms .
2. To impart analytical ability in solving variational problemsand integral equations.
3. Touse calculus of variation to find theextremum of a functional.

Course Outcomes (CO)

K1 to K4	CO1	Finding the solution of Fredholm and Volterra Integral equations.
	CO2	Explaining the method to reduce the differential equations to Integral equations.
	CO3	Solving Maximum or minimum of a functional using Calculus of Variation Techniques.
	CO4	Analyzing the Euler's finite difference method, the Ritz method and Kantorovich's method.

Syllabus

UNIT I **(24 Hours)**

Fourier Transforms: **Fourier sine and cosine transforms*** – Fourier transforms of derivatives – The Calculation of the Fourier transforms of some simple functions – The convolution integral – Parseval's theorem for cosine and sine transforms – the solution of PDEs by means of Fourier transforms – Laplace's equation in a half plane, infinite strip, semi infinite strip – Solutions of the Diffusion equation - the linear diffusion equation on a semi - infinite line – the two- dimensional diffusion equation.

UNIT II **(24 Hours)**

Introduction: Integral equations with separable kernels- Reduction to system of algebraic equations, Fredholm alternative – an approximate method, Fredholm integral equations of the first kind, method of successive approximations – Iterative scheme, Volterra integral equation, some results about the resolvent kernel, classical Fredholm theory- Fredholm's method of solution-Fredholm's first, second, third theorems.

20PMA412

UNIT III **(24 Hours)**

Application to ordinary differential equation – Initial value problem – boundary value problems– singular integral equation – Abel integral equation.

UNIT IV **(24 Hours)**

Calculus of Variations- Variation and its properties – Euler's equation – **functionals of the form** $\int_{x_0}^{x_1} F(x, y_1, y_2, ..., y_n, y_1', y_2', ..., y_n')\, dx$ ***** – functional dependent on higher order derivatives – functionals dependent on the functions of several independent variables – variational problems in parametric form –some applications.

UNIT V **(24 Hours)**

Direct Methods- Euler's finite difference method- the Ritz method – Kantorovich's method.

*** denotesSelf study(Questions may be taken from these portions also).**

Teaching Methods

Chalk and Talk / Power point presentation/ Seminar/Quiz/Discussion/Assignment/ Smart Class Room

Text Books

1. Ian. N.Sneddon, The use of integral Transforms, Tata McGraw-Hill Publishing Company Ltd., New Delhi, 1979. (For unit I only)

   Unit I Chapter 2 Sections 2.4 – 2.7, 2.9 , 2.10, 2.16.1 (a), (b), (c), 2.16 .2 (a), (b)

2. Ram. P.Kanwal, Linear equations theory and technique, Academic Press, New York & London, 1971. (For units II and III)

   Unit II Chapter 1 to Chapter 4

   Unit III Chapter 5 Sections 5.1 – 5.2

   Chapter 8 Sections 8.1 – 8.2

20PMA412

3. L.Elsgolts, Differential equations and the calculus of variations, MIR Publishers, Moscow, 1980. (For unit IV and V)

Unit IV Chapter 6 Sections 6.1- 6.7

Unit V Chapter 10 Sections 10.1- 10.4

Reference Books

1. Merle C Potter and Jack Goldberg, Mathematical Methods, 2nd Edition, Prentice Hall of India (P) Ltd, New Delhi, 2000.
2. C.Corduneanu, Integral Equations and Applications, Cambridge University Press, Cambridge, 1991
3. R.Weinstock, Calculus of Variations with Applications to Physics and Engineering, McGraw-Hill Book Co., Inc.,NewYork, 1952.

Mapping

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	M	H	S	M
CO2	H	H	S	M	H
CO3	H	S	H	H	H
CO4	H	H	H	S	S

S - Strong; **H**-High; **M**-Medium; **L**-Low

20PMA413

Programme Code : 02		M. Sc Mathematics		
Course Code:20PMA413		Core Paper 13 CONTROL THEORY		
Batch	**Semester**	**Hours / Week**	**Total Hours**	**Credits**
2020-2022	IV	8	120	5

Course Objectives

1.Toknow the basic results of Differential Equations and Fixed Point Methods.

2. To study the basics of observability, controllability, stability, stabilizability, optimal Control of linear and nonlinear system.

3. To develop skills to review research papers in the field of Controllability Problems.

Course Outcomes (CO)

K1 to K4	CO1	Choosing ordinary differential equations through state-space representations towards analyzing and designing dynamical systems.
	CO2	Understanding mathematical techniques to formulate and solve control theory problems.
	CO3	Solving the stability of the given linear and nonlinear system using matrix theory.
	CO4	Analyzing various optimal control formulations and necessary conditions of optimal control.

Syllabus

Unit I **(24 Hours)**

Motivation – **Basic Results of Differential Equations*** – Fixed point Methods – Observability of Linear systems – Non linear systems.

Unit II **(24 Hours)**

Controllability of Linear systems – Non linear systems.

Unit III **(24 Hours)**

Stability of Linear systems – Perturbed Linear systems – Non linear systems.

Unit IV **(24 Hours)**

Stabilizability –**Stabilization Via linear feedback control*** – The controllable Subspace – Stabilization with Restricted Feedback**.**

20PMA413

Unit V **(24 Hours)**

Optional Control – Linear Time varying systems – Time Invariant systems – Non linear systems.

*** denotes self study (Questions may be taken from these portions also).**

Teaching Methods

Chalk and Talk / Power point presentation/ Seminar/Quiz/Discussion/Assignment/Smart class room

Text Book

1. K. Balachandran and J. P. Daur, Elements of Control Theory, Narosa Publishing House, New Delhi, 2nd Edition 2012.
   - Unit I Chapter 1 Sections 1.1, 1.2, 1.3
     Chapter 2 Sections 2.1, 2.2
   - Unit II Chapter 3 Sections 3.1, 3.2
   - Unit III Chapter 4 Sections 4.1, 4.2, 4.3
   - Unit IV Chapter 5 Sections 5.1, 5.2, 5.3
   - Unit V Chapter 6 Sections 6.1, 6.2, 6.3

Reference Books

1. Gass.S, Control system theory and Applications, Pearson Education Ltd, Bangalore, 2007.
2. H. Hermes and J.P.Lasalle, Functional Analysis and Time Optimal Control, Academic Press, New York , 1969.
3. R.E.Kalman, P.L.Falband M.A. Arbib, Topics in Mathematical Systems Theory, McGraw Hill, New York, 1969.
4. D.L. Russell, Mathematics of Finite Dimensional Control Systems, Marcel Dekker, New York, 1979.

Mapping

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	H	H	S	M
CO2	H	H	S	M	H
CO3	M	S	H	H	H
CO4	H	H	H	S	S

S - Strong; **H**-High; **M**-Medium; **L**-Low

20PMA414

Programme Code:02		M. Sc Mathematics		
Course Code:20PMA414		Core Paper 14 OBJECT ORIENTED PROGRAMMING WITH C++ - THEORY		
Batch	**Semester**	**Hours / Week**	**Total Hours**	**Credits**
2020-2022	IV	5	75	4

Course Objectives

1. To enable the students to learn about the basic concepts of Object Oriented Programming Techniques, class structure, operators, functions in C++ and operators Overloading and Type Conversions.
2. To know the differences between object oriented programming and procedure oriented programming.
3. To apply object oriented techniques to solve the computing Problems.

Course Outcomes (CO)

K1 to K4	CO1	Finding solutions for problems in Mathematics, Engineering, Science and Technology using Object Oriented Programming.
	CO2	Classifying secured and unsecured data processing by applying Abstraction, Encapsulation and Information hiding.
	CO3	Constructing programmes using C++ features such as composition of objects, Inheritance and Polymorphism.
	CO4	Analyzing the concepts of Object Oriented Programming to solve real world problems.

Syllabus

UNIT I **(15 Hours)**

Principles of Object- Oriented Programming

Software crisis – Software evolution – A look at procedure-oriented programming – Object oriented programming paradigm – Basic concept of Object -oriented programming – Benefits of OOP – Object Oriented Languages – **Applications of OOP *.**

UNIT II **(15 Hours)**

Tokens, Expressions and Control Structures

Introduction – **Tokens – Keywords*** – Identifiers and constants – Basic data types – User Defined data types – Derived data types – Symbolic constants – Type compatibility – Declaration of variables – Dynamic initialization of variables – Reference variables – Operators in C++ - Scope resolution operator – Member Dereferencing operators - Memory management operators –

Manipulators – Type cast operator – Expressions and their Types – Special assignment expressions – Implicit conversions – Operator overloading – Operator precedence – Control structures.

UNIT III **(15 Hours)**

Functions in C++

Introduction – The main function – Function prototyping – Call by reference – Return by reference- Inline functions – Default arguments – Constant arguments – Function overloading – Friend and virtual functions – Math Library functions. **Managing Console I/O operations** Introduction – C++ streams - C++ stream classes – Unformatted I/O operations – Formatted Console I/O operations – Managing Output with Manipulators.

