UNIVERSITY OF MADRAS

SYLLABUS

Common

To

B.Sc. Mathematics

(for the academic year 2020-2021)

1. PREAMBLE

The curriculum of B.Sc. Mathematics is structured in a way that the students acquire in-depth knowledge to perceive the principles of the core. Basics in Algebra, Calculus , Analytical Geometry , Differential Equations and Transform Techniques are covered exclusively to prepare the students to proceed to the next level of Higher Mathematics of Linear Algebra, Real and Complex Analysis, Mechanics. A list of varied electives namely, Operations Research, Graph Theory, Number Theory, Programming Language 'C', Mathematical Modelling, Programming with Python are furnished to bridge between the Main and Applied Mathematics. The comprehensive curriculum design yields an excellent career opportunity in Research, Education, Public and Private Sectors, Business sectors, Banking, IT Industries and in every domain of contemporaries.

2. PROGRAM LEARNING OUTCOMES

The comprehensive course outline enables the students to enhance Computational skills and Mathematical reasoning. The program develops the ability to think critically, logically and analytically thereby preparing the students to enhanced career opportunities in Industries, Commerce, Education and Research.

NATURE AND EXTENT OF BACHELOR'S DEGREE PROGRAMME

Mathematics is the culmination of in-depth of knowledge of Algebra, Calculus, Differential equations and several other branches of Mathematics. This also leads to selected areas like Computer science and Statistics. Mathematics is a diverse discipline that deals with data, measurement and observations from science, with inference, deduction and proof and with mathematical models of natural phenomena of human behaviour and of social systems.

AIMS OF BACHELOR'S DEGREE PROGRAMME IN MATHEMATICS

The overall aim of B.Sc. Mathematics is to

- **develop broad and balanced knowledge and understanding of definitions, concepts, principles and theorems.**
- **enhance the ability of learners to apply the knowledge and skills acquired by them during the programme to solve specific theoretical and applied problems in mathematics.**
- **provide students/learners sufficient knowledge and skills enabling them to undertake further studies in mathematics and its allied areas on multiple disciplines concerned with mathematics.**

GRADUATE ATTRIBUTES IN MATHEMATICS

The graduate attributes in mathematics are mentioned in the expected course learning outcomes of each course which provides critical thinking, analytical reasoning, problem solving and research related skills etc,.

COURSE STRUCTURE

FIRST SEMESTER

Course Content	Name of the Course	Ins. Hrs	Credits	Int. Marks	Ext.Marks	Total
Part - I	Language Paper –I	5	3	25	75	100
Part - II	English Paper –I	4	3	25	75	100
Part - III	Core Paper-I: Algebra	5	4	25	75	100
	Core Paper-II: Differential Calculus	4	4	25	75	100
	Allied Paper- I (Calculus of finite differences and numerical methods I)	9	5	25	75	100
Part - IV	Basic Tamil/Adv. Tamil/ Non Major Elective –I	1	2	25	75	100
	Soft Skills –I	2	3	50	50	100

SECOND SEMESTER

Course Content	Name of the Course	Ins. Hrs	Credits	Int. Marks	Ext.Marks	Total
Part - I	Language Paper –II	5	3	25	75	100
Part - II	English Paper –II	5	3	25	75	100
Part - III	Core Paper-III: Trigonometry	4	4	25	75	100
	Core Paper-IV: Integral Calculus and Vector Analysis	5	4	25	75	100
	Allied Paper- II (Calculus of finite differences and numerical methods II)	9	5	25	75	100
Part - IV	Basic Tamil/Adv. Tamil/ Non Major Elective –II	1	2	25	75	100
	Soft Skills –II	1	3	50	50	100

THIRD SEMESTER

Course Content	Name of the Course	Ins. Hrs	Credits	Int. Marks	Ext.Marks	Total
Part - I	Language Paper –III	5	3	25	75	100
Part - II	English Paper –III	5	3	25	75	100
Part - III	Core Paper-V: Integral Calculus	5	4	25	75	100
	Core Paper-VI: Differential Equations	4	4	25	75	100
	Allied Paper- III (Mathematical statistics I)	9	5	25	75	100
Part - IV	Environmental Studies	1	2	25	75	100
	Soft Skills –III Essentials of spoken and presentation skills LEVEL I	1	3	50	50	100

