The Gandhigram Rural Institute (Deemed to be University)
Gandhigram - 624302
(Ministry of Human Resource Development, Govt. of India)
Accredited by NAAC with 'A' Grade (3rd cycle)

Department of Mathematics
B.Sc. Degree (Mathematics)
Pre-Requisite: Mathematics as a subject of study at the Higher Secondary level.
Revised Syllabus with effect from 2018 – 2019 onwards

Category	Course Code	Course Title	Number of Credits	Lecture Hours per week	Exam Duration (Hrs)	Marks		
						C.F.A	E.S.E	Total
	Semester-I							
Language	18TAMU0101/ 18MALU0101/ 18HIDU0101/ 18FREU0101	Language I (Tamil/Hindi/Malayalam/ French)	3	3	3	40	60	100
	18ENGU01F1	Language II English	3	3	3	40	60	100
Core Course	18MATU0101	Classical Algebra	4	4	3	40	60	100
	18MATU0102	Theory of Equations & Trigonometry	3	3	3	40	60	100
Allied Course	18MATU01B1	Introduction to Computers and Office Automation(theory)	3	3	3	30	45	75
	18MATU01B2	Introduction to Computers and Office Automation(practical)	1	2	--	--	--	--
Foundation Course	18NSSU0001/ 18FATU0001/ 18SPOU0001	NSS/FA/Sports	1	1	-	50	-	50
	18YOGU0002	Yoga	1	1	-	50	-	50
	18EVSU0001	Environmental Studies	3+1	5	-	40	60	100
TOTAL			**23**					
	Semester-II							
Language	18TAMU0202/ 18MALU0202/ 18HIDU0202/ 18FREU0202	Language I (Tamil/Hindi/Malayalam/ French)	3	3	3	40	60	100
	18ENGU02F2	Language II English	3	3	3	40	60	100
	18CTAU0001/ 18CHIU0001/ 18CMLU0001	Core Hindi/Core Tamil/Core Malayalam	2	2	2	20	30	50

Core Course	18MATU0203	Mathematical Statistics	3	3	3	40	60	100
Allied Course	18MATU02B3	Object Oriented Programming with C++(theory)	3	3	3	30	45	75
	18MATU02B4	Object Oriented Programming with C++(practical)	1	2	3	30	20	50
Foundation Course	18GTPU0001	Gandhi's Life, Thought and Work	2	2	2	20	30	50
	18EXNU0001	Extension Education	2	2	--	20	30	50
Soft Skills	18ENGU00C1	Communication and Soft Skills	2	2	--	20	30	50
TOTAL			**21**					
	Semester-III							
Language	18TAMU0303/ 18MALU0303/ 18HIDU0303/ 18FREU0303	Language I (Tamil/Hindi/Malayalam /French)	3	3	3	40	60	100
	18ENGU03F3	Language II English	3	3	3	40	60	100
	18CTAU0002 / 18CHIU0002 / 18CMLU0002	Core Tamil/Core Hindi/ Core Malayalam	2	2	2	20	30	50
Core Course	18MATU0304	Calculus	4	4	3	40	60	100
Allied Course	18PHYU01A1 / 18MATU03B5	1.Allied Physics-I(or) 2.Allied Statistics-I	3	3	3	30	45	75
	18PHYU02A3	1.Allied Physics-I (Practical) (or) 2.Allied Statistics-I (Practical)	1	3	-	-	-	-
Computer Skill	18MATU0305	Programming with JAVA (Theory)	3	3	3	40	60	100
	18MATU0306	Programming with JAVA (practical)	1	2	3	15	10	25
Foundation Course	18SHSU0001	Shanthi Sena	1	2	--			
Extension	18EXNU03V1	Village Placement Programme	2	--	--	50	--	50
Compulsory Non Credit Course	18MATU00F1	Compulsory Non Credit Course (Extension / Field Visit)	--	--	--	50	--	50

TOTAL			**23**					--
	Semester – IV							
Core Course	18MATU0407	Abstract Algebra	4	4	3	40	60	100
	18MATU0408	Sequences and Series	4	4	3	40	60	100
	18MATU0409	Differential Equations	4	4	3	40	60	100
Allied Course	18PHYU02A2 / 18MATU04B6	1.Allied Physics-II (or) 2.Allied Statistics-II	3	3	3	30	45	75
	18PHYU04A3 / 18MATU04B7	1.Allied Physics-II (Practical) (or) 2.Allied Statistics-II (Practical)	1	2	3	15	10	25
Electives	18MATU04EX	Major Elective	3	3	3	40	60	100
		Non Major Elective	3	3	3	40	60	100
Compulsory Non Credit Course	18MATU00F2	Compulsory Non Credit Course Extension / Field Visit	-	-	--	50	--	50
TOTAL			**22**					--
	Semester – V							
Core Course	18MATU0510	Linear Algebra	4	4	3	40	60	100
	18MATU0511	Real Analysis	4	4	3	40	60	100
	18MATU0512	Linear Programming	4	4	3	40	60	100
Electives	18MATU05EX	Major Elective	3	3	3	40	60	100
		Non Major Elective	3	3	3	40	60	100
Skill Based Elective	18MATU05S1	Quantitative Skills	2	2	--	20	30	50
TOTAL			**20**					
	Semester – VI							
Core Course	18MATU0613	Complex Analysis	4	4	3	40	60	100
	18MATU0614	Graph Theory	4	4	3	40	60	100
	18MATU0615	Mechanics	4	4	3	40	60	100
	18MATU0616	Operations Research	3	3	3	40	60	100
Modular Course	18MATU06MX	Modular Course	2	2	--	50	--	50
	18MATU06MX	Modular Course	2	2	--	50	--	50
Project	18MATU0617	Project	4	8	--	40	40+20	100
TOTAL			**23**					
GRAND TOTAL			**132**					

Note: * End Semester Examination at the end of the Second Semester

MAJOR ELECTIVES:

(18MATU04EX/ 18MATU05EX)

Semester -IV

1. 18MATU04E1 Analytical Geometry
2. 18MATU04E2 Financial Mathematics
3. 18MATU04E3 Matrix Analysis With Applications (Online)

Semester -V

1. 18MATU05E4Numerical Methods
2. 18MATU05E5Introduction to Actuarial Science
3. 18MATU05E6 Mathematical Modelling: Analysis And Applications (Online)

MODULAR COURSES: (18MATU06MX)

Semester -V

1. Fuzzy Set Theory
2. Mathematical Skills
3. Vector Calculus

ABSTRACT	
Course type	**Total number of Courses**
Core Course	17
Major Elective Course	02
Non-Major Elective Course	02
Allied Course	04
Modular Course	02
Foundation Course	06
Compulsory Non Credit Course	02
Language	08
Soft Skills	01
Computer Skill	01
Skill Based Elective	01
Project	01
Extension	01

Core Course	Semester I	
18MATU0101	CLASSICAL ALGEBRA	Credits: 4

Objective: To impart skills in the various applications of algebraic methods.

Specific outcome of learning:

- The learner will acquire knowledge of solving problems in matrices
- The learner will acquire skills of basic concepts of set theory
- The learner will become proficient in various types of functions
- The learner will become proficient in lub , glb of sets and inequalities
- The learner will acquire knowledge of basic concepts of number theory

Unit 1: Theory of Matrices: Types of matrices- Operations on Matrices- Inverse Matrix- Solution of simultaneous equations- Rank of a matrix- Homogeneous and Non-homogeneous linear equations- Eigen values and Eigen vectors- Cayley-Hamilton theorem.

(14 hours)

Unit 2: Concept of a set- Finite and Infinite set – Set inclusion – Algebra of Sets – Cartesian product of sets – Related Problems.

(13 hours)

Unit 3: Relations and Mappings – Equivalence relations – Partial order – Functions - Algebra of Functions - Countable sets-uncountable sets.

(12 hours)

Unit 4: Intervals in R-Bounded sets-Least upper bound and Greatest lower bound-Inequalities of Holder's and Minkowski's-Bounded functions.

(12 hours)

Unit 5: Number Theory: Prime Numbers and Composite Numbers - Euler's function - Divisibility and Congruence relations - Fermat's theorem - Wilson's theorem.

(14 hours)

Text Books:

1. S. Arumugam& A. T. Isaac, **Modern Algebra**, SciTech Publications, India Pvt. Ltd., 2003.
Unit 2: Chapter 1,
Unit3: Chapter: 2 (up to 2.4).
2. S. Arumugam& A. Thangapandi Isaac, **Modern Analysis**, New Gamma Publishing House, Palayamkottai, 2015.
Unit 3-Secs 1.2-1.3.
Unit 4-Sec. 1.4.
3. S. Arumugam& A. Thangapandi Isaac, **Sequences and series**, New Gamma Publishing House, Palayamkottai, 2012.Unit 4-Secs 1.2-1.5.
4. T. K.ManicavachagomPillay,T.Natarajan, KS.Ganapathy, **Algebra**, Vol. 2, S. ViswanathanPublications(India) Pvt. Ltd. Chennai, 2012. Unit 1: Chapter 2, Unit 5: Chapter 5.

References:

1. S. Narayanan & T. K. ManickavasagamPillai, **Modern Algebra**, Vol. I, S. Viswanathan Pvt. Ltd., Chennai, 1997.
2. Seymour Lipschutz, **Set theory & Related Topics**, Schaum'soutlines, 2nd Edition, Tata McGraw Hill, New Delhi, 2005.
3. Arumugam&Issac, **Classical Algebra**, New gamma Publishing house, Tirunelveli, 2003.

Web Resources:

1. http://nptel.ac.in/courses/109104124/
2. https://onlinecourses.nptel.ac.in/noc18_ma13
3. https://onlinecourses.nptel.ac.in/noc18_ma16
4. www.maths.manchester.ac.uk/~avb/0n1_pdf/0N1_All.pdf
5. https://www.maths.ed.ac.uk/~v1ranick/papers/matrices.pdf

LECTURE SCHEDULE

Unit	Topics	No. hours
1	Theory of Matrices: Types of matrices- Operations on Matrices- Inverse Matrix.	3
	Solution of simultaneous equations- Rank of a matrix	3
	Homogeneous and Non-homogeneous linear equations	4
	Eigen values and Eigen vectors- Cayley-Hamilton theorem.	4
		Total 14
2	Concept of a set- Finite and Infinite set	3
	Set inclusion – Algebra of Sets	4
	Cartesian product of sets	3
	Related Problems.	3
		Total 13
3	Relations and Mappings.	3
	Equivalence relations – Partial order.	3
	Functions - Algebra of Functions.	3
	Countable sets-uncountable sets.	3
		Total 12
4	Intervals in R-Bounded sets.	3
	Least upper bound and Greatest lower bound.	3
	Inequalities of Holder's and Minkowski's.	3
	Bounded functions.	3
		Total 12

5	Number Theory: Prime Numbers and Composite Numbers	3
	Euler's function	3
	Divisibility and Congruence relations	4
	Fermat's theorem - Wilson's theorem.	3
		Total 13
		Grand Total 64

Core Course	Semester I	
18MATU0102	THEORY OF EQUATIONSAND TRIGONOMETRY	Credits: 3

Objective: To learn techniques of solving algebraic and trigonometric equations.

Specific outcome of learning:

- The learner will acquire basic concepts of roots and coefficients of equation.
- The learner will acquire skills of solving problems in transformation of equations.
- The learner will acquire skills of solving problems in Newton's and Horner's Method.
- The learner will gain knowledge of trigonometric functions and related problems.
- The learner will become proficient in various types of hyperbolic functions.

Unit 1: Theory of Equations: Remainder Theorem - Fundamental Theorem of Algebra - Relations between roots and coefficients - Symmetric functions of roots.

(10 hours)

Unit2: Transformation of Equations - Reciprocal Equations –To increase or decrease the roots of a given equation by a given quantity – Form of the quotient and remainder when a polynomial is divided by a binomial – Removal of terms.

(10 hours)

Unit 3: Descartes' rule of signs – Rolles' Theorem – Strum's Theorem - Newton's Method of Divisors -– Horner's Method.

(9 hours)

Unit 4: Trigonometry: Expansion of $cosn\theta$,$sin\ n\theta$ and $tan\ n\theta$–Powers of sines and cosines of θ– Expansions of $sin^n\theta$, $cos^n x$, $sin\ \theta$ and $cos\ \theta$ - Properties and their related problems.

(10 hours)

Unit5: Hyperbolic functions -Inverse hyperbolic functions- Logarithm of Complex Quantities.

(9 hours)

Text Books:

1. T. K. Manicavachagom Pillay, T. Natarajan & K. S. Ganapathy, **Algebra**, Vol. 1, S. Viswanathan (Printers & Publishers) Pvt. Ltd., Chennai, 2014. Unit 1: Chapter 6, Sections 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12. Unit 2: Chapter 6, Sections 15, 16, 17, 18, 19. Unit 3: Chapter 6, Sections 24, 25, 27, 29.4, 30.
2. S. Narayanan & T. K. Manicavachagom Pillay, **Trigonometry**, S. Viswanathan (Printers & Publishers) Pvt. Ltd., Chennai, 2001. Unit 4: Chapter III, Sections 1, 2, 4, 5. Unit 5: Chapter IV, Sections 1, 2(2.1, 2.2, 2.3) & Chapter V, Section 5 (Only).

Reference:

1. Arumugam & Issac, **Theory of Equations, Theory of Numbers and Trigonometry**, New gamma Publishing house, Tirunelveli, 2011.

Web Resources:

1. https://www.youtube.com/watch?v=V4fCrkWJ8tc
2. https://www.youtube.com/playlist?list=PLOnJQiDsowoiyJH7qgTXkLjeVOzlVvumh
3. https://cosmolearning.org/courses/trigonometry-complex-numbers/

LECTURE SCHEDULE

Unit	Topics	No. hours
1	Remainder Theorem	2
	Fundamental Theorem of Algebra	2
	Relations between roots and coefficients	3
	Symmetric functions of rootsss	3
		Total 10
2	Transformation of Equations - Reciprocal Equations	3
	To increase or decrease the roots of a given equation by a given quantity	3
	Form of the quotient and remainder when a polynomial is divided by a binomial	2
	Removal of terms	2
		Total 10
3	Descartes' rule of signs – Rolle's Theorem	3
	Strum's Theorem	2
	Newton's Method of Divisors	2
	Horner's Method	2
		Total 9s
4	Expansion of $cosn\theta$,$sin\ n\theta$ and $tan\ n\theta$	3
	Powers of sines and cosines of θ	3
	Expansions of $sin^n\theta$, $cos^n x$, $sin\ \theta$ and $cos\ \theta$ - Properties	2

	Related problems	2
		Total 10
5	Hyperbolic functions	3
	Inverse hyperbolic functions	3
	Logarithm of Complex Numbers	3
		Total 9
		Grand Total 48

Allied Course- Theory **Semester I**

18MATU01B1 INTRODUCTION TO COMPUTERS AND OFFICE AUTOMATION Credits: 3

Objective: To gain basic knowledge about computer peripherals, MS Office, Internet and E-commerce.

Specific outcome of learning:

- The learner will become proficient in MS windows software
- The learner will become proficient in MS word
- Proficient in data representation in diagram via MS Excel
- Proficient in preparation of power points
- Proficient in creation of E-mail and uses of web browser

Unit 1: Introduction to Computer**:** Block diagram, Memories, Devices, Operating System, Devices. Introduction to Windows**:** Starting Windows - Desktop - closing Windows - Start button - icons - Task bar - shortcut icons. Word pad: Creating &Saving a file, opening the saved file, word processing. Paint: creating & editing bitmaps - Multimedia tools - file system. Hard disk: Drive - folders - file - Exploring the files. My Computer - Explorer - moving files, deleting, cut, copy, paste - Exploring web.

(10 hours)

Unit 2: Word Processing using MS WORD: Word processing - Advantages – MS WORD – Definition. Document: Create - save - Printing - Resave – Close- Exiting word. Editing: Opening document – cursor movement - selecting text - deleting - undo redo - Moving text - Copying text. Formatting text: Font - paragraph formatting - bullets & numbering - getting help - find and replace text - spell checking and correction - grammar checking - auto correct - auto text - using thesaurus – using tabs - defining & changing page setup - page print options. Tables: creating &formatting, multiple columns. Math equations and typesetting in MS Word.

(10 hours)

Unit 3: MS-EXCEL: Introduction to worksheet and Excel - Definitions - Advantages - Organization of worksheet area - entering information - number - Formula - save - data alignment - editing - range -definition - specifying - changing column width - row height -

centering cell across column, hiding columns and rows - moving and copying data - inserting and deleting rows and columns - getting help.

(9 hours)

Unit 4: MS-EXCEL**:** Formatting the worksheet - printing - setting up page and margin- defining header and footer - print options. Chart: creation - changing type - resize and move – controlling the appearance - modifying - deleting - printing - naming ranges - using statistical, Mathematical and financial functions - using drawing tool bar.

(10 hours)

Unit 5: MS-POWER POINT: Introduction - Menus - Toolbar - Navigating Power Point– Creating Slides, Presentation, Animation, etc - working with Power Point. Internet: Internet Browsing, creating mail ID, Using search engines etc. – To know important govt. webpage's for various forms, formats, exams etc, National/International University/Institute websites.