UNIT IV **(15 Hours)**

Classes and Objects

Introduction – C structures revisited – Specifying a class – Defining member functions – A C++ program with class – Making an outside function inline – Nesting of member functions – Private member functions – Arrays within a class – Memory allocation for objects – Static data members – Staticmember functions – Arrays of objects – Objects as function arguments – Friendly functions – Returning objects – Constant member functions.

Constructors and Destructors

Introduction – Constructors – Parameterized Constructors – Multiple constructors in a class – Constructors with default arguments – Dynamic initializations of objects – Copy constructor – Constructing two- dimensional arrays – Constant objects – Destructors.

UNIT V **(15 Hours)**

Operators Overloading and Type Conversions

Introductions – Defining operator overloading – Overloading unary operators – Overloading Binary operators – Overloading Binary operators using friends – Manipulation of strings using operators – Rules of overloading operators.

20PMA414

Inheritance: Extending Classes

Introduction – Defining Derived Classes – Single inheritance – Making a Private member inheritable – Multilevel inheritance – Multiple inheritance – Hierarchical inheritance – Hybrid inheritance – Virtual Base Classes – Abstract Classes – Constructors in Derived Classes – Member Classes – Nesting of Classes.

***denotes Self study (Questions may be taken from these portions also).**

Teaching Methods

Chalk and Talk / Power point presentation/ Seminar/Quiz/Discussion/Assignment/ Smart Class Room

Text Book

E.Balaguruswamy, Object Oriented Programming with C++, Tata McGraw Hill Publishing Company Ltd, 1999.

Unit I	Sections 1.1 to 1.8
Unit II	Sections 3.1 to 3.24
Unit III	Sections 4.1 to 4.11 & 10.1 to 10.6
Unit IV	Sections 5.1 to 5.17 & 6.1 to 6.7, 6.9 to 6.11
Unit V	Sections 7.1 to 7.7 & 8.1 to 8.12

Reference Books

1.AshokN.Kamthane, Object Oriented Programming with ANSI and TURBO C++, Pearson Education (P) Ltd, 2003.

2. BjarmeStroustrup, The C++ Programming Language, AT & T Labs, Murray Hill, New Jersey, 1998.

Mapping

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	H	S	H	S
CO2	H	S	H	M	H
CO3	S	H	S	S	S
CO4	M	S	M	H	M

S - Strong; **H**-High; **M**-Medium; **L**-Low

20PMA4CM

Programme Code : 02		M. Sc Mathematics		
Course Code:20PMA4CM		Core Practical 2 OBJECT ORIENTED PROGRAMMING WITH C++ - PRACTICAL		
Batch	**Semester**	**Hours / Week**	**Total Hours**	**Credits**
2020-2022	IV	2	30	2

Course Objectives

1. To identify and formulate the techniques of software development using Object Oriented Programming concepts.
2. To find the solution of complex problems spanning the breadth of the C++ Programming language.

3. To write programs for problems in various domains like Mathematics, Science, Technology and real world problems.

Course Outcomes (CO)

K3 to K5	CO1	Applying the concepts of Object Oriented Program for building object based applications.
	CO2	Analyzing different logic with suitable validations for a given problem.
	CO3	Interpret and design the Exception Handling Techniques for resolving run-time errors using file I/O.

LIST OF PRACTICAL

OBJECT AND CLASSES

1. Create a class ARITH which consists of a FLOAT and an INTEGER variable. Write member functions ADD ( ), SUB ( ) , MUL ( ) , DIV ( ), MOD ( ) to perform addition, subtraction , multiplication, division and modulus respectively. Write member functions to get and display values.

2. Create a class metre with member functions take ( ) and show ( ) to convert metres into kilometres and centimetres and show the results.

5 hrs

CONTROL STRUCTURES

3.Write a program to evaluate the following function to 0.00001% accuracy

(i) $\sin x = x - \frac{x^3}{3!} + \frac{x^5}{5!} - \frac{x^7}{7!} + \ldots$

(ii) $\cos x = 1 - \frac{x^2}{2!} + \frac{x^4}{4!} - \frac{x^6}{6!} + \ldots$

4. Write a program to calculate the variance and standard deviation of N numbers. 4 hrs

20PMA4CM

CONSTRUCTORS AND DESTRUCTORS

5. Create a class complex with float variables. Add two complex values using overloaded constructors. 4 hrs

OPERATOR OVERLOADING

6. Create a class MAT has a 2 D matrix and R& C represent the rows and columns of the matrix. Overload the operators + , - , * to add , subtract and multiply two matrices. Write member functions to get and display MAT object values.

7. Create a class STRING. Write member functions to initialize, get and display strings. Overload the operator + to concatenate two strings , = = to compare 2 strings and a member functions to find the length of the string. 6 hrs

INHERITANCE

8. Create a class which consists of EMPLOYEE detail like eno ,ename, dept, basic salary, grade. Write member functions to get and display them. Derive the class PAY from the above class and write a member function to calculate da, hra, pf, depending on the grade and display thePayslip in a neat format using console I/ O.

9. Create a class SHAPE which consists of two VIRTUAL FUNCTIONS Cal _ Area ( ) and Cal _ Peri to calculate Area and perimeter of various figures. Derive three classes SQUARE, RECTANGLE and TRIANGLE from the class SHAPE and calculate Area and perimeter of each class separately and display the results*.

10. Create two classes which consists of two private variables, one integer and one float variable in each class. Write member functions to get and display them. Write a FRIEND function common to arguments and the integer and float values of both the objects separately and display the results. 7 hrs

CONSOLE I / O

11. Write a user defined function USERFUN ( ) which has the formatting commands like setw ( ), showpoint , showpos, precision ( ) . Write a program which prints a multiplication table and uses USERFUN ( ) for formatting.

12. Write a program to read the name, number, meter reading, consumed units and print out the same and the total bill amount* . 4 hrs

20PMA4CM

Distribution of Marks in ESE

Experiment	:	50
Record	:	10
Total		**60**

CIA

CIA Practical Exam	:	25
Attendance	:	5
Observation Note Book	:	10
Total		**40**

To be awarded jointly by the internal and external examiners

Mapping

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	H	H	S	M	S
CO2	H	S	H	S	M
CO3	M	S	M	M	S

S - Strong; **H**-High; **M**-Medium; **L**-Low

20PMA4Z1

ProgrammeCode :02	M. Sc Mathematics
Course code: 20PMA4Z1	Project
Batch2020-2022	**Credits**:4

CourseObjectives

1.To study the basic concepts related to the Project work.

2.To know the respective research fields.

3. To know the concept of writing a dissertation in an effective way.

Course Outcomes (CO)

K3 to K5	CO1	Applying the relative notions in the respective areas and finding the results.
	CO2	Analyzing results with the existing results.
	CO3	Interpreting the results with suitable examples.

Mapping

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	S	H	H
CO2	H	S	S	M	S
CO3	S	H	H	S	M

S - Strong; **H**-High; **M**-Medium; **L**-Low

20PMA0D1

ProgrammeCode : 02	M. Sc Mathematics
Course code: 20PMA0D1	ALC 1 DISCRETE MATHEMATICS AND AUTOMATA THEORY
Batch2020-2022	**Credits** 2

Course Objectives

1. To understand mathematical foundations to create mathematical arguments.
2. To enable to know how lattices and Boolean algebra are used as mathematical models of network systems.
3. To know about Automata Theory and its applications.

Course Outcomes (CO)

K1 to K4	CO1	Remembering the concepts of Mathematical logic.
	CO2	Explaining the implication problems using truth table , replacement process and rules of inference.
	CO3	Solving normal forms of given logical expression.
	CO4	Analyzing Karnaugh map for simplifying the Boolean expression.

Syllabus

UNIT I

Logic – introduction* – T F – statements – Connectives - atomic and compound statements – well formed formulae – Truth Table of a formula – Tautology

UNIT II

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

UNIT III

Theory of inference – indirect method of proof - open statements - Quantifiers

UNIT IV

Boolean algebra – Boolean Polynomials – Karnaugh map (K – map for 5 variables and 6 variables are not included) Switching circuits (simple circuits)

20PMA0D1

UNIT V

Theory of Automata – **definition – description*** – transition systems – properties – acceptability of a string by a finite automaton – Non deterministic finite state machines - the equivalence of DFA and NDFA - Mealy and Moore models

Text Books

1. M.K Venkataraman ,N.Sridharan and N.Chandrasekaran , Discrete mathematics - The National Publish Company, New Delhi, 2000.

Unit I	Chapter 9	Sections 1, 2, 3, 4, 5, 6, 7
Unit II	Chapter 9	Sections 8, 9, 10, 11, 12,
Unit III	Chapter 9	Sections 13, 1 4, 15
Unit IV	Chapter 10	Sections 5, 6, 7, 8

2. K.L.P Mishra &N.Chandrasekaran, Theory of computer sciences, Second Edition, Prentice Hall of India Private Ltd., 2001

Unit V	Chapter 2	Sections 2.1, 2.2, 2.3, 2.4, 2.5, 2.6, 2.7, 2.8

Reference Books

1. J.P.Trembley and R.Manohar , Discrete Mathematical Structures with applications to Computer Science, International Edition, McGraw Hill, 1975.