FOURTH SEMESTER

Course Content	Name of the Course	Ins. Hrs	Credits	Int. Marks	Ext.Marks	Total
Part - I	Language Paper –IV	5	3	25	75	100
Part - II	English Paper –IV	5	3	25	75	100
Part - III	Core Paper-VII: Transform Techniques	4	4	25	75	100
	Core Paper-VIII: Statics	5	4	25	75	100
	Allied Paper- IV (Mathematical Statistics II)	9	5	25	75	100
Part - IV	Soft Skills –IV Essentials of spoken and presentation skills LEVEL II	1	3	50	50	100

FIFTH SEMESTER

Course Content	Name of the Course	Ins. Hrs	Credits	Int. Marks	Ext.Marks	Total
Part - III	Core Paper-IX: Algebraic Structures	6	4	25	75	100
	Core Paper -X: Real Analysis-I	6	4	25	75	100
	Core Paper-XI: Dynamics	6	4	25	75	100

	Core Paper – XII: Discrete Mathematics	6	4	25	75	100
	Elective paper -I PROGRAMMING LANGUAGE 'C' WITH PRACTICALS.	6	5	25	75	100
Part - IV	Value Education		2	25	75	100

SIXTH SEMESTER

Course Content	**Name of the Course**	**Ins. Hrs**	**Credits**	**Int. Marks**	**Ext.Marks**	**Total**
Part - III	Core Paper-XIII: Linear Algebra	6	4	25	75	100
	Core Paper -XIV: Real Analysis-II	6	4	25	75	100
	Core Paper-XV: Complex Analysis	6	4	25	75	100
	Elective Paper -II: Graph Theory.	6	5	25	75	100
	Elective Paper -III: Operations Research.	6	5	25	75	100
Part - V	Extension Activity		1			

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CORE PAPER I-ALGEBRA(SM21A)

Course Objectives:

Students will acquire knowledge

- To create a strong base in solving polynomial equations .
- About symmetric, skew symmetric, Hermitian & Skew Hermitian matrices to find eigen values, eigen vectors and Cayley Hamilton theorem.
- To solve binomial, exponential and Logarithmic series, Introduction to number theory.

Unit 1

Theory of Equations :Polynomial equations with Imaginary and irrational roots- Relation between roots and coefficients- Symmetric functions of roots in terms of coefficients.

Chapter 6 : Section 9 to 12.

Unit 2

Reciprocal equations - Standard form-Increase or Decrease the roots of the given equation -Removal of terms Approximate solutions of roots of polynomials by Horner's method.
Chapter 6: section 16, 16.1, 16.2, 17, 30.

Unit 3

Summation of Series : Binomial- Exponential -Logarithmic series (Theorems without proof):
Chapter 3: Section 10, Chapter 4: Section 3, 3.1, 3.5, 3.6, 3.7 (omit 3.4)

Unit 4

Symmetric- Skew Symmetric- Hermitian- Skew Hermitian- Orthogonal Matrices- Eigen values & Eigen Vectors- Similar matrices- Cayley - Hamilton Theorem.
Chapter 2: Section 6.1 to 6.3, 9.1, 9.2, 16, 16.1, 16.2, 16.3.

Unit 5

Prime number and Composite number - Divisors of a given number N- Euler's function (without proof) - Integral part of a real number - congruences.
Chapter 5: Section 1 to 13.

Learning Outcomes:

Student will be able to

- Know about the basic ideas on theory of equations, matrices and theory of numbers.
- solve applied problems in number theory.
- Know about summation of series.

Contents and treatment as in

1. Algebra, Volume I by T. K. ManicavachagamPillay,T.Natarajan, K.S.Ganapathy, Viswanathan Publication 2007 - Unit – 1 and 2.

2. Algebra, Volume II by T. K. ManicavachagomPillay ,T.Natarajan ,K.S.Ganapathy, Viswanathan Publication 2008 - Unit – 3, 4 and 5.

Reference:-

1. Algebra by S. Arumugam (New Gama publishing house, Palayamkottai).
2. Algebra and Trigonometry, Volume I and II by P.R.Vittal, V.Malini (Margham Publishers).

e-Resources:

1. http://mathworld.wolfram.com
2. http://www.themathpage.com/

CORE PAPER II - DIFFERENTIAL CALCULUS (SM21B)

Course Objectives:

Students will acquire knowledge

- To find the derivatives - rate of change of quantity with respect to others.
- To find The maximum and minimun value of the curve
- .To solve the problems on asymptotes.