(9 hours)

Text Book:

1. Sanjay Saxena, **MS-Office -2000 for every one**, Vikas Publishing House Pvt. Ltd., New Delhi, 2000.
   Unit 1: Part I, Unit 2: Part II, III, Unit 3, 4: Part IV, Unit 5: Part V.

Reference:

1. R.X. Taxali, **P.C. Software for Windows 98 Made simple**, TATA McGraw-Hill Publishing Company Ltd., New Delhi, 2001.

LECTURE SCHEDULE

Unit	Topics	No. hours
1	Block diagram, Memories, Devices, Operating System, Devices.	2
	Starting Windows - Desktop - closing Windows - Start button - icons - Task bar - shortcut icons.	2
	Creating &Saving a file, opening the saved file, word processing. Paint: creating & editing bitmaps - Multimedia tools - file system.	3
	Hard disk: Drive - folders - file - Exploring the files. My Computer - Explorer - moving files, deleting, cut, copy, paste - Exploring web.	3
		Total 10
2	Word Processing using MS WORD: Word processing - Advantages – MS WORD – Definition. Document: Create - save - Printing - Resave – Close- Exiting word.	3
	Editing: Opening document – cursor movement - selecting text - deleting - undo redo - Moving text - Copying text.	3

	Font - paragraph formatting - bullets & numbering - getting help - find and replace text - spell checking and correction - grammar checking - auto correct - auto text - using thesaurus – using tabs - defining & changing page setup - page print options.	2
	Tables: creating &formatting, multiple columns. Math equations and typesetting in MS Word.	2
		Total 10
3	MS-EXCEL: Introduction to worksheet and Excel - Definitions - Advantages - Organization of worksheet area - entering information	3
	Number - Formula - save - data alignment - editing - range -definition – specifying	2
	Changing column width - row height - centering cell across column, hiding columns and rows	2
	Moving and copying data - inserting and deleting rows and columns - getting help.	2
		Total 9
4	Formatting the worksheet - printing - setting up page and margin- defining header and footer - print options.	3
	Chart: creation - changing type - resize and move	3
	Controlling the appearance - modifying - deleting - printing - naming ranges - using statistical,	2
	Mathematical and financial functions - using drawing tool bar.	2
		Total 10
5	Introduction - Menus - Toolbar - Navigating Power Point– Creating Slides, Presentation, Animation, etc - working with Power Point.	3
	Internet: Internet Browsing, creating mail ID, Using search engines etc.	3
	To know important govt. webpage's for various forms, formats, exams etc, National/International University/Institute websites.	3
		Total 9
		Grand Total 48

Allied Course-Practical	Semester I	
18MATU01B2	INTRODUCTION TO COMPUTERS AND OFFICE AUTOMATION	Credit:1

Practical related to Computer Skill

1. Note pad Applications
2. Control Panel Setup
3. Designing Advertisement and Document creation with special features like header, footer, tables, etc.
4. Typing practices on Algebraic & Transcendental Equations, System of Equations, Matrices, Integral Equations, Differential Equations, etc. in MS Word
5. Table creation and Table editing, Table to Text / Text to Table conversion in MS Word
6. Electricity Bill creation, Mark sheet creation and Charts in Work Sheet
7. Power Point presentation on various concepts
8. Regression Equation Worksheet

Core Course	Semester II	
18MATU0203	MATHEMATICAL STATISTICS	Credits: 3

Objective: To impart skills in various applications of statistical methods.

Specific outcome of learning: The learner will be able to

- analyze the given data by using statistical methods.
- understand the basic concepts of probability and related results.
- use different probabilistic methods to solve problems arise in different situations.
- construct and evaluate hypothesis tests.
- apply sampling techniques to real life situations.

Unit 1: Measures of Central Tendency – Measures of Dispersion – Moments, Skewness and Kurtosis.

(14 hours)

Unit 2: Theory of Probability: Definition – Axioms – Addition and Multiplication Theorems – Baye's Theorem on conditional probability and its applications.

(12 hours)

Unit 3: Random variables – Discrete and Continuous – Definition of Probability Mass Function and Density Function – Distribution Functions – Properties – Mathematical Expectations – Mean, Variance and Moments – Moment Generating Functions – Simple properties.

(14 hours)

Unit 4: Theoretical distributions – Discrete: Binomial Distribution and Poisson distribution – Continuous: Normal Distribution Properties and Applications.

(12 hours)

Unit 5: Curve Fitting by the Method of Least Squares – Correlation – Properties – Regression – Equations of Regression Lines – Angle between Regression Lines – Properties and Applications.

(12 hours)

Text Book:

1. S. Arumugam& A. Thangapandi Isaac, **Statistics**, New Gamma Publishing House, 2006.
   Unit 1: Chapter 1: Sections 1.0 -1.4; Chapter 2: Section 2.0-2.5; Chapter 3: Sections: 3.0 -3.2; Chapter 4: Sections: 4.0 -4.2;
   Unit 2:Chapter 11: Sections: 11.0 -11.2.
   Unit 3: Chapter 12: Sections 12.0 -12.5.
   Unit 4: Chapter 13: Sections 13.0-13.3.
   Unit 5: Chapter 5: Section 5.0, 5.1; Chapter 6: Section 6.0-6.3

References:

1. J.N. Kapoor& H.C. Saxena, **Mathematical Statistics**, S. Chand & Co Pvt. Ltd., New Delhi, 1994.
2. S. C. Gupta & V. K. Kapoor, **Fundamentals of Mathematical Statistics**, S. Chand & Sons Pvt. Ltd., New Delhi, 1994.

LECTURE SCHEDULE

Unit	Topics	No. hours
1	Measures of Central Tendency	2
	Measures of Dispersion	2
	Moments, Skewness and Kurtosis	3
		Total 14
2	Theory of Probability: Definition – Axioms	2
	Addition and Multiplication Theorems	3
	Baye's Theorem on conditional probability	4
	Its applications	3
		Total 12
3	Random variables	1
	Discrete and Continuous	1
	Definition of Probability Mass Function and Density Function	2
	Distribution Functions	2
	Properties	2
	Mathematical Expectations	1

	Mean, Variance and Moments	2
	Moment Generating Functions	2
	Simple properties	1
		Total 14
4	Theoretical distributions	1
	Discrete: Binomial Distribution and Poisson distribution	6
	Continuous: Normal Distribution Properties and Applications.	5
		Total 12
5	Curve Fitting by the Method of Least Squares	2
	Correlation	2
	Properties	1
	Regression	1
	Equations of Regression Lines	2
	Angle between Regression Lines	2
	Properties and Applications.	2
		Total 12
		Grand Total 64

Allied Course -Theory **Semester II**
18MATU02B3 **OBJECT ORIENTED PROGRAMMING WITH C++** **Credits: 3**

Objective: To develop programming skills in C++ and its object oriented programming concepts.

Specific outcome of learning:

- The learner will become proficient in object oriented programming concept and proficient in C++ tokens
- Proficient in C++ operators
- Proficient in C++ class declaration and definition and its objects
- Proficient in constructors, destructors and operator overloading
- Proficient in the concept inheritance

Unit 1: What is C++ - Applications of C++ - A simple C++ program - An example with class - tokens - keywords - Identifiers and constants - basic, user defined, derived data types- symbolic constants - type compatibility - declaration of variables - dynamic initialization of variables.

(14 hours)

Unit 2: Operator in C++ - scope resolution, member differencing, memory management operators - manipulators - type cast operator - the main function - function prototyping - call by reference - return by reference - inline functions - default, constant arguments - function overloading - math library functions.

(14 hours)

Unit 3: C structure - specifying a class - defining member function - a C++ program with class making an outside function inline - nesting of member function - private member function - array within class - static data members - static member functions - array of objects -objects as function arguments - friendly functions

(12 hours)

Unit 4: Constructors – parameterized constructors - multiple constructors in a class - constructors with default arguments - dynamic initialization of objects - copy constructor - dynamic constructors – destructors - defining operator overloading - overloading unary, binary operators.

(12 hours)

Unit 5: Defining derived classes - single inheritance - multilevel inheritance - multiple inheritance-hierarchical inheritance -hybrid inheritance - virtual base class - abstract classes - constructors in derived classes.

(12 hours)

Text Book:

1. E. Balagurusamy, **Object Oriented Programming with C++,** Third edition, Tata McGraw-Hill publication, New Delhi, 2006.

   Unit 1: Chapters: 2.1 - 2.5, 3.1- 3.11,
   Unit 2: 3.13-3.18, 4.1-4.9 & 4.11.
   Unit 3: 5.1- 5.9, 5.11-5.15.
   Unit 4: 6.1-6.8, 6.11, 7.2-7.5.
   Unit 5: 8.1-8.11.

References:

1. V. Ravichandran, **Programming with C++,** Second Edition Tata McGraw - Hill, New Delhi, 2006.
2. H. Schildt, **The complete Reference of C++,** Tata-McGraw-Hill publishing Company Ltd. New Delhi, 2003.

LECTURE SCHEDULE

Unit	Topics	No. hours
1	What is C++ and applications of C++	4
	Tokens	3
	Basic, user defined, derived data types-symbolic constants	4
	Declaration of variables	3
		Total 14

2	Operator in C++	4
	Manipulators	4
	Main function	3
	Math library functions	3
		Total 14
3	C structure	3
	C++ program with making an outside function inline	3
	Private member function	3
	Static data members	3
		Total 12
4	Constructors	3
	Constructors with default arguments	3
	Dynamic constructors	3
	Destructors defining operator overloading	3
		Total 12
5	Defining derived classes	3
	Multilevel inheritance	3
	Hierarchical inheritance	3
	Virtual base class	3
		Total 12
		Grand Total 64

Allied Course -Practical **Semester II**
18MATU02B4 **OBJECT ORIENTED PROGRAMMING WITH C++** **Credit: 1**

Practical related to Object Oriented Programming with C++

1. List the prime numbers in a given range
2. Display Fibonacci series
3. Sorting given list of names in alphabetical order
4. Sorting given list of numbers in ascending order
5. Read and display for a given matrix of any order
6. Compute simple and compound interest values
7. Computer biggest among three numbers
8. Compute biggest among N integers
9. Compute factorial of a given number using recursive function
10. Write a program to swap the values using functions
11. Print perfect squares in a given range
12. Write a program to solve a quadratic equation and test with three types of roots.

13. Write a program to calculate the following functions to 0.0001% accuracy
    a) $\sin x = x - \frac{x^3}{3!} + \frac{x^5}{5!} - \cdots$
    b) $SUM = 1 + \left(\frac{1}{2}\right)^2 + \left(\frac{1}{3}\right)^3 + \left(\frac{1}{4}\right)^4 + \cdots$
    c) $\cos x = 1 - \frac{x^2}{2!} + \frac{x^4}{4!} - \cdots$
14. Write a program to calculate variance and SD of N numbers
15. Write a program to read two matrices and compute matrix multiplication using functions
16. Prepare employee details using class with array of objects
17. Program to illustrate objects as function arguments
18. Program to illustrate parameterized constructors
19. Program to illustrate multiple constructors in a class
20. Show by a suitable program: how the unary minus operator is overloaded?
21. Show by a suitable program: how the binary operator is overloaded?
22. Prepare student mark list by using multilevel inheritance
23. Program to illustrate multiple inheritance
24. Prepare student mark list by using hybrid inheritance
25. Prepare student mark list by using the concept of virtual base class

Core Course	Semester III	
18MATU0304	CALCULUS	Credits: 4

Objective: To learn the different concepts of differential and integral calculus.

Specific outcome of learning:

- The learner will gain knowledge of various types of differentiation
- The learner will acquire basic knowledge of applications of differentiation
- The learner will become proficient in Reimann integrals
- The learner will acquire skills of applications of multiple integrals
- The learner will gain concepts of change of variables

Unit 1: Differentiation: Limits and continuity -Standard forms-Logarithmic differentiation-Transformation, Rolle's theorem- Mean value theorem-Generalised mean value theorem.

(14 hours)

Unit 2: Differential Calculus: Successive Differentiation - Leibnitz theorem and its applications - Curvature - Radius of Curvature and Centre of Curvature - Evolutes and Involutes-Maxima and Minima.

(12 hours)

Unit 3: Integral Calculus:Evaluation of Definite integrals- Integration by parts - Reduction formulae - Integration as the limit of a sum.

(13 hours)

Unit 4: Double and Triple integrals: Double Integrals- Evaluation of double integrals- Triple integrals- Jacobians- Change of variables in double and Triple integrals.

(12 hours)

Unit 5: Application of Integration: Length of a curve- Area- Volume of a solid of revolution – Surface area of a solid of revolution– Volume as Triple integral- Area of surfaces.

(13 hours)

Text Books:

1. S. Narayanan & T. K. ManickavasagamPillai, **Calculus,Vol.1**. S. Viswanathan Pvt. Ltd., Chennai, 2004.
   Unit 1:Chapter I Secs 5-12, Chapter II, Chapter VI Secs 6.1-6.2.5.
   Unit 2: Chapter III, Chapter V Secs 1.1-1.5, Chapter X Secs 10.2.1-10.3.1.
2. S. Arumugam& A. Thangapandi Isaac, **Calculus,Vol.2.,**New Gamma Publishing House, Palayamkottai, 1999.
   Unit 3:Chapter 2 Secs 2.6-2.9.
   Unit 4:Chapter 4 Secs 4.1-4.5.
   Unit 5:Chapter 6 Secs 6.1-6.6.

References:

1. George B. Thomas, JR &Ross L. Finney, **Calculus and Analytic Geometry,** Sixth edition, Narosa Publishing House, New Delhi, 1986.
2. S. Arumugam& A. Thangapandi Isaac, **Calculus,**Vol.1, New GammapublishingHouse, Palayamkottai,1999.

Web Resources:

1. https://freevideolectures.com/course/2502/calculus
2. https://freevideolectures.com/course/2071/calculus-i-key-concepts

LECTURE SCHEDULE

Unit	Topics	No. hours
1	Differentiation: Limits and continuity	3
	Standard forms	4
	Logarithmic differentiation-Transformation	3
	Rolle's theorem- Mean value theorem- Generalised mean value theorem	4
		Total 14

2	Differential Calculus: Successive Differentiation	3
	Leibnitz theorem and its applications	2
	Curvature - Radius of Curvature and Centre of Curvature - Evolutes and Involutes	4
	Maxima and Minima.	3
		Total 12
3	Integral Calculus: Evaluation of Definite integrals	4
	Integration by parts	3
	Reduction formulae	3
	Integration as the limit of a sum.	3
		Total 13
4	Double and Triple integrals: Double Integrals- Evaluation of double integrals	3
	Triple integrals	3
	Jacobians	3
	Change of variables in double and Triple integrals.	3
		Total 12
5	Application of Integration: Length of a curve- Area	3
	Volume of a solid of revolution	3
	Surface area of a solid of revolution	3
	Volume as Triple integral- Area of surfaces.	4
		Total 13
		Grand Total 64

Allied Course (Theory) Semester III
18MATU03B5 ALLIED STATISTICS-I Credits: 3

Objective: To impart deep knowledge about statistical methods.

Specific outcome of learning: The learner will be able to

- analyze the concept about the methods of attributes.
- calculate standard error and sampling distribution.
- know more skills about the occurrence of null and alternate hypotheses.
- analyze the given data by using Chi-square test.
- analyze the variance and coding of data.

Unit 1: Association of Attributes: Introduction-Difference between correlation and association-Notation and Terminology-Consistency of data- association and disassociation-methods of studying association-Miscellaneous illustrations.

(10 hours)

Unit 2: Statistical inference-Tests of hypotheses: Introduction-standard error and sampling distribution-estimation.

(10 hours)

Unit 3: Statistical inference- Tests of hypotheses (continued): test of significance for large samples Test of significance for small samples.

(9 hours)

Unit 4:

χ^2 test and goodness of fit:Introduction-χ^2 defined-conditions for applying χ^2 test-Yates' corrections-Uses of χ^2 test-additive property of χ^2 - Chi-square for specified value of population variance.

(9 hours)

Unit – 5

Analysis of variance-assumptions in analysis of variance-technique of analysis of variance-coding of data-analysis of variance in two-way classification model.

(10 hours)

Text Book:

1. S.P. Gupta, Statistical Methods, Sultan Chand & Sons, New Delhi, 2001.
   Unit I: Page number 477-499.
   Unit II: Page number 881-901.
   Unit III: Page number 901-929.
   Unit IV: Page number 953-972.
   Unit V: Page number 1009-1038.

Reference Books:

1. S. C. Gupta and V. K. Kapoor, Fundamentals of Mathematical statistics, Sultan Chand & Sons, New Delhi, 1994.
2. Chung, Elementary Probability Theory with Stochastic Process, Narosa publishing House, New Delhi, 1993.
3. J. N. Kapoor and H. C. Saxena, Mathematical Staitstics, Sultan Chand & Sons, New Delhi, 1994.