Mapping

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	H	S	M	M
CO2	H	S	H	M	M
CO3	S	H	S	M	M
CO4	M	S	M	H	M

S - Strong; **H**-High; **M**-Medium; **L**-Low

20PMA0D2

ProgrammeCode :02	M. Sc Mathematics
Course code: 20PMA0D2	ALC 2ASTRONOMY
Batch 2020-2022	**Credits** 2

Course Objectives

1. To acquire the knowledge about the celestial objects and planets.
2. Develop skills to design observing projects with research telescopes and projects drawing upon data in the literature and in archives.
3. To be familiar with the appearance of a range of common astronomical objects, such as asteroids, comets, satellites, planets, stars, and galaxies.

Course Outcomes(CO)

K1 to K4	CO1	Defining about the observed properties of physical systems that comprise the known universe.
	CO2	Demonstrate their ability to read, understand, and critically analyze the astronomical/physical concepts
	CO3	Applying their physics and mathematical skills to problems in the areas of planetary science.
	CO4	Analyze to draw valid scientific conclusions and communicate those conclusions in a clear and articulate manner.

Syllabus

UNIT I Celestial sphere, Diurnal Motion – Celestial Co-ordinates.

UNIT II The Earth: **Zones of Earth*** – Terrestrial Latitudes and Longitudes – Dip of Horizon – Twilight.

UNIT II Refraction

UNIT IV **Kepler's laws*,** seasons – calendar

UNIT V The moon – eclipses.

20PMA0D2

Text Book

S.Kumaravelu and SusheelaKumaravelu, Astronomy for Degree classes,

Rainbow Printers, Nagercoil, 2000.

Unit I	Chapter II	Sections 39 to 79
Unit II	Chapter III	Sections 1, 2, 5 ,6
Unit III	Chapter IV	
Unit IV	Chapter VI	
	Chapter VII	Sections 2, 3
Unit V	Chapter XII	

Chapter XIII.

Reference

1. V.B.Bhatia , Text book for Astronomy and Astrophysics with elements of Cosmology,

   2nd Edition, Narosa Publishing House, New Delhi, 2001.

Mapping

	PSO1	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	H	M	S	H	S
CO2	M	S	H	S	H
CO3	S	H	S	H	M
CO4	H	S	M	M	S

S- Strong; H-High; M-Medium; L-Low

20PMA0D3

ProgrammeCode : 02	M. Sc Mathematics
Course code: 20PMA0D3	ALC 3 INTERNET AND JAVA PROGRAMMING
Batch2020-2022	**Credits** 2

Course Objectives

1. To understand the difference between C, C++ and Java Programs.
2. To explore the Java Applications and to identify the variations between Stand alone java applications and Web based applications.
3. To provide the advanced concepts in java programming like Package, Multi Thread and Applet.

Course Outcomes (CO)

K1 to K4	CO1	Remembering the basic concepts of OOPs, Data Types, Control Statements and Tokens.
	CO2	Understanding about the java statements.
	CO3	Applying the concept of Package, Thread and Applet in program
	CO4	Inspect the java concepts and get the new innovative ideas.

Syllabus

UNIT I

Introduction to internet – Design concepts – Introduction to internet – Resources of Internet – Hardware requirements – Software requirements of internet – internet Service Providers – Internet Addressing. Introduction to web – Using the web – URL schemes – Host names and port numbers – **Using the browser – Hypertext and HTML *.**

UNIT II

Java history - Java features – Java Differs from C and C++ - Java and internet – Java Environment – **Java program structure – Java tokens*** – Java statements – Implementing java program – Java virtual machine – command line arguments – constant s- variables – data types – operator and expressions – Decision making and looping.

20PMA0D3

UNIT III

Classes – Defining a class – Adding variables – Adding methods – creating objects – Accessing class members – constructors – methods overloading – static numbers – nesting of methods – inheritance – overloading methods – final variables and methods – find class – finalizer methods -abstract methods and class – visibility control – arrays – creating an array – Two dimensional arrays – vectors – Wrapper – classes – interfaces – multiple inheritance.

UNIT IV

Packages – Java API packages – Using system packages – naming conventions – creating packages – Accessing a package – using a package – Adding a class to a package – hiding classes. Multithreaded programming – creating threads – extending a thread class – stopping and blocking a thread – life cycle of a thread – using thread methods - thread exceptions – thread priority – Synchronization – managing errors and exceptional.

UNIT V

Applet programming – Building Applet code – Applet life cycle – creating an executable applet – AWT – Graphics Programming.

Text Books

1. E. Balagurusamy, Programming with Java, Tata Mcgraw Hill, 1998.
2. Harley Hahn, The Internet Complete Reference, 2nd Edition – Tata Mcgraw Hill, 1996.
3. PatricNaughton, Java Hand Book, Tata Mcgraw Hill, 1996

Reference Books

1. Wendy G.Lehnert, Internet, 101 Pearson Education Asia, Addison Wesley Longman , 2001.
2. Ned Snell, Teach yourself the Internet in 24 hours, Published by G.C.Jain for Techmedia, 1998.
3. C.Muthu, Programming with Java, Vijay Nicole irnprints Pvt., Ltd, 2004.

20PMA0D3

4. H.M.Deitel, P.J.Deitel, Java ™ Hour to program, Pearson Education pre Ltd., 2005.

Mapping

	PSO1	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	H	M	S	H	S
CO2	M	S	H	S	H
CO3	S	H	S	H	M
CO4	H	S	M	M	S

S- Strong; H-High; M-Medium; L-Low

ProgrammeCode : 02	M. Sc Mathematics		
Major Elective Paper -FLUID DYNAMICS			
Batch 2020-2022	**Hours / Week** 7	**Total Hours** 105	**Credits** 5

Course Objectives

1.To have a good understanding of the fundamental equation of viscous compressible fluid.
2.To enable to Bernoulli equations, Momentum theorems and its applications.
3.To understand the motion of solid bodies in fluid and sound knowledge of boundary layer theory.

Course Outcomes (CO)

K1 to K4	CO1	Defining the fundamental aspects of fluid flow behaviour.
	CO2	Classifying the flow patterns of a fluid (gas or liquid) depend on its characteristic.
	CO3	Utilizing the fluid dynamics to analyze the flow of air over the surface to calculate pressure, changes in velocity using the Blasius's equation.
	CO4	Analyzing the steady state kinetic energy equation for fluid flow systems and estimate pressure drop in fluid flow systems.

Syllabus

UNIT I **(21Hours)**

Introductory Notions – Velocity – Stream Lines and path lines – Stream tubes and Filaments – Fluid Body – Density –pressure*. Differentiation following the fluid – Equation of continuity – Boundary conditions (Kinematical and physical) - Rate of change of linear momentum – Equation of motion of an inviscid fluid.

UNIT II **(21Hours)**

Euler's momentum theorem - conservative forces - Bernoulli's theorem in steady motion – Energy equation for inviscid fluid – circulation – Kelvin's theorem – vortex motion – Helmholtz equation.

UNIT III **(21Hours)**

Two-dimensional motion* – two-dimensional functions – complex potential -Basic singularities – source, vortex and doublet. Circle theorem - Flow past a circular cylinder with circulation – conformal transformation – Blasius's theorem – lift force.

UNIT IV **(21Hours)**

Viscous flow – Navier Stokes Equations – vorticity and circulation in a viscous fluid – steady flow through an arbitrary cylinder under pressure – steady couette flow between cylinders in relative motion – steady flow between parallel planes.

UNIT V **(21Hours)**

TheLaminar boundary layer in incompressible flow - Boundary layer concept – Boundary layer equations. Displacement thickness – momentum thickness – kinetic energy thickness – integral equation of boundary layer – flow parallel to semi-infinite flat plate – Blasius's equation and its solution in series.

*** denotesSelf study(Questions may be taken from these portions also).**

Teaching Methods

Chalk and Talk / Power point presentation/ Seminar/Quiz/Discussion/Assignment/Smart Class Room

Text Books

1. L.M.Milne Thomson, Theoretical Hydro dynamics, Macmillan Company, Vedition, 1968. (For Units I and II)

Unit I	Chapter 1	Sections1.0 – 1.3
	Chapter 3	Sections 3.10 – 3.40 (omit sections 3.32)
Unit II	Chapter 3	Sections 3.41 to 3.53 (omit sections 3.44)

2. N.Curle and H.J.Davies, Modern Fluid Dynamics – Vol. I, D.Vannostrand Company Ltd, London, 1968. (For Units III, IV and V)

Unit III	Chapter 3	Sections 3.1 – 3.7 (omit 3.4 & 3.5.3)
Unit IV	Chapter 5	Sections 5.1 to 5.3 (omit 5.3.4 and 5.3.5)
Unit V	Chapter 6	Sections 6.1 – 6.3 (omit 6.2.2 and 6.3.2 to 6.3.5)

Reference Books

1. F.Chorlton, Text book of Fluid Dynamics , CBS Publishers and distributors, New Delhi-32,1998.
2. M.D.Raisinghawia, Fluid Dynamics, S.Chand and Company Ltd, New Delhi - 55,

1995.