Web Resources:

1. https://nptel.ac.in/courses/111105041/
2. https://nptel.ac.in/courses/111105090/
3. http://www.nptelvideos.in/2012/11/probability-and-statistics.html

LECTURE SCHEDULE

Unit	Topics	No. hours
1	Introduction-Difference between correlation and association	2
	Notation and Terminology-Consistency of data	2
	association and disassociation	3
	methods of studying association-Miscellaneous illustrations	3
		Total 10
2	Introduction	3
	standard error and sampling distribution	3
	estimation	4
		Total 10
3	test of significance for large samples	3
	Two-tailed test for difference between the means of two samples	3
	Test of significance for small samples	3
		Total 9
4	Introduction-χ^2 defined-conditions for applying χ^2 test	3
	Yates' corrections-Uses of χ^2 test-additive property of χ^2	3
	Chi-square for specified value of population variance.	3
		Total 9
5	analysis of variance-assumptions in analysis of variance	3
	technique of analysis of variance-coding of data	4
	analysis of variance in two-way classification model.	3
		Total 10
		Grand Total 48

Core Course-Theory	Semester III	
18MATU0305	PROGRAMMING WITH JAVA	Credits: 3

Objective: To develop object oriented programming skills in JAVA and its applications in webpage designing, geometry and graphical representation of statistical data.

Specific outcome of learning:

- The learner will become proficient in the creation and implementation of java programs and Java tokens
- Proficient in operators and expressions

- Proficient in decision making and looping
- Proficient in interfaces
- Proficient in applet and graphics programming with geometry and statistical data analysis

Unit 1:Overview of java language: Introduction - Simple java program - An application with two classes - Java program structure - Java tokens - Java statements - implementing a java program - Java virtual machine - Command line arguments: Constants, Variables and Data types - declaration of variables giving values to variables - Scope of variables - Symbolic constants - Type casting - Getting values of variables - Standard default values.

(14 hours)

Unit 2: Operators and Expressions: Arithmetic operators - Relational operators - Logical operators -Assignment operators - Increment and decrement operators- Conditional operators - Bitwise operators - Special operators- - Arithmetic expressions -Evaluation of expressions - Precedence of Arithmetic operators - Type conversion in expressions - Operator precedence and associativity. 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 - Switch statement –The?: operator.

(14 hours)

Unit 3: Decision making and Looping: The while statement - The do statement - the for statement - Jumps in loops - Labeled loops. Classes, Objects and Methods Defining a Class - Adding variables -.Adding methods - Creating Objects - Accessing Class members - Constructors -Methods. Overloading - Static members- Nesting of methods - Inheritance: Extending a class - Overriding methods - Final variables and methods - final classes - finalizer methods - Abstract methods and classes - visibility control - Arrays - One dimensional. Arrays - Crating an array -Two dimensional array - Strings - Vectors - wrapper Classes.

(12 hours)

Unit 4: Interfaces: Defining interfaces - Extending interfaces - Implementing interfaces - Accessing interface variables - 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.

(12 hours)

Unit 5: Applet Programming: Introduction - How applets differ from applications - Preparing to write applet - Building applet code - Applet life cycle - Creating an executable applet - Designing a web page - Applet tag - Adding applet to HTML File - Running The Applet - More about applet tag - Displaying numerical values- Getting input from the user. Graphics Programming: Introduction - The Graphics class - Lines and Rectangles - Circles and Ellipses - Drawing arcs - Drawing polygons -. Line graphs - Using control loops in applets - Drawing bar charts.

(12 hours)

Text Book:

1. E.Balagurusamy, **Programming with Java**, McGraw - Hill Publishing Company Ltd., New Delhi, 2005.
   Unit 1: Chapters 3, 4
   Unit 2: Chapters 5, 6
   Unit 3: Chapters 7, 8, 9
   Unit 4: Chapters 10, 11
   Unit 5: Chapters 14, 15.

References:

1. H. Sehildt, **JAVA2: The Complete Reference,** Fourth Edition, TMH Publishing Company, New Delhi, 2001.
2. C. Xavier, **Programming with JAVA 2**, SciTech Publications, Chennai, 2000

LECTURE SCHEDULE

Unit	Topics	No. hours
1	Overview of java language Introduction	4
	Java program structure Java tokens	4
	Command line arguments	3
	Declaration of variables giving values to variables	3
		Total 14
2	Operators	4
	Expressions	4
	Decision making and Branching	3
	Nesting of if else statements	3
		Total 14
3	Decision making and looping	3
	Classes, objects and methods defining a class	3
	Overloading	3
	Arrays	3
		Total 12
4	Interfaces	3
	Packages	3
	Creating packages and Accessing a package	3
	Using a package and adding package hiding classes	3
		Total 12
5	Applet Programming Introduction	3
	Creating an executable applet Designing a web page	3
	Graphics Programming Introduction	3
	Drawing polygons Line graphs	3
		Total 12
		Grand Total 64

Core Course -Practical	Semester III	
18MATU0306	PROGRAMMING WITH JAVA	Credit: 1

Practical related to Programming with Java

1. Write a program to determine the sum of harmonic series
2. Write a program to convert the given temperature in Fahrenheit to Celsius
3. Write a program to perform any 5 math functions
4. Write a program to solve two linear equations with two unknowns
5. Prepare your house EB bill according to unit price of reading range by TNEB
6. Display Floyd's triangle
7. Compute power of 2 using for loop
8. Reverse the digits using while loop
9. Write a program that computes and prints a table of factorials for any given m.
10. Write a program to compute sum of digits of a given integer
11. Write a program using do….while loop to calculate and print first m Fibonacci numbers
12. Program to illustrate Class
13. Program to illustrate Constructors
14. Program to illustrate method overloading
15. Program to illustrate static members
16. Program to illustrate inheritance concept
17. Write a program to sort a list of numbers
18. Write a program to perform matrix multiplication
19. Write a program for alphabetical ordering of strings
20. Write a program to calculate compound interest value by using wrapper class methods
21. Prepare student mark list by implementing multiple inheritance using interfaces
22. Program to illustrate packages
23. Develop an applet that receives three numeric values as input from the user and then displays the largest value on the screen. Write a HTML page and test the applet.
24. Applet program to display bar chart for the following data:

Year	:	2010	2011	2012	2013	2014	2015
Turnover (Rs. Crores)	:	110	150	100	170	190	120

25. Write applets to draw the following shapes:
    a) Cone
    b) Cylinder
    c) Cube
    d) Square inside a circle
    e) Circle inside a square

Core Course	Semester IV	
18MATU0407	ABSTRACT ALGEBRA	Credits: 4

Objective: To provide some knowledge about various algebraic structures.

Specific outcome of learning: The learner will be able to

- recognize the basic properties of groups and subgroups.
- understand the types of homomorphism and use them to classify groups.
- apply the theorems to study the structure of groups.
- recognize the basic properties of rings, fields and integral domains.
- apply the algebraic methods for solving problems.

Unit 1: Groups: Introduction - Definition and examples - Elementary properties of a group – Equivalent definition of a group – Permutation groups.

(13 hours)

Unit 2: Subgroups – Cyclic groups - Order of an element –Cosets and Lagrange's theorem

(14 hours)

Unit 3: Normal subgroups and quotient groups – Isomorphism - Cayley's theorem - Homomorphisms.

(13 hours)

Unit 4: Rings: Definition and examples – Elementary properties of rings – Isomorphism - Type of rings – Characteristic of a ring – Subring.

(12 hours)

Unit 5: Ideals - Quotient rings – Maximal and prime ideals - Homomorphism of rings.

(12 hours)

Text Book:

1. S. Arumugam& A. T. Isaac, **Modern Algebra**, SciTech Publications(India) Pvt. Ltd., 2003.
   Unit 1: Chapter 3: Sections 3.0, 3.1, 3.2, 3.3, 3.4
   Unit 2: Chapter 3: Sections 3.5, 3.6, 3.7, 3.8
   Unit 3: Chapter 3: Sections 3.9, 3.10, 3.11
   Unit 4: Chapter 4: Sections 4.1, 4.2, 4.3, 4.4, 4.5, 4.6
   Unit 5: Chapter 4: Sections 4.7, 4.8, 4.9, 4.20

References:

1. S. Narayanan & T. K. ManickavasagamPillai, **Modern Algebra**, Vol. II, S. Viswanathan Pvt. Ltd., Chennai, 1997.
2. John. B. Fraleigh, **A first course in abstract algebra**, 7th edition, Addison-Wesley Publications, US, 2003.

LECTURE SCHEDULE

Unit	Topics	No. hours
1	Definition and examples of group	4
	Elementary properties of a group	3
	Equivalent definitions of a group	3
	Permutation groups	3
		Total 13
2	Subgroups	4
	Cyclic groups	4
	Order of an element	3
	Cosets and Lagrange's Theorem	3
		Total 14
3	Normal subgroups and quotient groups	4
	Isomorphism	4
	Cayley's theorem	2
	Homomorphisms	3
		Total 13
4	Definition and examples of rings	2
	Elementary properties of rings	2
	Isomorphism	2
	Type of rings	2
	Characteristics of a ring	2
	Subring	2
		Total 12
5	Ideals	3
	Quotient rings	3
	Maximum and prime ideals	3
	Homomorphism of rings	3
		Total 12
		Grand Total 64

Core Course	Semester IV	
18MATU0408	SEQUENCES AND SERIES	Credits: 4

Objective: To enhance basic skills in the areas of sequences and series.

Specific outcome of learning: The learner will become proficient in

- Sequences and types of sequences
- Behavior of sequences and its subsequences

- Infinite series and various tests for finding its convergence
- Binomial Series, Exponential Series and Logarithmic Series
- Summations of trigonometric series and problems

Unit 1: Sequences: Introduction – Sequences-Bounded sequences - Monotonic sequences - Convergent sequences-Divergent and oscillating sequences.

(11 hours)

Unit 2: The algebra of limits - Behaviour of monotonic sequences-Some theorems on limits – Subsequences -Limit points.

(9 hours)

Unit 3: Cauchy sequences-The upper and lower limit of a sequences - Series of positive terms: Infinite series-Comparison test-Kummer's test - Root test and Condensation test.

(10 hours)

Unit 4: Binomial Series - Exponential Series and Logarithmic Series.

(10 hours)

Unit 5: Summations of trigonometric series-Properties and their related problems.

(10 hours)

Text Books:

1. S. Arumugam& A. Thangapandi Isaac, **Sequences and series**, New Gamma Publishing House, Palayamkottai, 2015.Unit 1-Sections 3.0, 3.1, 3.2, 3.3, 3.4, 3.5. Unit 2-Sections 3.6, 3.7, 3.8, 3.9, and 3.10. Unit 3-Sections3.11, 3.12, 4.1, 4.2, 4.3, 4.4.
2. S. Arumugam, A. Thangapandi Isaac& A. Somasundaram**Engineering Mathematics**, Volume 1, Scitech Publications (India) Pvt. Ltd, Chennai.Unit 4 -Sections 1.7, 1.8, 1.9.
3. S. Narayanan & T. K. ManicavachagomPillai, **Trigonometry**,S.Viswanathan Pvt. Ltd., Chennai, 2001.Unit 5- Chapters VI: Sections 1, 2, 3.

References:

1. N. P. Bali, **Real Analysis**, An imprint of Laxmi Publications Pvt. Ltd., New Delhi, 2005.
2. T. K. Manicavachagom Pillay, T. Natarajan & K. S. Ganapathy, **Algebra**, Vol. 1, S. Viswanathan (Printers & Publishers) Pvt. Ltd., Chennai, 2014.
3. Arumugam & Issac, **Theory of Equations, Theory of Numbers and Trigonometry**, New gamma Publishing house, Tirunelveli, 2011.
4. Richard R. Goldberg,**Methods of Real Analysis**, Oxford & IBH Publishing CO. PVT. LTD., New Delhi, 1970.
5. Ajith Kumar and S. Kumaresan, **A Basic Course in Real Analysis** CRC Press, Reprint 2015

Web Resources:

1. https://nptel.ac.in/courses/111106053/46
2. http://nptel.ac.in/courses/109104124/

LECTURE SCHEDULE

Unit	Topics	No. hours
1	Sequences: Introduction – Sequences	2
	Bounded sequences	3
	Monotonic sequences	2
	Convergent sequences-Divergent and oscillating sequences	4
		Total 11
2	The algebra of limits - Behaviour of monotonic sequences	2
	Some theorems on limits	3
	Subsequences	2
	Limit points	2
		Total 9
3	Cauchy sequences	3
	The upper and lower limit of a sequences	2
	Series of positive terms: Infinite series	2
	Comparison test-Kummer's test - Root test and Condensation test.	3
		Total 10
4	Binomial Series	4
	Exponential Series	3
	Logarithmic Series.	3
		Total 10
5	Summations of trigonometric series	4
	Properties and their related problems.	4
		Total 8
		Grand Total 48

Core Course	Semester IV	
18MATU0409	DIFFERENTIAL EQUATIONS	Credits: 4

Objective: To introduce the basic concepts of differential equations and Fourier series.

Specific outcome of learning: The learner will

- Understand the basic concepts of first order differential equation and it applications.
- Determine solutions to second order linear homogeneous, non-homogeneous differential equations with constant coefficients.
- Find solutions by applying Laplace transform methods.

- Understand the elementary theory of partial differential equations, and solve it using various techniques.
- Familiar with Fourier series and their applications to partial differential equations.

Unit 1: Differential Equations: Introduction – First order O.D.E – Types of first order O.D.E – first order O.D.E of higher degree.

(13 hours)

Unit 2: Linear Second Order Equations with constant coefficient and particular integral of the functions of the type x^m, $e^{ax}\cos bx$ and $e^{ax}\sin bx$ only. Homogeneous linear equations with variable coefficients - Simultaneous Equations.

(14 hours)

Unit 3: Laplace Transform of Elementary Functions - Laplace Transforms of Periodic Functions - Inverse Transforms - Solutions of Ordinary Second Order Differential Equations with Constant Coefficients. (12 hours)

Unit 4: Partial Differential Equations (PDE) Forming a PDE - Lagrange Method of solving Linear Equations - Standard forms of PDE - Charpits Method. (13 hours)

Unit 5: Fourier series: Expansion of a function - Drichlet's Conditions - Determining the Fourier Coefficients- Odd and Even Functions - Half Range Sine Series - Half Range Cosine Series.

(12 hours)

Text Books:

1. S. Narayanan &T.K. Manickavachagom Pillay, **Differential Equations and its Applications,** S. Viswanathan Pvt. Ltd., Chennai, 2013.

   Unit 1: Chapters I, II, IV
   Unit 2: Chapter V (up to section 6), Chapter VI.
   Unit 3: Chapter IX
   Unit 4: Chapter XII

2. T. Veerarajan,**Transforms and Partial Differential Equations,** Tata McGraw Hill Education Private Ltd., New Delhi, 2012.

   Unit 5: Chapter 1-Section 1.1 – 1.9

References:

1. Arumugam& Isaac, **Differential Equations and Applications,** New Gamma Publishing House, 2003.

2. M. D. Raisinghania, **Advanced Differential equations,** S. Chand Publications, New Delhi 2004.
3. K. Vairaamanickam, Nirmala P. Ratchagar& T. Tamilselvan, **Transforms and Partial Differential Equations,** SciTech Publications Pvt. Ltd., 2011.

Web Resources:

1. https://nptel.ac.in/courses/122107037/14
2. https://nptel.ac.in/courses/111107111/

LECTURE SCHEDULE

Unit	Topics	No. hours
1	Differential Equations: Introduction.	4
	First order O.D.E and types of first order O.D.E.	5
	First order O.D.E of higher degree.	4
		Total 13
2	Linear Second Order Equations with constant of the second order with variable coefficients.	4
	Particular integral of the functions of the type X^m, e^{ax}cosbx and e^{ax} sin bx.	4
	Homogeneous linear equations with variable coefficients.	3
	Simultaneous Equations.	3
		Total 14
3	Laplace Transform of Elementary Functions.	3
	Laplace Transforms of Periodic Functions.	3
	Inverse Laplace Transforms.	3
	Solutions of Ordinary Second Order Differential Equations with Constant Coefficients.	3
		Total 12
4	Partial Differential Equations: Introduction, Forming a PDE.	5
	Lagrange Method of solving Linear Equations.	4
	Standard forms of PDE and Charpit's Method.	4
		Total 13
5	Fourier series: Introduction and Expansion of a function.	3
	Drichlet's Conditions and Determining the Fourier Coefficients.	3
	Odd and Even Functions.	3
	Half Range Sine Series and Half Range Cosine Series.	3
		Total 12
		Grand Total 64

Allied Course (Theory)	Semester IV	
18MATU04B6	ALLIED STATISTICS-II	Credits: 3

Objective: To impart deep knowledge about statistical methods.

Specific outcome of learning: The learner will be able to

- obtain the moments of various orders.
- analyze the convergence in probability.
- understand about special types of continuous probability distributions.
- analyze different factors that varies with respect to time.
- know about the various methods and uses of vital statistics.

Unit –1

Generating functions and Law of large numbers: Moment generating functions-cumulants-characteristic functions.

(10 hours)

Unit –2

Generating functions and Law of large numbers(continued): Chebychev's inequality-convergence in probability- weak law of large numbers.

(9 hours)

Unit- 3

Special continuous probability distributions: Rectangular(or uniform) distribution-triangular distribution-gamma distribution-beta distribution of first kind-beta distribution of second kind.

(10 hours)

Unit – 4

Special continuous probability distributions (continued): Exponential distribution-standard Laplace distribution- Cauchy distribution.

(9 hours)

Unit – 5

Vital Statistics: Introduction-vital statistics defined-uses of vital statistics-methods of obtaining vital statistics-measurement of fertility-reproduction rates-measurement of mortality.

(10 hours)

Text Book:

1. S. C. Gupta and V. K. Kapoor, Fundamentals of Mathematical statistics, Sultan Chand & Sons, New Delhi, 1994.

Unit I: page numbers 7.1-7.17
Unit II: page numbers 7.24-7.39
Unit III: page numbers 9.29 -9.50
Unit IV: page numbers 9.50-9.55, 9.58-9.63

3. S.P. Gupta, Statistical Methods, Sultan Chand & Sons, New Delhi, 2001.
Unit V: Page numbers 711-736.

Reference Books:

1. Chung, Elementary Probability Theory with Stochastic Process, Narosa publishing House, New Delhi, 1993.
2. J. N. Kapoor and H. C. Saxena, Mathematical Staitstics, Sultan Chand & Sons, New Delhi, 1994.

LECTURE SCHEDULE

Unit	Topics	No. hours
1	Generating functions and Law of large numbers: Moment generating functions.	3
	cumulants	3
	characteristic functions	4
		Total 10
2	Chebychev's inequality	3
	convergence in probability.	3
	weak law of large numbers	3
		Total 9
3	Rectangular(or uniform) distribution	2
	triangular distribution	2
	gamma distribution-beta distribution of first kind	3
	beta distribution of second kind.	3
		Total 10
4	Exponential distribution,	3
	Standard Laplace distribution	3
	Cauchy distribution	3
		Total 9
5	Introduction-vital statistics defined	2
	uses of vital statistics-methods of obtaining vital statistics	2
	measurement of fertility-reproduction rates	3
	measurement of mortality.	3
		Total 10
		Grand Total 48

Allied Course (Practical)	Semester – III &IV	
18MATU04B7	ALLIED STATISTICS - PRACTICAL	Credits – 2

List of Practicals

Drawing bar charts, Pie diagrams, Histograms, Pictograms, 3-D bars and other related diagrams.

Drawing graphs of frequency curves, frequency polygons, Normal probability curve, cumulative distribution curves, probability curves for different distributions.

Computation of Mean, Variance, Skewness and Moments, Kurtosis measures.

Computation of Moment generating functions, characteristic functions, cumulants and related measures.

Computation of Covariance, Correlation Coefficient, Equations of Regression lines and curves.

Computing F-ratio and preparation of Analysis of variance tables.

Computation of Index Numbers

Analysis of time series: Introduction-time series-components of a time series-measurement of trends.

SPSS Package

Reference Books:

1. S.C. Gupta and V.K. Kapoor, Fundamentals of Mathematical Statistics, Sultan Chand and Sons (1994).
2. N. Kapoor and H.C. Saxena, Mathematical Statistics, S. Chand and Co. (1994).
3. Chung, Elementary Probability theory with Stochastic Process, Narosa publishing House (1993).
4. Arumugam and Isaac, Statistics, New Gamma Publications, July 2016.
5. S.P. Gupta, Statistical Methods, Sultan Chand & Sons, New Delhi, 2001.

Software : SPSS package 11.6 version

Core Course	Semester V	
18MATU0510	LINEAR ALGEBRA	Credits: 4

Objective: To introduce the fundamentals of vector spaces.

Specific outcome of learning: The learner will be able to

- recognize the basic properties of vector spaces.
- understand the concepts of linear algebra in geometric point of view.
- visualize linear transformations as matrix form.
- apply the tools of linear algebra to solve the system of equations.
- formulate the importance and applications of linear algebra in many branches of mathematics.

Unit1: Vector Spaces: Introduction - Definition and examples – Subspaces.

(12 hours)

Unit2: Linear transformation – Span of a set – Linear independence.

(13 hours)

Unit3: Basis and dimension- Rank and nullity - Matrix of a linear transformation.

(14 hours)

Unit4: Inner product spaces: Introduction - Definition and examples –Orthogonality – Orthogonal Complement.

(12 hours)

Unit5: Elementary transformations - Rank of a matrix – Simultaneous linear equations – Characteristic equation and Cayley Hamilton Theorem – Eigen values and eigen vectors.

(13 hours)

Text Book:

1. S. Arumugam&A. T. Isaac, **Modern Algebra**, SciTech Publications(India) Pvt. Ltd., 2003.
   Unit 1: Chapter 5: Sections 5.0, 5.1, 5.2.
   Unit 2:Chapter 5: Sections 5.3, 5.4, 5.5.
   Unit 3:Chapter 5: Sections 5.6, 5.7, 5.8.
   Unit 4:Chapter 6: Sections 6.0, 6.1, 6.2, 6.3.
   Unit 5:Chapter 7: Sections 7.4, 7.5, 7.6, 7.7, 7.8.

References:

1. S. Narayanan & T. K. ManickavasagamPillai, **Modern Algebra**,Vo1 III, S. ViswanathanPvt. Ltd., Chennai, 1997.
2. S. Kumaresan, **Linear Algebra: A Geometric approach**, Prentice Hall of India, 2006.
3. VivekSahai&VikasBist, **Linear Algebra**, Narosa Publishing House, 2002.

Web Resources:

1. https://onlinecourses.nptel.ac.in/noc18_ma13

LECTURE SCHEDULE

Unit	Topics	No. hours
1	Vector spaces: Definition and examples, properties	7
	Subspaces	5
		Total 12
2	Linear transformation	4
	Span of a set	5
	Linear independence	4
		Total 13
3	Basis and dimension	5
	Rank and nullity	4
	Matrix of a linear transformation	5
		Total 14
4	Inner product spaces: Definition, examples and results	5
	Orthogonality	3
	Orthogonal Complement	4
		Total 12
5	Rank of a matrix	2
	Simultaneous linear equations	3
	Characteristic equation and Cayley Hamilton Theorem	4
	Eigen values and eigen vectors	4
		Total 13
		Grand Total 64

Core Course	Semester V	
18MATU0511	REAL ANALYSIS	Credits: 4

Objective: To impart concepts about sets with metric and related properties.

Specific outcome of learning: The learner will become proficient in

- Sets with various metric functions
- Open sets and closed sets and its properties
- Completeness of a metric space
- Continuous and discontinuous functions on metric spaces
- Connected metric spaces and properties of continuous functions on it

Unit 1: Limit of a function on the real line- Metric spaces- Limits in metric spaces- Functions continuous at a point on the real line - Functions continuous on a metric space.

(14 hours)

Unit 2: Open sets- Closed sets- Discontinuous function on R- More about open sets.

(12 hours)

Unit 3: Connected sets- Bounded sets and totally bounded sets- Complete metric spaces- Compact metric spaces.

(14 hours)

Unit 4: Continuous functions on compact metric spaces- Continuity of the inverse function, Uniform continuity.

(11 hours)

Unit 5: Definition of the Riemann integral- Existence of the Riemann integral- Properties of the Riemann integral- Derivatives- Rolle's theorem- The law of the mean- Fundamental theorem of calculus- Improper integrals.

(13 hours)

Text Book:

1. Richard R. Goldberg, **Methods of Real Analysis**,Oxford & IBH Publishing Co. Pvt. Ltd, New Delhi, 1970.
   Unit 1-Secs 4.1-4.3, 5.1-5.3.
   Unit 2-Secs 5.4-5.6,6.1.
   Unit 3-Secs 6.2-6.5.
   Unit 4-Secs 6.4-6.8.
   Unit 5-Secs 7.2-7.9.

References:

1. N. P. Bali, **Real Analysis**, An imprint of Laxmi Publications Pvt. Ltd., New Delhi, 2005.
2. Sterling K. Berberian, **A First Course In Real Analysis**, Springer, New York, 2004.
3. S. Arumugam& A. Thangapandi Isaac, **Modern Analysis**, New Gamma Publishing House, Palayamkottai, 2002.
4. Robert G. Bartle and Donald R. Sherbert, **Introduction to Real Analysis**, John Wiley and Sons, New Delhi, 1982.
5. S. C. Malik & Savita Arora, **Mathematical Analysis**, New Age International LTD., New Delhi, 1992

LECTURE SCHEDULE

Unit	Topics	No. of Hours
1	Limit of a function on the real line.	2
	Metric spaces	3
	Limits in metric spaces	3
	Functions continuous at a point on the real line	3
	Functions continuous on a metric space	2
	Total	14

2	Open sets	4
	Closed sets	3
	Discontinuous function on R	2
	More about open sets.	3
	Total	12
3	Connected sets	4
	Bounded sets and totally bounded sets	3
	Complete metric spaces	3
	Compact metric spaces.	4
	Total	14
4	Continuous functions on compact metric spaces	4
	Continuity of the inverse function	4
	Uniform continuity.	3
	Total	11
5	Definition of the Riemann integral- Existence of the Riemann integral	2
	Properties of the Riemann integral	3
	Derivatives- Rolle's theorem-	4
	The law of the mean	1
	Fundamental theorem of calculus- Improper integrals.	3
	Total	13
	Grand Total	64

Core Course	Semester V	
18MATU0512	LINEAR PROGRAMMING	Credits: 4

Objective: To impart the basic concepts and applications of linear programming.

Specific outcome of learning:

- The learner will formulate a linear programming problem and solve them graphically and simplex method
- The learner will be able to understand the concepts of duality programming
- The learner will analyze the different aspects of transportation problems and also assignment problems
- The learner will develop, organize, evaluate short, long term processes and solve problems
- The learner will acquire the knowledge of basics in game theory

Unit 1: Mathematical Formulation of LPP and Problems - Graphical Solution - Simplex Method – Big M Method - Two Phase Method.

(13 hours)

Unit 2: Duality in Linear Programming: Introduction – General Primal-Dual Pair – Formulating a Dual Problem - Duality and Simplex Method - Dual Simplex Method.

(13 hours)

Unit 3: Transportation Problem (TP): Introduction - Mathematical Formulation of TP - Finding an Initial Basic Feasible Solution using North West Corner Rule and Vogel's approximation method –Transportation Algorithm (MODI Method) - Unbalanced Transportation Problems. Assignment Problems (AP): Mathematical formulation of AP - Assignment algorithm –The Travelling Salesman Problem.

(13 hours)

Unit 4: Sequencing Problem: Introduction - Problem of Sequencing – Basic Terms used in Sequencing – Processing 'n' Jobs through Two Machines– Processing 'n' Jobs through k Machines- Processing 2 Jobs through k machines.

(13 hours)

Unit 5: Games and Strategies: Introduction – Two-Person Zero-Sum Games –Some Basic Terms – The MAXIMIN-MINIMAXPrinciple - Games without Saddle Points-Mixed Strategies - Graphical Solution of $2\times n$ and $m\times 2$ Games - Dominance Property.

(12 hours)

Text Book:

1. KantiSwarup, P. K. Gupta& Man Mohan, **Operations Research**, Sultan Chand& Sons, New Delhi, Eighteenth Thoroughly Revised Edition, 2015.
   Unit 1: Chapter 2: Sections 2:3,2.4, Chapter 3: Sections 3.2, Chapter 4: Sections 4.3, 4.4.Unit 2: Chapter 5: Sections 5.1, 5.2, 5.3, 5.7, 5.9.
   Unit 3: Chapter 10: Sections 10.1, 10.2,10.9(1&3), 10.13, 10.15, Chapter 11: Sections 11.2, 11.3, 11.7.
   Unit 4: Chapter 12: Sections 12.1, 12.2, 12.3, 12.4, 12.5, 12.6.
   Unit 5: Chapter 17: Sections 17.1, 17.2, 17.3, 17.4, 17.5, 17.6, 17.7.

References:

1. P. K. Gupta & D. S. Hira, **Operations Research**, S. Chand &Company Ltd., New Delhi, 2013.
2. J. K. Sharma, **Operations Research theory and its applications,** 2nd Edition, Macmillan, New Delhi, 2006.
3. R. Panneerselvam, **Operations Research**, Prentice Hall of India Pvt. Ltd., New Delhi, 2002.

Web Resources:

1. https://nptel.ac.in/courses/112106134/
2. https://nptel.ac.in/courses/111105039/

LECTURE SCHEDULE

Unit	Topics	No. hours
1	Mathematical Formulation of LPP and Problems	3
	Graphical Solution	2
	Simplex Method	2
	Big M Method	3
	Two Phase Method.	3
		Total 13
2	Duality in Linear Programming: Introduction	2
	General Primal-Dual Pair	2
	Formulatinga Dual Problem	3
	Duality and Simplex Method	3
	Dual Simplex Method	3
		Total 13
3	Transportation Problem (TP): Introduction	1
	Mathematical Formulation of TP	1
	Finding an Initial Basic Feasible Solution using North West Corner Rule and Vogel's approximation method	3
	Transportation Algorithm (MODI Method)	2
	Unbalanced Transportation Problems.	1
	Assignment Problems (AP): Mathematical formulation of AP	1
	Assignment algorithm	2
	The Travelling Salesman Problem.	2
		Total 13
4	Sequencing Problem: Introduction	2
	Problem of Sequencing	2s
	Basic Terms used in Sequencing	2
	Processing 'n' Jobs through Two Machines	3
	Processing 'n' Jobs through k Machines	2
	Processing 2 Jobs through k machines	2
		Total 13
5	Games and Strategies: Introduction	1
	Two-Person Zero-Sum Games	1
	Some Basic Terms	1
	The MAXIMIN-MINIMAXPrinciple	1
	Games without Saddle Points	2
	Mixed Strategies	2

	Graphical Solution of $2\times n$ and $m\times 2$ Games	2
	Dominance Property	2
		Total 12
		Grand Total 64

Skill Based Elective	Semester V	
18MATU05S1	QUANTITATIVE SKILLS	Credits: 2

Objective: To impart skills in numerical and quantitative techniques.

Specific outcome of learning: The leaner will be

- Able to critically evaluate various real life situations by resorting to Analysis of key issues and factors.
- Proficient in applying graphs, charts and probability techniques on various problems.
- Proficient in the problems on relations, coding and decoding.
- Able to demonstrate various principles involved in solving mathematical problems and thereby reducing the time taken for performing job functions.
- Able to face interviews.

Unit 1: H.C.F and L.C.M of Numbers- decimal fractions- simplifications- square roots and cube roots- average- Problems on Numbers- Problems on Ages, Surds and Indices.

(6 hours)

Unit 2: Tabulation- Bar graphs- Pie charts- Line graphs- Permutation and combinations- Probability- true discount- Banker's discount- Heights and distances.

(7 hours)

Unit 3: Percentages- Profit and Loss- Ratio-Proportion- Partnership- Chain rule- Time and work- Pies and cistern-Time and Distances.

(6 hours)

Unit 4: Problems on Trains- Boats and Streams- Coding and decoding- Blood Relations- Logical Venn Diagram.

(7 hours)

Unit 5: Logical deduction- Alphabet Test- Deriving conclusion from passages- Group discussion (on any current relevant topic).

(6 hours)

Text Book:

1. R.S. Aggarwal, **Quantitative Aptitude,** 7th Revised Edition, S. Chand & Company Ltd., New Delhi, 2015.

Reference:

1. R.S. Aggarwal, **A Modern approach to verbal Reasoning**, (Fully solved), Chand & Company Ltd., New Delhi, 2012.

LECTURE SCHEDULE

Unit	Topics	No. Hours
1	H.C.F and L.C.M of Numbers- decimal fractions	2
	Simplifications- square roots and cube roots	2
	Average- Problems on Numbers	2
	Problems on Ages Surds and Indices	2
		Total 8
2	Tabulation- Bar graphs- Pie charts- Line graphs	2
	Permutation and combinations-Probability	2
	True discount- Banker's discount	2
	Heights and distances	1
		Total 7
3	Percentages- Profit and Loss	2
	Ratio-Proportion- Partnership	2
	Chain rule- Time and work- Pies and cistern-Time and Distances	2
		Total 6
4	Problems on Trains	1
	Boats and Streams	1
	Coding and decoding- Blood Relations	2
	Logical Venn Diagram	2
		Total 6
5	Logical deduction	1
	Alphabet Test	1
	Deriving conclusion from passages	2
	Group discussion	1
		Total 5
		Grand Total 32

Core Course	Semester VI	
18MATU0613	COMPLEX ANALYSIS	Credits: 4

Objective: To introduce the concepts of complex numbers and analytic functions.

Specific outcome of learning:

- The learner will acquire basic concepts of analytic function and its properties

- The learner will acquire basic knowledge about conformal and bilinear transformation
- The learner will gain knowledge of integration of complex valued function
- The learner will become proficient in series of analytic function
- The learner will acquire skills of finding integral values of complex function using residues

Unit 1: Functions of complex variables-Limits- Continuous functions- Differentiability-Cauchy Riemann Equation–Analytic functions - Harmonic function-Conformal mapping.