Mapping

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	H	M	H	H
CO2	H	S	M	M	H
CO3	S	H	M	H	H
CO4	H	M	H	H	S

S - Strong; **H**-High; **M**-Medium; **L**-Low

Programme Code : 02	M. Sc Mathematics		
Major Elective Paper - GRAPH THEORY			
Batch	**Hours / Week**	**Total Hours**	**Credits**
2020-2022	7	105	5

Course Objectives

1. It enables students to impart the different concepts of theory of graphs.
2. The study helps to modelling the real word problems to get solutions.
3. It motivates the students to pursue research.

Course Outcomes (CO)

K1 to K4	CO1	Remembering different types of graphs and their applications
	CO2	Understand various operations on graphs
	CO3	Analysis the applications of different parameters of a graph.
	CO4	Applying the concept of chromatic and domination numbers and its real life applications

Syllabus

Unit I **(21 hours)**

Basic results - Basic concepts - Sub graphs - Degrees of vertices – Paths Connectedness - Operations on graphs.

Unit II **(21 hours)**

Connectivity - Vertex cut and edge cut - Connectivity and edge connectivity - Trees –Definitions, Characterization and simple properties - Centers and Centroids

Unit III **(21 hours)**

Independent sets and Matchings: Introduction - Vertex independent sets and Vertex covering - Edge independent sets - Matching and factors - Eulerian andHamiltonian graphs: Introduction - Eulerian graphs.

Unit IV **(21 hours)**

Graph Colorings: Introduction - Vertex colorings - Critical graphs. Planarity: Introduction - Planar and Non Planar graphs - Euler formula and its consequences – K_5 and $K_{3,3}$ are non- planar.

Unit V **(21 hours)**

Triangulated in graphs: Introduction **– Perfect Graphs*** - Triangulated graphs – Domination in graphs: Introduction - Domination in graphs - Bounds for the domination number.

***denotes Self study (Questions may be taken from these portions also).**

Teaching Methods

Chalk and Talk / Power point presentation/ Seminar/Quiz/Discussion/Assignment/Smart Class Room

Text Books

1. R. Balakrishnan& K. Ranganathan, A Text Book of Graph Theory, Springer - Verlag New York, Inc., 2000.
   Unit 1 : Chapter I: Sections: 1.1 – 1.5 and 1.8 (Omit Exercise problems)
   Unit 2 : Chapter III : Sections: 3.1 – 3.2 ; Chapter IV: Sections: 4.1 – 4.3(Omit Exercise problems)
   Unit 3 : Chapter V : Sections : 5.1 – 5.4 ; Chapter VI : Sections: 6.0 – 6.2 (Omit Exercise problems)
   Unit 4 : Chapter VII: Sections : 7.1 – 7.3 ; Chapter VIII : Sections: 8.1 – 8.3 (Omit Exercise problems)
   Unit 5 : Chapter IX: Sections : 9.1 –9.3 ; Chapter X : Sections: 10.1 – 10.3 (Omit Exercise problems)

References

1. F. Harary, Graph Theory, Addison-Wesley, Reading Mass., 1969
2. J. A. Bondy and U. S. R. Murty, Graph theory with applications, The Mac Millan Press Ltd., 1976.
3. G. Chartrand and L. Lesniak, Graphs and Digraphs, Chapman and Hall, CRC, fourth edition, 2005.
4. J.Clark and D.A.Holton , A First look at Graph Theory, Allied Publishers, New Delhi, 1995.

Mapping

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	H	H	S	S
CO2	H	H	S	S	H
CO3	S	S	H	H	S
CO4	H	H	S	S	S

S - Strong; **H**-High; **M**-Medium; **L**-Low

ProgrammeCode : 02	M. Sc Mathematics		
Major Elective Paper- FUNDAMENTALS OF ACTUARIAL MATHEMATICS			
Batch 2020-2022	**Hours / Week** 7	**Total Hours** 105	**Credits** 5

Course Objectives

1 To use standard techniques of mathematics to solve problems in actuarial science

2. To calculate the values of Annuity and Annuity dues .

3.To know the concepts of Life insurance premiums, Temporary assurance, Whole Life assurance and the values of policies.

Course Outcomes (CO)

K1 to K4	CO1	Remembering the concept of Insurance policies and its benefits.
	CO2	Understanding the consequences of events involving risk and uncertainity.
	CO3	Applying various modelling techniques to evaluate quantitative risk analysis.
	CO4	Analysing the appropriate Life insurance plans suitable for the individual or concern.

Syllabus

UNIT I **(21 Hours)**

Annuities Certain – Present Values* – Amounts –Deferred Annuities – Perpetuities Present Value of an Immediate Annuity Certain – Accumulated Value of Annuity – Relation between S_n and a_n – Present Value of a Deferred Annuity Certain – Accumulated Value of a Deferred Annuity Certain – The Accumulated Value of an Annuity due of one p.a. for a term of n years – Perpetuity – Present Value of an Immediate Perpetuity of 1 p.a – Present Value of a Perpetuity due of 1 p.a – Deferred Perpetuity with Determent Period of m years – Mortality Table – The Probabilities of Survival and Death.

UNIT II **(21 Hours)**

Life Insurance Premiums – General Considerations* – Assurance Benefits – Pure Endowment Assurance – Endowment Assurance – Temporary Assurance or Term Assurance – Whole Life Assurance – Pure Endowment Assurance – Endowment Assurance – Double Endowment Assurance – Increasing Temporary Assurance – Increasing Whole Life Assurance – Commutation Functions D_x,C_x,M_x and R_x – Expressions for Present Values of Assurance - Benefits

in Terms of Commutation Functions – Fixed Term (Marriage) Endowment – Educational Annuity Plan.

UNIT III **(21 Hours)**

Life Annuities and Temporary Annuities – Commutation Functions N_x – To Find the Present Value of an Annuity Due of Re. 1 p.a for Life – Temporary Immediate Life Annuity – Expression for $a_{x:\,n}$ - Deferred Temporary Life Annuity – Variable Life Annuity - Increasing Life Annuity – Commutation Function S_x – Increasing - Temporary Life Annuity – Tables of Life Annuity and Temporary Life Annuity - Variations in the Present Values of Annuities – Life Annuities Payable at Frequent Intervals.

UNIT IV **(21 Hours)**

Net Premiums for Assurance Plans – Natural Premiums – Level Annual Premium – Symbols for Level Annual Premium under Various Assurance Plans – Mathematical Expressions for level Annual Premium under Level Annual Premium under Various Plans for Sum Assure of Re. 1 – Net Premiums – Consequences of Charging Level Premium – Consequences of Withdrawals – Net Premiums for Annuity Plans – Immediate Annuities Deferred Annuities.

UNIT V **(21 Hours)**

Premium Conversion Tables – Single Premium Conversion Tables – Annual Premium Conversion Tables – Policy Values - Two Kinds of Policy Values – Policy Value in Symbols – Calculation of Policy Value for Unit Sum Assure – Numerical Example: Retrospective Method and Comparison with Prospective Value – Derivative of Theoretical Expressions for Policy Value, ${}_tV_x$ by the Retrospective Method and Prospective Method – Other Expressions for Policy Value – Surrender Values – Paid up Policies – Alteration of Policy Contracts.

*** denotesSelf study(Questions may be taken from these portions also).**

Teaching Methods

Chalk and Talk / Power point presentation/ Seminar/Quiz/Discussion/Assignment/Smart Class Room

Text Book

Mathematical Basis of Life Assurance, Insurance Institute of India, Mumbai, June 2007.

Unit I	Sections II.1 to II.27
	Sections V.1 to V.7
Unit II	Sections VIII.1 to VIII. 6
	Sections IX .1 to IX.19
Unit III	Sections X.1 to X.16
Unit IV	Sections XI.1 to XI.7
	Sections XII.1 to XII.4
Unit V	Sections XIII.1 to XIII.6
	Sections XV.1 to XV.10

Reference Book

1. Statistics, Insurance Institute of India, Mumbai, 1989.

Mapping

	PSO1	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	H	S	S	H	S
CO2	M	S	H	S	H
CO3	S	H	M	H	M
CO4	H	S	M	M	S

S- Strong; H-High; M-Medium; L-Low

ProgrammeCode : 02	M. Sc Mathematics		
Major Elective Paper - CRYPTOGRAPHY			
Batch2020-2022	**Hours / Week** 7	**Total Hours** 105	**Credits** 5

Course Objectives

1.To enable the students to acquire the knowledge about Classical Cipher Systems**,** Shift Registers and Public Key systems.