(13 hours)

Unit 2: Elementary mappings - Bilinear transformations –Cross Ratio-Fixed points of bilinear transformations- Some special bilinear transformations.

(12 hours)

Unit 3: Integration in the Complex plane - Cauchy's theorem - Cauchy's Integral formula - Cauchy's Integral formula for higher derivatives- Liouville's theorem - Maximum modulus theorem.

(13 hours)

Unit 4: Sequences and series of functions – Power series-Taylor's and Laurent's series –Zeros of an analytic functions- Singular points - Types of singularities.

(15 hours)

Unit 5: Residues –Cauchy's Residue theorem –Evaluation of definite integrals.

(11 hours)

Text Book:

1. S. Arumugam, A. Thangapandi Isaac& A. Somasundaram, **Complex Analysis**, SciTech Publications, India, Pvt. Ltd., 2002.
   Unit 1: Chapter 2 (Sections 2.0-2.9)
   Unit 2: Chapter 3 (Sections 3.0-3.5), Chapter 5 (Sections 5.0-5.7)
   Unit 3: Chapter 6 (Sections 6.0-6.4)
   Unit 4: Chapter 4 (Sections 4.0-4.4), Chapter 7 (Sections 7.0-7.4)
   Unit 5: Chapter 8 (Sections 8.0-8.3)

References:

1. S. Narayanan & T.K. ManickavasagamPillai, **Complex Analysis**, S. Viswanathan Publishers, Chennai, 1997.
2. S. Ponnusamy, **Foundations of Complex Analysis**, 2nd Edition, Narosa Publication, New Delhi, 2005.
3. R. V. Churchill & J.W. Brown, **Complex variables and applications**, 5th Edition, McGraw Hill, Singapore, 1990.

Web Resources:

1) https://nptel.ac.in/courses/111107056/
2) https://cosmolearning.org/courses/advanced-complex-analysis-i/

LECTURE SCHEDULE

Units	Contents	Hours
1	Functions of complex variables-Limits	2
	Continuous functions- Differentiability	2
	Cauchy Riemann Equation	3
	Analytic functions - Harmonic function	4
	Conformal mapping.	2
	Total	13
2	Elementary mappings	2
	Bilinear transformations	3
	Cross Ratio	2
	Fixed points of bilinear transformations	2
	Some special bilinear transformations.	3
	Total	12
3	Integration in the Complex plane	4
	Cauchy's theorem	3
	Cauchy's Integral formula - Cauchy's Integral formula for higher derivatives	3
	Liouville's theorem - Maximum modulus theorem.	3
	Total	13
4	Sequences and series of functions	2
	Power series	2
	Taylor's and Laurent's series	4
	Zeros of an analytic functions	3
	Singular points - Types of singularities.	4
	Total	15
5	Residues	3
	Cauchy's Residue theorem	4
	Evaluation of definite integrals	4
	Total	11
	Grand Total	64

Core Course	Semester VI	
18MATU0614	GRAPH THEORY	Credits: 4

Objective: To acquire knowledge of fundamentals of graphs and its applications.
Specific outcome of learning: The learner will be able to

- understand different models of a graph

- recognize various parameters of graphs
- understand various properties of graphs
- use graph theoretic methods to solve different real life problems

Unit 1: Graphs and Subgraphs: Introduction – Definition and examples – Degree – Subgraphs – Isomorphism – Ramsey Numbers – Independent sets and coverings – Intersection graphs and line graphs – Matrices – Operations on graphs.

(14 hours)

Unit 2: Degree Sequences: Introduction – Degree sequences – Graphic sequences - Connectedness: Introduction – Walks, trails and paths – Connectedness and components – Blocks – Connectivity.

(12 hours)

Unit 3: Eulerian and Hamiltonian graphs: Introduction – Eulerian Graphs – Hamiltonian graphs – Trees: Introduction – Characterization of trees–Centre of a tree.

(13 hours)

Unit 4: Matchings: Introduction – Matchings – Matchings in bipartite graphs – Planarity: Introduction- Definition and properties.

(12 hours)

Unit 5: Colourability: Introduction – Chromatic number and chromatic index – Directed graphs: Introduction – Definitions and basic properties – paths and connections.

(13 hours)

Text Book:

1. S. Arumugam & S. Ramachandran, **Invitation to Graph Theory**, SciTech Publications (India) Pvt. Ltd., 2001.
   Unit 1: Chapter 2: Sections 2.0 – 2.9
   Unit 2: Chapter 3: Sections 3.0 – 3.2 & Chapter 4: Section 4.0 – 4.4
   Unit 3: Chapter 5: Sections 5.0 – 5. 2 & Chapter 6: Section 6.0 – 6.2
   Unit 4: Chapter 7: Sections 7.0 – 7.2 & Chapter 8: Section 8.0, 8.1
   Unit 5: Chapter 9: Sections 9.0, 9.1 & Chapter 10: Section 10.0 – 10.3

References:

1. J.A. Bondy & U.S.R.Murty,**Graph Theory with Applications**, Elsevier, New York,1976.
2. S.A.Choudam, **A first course in Graph Theory, Macmillian**, India Ltd., Delhi,2007.
3. J.Clark & D.A.Holton, **A first Look at Graph Theory**, Allied Publishers, New Delhi,1995.

LECTURE SCHEDULE

Unit	Topics	No. hours
1	Graphs and Subgraphs: Introduction- Definition and examples	4
	Degree–Subgraphs	2
	Isomorphism - Ramsey Numbers	3
	Independent sets and coverings - Intersection graphs and line graphs	3
	Matrices – Operations on graphs	2
		Total 14
2	Degree sequences – Graphic sequences	3
	Connectedness: Introduction	2
	Walks, trails and paths	2
	Connectedness and components – Blocks	3
	Connectivity	2
		Total 12
3	Eulerian Graphs	4
	Hamiltonian graphs	4
	Trees: Introduction - Characterization of trees	4
	Centre of a tree	1
		Total 13
4	Matchings	3
	Matchings in bipartite graphs	3
	Planarity: Introduction	2
	Definition and properties.	4
		Total 12
5	Colourability: Introduction	2
	Chromatic number and chromatic index	4
	Directed graphs: Introduction	2
	Definitions and basic properties	3
	Paths and connections	2
		Total 13
	Grand Total 64	

Core Course	Semester VI	
18MATU0615	MECHANICS	Credits: 4

Objective: To learn the application of geometric and trigonometric properties in equilibrium and motion of particles.

Specific outcome of learning:

- The learner will be able to apply geometrical concepts in parallel forces, moments and couples
- Proficient in static equilibrium of three forces acting on a rigid body and friction
- Proficient in Newton's laws of motion and projectiles
- Proficient in collision of elastic bodies
- Proficient in motion under action of central forces

Unit 1: Basic Concepts and Principles - Forces acting at a Point - Lami's Theorem and Applications - Parallel Forces - Like and Unlike Parallel Forces - Moment of a force - Couples – Related problems.

(14 hours)

Unit 2: Equilibrium of Three Forces acting on a rigid body - Friction - Laws of Friction - Angle of Friction - Cone of Friction - Properties and related simple problems.

(12 hours)

Unit 3: Motion in a Straight line under uniform acceleration - Newton's Laws of motion. Projectiles: Definition - Path of Projectile - Range on an Inclined Plane - Properties and Problems.

(14 hours)

Unit 4: Impulse and Impact: Collision of Elastic Bodies – Direct and Oblique Impact – Loss of Kinetic Energy – Related Properties and simple problems.

(12 hours)

Unit 5: Central Orbits: Motion under the action of Central Forces - Properties and Related Problems - Differential Equation of Central Orbit - Pedal Equation of Central Orbit - Velocities in a Central Orbit - Law of Forces - Properties and Related Problems.

(12 hours)

Text Books:

1. M. K. Venkataraman, **Statics**, Agasthiar Publications, Trichy, 2004.
   Unit 1: Chapters 2, 3, 4
   Unit 2: Chapters 5, 7
2. M. K. Venkataraman, **Dynamics**, Agasthiar Publications, Trichy, 2004.
   Unit 3: Chapters 3: section 3.22, Chapter 4: Section 4.3, Chapter 6
   Unit 4: Chapter 8
   Unit 5: Chapter 11

References:

1. T. K. ManickavasagamPillai, **Statics,** S. Viswanathan& Co., Chennai, 1980.
2. S. Narayanan, **Dynamics**, S. Chand & Co., New Delhi, 1980.

LECTURE SCHEDULE

Unit	Topics	No. hours
1	Basic Concepts and Principles Forces acting at a Point	4
	Lami's Theorem and Applications	3
	Like and Unlike Parallel Forces Moment of a force	4
	Couples Related problems	3
		Total 14
2	Equilibrium of Three Forces acting on a rigid body	3
	Laws of Friction	3
	Angle of Friction	3
	Cone of Friction Properties and related problems	3
		Total 12
3	Motion in a Straight line under uniform acceleration	4
	Newton's Laws of motion	3
	Projectiles Definition Path of Projectile	3
	Range on an Inclined Plane Properties and Problems	4
		Total 14
4	Impulse and Impact Collision of Elastic Bodies	3
	Direct and Oblique Impact	3
	Loss of Kinetic Energy	3
	Related Properties and Simple Problems	3
		Total 12
5	Central Orbits Motion under the action of central forces	3
	Differential Equation of Central Orbit	3
	Velocities and Pedal Equation of Central Orbit	3
	Law of Forces Properties and related problems	3
		Total 12
		Grand Total 64

Core Course	Semester VI	
18MATU0616	OPERATIONS RESEARCH	Credits: 3

Objective: To impart mathematical modeling skills through operations research techniques.

Specific outcome of learning: The learner will become proficient in modeling and decision making processes in mathematics and engineering.

- The student will be able to demonstrate knowledge of the major concepts of decision theory and decision making process.
- Students will be able to identify the basic analysis of queuing systems.
- Students will be able to identify the basic analysis of various inventory models.
- The students will acquire the knowledge of system reliability and specific types of simulation.
- The learner will become to understand the role and application of PERT/CPM for project scheduling.

Unit 1: Decision Analysis: Introduction – Decision-Making Problem – Decision-Making Process – Decision-Making Environment – Decision under Uncertainty – Decision under Risk.

(9 hours)

Unit 2: Queuing Theory: Introduction – Queuing System – Operating Characteristics of a Queuing System – Probability Distributions in Queuing System – Classification of Queuing Models – Definitions of Transient and Steady States – Poisson Queuing system (Model I, II, and III only).

(10 hours)

Unit 3: Inventory Control: Introduction – Types of Inventories – Reasons for Carrying Inventories - The inventory decisions – Cost Associated with Inventories – Factors Affecting Inventory Control – The Concept of Economic Order Quantity (EOQ) – Deterministic Inventory Problems with No Shortages – Deterministic Inventory Problems with Shortages.

(10 hours)

Unit 4: Replacement Problems and System Reliability: Introduction - Replacement of Equipment/Asset that Deteriorates Gradually – Replacement of Equipment that Fails Suddenly.

(9 hours)

Unit 5: Network Scheduling by PERT/CPM: Introduction – Network: Basic Components – Logical Sequencing – Rules for Network Construction – Critical Path Analysis – Probability Considerations in PERT.

(10 hours)

Text Book:

1. KantiSwarup, P. K. Gupta& Man Mohan, **Operations Research**, Sultan Chand& Sons, New Delhi, Eighteenth Thoroughly Revised Edition, 2015.

Unit 1: Chapter 16: Sections 16.1, 16.2, 16.3, 16.4, 16.5, 16.6.
Unit 2: Chapter 21: Sections 21.1, 21.2, 21.4, 21.6, 21.7, 21.8, 21.9 (First Three Models only).
Unit 3: Chapter 19: Sections 19.1, 19.2, 19.3, 19.4, 19.6, 19.7, 19.9, 19.10, 19.11.
Unit 4: Chapter 18: Sections 18. 1, 18.2 and 18.3.
Unit 5: Chapter 25: Sections 25.1, 25.2, 25.3, 25.4, 25.6, 25.7.

References:

1. P. K. Gupta & D. S. Hira, **Operations Research**, S. Chand and Company Ltd., New Delhi, 2013.
2. J. K. Sharma, **Operations Research theory and its applications**, 2nd Edition, Macmillan India Limited, 2003.

Web Resources:

1. https://nptel.ac.in/courses/112106134/
2. https://nptel.ac.in/courses/111105039/

LECTURE SCHEDULE

Unit	Topics	No. hours
1	Decision Analysis: Introduction	1
	Decision-Making Problem	1
	Decision-Making Process	2
	Decision-Making Environment	1
	Decision under Uncertainty	2
	Decision under Risk	2
		Total 9
2	Queuing Theory: Introduction and Queuing System	1
	Operating Characteristics of a Queuing System	1
	Probability Distributions in Queuing System	2
	Classification of Queuing Models, Definitions of Transient and Steady States	1
	Poisson Queuing system Model I	2
	Poisson Queuing system Model II	1
	Poisson Queuing system Model III	2
		Total 10
3	Inventory Control: Introduction, Types of Inventories	1
	Reasons for Carrying Inventories, The inventory decisions	1
	Cost Associated with Inventories, Factors Affecting Inventory Control andThe Concept of Economic Order Quantity (EOQ)	1
	Deterministic Inventory Problems with No Shortages	4
	Deterministic Inventory Problems with Shortages.	3
		Total 10

4	Replacement Problems and System Reliability: Introduction	2
	Replacement of Equipment/Asset that Deteriorates Gradually	3
	Replacement of Equipment that Fails Suddenly	4
		Total 9
5	Network Scheduling by PERT/CPM: Introduction – Network: Basic Components	1
	Logical Sequencing – Rules for Network Construction	1
	Critical Path Analysis	4
	Probability Considerations in PERT.	4
		Total 10
		Grand Total 48

Core Course
18MATU0617 **Project Report** **Credits: 4**

Modular Course **Semester VI**
18MATU06M1 **FUZZY SET THEORY** **Credits: 2**

Specific outcome of learning: The learner will be able to

- recognize the concept of fuzzy sets and its properties.
- distinguish fuzzy sets from crisp sets.
- perform various operations on fuzzy sets.
- understand the fuzzy graphs and fuzzy relations.

Unit 1: Fuzzy Sets: Sets- Definition of Fuzzy - Expanding Concepts of Fuzzy Set -Standard Operation of Fuzzy Set- Fuzzy Complement – Fuzzy Union– Fuzzy Intersection – Other Operations in Fuzzy Set – T-norms and T-conorms.

(16 hours)

Unit 2: Fuzzy Relation and Composition: Fuzzy Relation– Extension of Fuzzy set - Fuzzy Graph and Relation:Fuzzy Graph – Characteristics of Fuzzy Relation- Classification of Fuzzy Relation- Other Fuzzy Relations.

(16 hours)

Text Book:

1. Kwang H. Lee, **First Course on Fuzzy Theory and Applications**, Springer, New York, 2005.

Unit 1: Chapter 1: Sections 1.4-1.6; Chapter 2: Sections 2.1 - 2.6
Unit 2: Chapter 3: Sections 3.3 - 3.4; Chapter 4: Sections 4.1 - 4.4

References:

1. G. J. Klir and B. Yuan, **Fuzzy Sets and Fuzzy Logic**, Prentice-Hall India, 1995.
2. H. J. Zimmermann, **Fuzzy Set Theory and Its Applications**, Springer, 2001.
3. Didier Dubois and Henri Prade, **Fuzzy Sets and Systems: Theory and Applications**, Academic Press, 1980.

LECTURE SCHEDULE

Unit	Topics	No. hours
1	Sets	2
	Definition of Fuzzy Set	2
	Expanding Concepts of Fuzzy Set	2
	Standard Operation of Fuzzy Set	2
	Fuzzy Complement	2
	Fuzzy Union	2
	Fuzzy Intersection	2
	Other Operations in Fuzzy Set	1
	T-norms and T-conorms	1
		Total 16
2	Fuzzy Relation	2
	Extension of Fuzzy Set	2
	Fuzzy Graph	3
	Characteristics of Fuzzy Relation	3
	Classification of Fuzzy Relation	3
	Other Fuzzy Relations	3
		Total 16
		Grand Total 32

Modular Course	Semester VI	
18MATU 06M2	MATHEMATICAL SKILLS	Credits: 2

Objective: To impart Mathematical competitive skills.

Specific outcome of learning:

- The learner will acquire knowledge of interest calculation.
- The learner will become proficient in odd man out and series problems.

Unit 1: Allegation or mixture – Simple Interest – Compound Interest – Area.

(16 hours)

Unit 2: Volume and surface Areas - Calendar - Odd man out and series.

(16 hours)

Text Books:

1.R.S.Aggarwal, **Quantitative Aptitude,** 7th Revised Edition, S. Chand and Company Ltd, New Delhi, 2015

Unit 1: Section1, Topic 20,21,22,24

Unit 2: Section1, Topic 25, 27, 35

Reference:

1. AbhijitGuha, **Quantitative Aptitude for MBA Entrance Examinations**, Tata McGraw-Hill Publishing Company Ltd, New Delhi, 2006

Web Resources:

1. https://www.youtube.com/watch?v=ARSxlUX1yWw

LECTURE SCHEDULE

Unit	Topics	No. Hours
1	Allegation or mixture	4
	Simple Interest	4
	Compound Interest	4
	Area	4
		Total 16
2	Volume	4
	surface Areas	4
	Calendar	4
	Odd man out and series	4
		Total 16
	Grand Total	32

Modular Course	Semester VI	
18MATU 06M3	VECTOR CALCULUS	Credits: 2

Objective: To impart skills of vector calculus techniques.

Specific outcome of learning

- The learner will become proficient in Vector Differentiation.
- The learner will acquire knowledge of Vector Integration.

Unit 1: Vector Differentiation: Introductory Ideas-Vector Products-Gradient-Divergence - Curl.

(16 hours)

Unit 2: Vector Integration: Line integral-Surface integral–Volume integral-Gauss divergence theorem(without proof) -Stoke's theorem (without proof) – Green's theorem (without proof).

(16 hours)

Text Books:

1. S. Narayanan & T. K. ManicavachagomPillai, **Vector Algebra and Analysis**,S.Viswanathan Pvt. Ltd., Chennai, 1995.Unit 1- Chapters 1, 2, 4, Unit 2- Chapter 6.

Reference:

1. S. Arumugam, A. Thangapandi Isaac, **Calculus volume II**, New Gamma Publishing House, 1999

Web Resources:

1. https://cosmolearning.org › Subject: Mathematics › Courses › Vector Calculus
2. www.math.canterbury.ac.nz/php/resources/math100/vector-geometry-and-vector-calculus

LECTURE SCHEDULE

Unit	Topics	No. Hours
1	Vector Differentiation: Introductory Ideas	4
	Vector Products	4
	Gradient	4
	Divergence – Curl	4
		Total 16
2	Vector Integration: Line integral	4
	Surface integral	4
	Volume integral	4
	Gauss divergence theorem(without proof) -Stoke's theorem (without proof) – Green's theorem (without proof).	4
		Total 16
	Grand Total	32

Major Elective	Semester IV	
18MATU04E1	ANALYTICAL GEOMETRY 3D	Credits: 3

Objective: To study the various properties of geometrical figures in two dimension and three dimension.

Specific outcome of learning: The learner will

- acquire knowledge of representing conics in polar co-ordinates.
- acquire knowledge of planes and its properties as a 3 dimensional objects.
- understand the concepts skew lines and spheres.
- solving problems related to geometry of two dimension and three dimension.

Unit l: Polar Equations: Representation of basic curves in polar coordinates. General equation of Conic: Tracing the Conic - Properties and its applications.

(10 hours)

Unit 2: Rectangular Cartesian co-ordinates: Direction cosines of a line: Co-ordinates – Projections – Direction Cosines.

(10 hours)

Unit 3: The Plane: Equations of Plane – Angle between planes – Length of perpendicular from a point on the plane.

(9 hours)

Unit 4: The Straight Line: Equation of the straight line – coplanar lines – skew lines – intersection of three planes.

(10 hours)

Unit 5: The Sphere:Equation of Sphere – Equation of a circle on a sphere – intersection of two spheres.

(9 hours)

Text Books:

1. S. Narayanan & T. K. ManickavasagamPillai, **Analytical Geometry 2D**, S. Viswanathan Pvt. Ltd., Chennai, 2001. Unit 1 : Chapter IX (up to section 9), X (up to section 8)
2. S. Narayanan & T. K. ManickavasagamPillai, **Analytical Geometry 3D**, S. Viswanathan Pvt. Ltd., Chennai, 2001.Unit 2: Chapter I, Unit 3: Chapter II, Unit 4: Chapter III, Unit 5: Chapter IV.

References:

1. George B. Thomas, JR & Ross L.Finney, **Calculus and Analytic Geometry**, Sixth edition, Narosa Publishing House, New Delhi, 1986.
2. S. Arumugam&Issac, **Analytical Geometry 3D and Vector Calculus**, New Gamma Publications – Palayamkottai, 1997.

Web Resources:

1. https://nptel.ac.in/Aeronautical/Applied%20Mathematics-1/index.php
2. https://freevideolectures.com/course/2776/ma-141-analytic-geometry-and-calculus-i
3. https://cosmolearning.org/courses/mah-by-fives-trigonometry-502/
4. https://cosmolearning.org/courses/pre-calculus-6-9-trigonometry-review/

LECTURE SCHEDULE

Unit	Topics	No. hours
1	Polar Equations: Representation of basic curves in polar coordinates.	3
	General equation of Conic: Tracing the Conic.	3
	Properties and its applications.	4
		Total 10
2	Rectangular Cartesian co-ordinates: Direction cosines of a line: Co-ordinates	4
	Projections	3
	Direction Cosines	3
		Total 10
3	The Plane: Equations of Plane	3
	Angle between planes	3
	Length of perpendicular	3
		Total 9
4	The Straight Line: Equation of the straight line	3
	coplanar lines, skew lines	4
	Intersection of three planes.	3
		Total 10
5	The Sphere:Equation of Sphere.	3
	Equation of a circle on a sphere	3
	intersection of two spheres	3
		Total 9
		Grand Total 48

Major Elective | **Semester IV**
18MATU04E2 | **FINANCIAL MATHEMATICS** | **Credits: 3**

Objective: To impart mathematical concepts related to finance and insurance.

Specific outcome of learning:

- Specialise advanced topics in the area of financial mathematics and actuarial analysis and their applications
- Differentiate between simple and compound interest and extrapolate the advantages and disadvantages of each in specific situations
- Do calculations using computational tools efficiently and correctly and verify solutions in terms of the context.
- Use solutions to calculations effectively to define the changes that occur over a period.
- Students will use methods of correlation and regression to analyse and interpret a given data set and make predictions.

Unit 1: Mathematics of Compound interest - Mathematical base of life contingencies - effective interest rate, nominal interest rate - continuous payments, interest in advance - perpetuities - annuities - repayment of debit- internal rate of return future life time of a life aged x - the model - force of mortality - analytical distribution of T – the curate future life time of (x) - Life table -Probabilities of deaths for fraction of a year.

(9 hours)

Unit 2: Life insurance - insurance types - whole life and term insurance – pure Endowment - Endowments - insurance, payable at the moment of death- general type of life insurance - variable life insurance - recursive formula. Life annuities - elementary life annuities - payment made more frequently than once a year - variables life annuities - types of life annuities - recursive formula - inequalities - Payment starting at non-integral age. Net premium - elementary forms of insurance - whole life - Term insurance, pure Endowment - Endowments - deferred life annuities - premium paid m times year - general type of life insurance - policies with premium refund - stochastic interest.

(10 hours)

Unit 3: Net premium reserves - examples - recursive consideration - survival risk - net premium risk of a whole life insurance - net premium reserve at fractional duration - allocations of overall loss to policy year - conversion of an insurance - Technical gain - procedure for pure endowment - continuous model - multiple decrements model - forces of decrement - curate life time of (x), general type of insurance, net premium reserve - continuous model. Multiple life insurance - Joint life status – simplification- last survivor status general symmetric status - Schuette-Nesbitt formula - asymmetric annuities- asymmetric insurances.

(10 hours)

Unit 4: The total claim amount in a portfolio - normal approximations - calculation of total claim amount distribution - compound Poisson approximation - recursive calculation of compound Poisson distribution - reinsurance stop-loss reinsurance - expense loading – introduction expenses loaded premium - expense loaded premium reserves - estimating probabilities of death - problem description - classical method - Alternative solution -

maximum likelihood method - statistical inference - Bayesian approach - multiple causes of decrement - interpretation of result.

(10 hours)

Unit 5: Applications in regression analysis - Functional form -dummy variable - distributed log model - forecasting - binary choice model - interpretation of binary choice model - solved problems.

(9 hours)

Text Books:

1. Hans U.Gerber, **Life Insurance Mathematics,**Third edition, Springer Verlag, New York 1997. Chapters: 1-ll.
2. D.Salvalore& D.Reagle, **Statistics and Economics**, Schaum's outline Series, Tata McGraw Hill, New Delhi, 2005. Chapter 8 only.

Web Resources:

1. https://cosmolearning.org/video-lectures/introducion-financial-mathematics/
2. https://freevideolectures.com/course/2055/mathematical-methods-for-engineers-ii/14

LECTURE SCHEDULE

Unit	Topics	No. hours
1	Mathematics of Compound interest - Mathematical base of life contingencies	1
	effective interest rate, nominal interest rate	1
	continuous payments, interest in advance	2
	perpetuities - annuities - repayment of debit	1
	internal rate of return future life time of a life aged x - the model - force of mortality	2
	analytical distribution of T – the curate future life time of (x) - Life table - Probabilities of deaths for fraction of a year.	2
		Total 9
2	Life insurance - insurance types - whole life and term insurance	1
	pureEndowment - Endowments	1
	insurance, payable at the moment of death- general type of life insurance - variable life insurance - recursive formula.	2
	Life annuities - elementary life annuities - payment made more frequently than once a year - variables life annuities - types of life annuities	1
	recursive formula - inequalities - Payment starting at non-integral age.	2
	Net premium - elementary forms of insurance - whole life - Term insurance, pure Endowment - Endowments - deferred life annuities - premium paid m times year	1

	general type of life insurance - policies with premium refund - stochastic interest	2
		Total 10
3	Net premium reserves - examples - recursive consideration - survival risk	1
	net premium risk of a whole life insurance - net premium reserve at fractional duration - allocations of overall loss to policy year - conversion of an insurance	1
	Technical gain - procedure for pure endowment - continuous model - multiple decrements model - forces of decrement	1
	curate life time of (x), general type of insurance, net premium reserve - continuous model.	3
	Multiple life insurance - Joint life status – simplification- last survivor status general symmetric status - Schuette-Nesbitt formula - asymmetric annuities- asymmetric insurances	4
		Total 10
4	The total claim amount in a portfolio - normal approximations - calculation of total claim amount distribution	2
	compound Poisson approximation - recursive calculation of compound Poisson distribution	2
	reinsurance stop-loss reinsurance - expense loading – introduction expenses loaded premium - expense loaded premium reserves	2
	estimating probabilities of death - problem description - classical method.	1
	Alternative solution - maximum likelihood method	1
	statistical inference - Bayesian approach - multiple causes of decrement - interpretation of result	2
	Total 10	
5	Applications in regression analysis - Functional form	1
	dummy variable - distributed log model - forecasting	1
	binary choice model - interpretation of binary choice model	4
	Solved problems.	3
		Total 9
		Grand Total 48

Major Elective	Semester IV	
18MATP04E3	MATRIX ANALYSIS WITH APPLICATIONS	Credits: 3

ABOUT THE COUSRSE:

This course is offered to UG and PG students of Engineering/Science background. It contains the concepts related to matrix theory and their applications in various disciplines. It covers a depth understanding of matrix computations involving rank, eigenvalues, eigenvectors, linear transformation, similarity transformations, (diagonalisation, Jordan canonical form, etc). It also involves various iterative methods, including Krylov subspace methods. Finally, topics like positive matrices, non-negative matrices and polar decomposition are discussed in detail with their applications.

COURSE LAYOUT:

Week 1 : Echelon form and Rank of a matrix, Solution of system of linear equations.
Week 2 : Vector spaces and their properties, subspaces, basis and dimension, linear transformations.
Week 3 : Eigen values and eigen vectors, Calyey Haminton theorem, diagonalization.
Week 4 : Special matrices, Gerschgorin theorem, inner product spaces, matrix norms and Gram Schmidt Process
Week 5 : Normal and Positive Definite matrices, Quadratic forms with applications
Week 6 : Evaluation of matrix functions, SVD and its applications
Week 7 : Stationary and non-stationary iterative methods for linear system
Week 8 : Krylov subspace methods, analysis of positive and non-negative matrices, polar decomposition theorem

SUGGESTED READING MATERIALS:

1. Hoffman, K. and Kunze, R., "Linear Algebra", 2nd edition, Pearson Education (Asia) Pvt. Ltd/ Prentice Hall of India (2004)
2. Leon, S.J., "Linear Algebra with Applications", 8th Edition, Pearson (2009)
3. Peter, J. Olever and Shakiban, C., "Applied Linear Algebra", 1st Edition , Prentice Hall (2005).
4. Strang, G., "Linear Algebra and its Applications", 3rd edition, Thomson Learning Asia Pvt Ltd (2003)
5. Saad, Y., Iterative Methods for Sparse Linear Systems, second edition, SIAM, 2003.
6. Meyer C. D., Matrix Analysis and Applied Linear Algebra, ISBN-10: 0898714540

Web Sourses:https://onlinecourses.nptel.ac.in/noc18_ma14/preview

Major Elective	Semester V	
18MATU05E4	NUMERICAL METHODS	Credits: 3

Objective: To develop efficient algorithms for solving problems in Science, Engineering and Technology.

Specific outcome of learning:

- The learner will capable of solving the interpolation problems.
- Students will be able to identify the basic concept of numerical differentiation and integration, principle of least squares.
- The leaner will analyze the different aspects of numerical solution of algebraic and transcendental equations.
- The learner will become knowledgeable in solving solution to simultaneous linear equations.
- The learner will become to understand the role and application of nnumerical solution of ordinary differential equations.

Unit 1: Errors in Numerical Calculations: Errors and their computations - A general error formula - Error in a series Approximation. Solution of Algebraic and Transcendental equations: The Bisection method – The Method of False position - Iteration method - Newton - Raphson method.

(9 hours)

Unit 2: Interpolation: Finite differences - Forward Differences – Backward Differences - Central Differences - Symbolic Relations and Separation of Symbols. Newton's Formulae for Interpolation - Gauss's central difference formulae - Stirling's formula - Interpolation with unevenly spaced points: Lagrange's interpolation formula - Lagrange's Inverse Interpolation.

(9 hours)

Unit 3: Numerical Differentiation: Derivatives using Newton's Forward Difference Formula – Derivatives using Newton's Backward Difference Formula - Derivatives using Stirling's Formula - Maxima and Minima of Tabulated Function. Numerical Integration: - Trapezoidal Rule - Simpson's 1/3 Rule - Simpson's 3/8 Rule - Romberg Integration.

(9 hours)

Unit 4: Numerical Solutions of System of Linear Equations: Gauss elimination method - Gauss - Jordan method – Modification of the Gauss Method to compute the Inverse - Jacobi's method - Gauss - Seidel method.

(9 hours)

Unit 5: Numerical Solutions of Ordinary Differential Equations: Solution by Taylor's series - Picard's method of successive approximations – Euler's Method – Modified Euler's Method – Runge - Kutta Methods - Milne's Predictor -Corrector Method.

(12 hours)

Text Book:

1. S. S. Sastry, **Introductory Methods of Numerical Analysis**, Fifth Edition,PHI Learning Pvt. Ltd., Delhi, 2015.
   Unit 1: Chapter 1: Section 1.3 to 1.5, Chapter 2: Section 2.1 to 2.5
   Unit 2: Chapter 3: Section 3.3.1 to 3.3.4, 3.6, 3.7.1, 3.7.2, 3.9.1
   Unit 3: Chapter 6: Section 6.2, 6.3, 6.4.1, 6.4.2, 6.4.3, 6.4.6
   Unit 4: Chapter 7: Section 7.5.1, 7.5.3, 7.5.4, 7.6.
   Unit 5: Chapter 8: Section 8.2, 8.3, 8.4, 8.4.2, 8.5, 8.6.2

References:

1. Gerald &Wheatly, **Applied Numerical Analysis**, Sixth Edition, Pearson Education Pvt. Ltd., New Delhi, 2002.
2. S. Arumugam, A. Thangapandi Isaac & A. Somasundaram, **NumericalMethods,**Scitech Publications Pvt. Ltd., 2001.
3. V. N. Vedamurthy&N. Ch. S. N. Iyengar, **Numerical Methods**, Vikas Publishing House Pvt. Ltd. New Delhi, 2000.

Web Resources:

1. http://nptel.ac.in/courses/109104124/
2. http://nptel.ac.in/courses/111107105/

LECTURE SCHEDULE

Unit	Topics	No. Hours
1	Errors in Numerical Calculations: Errors and their computations - A general error formula - Error in a series Approximation.	3
	Solution of Algebraic and Transcendental equations: The Bisection method – The Method of False position	3
	Iteration method - Newton - Raphson method.	3
		Total 9
2	Interpolation: Finite differences - Forward Differences – Backward Differences - Central Differences	2
	Symbolic Relations and Separation of Symbols-	1
	Newton's Formulae for Interpolation- Gauss's central difference formulae - Stirling's formula	4
	Interpolation with unevenly spaced points: Lagrange's interpolation formula - Lagrange's Inverse Interpolation.	2
		Total 9
3	Numerical Differentiation: Derivatives using Newton's Forward Difference Formula – Derivatives using Newton's Backward Difference Formula	3

	Derivatives using Stirling's Formula - Maxima and Minima of Tabulated Function.	2
	Numerical Integration: - Trapezoidal Rule - Simpson's 1/3 Rule - Simpson's 3/8 Rule - Romberg Integration.	4
		Total 9
4	Numerical Solutions of System of Linear Equations: Gauss elimination method	2
	Gauss - Jordan method	2
	Modification of the Gauss Method to compute the Inverse	2
	Jacobi's method - Gauss - Seidel method.	3
		Total 9
5	Numerical Solutions of Ordinary Differential Equations: Solution by Taylor's series	2
	Picard's method of successive approximations – Euler's Method – Modified Euler's Method	4
	Runge - Kutta Methods	3
	Milne's Predictor -Corrector Method	3
		Total 12
		Grand Total 48

Major Elective **Semester V**
18MATU05E5 **INTRODUCTION TO ACTUARIAL SCIENCE** **Credits: 3**

Objective: To impart various concepts related to insurance.