2. To be familiar with information security awareness and a clear understanding of its importance.

3. To be exposed to the importance of integrating people, processes and technology.

Course Outcomes (CO)

K1 to K4	CO1	Remembering the basic encryption techniques.
	CO2	Understanding the cryptographic theories, principles and technique used in security properties.
	CO3	Constructing a range of different cryptosystems from an applied view point.
	CO4	Analyzing the methods of Cryptography

Syllabus

UNIT I **(21 Hours)**

Classical Cipher Systems: Introduction – **Transposition ciphers*** – Substitution ciphers – The Haselin Machine.

UNIT II **(21 Hours)**

The information themeticalapproach : The general scheme – The information measure and absolute security – The unicity distance.

UNIT III **(21 Hours)**

The Data Encryption Standard : The DES algorithm – Analysis of DES – The modes of the DES.

UNIT IV **(21 Hours)**

Shift Registers : Stream and block enciphering – The theory of Finite state machines – shift registers – Random properties of shift register sequences – The generating function.

UNIT V **(21 Hours)**

Public Key systems : Introduction – **The RSA system*** – Public Key systems based on elliptic curves.

*** denotesSelf study(Questions may be taken from these portions also).**

Teaching Methods

Chalk and Talk / Power point presentation/ Seminar/Quiz/Discussion/Assignment/Smart Class Room

Text Book

Jan C A Van Der Lubby, Basic Methods of cryptography , Cambridge University Press, 1998.

Unit I	Sections	2.1 to 2.4
Unit II	Sections	3.1 to 3.3
Unit III	Sections	4.1 , 4.4 and 4.5
Unit IV	Sections	5.1 to 5.5
Unit V	Sections	6.1, 6.2 and 6.5

Reference Books

K.Blitz N.A., course in number theory and cryptography, Springer verlag, 1988.

Mapping

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	M	S	S	H	S
CO2	M	S	H	M	H
CO3	S	H	S	H	M
CO4	H	S	M	M	S

S - Strong; **H**-High; **M**-Medium; **L**-Low

Programme Code : 02	**M.Sc Mathematics**		
Major Elective Paper : **STOCHASTIC PROCESSES**			
Batch	**Hours / Week**	**Total Hours**	**Credits**
2020-2022	7	105	5

Course Objectives

1. To know the basic concepts of Laplace transforms.
2. To study the fundamentals of stochastic process.
3. To know the applications of queuing systems.

Course Outcomes(CO)

K1 to K4	CO1	Remembering the basic concepts of Difference equations.
	CO2	Understanding the concepts of Markov chains.
	CO3	Identifying the concepts of Poisson process and related distributions.
	CO4	Analyzing Stochastic process in queuing and reliability.

Syllabus

UNIT I **(15 Hours)**

Generating function – Laplace transforms – Laplace transforms of a probability distribution function Difference equations – Differential difference equations – *__Matrix analysis__.

UNIT II **(15 Hours)**

Stochastic process – notion – specification – stationary process – Markov chains – Definition and examples – Higher transition probabilities.

UNIT III **(15 Hours)**

Classification of states and chains – Determination of Higher transition probabilities – stability of Markov system – limiting behavior.

UNIT IV **(15 Hours)**

Poisson process and related distributions – generalization of Poisson process – Birth and death process.

UNIT V **(15 Hours)**

Stochastic process in queuing and reliability – queuing systems, m/m/1 models – Birth and death process in queuing theory – Mutti channel models – Bulk Queues.

*** denotes self study (Questions may be asked from these portions also)**

Teaching methods

Chalk and Talk/Power point Presentations/Group discussions/Seminar /Assignment/Smart Class Room

Text Book

J. Medhi, Scope and treatment as in "Stochastic Process" ,Wiley Publishers,1994.

Reference Books

1. First course in Stochastic Process by Samuel Kartin.
2. Stochastic Process by Srinivasan and Metha (TATA McGraw Hill)
3. Elements of Applied Stochastic Process by V. Narayanan.

Mapping

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	M	H	M	S
CO2	H	S	M	H	S
CO3	S	M	M	S	H
CO4	M	H	S	H	M

S- Strong; H-High; M-Medium; L-Low

Programme Code : 02	**M.Sc Mathematics**		
Major Elective **–** Mathematical Modeling			
Batch	**Hours / Week**	**Total Hours**	**Credits**
2020-2022	7	105	5

Course Objectives

1. To understand physical systems through Mathematical models.
2. To understand applications of differential equations, difference equations and graph theory in Mathematical modelling.

Course Outcomes (CO)

K1 to K4	CO1	Remembering the basic concepts of differential equations.
	CO2	Understanding the properties Mathematical Models.
	CO3	Identifying difference equations through modeling.
	CO4	Analyzing the concepts of seven bridge problem.

Syllabus

UNIT I **(15 Hours)**

Ordinary differential equation – Linear growth model – Growth of science and scientists – Non-linear growth and decay models – Diffusion of glucose or a medicine in the bloodstream. .

UNIT II **(15 Hours)**

Modelling in population dynamics – Prey-predator models – Competition models – Multi-species models – Modeling of epidemics – Simple epidemic models – A model for diabetic-mellitus.

UNIT III **(15 Hours)**

Modeling in second order ODE – Modelling of planetary motion – Motion under central force – *__Circular motion__ – Elliptic motion of a satellites – Rectilinear motion.

UNIT IV **(15 Hours)**

Modeling through difference equations – Linear difference equations – Obtaining complementary function by use of matrices – Harrod model – Cob-web model – Applications of Actuarial Science.

UNIT V **(15 Hours)**

Modelling through graphs – Seven bridge problem – representing results of tournament – Genetic graph – Food web – Communication network – Matrices associated with a directed graph – Detection of clique – Terms of signed graph.

*** denotes self study (Questions may be asked from these portions also)**

Teaching Methods

Chalk and Talk/PowerPoint presentation/ Seminar/ Quiz/ Discussion/ Assignment/ Smart Class Room

Text Books

1. T.N. Kapur, Mathematical Modeling, Wiley Eastern Limited, New Age International Pvt.Ltd., Reprint 2013.

Unit I	Chapter 2	Sections 2.1- 2.3, 2.4.2
Unit II	Chapter 3	Sections 3.1.1-3.1.3, 3.2.1 & 3.5.1
Unit III	Chapter 4	Sections 4.1.1 – 4.3.1
Unit IV	Chapter 5	Sections 5.2.1 – 5.2.6,5.3.1,5.3.2& 5.3.4
Unit V	Chapter 7	Sections 7.1.2 – 7.3.1

Reference Books

1. J.N.Kapur, Mathematical Models in Biology and Medicine, Affiliated East-West Press, New Delhi, 1985.
2. R. Olink, Mathematical Models in Social and Life Sciences, 1978.

Mapping

PSO / CO	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	S	H	M	S	H
CO2	H	M	S	H	M
CO3	M	H	M	S	H
CO4	H	S	M	H	M

S - Strong; **H**-High; **M**-Medium; **L**-Low

ProgrammeCode : 02	M. Sc Mathematics		
Non Major Elective Paper - SYSTEMS ANALYSIS AND DESIGN			
Batch2020-2022	**Hours / Week** 4	**Total Hours** 60	**Credits** 5

Course Objectives

1. To enable the learners to understand the concepts of Foundations for systems development, Structuring system requirements and Designing Data bases.
2. To explain the principles, methods and techniques of systems development.
3. To elaborate on the application areas for different types of methods.

Course Outcomes (CO)

K1 to K4	CO1	Defining and describe the phases of the system development life cycle.
	CO2	Demonstrating the forms and reports and designing interfaces.
	CO3	Building the system development alternatives.
	CO4	Examining the system analysis problems.

Syllabus

UNIT-I **(12 Hours)**

Foundations for systems development: The systems development environment - Succeeding as a systems analyst – Automated tools for systems development - Initiating and planning systems development projects.

UNIT-II **(12 Hours)**

Analysis: Determining system requirements – Traditional methods – Modern methods – Radical methods – Internet Development: Determining system requirements – structuring system requirements: Process modeling.

UNIT-III **(12 Hours)**

Structuring system requirements: Logic modeling - Structuring systemrequirements : conceptual data modeling.

UNIT-IV **(12 Hours)**

Design: Designing databases - **Designing Forms and Reports – Designing**

Interfaces and dialogues* – Finalizing Design Specifications.

UNIT-V **(12 Hours)**

Implementation and Maintenance: System Implementation – Maintaining

Information systems.

*** denotesSelf study(Questions may be taken from these portions also).**

Teaching Methods

Chalk and Talk / Power point presentation/ Seminar/Quiz/Discussion/Assignment/Smart Class Room

Text Book

Jeffrey A. Hoffer, Joey F. George, Joseph S.Valacich , Modern Systems Analysis and Design, 3rd edition, Pearson Education, 2003.