Specific outcome of learning:

- Develop an understanding of the actuarial profession, what actuaries do, and how they do it.
- How liabilities in general insurance and life insurance are modelled and evaluated.
- why life insurance is so different and more predictable and despite
- Develop the critical and analytical thinking skills necessary for success in the profession.
- application of quantitative skills to problems in finance that normally involve risk or uncertainty.

Unit 1: The widening scope of Actuarial Theory and practice: Introduction – Financial Intermediaries -their role in resolving the "constitutional weakness" - Functional Approach to the Analysis of Intermediaries - Intermediating function If Banks, insurance, unit Trust and mutual funds. Banks, Insurance Companies and Pension Funds: Fundamental Similarities and

Differences- Banks loans, Credit Risk and Insurance -The Evolving Relationship Banking and Insurance - Some examples of the Evolving Product Links between Banks and Non-banks – conclusion.

(9 hours)

Unit 2: Investment and Valuation: Introduction-Cash Instruments-General Characteristics-Specific Cash instruments and Valuation Issues-Risk Characteristics – General Characteristics of conventional Bonds- Government Bonds-Corporate Bonds – Bond Valuation- Economic Analysis-Risk Characteristics-General Characteristics of Index Linked Bonds - Valuation - Economic Analysis - Risk Characteristics – Estimating Market Expectations of Inflation using Market Information.

(9 hours)

Unit 3: General Characteristics of Foreign Currency Bonds: Valuation-Economic Analysis - Risk Characteristics. General Characteristics of Equity Investment: Equity Valuation-Economic Analysis - Risk Analysis. Real Estate Investment: Valuation - Economic Analysis - Risk Analysis. International Equity Investment: International Equity Valuation - Economic Analysis - Risk Analysis - Derivatives - General Characteristics – Valuation - Risk Characteristics.

(9 hours)

Unit 4: Investment Risk: Introduction-Utility theory and Risk measures - Relating Utility Functions to Risk Aversion and the Risk Premium -Summary Risk Measures – Standard Deviation of Returns- Downside/Shortfall Risk Measures-Value at Risk-Practical Issues when Calculating VAR- Tail Loss-Combining Risk and Return Measures – Coherent Risk Measures-The use of Shortfall Constraints.

(9 hours)

Unit 5: Portfolio selection Techniques and Investment Modeling: Introduction – Immunization - Derivation of Conditions - Observation on the Theory of Immunization-The usefulness of Immunization in Practice-Modern Portfolio Theory – Portfolio Diversification-Efficient Portfolios-Capital Market Line- The Capital Asset Pricing Model. Modern Portfolio Theory: Insights and Limitations - Extension of Portfolio Theory to Include Actuarial Liabilities-Portfolio Optimization in the Presence of Liabilities-Connection between Redington and the Wise-Willkie Approach-Generalization of Portfolio Optimization in the Presence of Liabilities-Portfolio Selection in an Asset/Liability Framework using a Generalized Approach to Risk.

(12 hours)

Text Book:

1. Philip Booth, **Modern Actuarial Theory and Practice**, Second Edition, Chapman and Hall / CRC, New York, 2004. Chapter 1: Secs1.1 to. 1.11, Chapter 2: Secs2.1 to 2.9,Chapter 4: Secs4.1 to 4.6, Chapter 5: Secs5.1 to 5.4.

Web Resources:

1. https://www.edx.org/course/introduction-actuarial-science-anux-anu-actuarialx-1

LECTURE SCHEDULE

Unit	Topics	No. Hours
1	Introduction – Financial Intermediaries -their role in resolving the "constitutional weakness" - Functional Approach to the Analysis of Intermediaries	3
	Intermediating function If Banks, insurance, unit Trust and mutual funds. Banks, Insurance Companies and Pension Funds:	2
	Fundamental Similarities and Differences- Banks loans, Credit Risk and Insurance -The Evolving Relationship Banking and Insurance	2
	Some examples of the Evolving Product Links between Banks and Non-banks – conclusion.	2
		Total 9
2	Introduction-Cash Instruments-General Characteristics-Specific Cash instruments and Valuation Issues-Risk Characteristics.	2
	General Characteristics of conventional Bonds- Government Bonds-Corporate Bonds.	2
	Bond Valuation- Economic Analysis-Risk Characteristics-General Characteristics of Index Linked Bonds.	3
	Valuation - Economic Analysis - Risk Characteristics – Estimating Market Expectations of Inflation using Market Information.	2
		Total 9
3	Valuation-Economic Analysis - Risk Characteristics. General Characteristics of Equity Investment: Equity Valuation-Economic Analysis - Risk Analysis.	3
	Real Estate Investment: Valuation - Economic Analysis - Risk Analysis. International Equity Investment: International Equity Valuation - Economic Analysis - Risk Analysis - Derivatives - General Characteristics – Valuation - Risk Characteristics.	4
	Difference Formula – Derivatives using Newton's Backward Difference Formula	2
		Total 9
4	Introduction-Utility theory and Risk measures - Relating Utility Functions to Risk Aversion and the Risk Premium -Summary Risk Measures.	3
	Standard Deviation of Returns- Downside/Shortfall Risk Measures-Value at Risk.	2
	Practical Issues when Calculating VAR- Tail Loss-Combining Risk and Return Measures.	2
	Coherent Risk Measures- The use of Shortfall Constraints.	2

		Total 9
5	Introduction – Immunization - Derivation of Conditions - Observation on the Theory of Immunization-The usefulness of Immunization in Practice.	3
	Modern Portfolio Theory – Portfolio Diversification-Efficient Portfolios-Capital Market Line- The Capital Asset Pricing Model.	3
	Modern Portfolio Theory: Insights and Limitations - Extension of Portfolio Theory to Include Actuarial Liabilities-Portfolio Optimization in the Presence of Liabilities-Connection between Redington and the Wise.	3
	Willkie Approach-Generalization of Portfolio Optimization in the Presence of Liabilities-Portfolio Selection in an Asset/Liability Framework using a Generalized Approach to Risk.	3
		Total 12
		Grand Total 48

Major Elective **Semester V**

18MATP05E6 MATHEMATICAL MODELLING: ANALYSIS AND APPLICATIONS Credits: 3

ABOUT THE COURSE:

This course provides introduction of mathematical modeling and analysis in biological sciences. It is designed for students in both applied mathematics and bio-medical / biological sciences. The major content of this course is chosen from population dynamics. This course covers the fundamentals of deterministic models in both discrete and continuous time domain. This course includes both linear and non-linear models with sufficient amount of theoretical background. The relevant concepts and solution methods of various difference and differential equations are provided. We have also focused on graphical solution for clear analysis of nature of models

COURSE LAYOUT:

Week 1 : Overview of mathematical modeling, types of mathematical models and methods to solve the same; Discrete time linear models – Fibonacci rabbit model, cell-growth model, prey-predator model; Analytical solution methods and stability analysis of system of linear difference equations; Graphical solution – cobweb diagrams; Discrete time age structured model – Leslie Model; Jury's stability test; Numerical methods to find eigen values – power method and LR method.

Week 2 : Discrete time non-linear models- different cell division models, prey-predator model; Stability of non-linear discrete time models; Logistic difference equation; Bifurcation diagrams.

Week 3 : Introduction to continuous time models – limitations & advantage of discrete time model, need of continuous time models; Ordinary differential equation (ODE) – order, degree, solution and geometrical significance; Solution of first order first degree ODE – method of separation of variables, homogeneous equation, Bernoulli equation; Continuous time models – model for growth of micro-organisms, chemostat; Stability and linearization methods for system of ODE's. .

Week 4 : Continuous time single species model – Allee effect; Qualitative solution of differential equations using phase diagrams; Continuous time models – Lotka Volterra competition model, prey-predator models.

SUGGESTED READING MATERIALS:

1.J.N. Kapur, Mathematical Models in Biology and Medicine, East-West Press Private limited.
2.Leah, Edelstein, Keshet, Mathematical Models in Biology, SIAM publications.
3.J.D. Murray, Mathematical Biology Vol. I, II, 3rd edition, Springer publications.

Web Sources: https://onlinecourses.nptel.ac.in/noc18_ma18/preview

Non Major Elective (for other Departments) Semester -IV

18MATU04N1 BASIC NUMERICAL METHODS Credits:3

Objective: To develop efficient algorithms for solving problems in Science, Engineering and Technology.

Specific outcome of learning:

- The learner will be able to solve different kinds of problems in real life situation by interpolation methods
- Proficient in numerical differentiation and integration
- Proficient in solving numerically for algebraic and transcendental equations
- Proficient in solving systems of simultaneous equations
- Proficient in finding numerical solution of ordinary differential equations

Unit 1: Interpolation: Differences - relation between differences and derivatives - differences of polynomial - Newton's formula for forward interpolation - Backward interpolation–Central differences - Gauss's forward formula - backward formula and Stirling's interpolation formula. (11 hours)

Unit 2: Numerical Differentiation: Newton's formula, Gauss's formula for first and second derivatives. Numerical Integration: General quadrature formula - Trapezoidal rule – Simpson's rule- Weddle's rule. Curve Fitting: Principles of least squares - Fitting a straight line - A parabola and exponential curve.

(10 hours)

Unit 3: Numerical Algebra and Transcendental Equation: Finding approximate values of the roots Iteration method - Bisection method - Newton Raphson method –RegulaFalsi method.

(9 hours)

Unit 4: Solution to Simultaneous Linear Equation: Back substitution - Gauss elimination method Gauss - Jordon method. Iterative methods: Gauss - Jacobi's iteration method – Gauss-Seidal iterative method.

(9 hours)

Unit5: Numerical Solution of Ordinary Differential Equations: Taylor's series method - Euler's method - Modified Euler's method -Runge-Kutta method of second and fourth order.

(9 hours)

Text Book:

1. P. Kandasamy, K. Thilagavathy& K. Gunavathi, **Numerical Methods**, S. Chand & Company Ltd., New Delhi, 2012.
   Unit 1: Chapters 5, 6, 7
   Unit 2: Chapters 1, 9
   Unit 3: Chapter 3
   Unit 4: Chapter 4
   Unit 5: Chapter 11

References:

1. A. Singaravelu, **Numerical Methods**, Meenakshi Publications, Chennai, 1992.
2. S. Arumugam, **Numerical Methods,** 2nd edition, Scitech Publications (India) Pvt Ltd., 2010.

LECTURE SCHEDULE

Unit	Topics	No. hours
1	Interpolation Differences - relation between differences	3
	Newton's formula for forward- Backward interpolation	3
	Central differences Gauss's forward- backward formula	3
	Stirling's interpolation formula	2
		Total 11
2	Numerical Differentiation Newton's formula, Gauss's formula for first and second derivatives.	3
	Numerical Integration Trapezoidal rule	2
	Simpson's rule Weddle's rule	2
	Curve Fitting Principles of least squares	3
		Total 10

3	Numerical Algebra and Transcendental Equation Finding approximate values of the roots Iteration method	3
	Bisection method	2
	Newton Raphson method	2
	RegulaFalsi method	2
		Total 9
4	Solution to Simultaneous Linear Equation: Back substitution	3
	Gauss elimination method Gauss - Jordon method.	2
	Iterative methods Gauss - Jacobi's iteration method	2
	Gauss-Seidal iterative method	2
		Total 9
5	Numerical Solution of ODEs Taylor's series method	3
	Euler's method	2
	Modified Euler's method	2
	Runge-Kutta method of second and fourth order	2
		Total 9
		Grand Total 48

Non Major Elective (for other Departments) Semester V
18MATU05N2 QUANTITATIVE APTITUDE Credits: 3

Objective: To impart skills in numerical and quantitative techniques.

Specific outcome of learning: The learner will be

- able to critically evaluate various real life situations by resorting to Analysis of key issues and factors
- proficient in applying graphs, charts and probability techniques on various problems
- proficient in the problems on relations, coding and decoding
- able to demonstrate various principles involved in solving mathematical problems and thereby reducing the time taken for performing job functions
- able to face interviews

Unit 1:H.C.F and L.C.M of Numbers- decimal fractions- simplifications- square roots and cube roots- average- Problems on Numbers- Problems on Ages Surds and Indices.

(11 hours)

Unit 2: Tabulation- Bar graphs- Pie charts- Line graphs- Permutation and combinations- Probability- true discount- Banker's discount- Heights and distances.

(10 hours)

Unit 3: Percentages- Profit and Loss- Ratio-Proportion- Partnership- Chain rule- Time and work- Pies and cistern-Time and Distances.

(9 hours)

Unit 4: Problems on Trains- Boats and Streams- Coding and decoding- Blood Relations- Logical Venn Diagram.

(9 hours)

Unit 5: Logical deduction- Alphabet Test- Deriving conclusion from passages- Group discussion (on any current relevant topic).

(9 hours)

Text Book:

1. R.S. Aggarwal, **Quantitative Aptitude,** 7th Revised Edision, S. Chand & Company Ltd., New Delhi, 2015.

Reference:

1. R.S. Aggarwal, **A Modern approach to verbal Reasoning**, (Fully solved), Chand & Company Ltd., New Delhi, 2012.

Web Resources:

1.https://www.wiziq.com/tutorials/quantitative-aptitude
2.https://www.youtube.com/watch?v=l0OjOnNkFZM

LECTURE SCHEDULE

Unit	Topics	No. Hours
1	H.C.F and L.C.M of Numbers- decimal fractions	2
	Simplifications- square roots and cube roots	3
	Average- Problems on Numbers	3
	Problems on Ages Surds and Indices	3
		Total 11
2	Tabulation- Bar graphs- Pie charts- Line graphs	2
	Permutation and combinations-Probability	3
	True discount- Banker's discount	3
	Heights and distances	2
		Total 10
3	Percentages- Profit and Loss	3
	Ratio-Proportion- Partnership	3
	Chain rule- Time and work- Pies and cistern-Time and Distances	3
		Total 9
4	Problems on Trains	1
	Boats and Streams	3
	Coding and decoding- Blood Relations	3
	Logical Venn Diagram	2
		Total 9

5	Logical deduction	2
	Alphabet Test	2
	Deriving conclusion from passages	2
	Group discussion	3
		Total 9
		Grand Total 48

B. Com.	Semester-III	
18MATU03B1	MATHEMATICS- I	Credits: 4

Objective: To impart the fundamental concepts of statistical techniques.

Specific outcome of learning:

- The learner will gain knowledge about basic data collection statistical techniques
- The learner will acquire knowledge of various types of mean, median and mode
- The learner will become proficient in Measures of Dispersion
- The learner will acquire skills of solving problems in correlation and regression
- The learner will gain concepts of Index Numbers

Unit 1: Statistics: Meaning, Scope, Uses and Limitations of Statistics-Collection of Data-Primary and Secondary Data Sources- Classification, Tabulation and Interpretation.

(13 hours)

Unit 2: Measures of Central Tendencies: Arithmetic Mean, Geometric Mean, Harmonic Mean, Median and Mode.

(14 hours)

Unit 3: Measures of Dispersion: Range, Mean Deviation, Quartile Deviation, Standard Deviation and Co-efficient of Variation.

(13 hours)

Unit 4: Correlation: Meaning and Definition-Scatter Diagram-Pearson's Co-efficient of Correlation-Rank Correlation-Regression-Linear Regression-Simple Problems.

(12 hours)

Unit 5: Index Numbers: Method of construction-Aggregative & Relative Types-Cost of living Index- Growth Rate and Growth Index- Time Series- Definition-Applications.

(12 hours)

Text Book:

1. RSN Pillai&Bhagavathi ,**Statistics**, S. Chand & Company Ltd, New Delhi 2012.
   Unit 1: Chapters 3, 4, 5, 6, 7

Unit 2: Chapter 9

Unit 3: Chapters 10, 11

Unit 4: Chapters 12, 13

Unit 5: Chapter 14.

References:

1. P.R. Vittal, **Business Mathematics and Statistics**, 2002
2. P. Navnitham, **Business Mathematics & Statistics,** 2008

LECTURE SCHEDULE

Unit	Topics	No. hours
1	Meaning, Scope, Uses and Limitations of Statistics	5
	Collection of Data-Primary and Secondary Data Sources	4
	Classification, Tabulation and Interpretation	4
		Total 13
2	Arithmetic Mean	3
	Geometric Mean	3
	Harmonic Mean	3
	Median and Mode	5
		Total 14
3	Range, Mean Deviation, Quartile Deviation	6
	Standard Deviation and Co-efficient of Variation	7
		Total 13
4	Meaning and Definition-Scatter Diagram	3
	Pearson's Co-efficient of Correlation-Rank Correlation	3
	Regression-Linear Regression	3
	Related problems	3
		Total 12
5	Method of construction-Aggregative & Relative Types	3
	Cost of living Index- Growth Rate and Growth Index	3
	Time Series- Definition-Applications	3
	Related problems	3
		Total 12
		Grand Total 64

B.Com.	Semester-IV	
18MATU04B2	MATHEMATICS- II	Credits: 4

Objective: To gain basic knowledge about mathematical and operations research techniques.