Unit I	Sections	1, 2, 4, 6
Unit II	Sections	7, 8, 9 (Process Modeling)
Unit III	Sections	9,10
Unit IV	Sections	12, 13, 14, 15
Unit V	Sections	17, 18

Reference Books

1. Elias M Awad, Systems Analysis and Design, GalgotiaPubl, 2nd Edition,1996.

2. James A Senn, Analysis and Design of Information Systems, TMH Publ, 2nd Edition,1989.

Mapping

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	H	H	H
CO2	S	M	H	H	S
CO3	S	M	H	H	S
CO4	H	M	S	S	M

S - Strong; **H**-High; **M**-Medium; **L**-Low

ProgrammeCode : 02	M. Sc Mathematics		
Non-Major Elective Paper - VISUAL BASIC AND ORACLE			
Batch	**Hours / Week**	**Total Hours**	**Credits**
2020-2022	4	**60**	5

Course Objectives

1. To develop visual programming skills for modern software development.
2. To get the knowledge on Graphical User Interface.
3. To apply Visual Basic controls in data base managementsystem.

Course Outcomes (CO)

K1 to K4	CO1	Remembering the fundamentals of visual basic and procedures.
	CO2	Understanding the Visual Basic controls and command button properties.
	CO3	Making use of visual data manager and data bound control for the database programming with Visual Basic.
	CO4	Analyzing the connection between ORACLE and VB.

Syllabus

Unit I **(12 Hours)**

The fundamentals of VB – IDE – Variables – Procedures – Control flow statements – loop statements – simple programs on using procedures.

Unit II **(12 Hours)**

VB Controls – Text box – list box – combo box – scroll box – image – picture box – DIR control – **Drive control*** – Data control – file control – label command button properties – method of each control – small programs based on the above controls.

Unit III **(12 Hours)**

Advanced Active X controls – introduction to Active X – **Rich text box control*** – MS flexi grid control – common dialogue control – multiple document interface – database programming with VB using the Visual data manager – data validation -accessing fields in a record sets – Advanced data bound controls – data bound list control - data bound combo box control – data bound grid control.

Unit IV **(12 Hours)**

Windows API – Basic Concepts – accessing the WIN 32 API from VB – Windows arguments, declaring 32 bit functions and structures – what is OLE – an example of embedding and linking – Building your own Active X control.

Unit V **(12 Hours)**

ORACLE – DDL – DML – integrity and security – primary and foreign key relationship – An example of simple and compound queries – establishing connection between ORACLE and VB.

*** denotesSelf study(Questions may be taken from these portions also).**

Teaching Methods

Chalk and Talk / Power point presentation/ Seminar/Quiz/Discussion/Assignment/Smart Class Room

Text Book

Pertroutsoe.E, Mastering VB 6.0, BPB Publications, 1999.

Reference Books

1. P.K.McBride , Programming with Visual Basic, BPB Publications, New Delhi, 1999.
2. Penfolo, Microsoft Visual Basic, Galgotia Publishers, New Delhi , 1999.
3. Srikanth, First step to Oracle, BPB Publications, New Delhi, 1999.

Mapping

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	H	H	S	H	M
CO2	S	S	M	S	H
CO3	M	M	S	H	S
CO4	H	S	M	S	M

S - Strong; **H**-High; **M**-Medium; **L**-Low

ProgrammeCode : 02	M. Sc Mathematics		
Non Major Elective Paper- FUZZY LOGIC AND NEURAL NETWORKS			
Batch	**Hours / Week**	**Total Hours**	**Credits**
2020-2022	4	60	5

Course Objectives

1. To understand the concepts of fuzzy sets, knowledge representation using fuzzy rules, approximate reasoning, fuzzy operations and fuzzy logic.
2. To know the concepts of neural networks and neuro-modeling.
3. To study the basics of neural network architectures and some learning algorithms.

Course Outcomes (CO)

K1 to K4	CO1	Recalling the difference between crisp set theory and fuzzy set theory.
	CO2	Explaining the concepts of operations on fuzzy set.
	CO3	Applying the learning methods in neural network architectures.
	CO4	Examining the Back propagation learning algorithm.

Syllabus

UNIT I **(12 Hours)**

Fuzzy Sets: Crisp sets – Fuzzy sets: Basic Types, Basic concepts – Additional properties ofα-cuts – Representations of fuzzy sets – Extension prinicple for fuzzy sets.

UNIT II **(12 Hours)**

Operations On Fuzzy Sets:Types of operations – fuzzy complements – fuzzy intersections : t-Norms – Fuzzy unions : t-conorms.

UNIT III **(12 Hours)**

Fuzzy Logic: Classical logic – multivalued logics – **fuzzy propositions** – fuzzy quantifiers.

UNIT IV **(12 Hours)**

Fundamentals Of Neural Networks: Basic concepts – Model of an Artificial Neuron – Neural Networks Architectures – **characteristics of Neural Network** – Learning Methods – Early Neural Network Architectures.

UNIT V **(12 Hours)**

Backpropagation Networks: Introduction – Architecture of a Backpropagation Networks – Backpropagatiopn Learning.

*** denotesSelf study(Questions may be taken from these portions also).**

Teaching Methods

Chalk and Talk / Power point presentation/ Seminar/Quiz/Discussion/Assignment/Smart Class Room

Text Book

1. George J.Klir and Boyman, Fuzzy sets and Fuzzy Logic – Theory and Applications, PHI Learning Pvt. Ltd., 2012. (for units – I, II and III)

2. S. Rajasekaran and G.A.VijayalakshmiPai, Neural Networks, Fuzzy Logic and Genetic Algorithms, PHI Learning Pvt. Ltd., 2008. (for units – IV and V)

Unit I	Chapter1,2	Sec 1.2,1.3,1.4,2.1,2.2,2.3
Unit II	Chapter 3	Sec 3.1 – 3.4
Unit III	Chapter 8	Sec 8.1 – 8.3
Unit IV	Chapter 2	Sec 2.1,2.3 – 2.6,2.9
Unit V	Chapter 3	Sec 3.1,3.2.

Reference Books

George J.Klir and Tina A.Folger, Fuzzy Sets,Uncertainty and Information, Prentice-Hall of India Private Limited-Fourth printing-June 1995.

Mapping

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	H	M	H	S
CO2	H	S	M	M	S
CO3	M	M	S	S	H
CO4	S	H	H	S	M

S - Strong; **H**-High; **M**-Medium; **L**-Low

ProgrammeCode : 02	M. Sc Mathematics		
Non Major Elective Paper -MEASURE AND INTEGRATION			
Batch	**Hours / Week**	**Total Hours**	**Credits**
2020-2022	4	60	5

Course Objectives

1. To understand the concepts of Measurable functions and Integrable functions.
2. To know about Lebesgue measure and Lebesgue integral.
3. To apply measurable functions in convegencetheorems and The Radon – Nikodym theorem.

Course Outcomes (CO)

K1 to K4	CO1	Remembering the concepts of Measure and outer measure
	CO2	Classifying the difference between various measures
	CO3	Applying measure theory in theorems like monotone convergence theorem , bounded convergence theorem .
	CO4	Analyzing L^p spaces.

Syllabus

Unit I **(12 Hours)**

LebesgueMeasure : Introduction, Outer measure, Measurable sets and Lebesgue measure and Measurable functions.

Unit II **(12 Hours)**

The LebesgueIntegral : The Lebesgue integral of a bounded function over a set of finite measure, The integral of a non negative function, The general Lebesgue integral.

Unit III **(12 Hours)**

Differentiation and Integration **:** Differentiation of monotonic functions, Functions of bounded variation, Differentiation of an integral and Absolute continuity.

Unit IV **(12 Hours)**

Measure and Integration**:Measure spaces***, Measurable functions, Integration and General convergence theorems.

Unit V **(12 Hours)**

The Radon – Nikodym Theorem**:** Signed measures, The Randon- Nikodym Theorem and The L^P spaces.

*** denotesSelf study(Questions may be taken from these portions also).**

Teaching Methods

Chalk and Talk / Power point presentation/ Seminar/Quiz/Discussion/Assignment/Smart Class Room

Text Book

H.L. Royden , Real Analysis, 3rd Edition, Macmillan Publishing Company,

New York, 2007.

Unit I	Chapter 3	(Omit Sections 4 and 6)
Unit II	Chapter 4	(Omit Sections 1 and 5)
Unit III	Chapter 5	(Omit Section 5 only)
Unit IV	Chapter 11	Sections 1,2,3 and 4.
Unit V	Chapter 11	Sections 5, 6 and 7.

Reference Books

1. Walter Rudin, Principles of Mathematical Analysis, McGraw – Hill.Inc, New York, Third Edition, 1976.
2. G.de Barra, Wiley Eastern, Measure Theory and Integration, NewDelhi, 1981.

Mapping

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	H	H	S	H	M
CO2	M	S	M	M	H
CO3	S	H	S	H	S
CO4	S	S	H	S	S

S - Strong; **H**-High; **M**-Medium; **L**-Low

CIA / END SEMESTER THEORY EXAMINATION QUESTION PAPER PATTERN

M.SC MATHEMATICS

Pattern I

Time : 3 hrs Max Marks : 75

Section A

10 Questions 10x1 = 10 Marks
(Multiple Choice– 4 Choices only)

Section B

5 Questions 5x5 = 25 Marks
(Either Or Type)

Section C

5 Questions 5x8 = 40 Marks
(Either Or Type)

Total 75 Marks

Distribution of Marks for CIA

Tests (2)		15 Marks
	Assignment	5 Marks
	Attendance	5 Marks
	Total	25 Marks

JOB ORIENTED COURSE (JOC)

S.No	JOC	Department
1	Communicative English	English (UG)
2	Copy Writing	English (PG)
3	Visual Basic & Oracle	Mathematics (PG)
4	Maintenance and Troubleshooting of Electronic Equipments& Home Appliances	Physics (PG)
5	Textile Technology	Chemistry (PG)
6	Medicinal Plants and Phythotheraphy	Biochemistry (PG)
7	Plant Tissue Culture	Biotechnology (UG) & (PG)
8	Biofertilizer&Biocontrol Agents,	Biotechnology (UG) & (PG)
9	MS Office and Internet	Computer Science (UG)
10	Adobe Pagemaker and Photoshop	Computer Science & Computer Applications (UG)
11	Web Designing	Master of Computer Application (PG)
12	Food Processing and preservation	Plant Biology (PG)
13	Programming in R	Bioinformatics (PG)
14	Share Trading Operations	Commerce (PG)
15	Clinical Nutrition and Dietetics	Zoology (PG)

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KONGUNADU ARTS AND SCIENCE COLLEGE (AUTONOMOUS)

COIMBATORE – 641 029

Course Name : PG Diploma in Operations Research

Curriculum and Scheme of Examination under CBCS

(Applicable to the students admitted during the Academic Year 2020-2021)

Semester	Subject Code	Title of the Paper	Instruction hours/cycle	Exam. Marks			Duration of Exam	Credits
				CIA	ESE	TOTAL		
I	20PDM101	Core Paper 1 : Operations Research I	2	25	75	100	3	2
	20PDM102	Core Paper 2 : Operations Research II	2	25	75	100	3	2
	20PDM103	Core Paper 3 : C Programming – Theory	2	25	75	100	3	2
	20PDM1CL	Core Practical : C Programming – Lab	2	40	60	100	3	2
	Total		**8**			**400**		**8**
II	20PDM204	Core Paper 4 : Operations Research III	2	25	75	100	3	2
	20PDM205	Core Paper 5 : Operations Research IV	2	25	75	100	3	2
	20PDM2Z1	Project – Viva Voce	4	40	160	200	-	4
		Total	**8**			**400**		**8**
		Grand Total	**16**			**800**		**16**

Note:

CBCS – Choice Based Credit System
CIA – Continuous Internal Assessment
ESE – End of Semester Examinations

BLOOM'S TAXONOMY BASED ASSESSMENT PATTERN

K1-Remembering; **K2**-Understanding; **K3**-Applying; **K4**-Analyzing

3. Theory Examination - Part I, II & III

(i) CIA I & II and ESE: 75 Marks

Knowledge Level	Section	Marks	Description	Total
K1 – K2 Q1 to 10	A (Answer all)	10 x 1 = 10	MCQ	75
K2 – K4 Q11 to 15	B (Either or pattern)	5 x 5 = 25	Short Answers	
K2 - K4 Q16 to 20	C (Either or pattern)	5 x 8 = 40	Descriptive / Detailed	

2. Project Viva Voce:

Knowledge Level	Section	Marks	Total
K3	Project Report Viva voce	120	160
K4		40	

Components of Continuous Internal Assessment

Components			Marks	Total
Theory	CIA 1	75	(75+75 = 150/10) 15	25
	CIA 2	75		
	Assignment / Seminar		5	
	Attendance		5	
Project	Review		30	40
	Regularity		10	

20PDM101

Programme : PGDOR				
Course Code: 20PDM101		**Title :** Core Paper 1 : Operations Research-I		
Batch 2020-2021	Semester I	Hours / Week 2	Total Hours 30	Credits 2

Course Objectives

1. To get the knowledge of Linear programming problem.
2. To understand the concepts of transport and assignment problems.
3. To solve the LPP using different methds.

Course Outcomes (CO)

K1 to K4	CO1	Remembering the basics and characteristics of OR.
	CO2	Applying the notions of linear programming in solving transportation problems and Assignment Problem.
	CO3	Exerting the fundamental concept of L.P.P.
	CO4	Evaluating the concept of Balanced and Unbalanced problems

Unit I:

Formulation of L.P.P – Graphical solutions of L.P.P – Problems – Simplex Method – Problems – Revised Simplex method.

Unit II:

CharnesPenality Method (or) Big – M Method - Two PhaseSimplex method – Problems

Unit III:

Formulation of Dual problems – Primal – Dual pair in Matrix form – Dual Simplex method.

Unit IV:

The transportation Problems – Basic feasible solution by L.C.M – NWC- VAM-optimum solutions – unbalanced Transportation problems

Unit V:

The Assignment Problems – Assignment algorithm – optimum solutions – UnbalancedAssignment Problems.

Teaching Methods

Chalk and Talk / PowerPoint presentation / Seminar / Quiz / Discussion / Assignment

Text Book:

1. KandiSwarup, P. K. Gupta, Man Mohan, Operations Research, S. Chand & Sons Education Publications, New Delhi, 16th Revised Edition, 2013.

Reference Books:

1. Prem Kumar Gupta, D. S. Hira, Problems in Operations Research, S. Chand & Company Ltd, New Delhi, 7th Edition, 2014.
2. S. Dharani,Venkata Krishnan, Operations Research Principles and Problems, Keerthi publishing house PVT Ltd, 2000.
3. J. K. Sharma, Operations Research, Theory and Applications, Macmillan India PVT LTD, 4th Edition, 2013.

20PDM101

Mapping

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	H	M	S
CO2	H	S	S	H	S
CO3	H	H	S	M	H
CO4	M	H	H	M	S

S - Strong; **H**-High; **M**-Medium; **L**-Low

20PDM102

Programme : PGDOR				
Course Code: 20PDM102		**Title :** Core Paper 2 : Operations Research-II		
Batch 2020-2021	Semester I	Hours / Week 2	Total Hours 30	Credits 2

Course Objectives

1. To get the knowledge of Game theory.
2. To understand the concepts of inventory control and simulation..
3. To solve the network problems using different methods.

Course Outcomes (CO)

K1 to K4	CO1	Remembering the property in solving the problems in game theory.
	CO2	Understand the types of inventories and simulations.
	CO3	Exerting the fundamental concept of inventory control.
	CO4	Evaluating the concept of CPM & PERT

Unit I:

Game Theory – Two person zero sum game – The Maxmini – Minimax principle –problems - Solution of 2 x 2 rectangular Games – Domination Property – (2 x n) and (m x 2)graphical method – Problems.

Unit II:

Queueing Theory – Introduction – Queueing system – Characteristics of Queueingsystem – symbols and Notation – Classifications of queues – Problems in (M/M/1) :(∞/FIFO); (M/M/1) : (N/FIFO); (M/M/C) : (∞/FIFO); (M/M/C) : (*N*/FIFO).

Unit III:

Inventory control – Types of inventories – Inventory costs – EOQ Problem with no shortages – Production problem with no shortages – EOQ with shortages – Production problem with shortages – EOQ with price breaks.

Unit IV:

Simulation – Introduction – simulation models – Event – Types of simulation -Generation of Random Numbers – Mante-carlo simulation – simulation of queueing system.

Unit V:

Network scheduling by PERT / CPM – Introduction – Network and basic components– Rules of Network construction – Time calculation in Networks – CPM.PERT – PERT calculations..

Teaching Methods

Chalk and Talk / PowerPoint presentation / Seminar / Quiz / Discussion / Assignment

20PDM102

Text Book:

1. Kandiswarup, P. K. Gupta, Man Mohan, Operations Research, S. Chand & Sons Education Publications, New Delhi, 16th Revised Edition, 2013.

Reference Books:

1. Prem Kumar Gupta, D. S. Hira, Problems in Operations Research, S. Chand & Company Ltd, New Delhi, 7th Edition, 2014.

2. S. Dharani, Venkata Krishnan, Operations Research Principles and Problems, Keerthi publishing house PVT Ltd, 2000.

3. J. K. Sharma, Operations Research, Theory and Applications, Macmillan India PVT LTD, 4th Edition, 2013.

Mapping

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	H	S	H	M	S
CO2	H	H	S	H	S
CO3	S	H	S	M	H
CO4	M	S	H	M	S

S - Strong; **H**-High; **M**-Medium; **L**-Low

20PDM103

Programme : PGDOR				
Course Code: 20PDM103		**Title :** Core Paper 3 : C Programming- Theory		
Batch	**Semester**	**Hours / Week**	**Total Hours**	**Credits**
2020-2021	I	2	30	2

Course Objectives

1. To understand the C programming language.
2. To learn the concept of control statements, one dimensional, two dimensional and multi-dimensional arrays.
3. To solve the mathematical problems using C programs.