Specific outcome of learning:

- The learner will gain knowledge about basic set theory
- The learner will acquire knowledge of Simple and Compound Interest
- The learner will become proficient in Matrix theory
- The learner will acquire skills of solvingLinear Programming Problem
- The learner will gain concepts of Transportation and Assignment Problem

Unit 1: Set Theory: Types of Sets, Set Operations-Law and Properties of Sets- De-Morgan's Laws-Applications to Business and Economic Problems.

(12 hours)

Unit 2: Simple and Compound Interest: Effective Rate and Nominal Rate of Interest-Depreciation: Straight line method, Balancing Method and Annuities-Discounting.

(12 hours)

Unit 3: Matrix: Basic Concepts-Addition and Multiplication of Matrices- Properties- Inverse of Matrix- Rank of a Matrix.

(13 hours)

Unit 4: Linear Programming Problem: Formulation-Solutions by Graphical Method, Simplex Method: Feasible solution, Unbounded Solution, Infeasible solution.

(14 hours)

Unit 5: Transportation and Assignment Problem: Formulation and Solution of Transportation Models-North West Corner Rule (NWCM)-Vogel's Approximation Method (VAM)–Formulation and Solution of the Assignment Models-The Hungarian Method for Solution of the Assignment Problems-Variations of the Assignment Problem.

(13 hours)

Text Books:

1. P. Navnitham, **Business Mathematics & Statistics,** 2008, Unit 1,2,3&4
2. Prem Kumar Gupta & D. S. Hira, **Operations Research**, S. Chand & Company Ltd, Newdelhi, 2008. Unit 5: Chapter 3, Secs 3.5, Chapter 4, Secs 4.5&4.6

References:

1. RSN Pillai&Bhagavathi, **Statistics**, S. Chand & Company Ltd, New Delhi,2012.
2. S. P. Gupta & P. K. Gupta, **Business Statistics and Business Mathematics,** sultan chand& sons, 2009.

LECTURE SCHEDULE

Unit	Topics	No. hours
1	Types of Sets, Set Operations-Law and Properties of Sets	4
	De-Morgan's Laws	4
	Applications to Business and Economic Problems	4
		Total 12
2	Effective Rate and Nominal Rate of Interest	3
	Depreciation: Straight line method, Balancing Method and Annuities	3
	Discounting	3
	Related problems	3
		Total 12
3	Basic Concepts-Addition and Multiplication of Matrices-Properties	6
	Inverse of Matrix- Rank of a Matrix	7
		Total 13
4	Formulation-Solutions by Graphical Method	4
	Simplex Method: Feasible solution	4
	Unbounded Solution	3
	Infeasible solution	3
		Total 14
5	Formulation and Solution of Transportation Models-North West Corner Rule	4
	Vogel's Approximation Method (VAM)–Formulation and Solution of the Assignment Models	3
	The Hungarian Method for Solution of the Assignment Problems	3
	Variations of the Assignment Problem	3
		Total 13
		Grand Total 64

Semester: I

Allied Course (B.Sc., Physics/Chemistry Major)

18MATU01A1 ALLIED MATHEMATICS – I Credits:4

Objective: To impart different concepts of algebra and calculus.

Specific outcome of learning:

- The learner will gain knowledge of Binomial series and Exponential series
- The learner will acquire basic knowledge of Types of Matrices and Evaluation of Eigen values and Eigen vectors.
- The learner will become proficient in Successive Differentiation.
- The learner will acquire skills of applications of Curvature, Evolutes and Involutes.
- The learner will gain concepts of Definite integral

Unit 1: Binomial series, Exponential series and Logarithmic series – problems related to series.

(14 hours)

Unit 2: Types of Matrices: Symmetric and Skew symmetric matrices – Rank of a matrix – Test of Consistency of Equations using ranks – Characteristic equation - Cayley – Hamilton theorem – Evaluation of eigen values and eigen vectors.

(14 hours)

Unit 3: Successive Differentiation – Leibnitz's theorem and its application – Applications of Differential Calculus: Rate of change of variables – Velocity and Acceleration – Maxima and Minima.

(12 hours)

Unit 4: Curvature – Radius of Curvature and Centre of Curvature – Evolutes and Involutes.

(12 hours)

Unit 5: Properties of definite integral – Integration by parts – Reduction formulae – Integration as process of summation. Evaluation of double, triple integral (simple problems only).

(12 hours)

Text Books:

1. Arumugam& Isaac, **Ancillary Mathematics**, New Gamma Publishing House,Palayamkottai, 2002.
2. S. Narayanan & T.K. ManickavasagamPillai, **Ancillary Mathematics**, S.Viswanathan Pvt. Ltd., Chennai, 2002.

References:

1. S. Narayanan & T.K. ManickavasagamPillai, **Calculus**, Vol. I, S.Viswanathan Pvt. Ltd., Chennai, 2003.
2. T. K. ManickavasagamPillai,T. Natarajan& K.S. Ganapathy, **Algebra**, Vol. I,S.Viswanathan Pvt. Ltd., Chennai, 2003.

LECTURE SCHEDULE

Unit	Topics	No. hours
1	Binomial series	3
	Exponential series	3
	Logarithmic series	4
	Problems related to series	4
		Total 14
2	Types of Matrices, Symmetric and Skew symmetric matrix	3
	Rank of a matrix, Test of Consistency of Equations using ranks	3
	Characteristic equation, Cayley – Hamilton theorem	4
	Evaluation of Eigen values and Eigen vectors	4
		Total 14
3	Successive Differentiation	3
	Leibnitz's theorem and its application	3
	Applications of Differential Calculus, Rate of change of variables	3
	Velocity and Acceleration – Maxima and Minima	3
		Total 12
4	Curvature	3
	Radius of Curvature	3
	Centre of Curvature	3
	Evolutes and Involutes	3
		Total 12
5	Properties of definite integral, Integration by parts	3
	Reduction formulae	3
	Integration as process of summation.	3
	Evaluation of double, triple integral (simple problem only)	3
		Total 12
		Grand Total 64

B.Sc. Applied Geology	Semester – I	
18MATU01A3	ALLIED MATHEMATICS-I	Credits: 4

Objective: To learn the techniques of fundamentals of mathematics.

Specific outcome of learning:

- The learner will acquire skills of basic concepts of set theory and functions
- The learner will understand the basic concepts of straight lines and circles as a 2 dimensional objects.
- The learner will understand the basic concepts of parabola and ellipse as a 2 dimensional objects.
- The learner will acquire knowledge of solving problems in matrices
  s

Unit 1: Sets: Introduction- Concept of a Sets- and their representations- empty set- subsets- Power set- universal set- union and intersection of sets- difference of sets- complement of a set. Relations: Definition of relation - Types of relations: reflexive- symmetric- transitive and equivalence relations. Functions: Definition and Examples- Types of functions-one to one – onto- Composition of functions.

(12 hours)

Unit 2: Co-ordinate Geometry: Co-ordinate system- straight lines- slope of straight lines- straight lines passing through given two points- angle between two lines and related problems- Circles: General equation of a circle- tangent to a circle- Related problems.

(13 hours)

Unit 3: Conics: General equation of a conic- Standard equation of a parabola-Tangent to a parabola- Ellipse – Standard equation of an ellipse-Tangent to an ellipse-Related problems.

(13hours)

Unit 4: Matrices: Concept- notation- order- equality- types of matrices- zero matrix- transpose of a matrix- symmetric and skew symmetric matrices. Addition, multiplication and scalar multiplication of matrices- Related problems.

(14 hours)

Unit 5: Determinants: Determinant of a square matrix (up to 3 x 3 matrices), properties of determinants- Adjoint and inverse of a square matrix-Solving system of linear equations in two or three variables using inverse of a matrix.

(12 hours)

Text Books:

1. P.R. Vittal, **Business Mathematics,** Margham Publications, Chennai 1995.

Unit-1 : Chapter -1
Unit-2 : Chapter -12 (Page No. 338-385)
Unit-3 : Chapter -12 (Page No. 886-416)

Unit-4 : Chapter-14 (Page No. 595-623)
Unit-5 : Chapter-14 (Page No. 623-653)

Reference Books:

1. Seymour Lipschutz, Set theory & Related Topics, Schaum's outlines, 2 nd Edition, Tata McGraw Hill, New Delhi, 2005.
2. Arumugam&Issac, Classical Algebra, New gamma Publishing house, Tirunelveli, 2003.
3. S. Narayanan & T. K. Manickavasagam Pillai, Analytical Geometry 2D, S. Viswanathan Pvt. Ltd., Chennai, 2001.
4. R. Jayaprakasa Reddy and Y. Mallikarjuna Reddy, A Text Book of Business Mathematics, Ashish Publishing House, New Delhi, 2002.

LECTURE SCHEDULE

Unit	Topics	No. of Hours
1	Sets: Introduction- Concept of a Sets- and their representations	2
	Empty set- subsets-Power set- universal set- union and intersection of sets	2
	Difference of sets- complement of a set.	2
	Relations: Definition of relation - Types of relations: reflexive- symmetric- transitive and equivalence relations.	3
	Functions: Definition and Examples- Types of functions-one to one – onto- Composition of functions.	3
	Total	12
2	Co-ordinate system- straight lines- slope of straight lines	3
	Straight lines passing through given two points- angle between two lines and related problems	3
	Circles: General equation of a circle- tangent to a circle	3
	Problems on straight lines and circles.	4
	Total	13
3	General equation of a conic	1
	Standard equation of a parabola-Tangent to a parabola	4
	Ellipse – Standard equation of an ellipse-Tangent to an ellipse	4
	Related problems.	4
	Total	13
4	Matrices: Concept- notation- order- equality	2
	Types of matrices- zero matrix- transpose of a matrix- symmetric and skew symmetric matrices.	4
	Addition, multiplication and scalar multiplication of matrices	4
	Related problems.	4
	Total	14

5	Determinants: Determinant of a square matrix properties of determinants	4
	Adjoint and inverse of a square matrix	4
	Solving system of linear equations in two or three variables using inverse of a matrix.	4
	Total	12
	Grand Total	64

Semester: II

Allied Course **(B.Sc., Physics/Chemistry Major)**

18MATU02A2 **ALLIED MATHEMATICS – II** **Credits:4**

Objective: To impart different concepts of trigonometry, differential equation and vector calculus.

Specific outcome of learning:

- The learner will gain knowledge of Trigonometry functions and problems
- The learner will acquire basic knowledge of Hyperbolic functions and Logarithm of a Complex number
- The learner will become proficient in Differential equations of first order and higher degree
- The learner will acquire skills of applications of Laplace transforms
- The learner will gain concepts of Vector Calculus

Unit 1: Trigonometry: Expansion of functions $\sin n\,\theta, \cos n\theta, \tan n\theta$ – Series for $sin\ x, cos\ x, tan\ x, sin^n x\ and\ cos^n x$ –simple applications and problems.

(14 hours)

Unit 2: Hyperbolic functions – simple problems – Logarithm of a Complex number – simple applications.

(14 hours)

Unit 3: Differential equations of first order and higher degree (Equation solvable for p, x, y, including Clairaut's form) – Second order linear equations with constant coefficients (particular integrals of functions of the type $X^m, X^m e^{ax}, e^{ax} cosbx$ and $e^{ax} sinbx\ only$).

(12 hours)

Unit 4: Laplace transforms – Standard forms – Inverse transforms – Applications to solutions of differential equations.

(12 hours)

Unit 5: Vector Calculus: Gradient, Curl and Divergence of vector – Gauss's, Stoke's and Green's theorems (without proof) and evaluation of integrals using these theorems.

(12 hours)

Text Books:

1. Arumugam& Isaac, **Ancillary Mathematics**, New Gamma Publishing House,Palayamkottai, 2002.
2. T.K. ManickavasagamPillai, T. Natarajan& K.S.Ganapathy, **Calculus** Vol. II, Vol. III, S.Viswanathan Pvt. Ltd., Chennai, 2003.
3. S. Narayanan & T.K. ManickavasagamPillai, **Trigonometry,** S.Viswanathan Pvt. Ltd., Chennai, 2003.

Reference:

1. S. Narayanan & T.K. ManickavasagamPillai, **Ancillary Mathematics**, S. Viswanathan Pvt. Ltd., Chennai, 2002.

LECTURE SCHEDULE

Unit	Topics	No. hours
1	Trigonometry: Expansion of functionssin $n\theta, \cos n\theta, \tan n\theta$	5
	Series for $sin\ x, cos\ x, tan\ x, sin^n x\ and\ cos^n x$	5
	simple applications and problems	4
		Total 14
2	Hyperbolic functions	4
	Simple problems	3
	Logarithm of a Complex number	4
	Simple applications	3
		Total 14
3	Differential equations of first order and higher degree (Equation solvable for p, x, y, including Clairaut's form)	6
	Second order linear equations with constant coefficients (particular integrals of functions of the type $X^m, X^m e^{ax}, e^{ax} cosbx$ and $e^{ax} sinbx\ only$)	6
		Total 12
4	Laplace transforms	3
	Standard forms	3
	Inverse transforms	3
	Applications to solutions of differential equations.	3
		Total 12
5	Vector Calculus: Gradient	3
	Curl and Divergence of vector	3
	Gauss's, Stoke's and Green's theorems (without proof)	3

	Evaluation of integrals using these theorems	3
		Total 12
		Grand Total 64

B.Sc. Applied Geology	**Semester - II**	
18MATU02A4	**ALLIED MATHEMATICS-II**	**Credits: 4**

Objective: To learn the fundamentals of statistics, calculus, linear programming and numerical methods.

Specific outcome of learning:

- The learner will gain basic knowledge on fundamentals of statistics
- The learner will gain knowledge of differentiation and its applications
- The learner will acquire basic knowledge of integration
- The leaner will formulate a linear programming problem and solve them graphically and simplex method
- The learner will capable of solving the interpolation problems.

Unit 1: Statistics: Measures of central tendency – Mean, Median, Mode – Geometrical mean, Harmonic mean - Properties - Measures of Dispersion – Moments, Skewness and Kurtosis – Properties.

(13 hours)

Unit 2: Differentiation: Limits of functions- Definition of derivative – Differentiation of trigonometric, inverse trigonometric and logarithmic functions-Differentiation of Implicit functions- Parametric Differentiation- Successive Differentiation.

(14 hours)

Unit 3: Integration: Definition of integration-Standard rules on integration-Integration by substitution-Integration of rational functions- Integration by partial fractions-Integration by parts.

(13 hours)

Unit 4: Linear Programming: Feasible and optimal solution-Solution by graphical method-Simplex Method-Related problems.

(12 hours)

Unit 5: Numerical Methods: Interpolation- Finite differences- Newton's forward formula-Binomial method-Lagrange's formula-Related problems.

(12 hours)

Text Books:

1. S. C. Gupta and V. K. Kapoor, **Fundamentals of Mathematical statistics,** Sultan Chand & Sons, New Delhi, 1994.

Unit 1 : Chapter -2

1. P.R. Vittal, **Business Mathematics**, Margham Publications, Chennai 1995.

Unit - 2 : Chapter 13 (Page No. 434-502)
Unit – 3 : Chapter 13 (Page No. 535-579)
Unit – 4 : Chapter 16 (Page No. 676-729)
Unit – 5 : Chapter 22.

Reference Books:

1. S. Arumugam & A. Thangapandi Isaac, Statistics, New Gamma Publishing House, 2006.
2. George B. Thomas, JR & Ross L.Finney, Calculus and Analytic Geometry, Sixth edition, Narosa Publishing House, New Delhi, 1986.
3. R. Jayaprakasa Reddy and Y. Mallikarjuna Reddy, A Text Book of Business Mathematics, Ashish Publishing House, New Delhi, 2002.

LECTURE SCHEDULE

Unit	Topics	No. of Hours
1	Statistics: Measures of central tendency –	2
	Mean, Median, Mode	2
	Geometrical mean, Harmonic mean - Properties	3
	Measures of Dispersion	2
	Moments, Skewness and Kurtosis – Properties.	4
	Total	13
2	Differentiation: Limits of functions- Definition of derivative	2
	Differentiation of trigonometric, inverse trigonometric and logarithmic functions	3
	Differentiation of Implicit functions	3
	Parametric Differentiation	3
	Successive Differentiation.	3
	Total	14
3	Integration: Definition of integration- Standard rules on integration	2
	Integration by substitution	2
	Integration of rational functions	3
	Integration by partial fractions	3
	Integration by parts.	3
	Total	13

4	Linear Programming: Feasible and optimal solution	2
	Solution by graphical method	2
	Simplex Method	3
	Related problems.	5
	Total	12
5	Numerical Methods: Interpolation	2
	Finite differences	2
	Newton's forward formula	2
	Binomial method	2
	Lagrange's formula-Related problems.	4
	Total	12
	Grand Total	64