Course Outcomes (CO)

K1 to K4	CO1	Remembering the importance and functioning of C programming.
	CO2	Understanding the use of decision making statement and loop structures.
	CO3	Applying the operators and functions to solve mathematical problems.
	CO4	Distinguish different types of arrays.

UNIT I

Overview of C : History of C -Importance of C - Sample C Programs- Basic structure of C programs- Programming style - Executing a C Program.

Constants, Variables and Data types : Character set – C tokens – Keywords and identifiers – Constants – Variables – Data types – Declaration of variables – Assigning values to variables – Defining symbolic constants.

Operators:Arithmetic Operators – Relational Operators – Logical Operators – Assignment Operators- Increment and Decrement Operators – Conditional Operator – Bitwise Operators- Special Operators.

UNIT II

Expression : Arithmetic expressions – Evaluation of expressions – Precedence of arithmetic operators – Some computational problems – Type conversions in expressions – Operator precedence and associative – Mathematical functions.

Managing Input and Output Operations : Reading a character – Writing a character Formatted Input – Formatted Output.

UNIT III

Decision Making and Branching : Decision making with IF statement – Simple IF statement – The IF … ELSE statement – Nesting of IF … ELSE statements – The ELSE IF ladder – The Switch statement – The ? : operator- The GOTO statement.

UNIT IV

Decision Making and Looping : The WHILE statement – The DO statement – The FOR statement – Jumps in loops.

Array: Introduction-One-dimensional arrays-Declaration of one-dimensional arrays-Initialization of one-dimensional arrays-Two dimensional arrays- Initializing two dimensional arrays-Multi-dimensional arrays.

20PDM103

UNIT V

Character Arrays and Strings:Introduction **–** Declaring and initializing string variables – Reading strings – Writing strings – Arithmetic operations on characters – Putting strings together – comparison of two strings- String-handling functions – Table of Strings.

Teaching Methods

Chalk and Talk / PowerPoint presentation / Seminar / Quiz / Discussion / Assignment

Text Book

1. E. Balagurusamy, Programming in ANSI C , 7th edition, Tata McGraw- Hill Publishing Company Ltd., New Delhi, 2017.

Reference Books

1. Kris A. Jamsa, Programming in C, Gazlgotia Publication, New Delhi 1990.
2. V. Rajaraman, Computer Programming in C, Prentice Hall of India, New Delhi, 1994.
3. Stephen .G Kochan, Programming in C, CBS Publishers, New Delhi, 1991
4. S. Kalavathy, Operations Research with C programs, Third Edition, Vikas publishing House PVT. LTD, 2011.

Mapping

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	H	M	S
CO2	H	S	S	H	S
CO3	H	H	S	M	H
CO4	M	H	H	M	S

S - Strong; **H**-High; **M**-Medium; **L**-Low

20PDM1CL

Programme Code : PGDOR				
Course Code: 20PDM1CL		**Title :** Core Practical : C Programming- Lab		
Batch	**Semester**	**Hours / Week**	**Total Hours**	**Credits**
2020-2021	I	2	30	2

Course Objectives

1. To provide practical experience for the students to understand the structure of a C program.
2. To enrich the knowledge in solving mathematical problems using C programs.
3. To train the students to construct C programs on their own.

Course Outcomes (CO)

K3 to K4	CO1	Applying the concepts of loops and control statements in C programs.
	CO2	Classify the various operators used to develop a solution for a mathematical problem
	CO3	Evaluating the Operations Research problems using C programs.

List of Practical

1. Program to find Determinant of the Matrix.
2. Program to find the Multiplication of Matrices.
3. Program to solve the Simultaneous equations using Gauss Seidal method.
4. Program to solve the LPP using Simplex method.
5. Program to solve the Transportation problem using North West Corner method.
6. Program to solve the Game.
7. Program to solve the Queuing problem.

Distribution of Marks in ESE

Experiment	:	50
Record	:	10
Total		**60**

To be awarded jointly by the internal and external examiners.

CIA

CIA Practical	:	25
Exam Attendance	:	5
Observation Note	:	10
Total		**40**

Mapping

PSO / CO	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	S	S	H	H	S
CO2	S	M	S	M	M
CO3	S	S	H	S	H

S - Strong; **H**-High; **M**-Medium; **L**-Low

20PDM204

Programme : PGDOR				
Course Code: 20PDM204		**Title :**Core Paper 4 :Operations Research-III		
Batch 2020-2021	Semester II	Hours / Week 2	Total Hours 30	Credits 2

Course Objectives

1. To get the knowledge of Integer programming problem.
2. To understand the concepts of Markov analysis.
3. To solve the Non-LPP using different methods.

Course Outcomes (CO)

K1 to K4	CO1	Remembering the basic algorithms in Integer Programming Problem, Non-LPP.
	CO2	Applying the notions of integer programming and non- linear programming in solving Gromory's fractional cut and Kuhn Tucker condition.
	CO3	Exerting the fundamental concept of Dynamic programming problem.
	CO4	Evaluating the concept of Markov and Decision Analysis.

Unit I:

Integer Programming Problem – Gomory's fractional cut Method – Branch and Bound Method.

Unit II:

Non-linear Programming Problems – General NLPP – Lagrange multiplier – Hessian bordered Matrix –Problems

Unit III:

Dynamic Programming Problem – Recursive equation approach – D.P.P Algorithm – Solution of L.P.P by D.P.P.

Unit IV:

Markov Analysis – Stochastic process – Markov analysis Algorithm.

Unit V:

Decision Analysis – Decision Making environment – Decisions under uncertainty – Decision under risk – Decision – Tree Analysis.

Teaching Methods

Chalk and Talk / PowerPoint presentation / Seminar / Quiz / Discussion / Assignment

Text Book:

1. KandiSwarup, P. K. Gupta, Man Mohan, Operations Research, S. Chand & Sons Education Publications, New Delhi, 16th Revised Edition, 2013.

20PDM204

Reference Books:

1. Prem Kumar Gupta, D. S. Hira, Problems in Operations Research, S. Chand & Company Ltd, New Delhi, 7th Edition, 2014.
2. S. Dharani, Venkata Krishnan, Operations Research Principles and Problems, Keerthi publishing house PVT Ltd, 2000.
3. J. K. Sharma, Operations Research, Theory and Applications, Macmillan India PVT LTD, 4th Edition, 2013.

Mapping

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	H	S	M	S
CO2	H	S	S	H	S
CO3	H	S	H	M	H
CO4	M	H	H	M	S

S - Strong; **H**-High; **M**-Medium; **L**-Low

20PDM205

Programme : PGDOR				
Course Code: 20PDM205		**Title :** Core Paper 5 :Operations Research-IV		
Batch 2020-2021	Semester II	Hours / Week 2	Total Hours 30	Credits 2

Course Objectives

1. To get the knowledge of Sequencing problem.
2. To understand the concepts of Replacement problems.
3. To solve the Non-LPP using different methods.

Course Outcomes (CO)

K1 to K4	CO1	Remembering the basic terms used in sequencing problems.
	CO2	Applying the notions of information theory in solving various problems.
	CO3	Exerting the fundamental concept of Replacement problems.
	CO4	Evaluating the concept of Non-Linear programming methods.

UNIT--I: SEQUENCING PROBLEMS

Introduction-problem of sequencing - basic terms used in sequencing- processing n—jobs through 2 machines - processing n –jobs through k machines -- processing 2 jobs through k machines.

UNIT-II REPLACEMENT PROBLEMS

Introduction - Replacement of equipment / assets that deteriorates gradually – replacement of equipment that fails suddenly and problems.

UNIT—III NON-LINEAR PROGRAMMING METHODS:

Khun-tucker conditions with non-negtive constraints- Quadratic programming- Wolf's modified simplex method.

UNIT--IV: INFORMATION THEORY:

Introduction- A measure of Information-Axiomatic Approach to Information- Entrpy-The expected information- Some properties of entropy function-Joint and conditional entropies.

UNIT -- V :APPLICATIONS:

General solution of (mxn) rectangular games using simplex method - Reliability and system failure rates using replacement problems.

Teaching Methods

Chalk and Talk / PowerPoint presentation / Seminar / Quiz / Discussion / Assignment

20PDM205

Text Book:

1. KandiSwarup, P. K. Gupta, Man Mohan, Operations Research, S. Chand & Sons Education Publications, New Delhi, 16th Revised Edition, 2013.

Reference Books:

1. Prem Kumar Gupta, D. S. Hira, Problems in Operations Research, S. Chand & Company Ltd, New Delhi, 7th Edition, 2014.
2. S. Dharani, Venkata Krishnan, Operations Research Principles and Problems, Keerthi publishing house PVT Ltd, 2000.
3. J. K. Sharma, Operations Research, Theory and Applications, Macmillan India PVT LTD, 4th Edition, 2013.

Mapping

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	H	M	S
CO2	S	S	S	H	H
CO3	H	H	S	M	H
CO4	S	H	H	M	S

S - Strong; **H**-High; **M**-Medium; **L**-Low