Unit 1

Successive differentiation - n th derivative- standard results – Trigonometrical transformation – formation of equations using derivatives - Leibnitz's theorem and its applications

Chapter 3 section 1.1 to 1.6, 2.1 and 2.2

Unit 2

Total differential of a function – special cases – implicit functions - partial derivatives of a function of two functions - Maxima and Minima of functions of two variables- Lagrange's method of undetermined multipliers.

Chapter 8 : Section 1.3 to 1.5 and 1.7, Section 4, 4.1 and 5.

Unit 3

Envelopes – method of finding envelopes – Curvature- circle, radius and centre of curvature- Cartesian formula for radius of curvature – coordinates of the centre of curvature – evolute-and involute - radius of curvature and centre of curvature in polar coordinates – p-r equation

Chapter 10 Section 1.1 to 1.4 and Section 2.1 to 2.7

Unit 4

Polar coordinates - angle between the radius vector and the tangent – slope of the tangent in the polar coordinates – the angle of intersection of two curves in polar coordinates- polar sub tangent and polar sub normal – the length of arc in polar coordinates.

Chapter 9 Section 4.1 to 4.6

Unit 5

Definition-Asymptotes parallel to the axes – special cases – another method for finding asymptotes - asymptotes by inspection – intersection of a curve with an asymptote.

Chapter 11 - Section 1 to 7.

Learning Outcomes:

Student will be able to

- Solve differentiation problems and its application.
- Find the notion of curvature, evolutes, involutes and polar coordinates
- Determine the derivatives and higher derivatives of a function.

Content and treatment as in

"Calculus", Volume - 1 by S. Narayanan and T.K. Manicavachagompillay - S.Viswanathan publishers – 2006

Reference:-

1.Calculus , Dr. P.R. Vittal&Dr. V. Malini, Margham Publications, Chennai.
2.Calculus by Thomas and Fenny, Pearson Publication.
3.Calculus by Stewart
4. Calculus , Dr. P.R. Vittal&Dr. V. Malini, Margham Publications, Chennai.

e-Resources:

1. http://www.themathpage.com/
2. http://mathworld.wolfram.com
3. http://www.univie.ac.at/future.media/moe/galerie.html
4. http://www.analyzemath.com/calculus

Allied paper -I CALCULUS OF FINITE DIFFERENCES AND NUMERICAL ANALYSIS-I (SM3AB)

Course Objectives

Students will acquire knowledge about

- Numerical techniques used as powerful tools in scientific computing.
- Linear algebraic,transcendental equations and interpolation using finite difference formulae.
- Solving nonlinearequation

Unit 1

Solutions of algebraic and transcendental equations: Bisection method- Iteration method- Regula-falsi method- Newton-Raphson method.

Chapter 1 :Section 1.1 - 1.4

Unit 2

Solutions of Simultaneous Linear Equations: Gauss-Elimination method, Gauss-Jordan method, Crout's method, Gauss-Seidel method.

Chapter 2 :Section 2.1 - 2.4 , 2.6

Unit 3

Finite Differences: E operators and relation between them- Differences of a polynomial-Factorial polynomials- inverse operator Δ^{-1} -Summation Series.

Chapter 3 :Section 3.1 to 3.4, 3.6, 3.7.

Unit 4

Interpolation with Equal Intervals:Newton's Forward and Backward Interpolation formulae- Central Differences Formulae: Gauss-Forward and Backward Formulae- Stirling's Formula and Bessel's Formula-Equidistant terms with one or more missing values.

Chapter 4 :Section 4.1- 4.3 (omit 4.1a, 4.4), 4.7 .

Chapter 5 :Section 5.1- 5.6.

Unit 5

Interpolation with Unequal Intervals: Divided Differences - Newton's Divided Differences Formula for Interpolation -Lagrange's Formula for Interpolation-Inverse Interpolation-Lagrange's method-Reversion of Series method.

Chapter 6 :Section 6.1, 6.2, 6.5, 6.7.

Learning outcomes:

Students will be able

- To solve a system of equations using appropriate Numerical Method
- To approximate the function using appropriate Numerical Method
- To prove results for numerical root finding methods.

Content and Treatment as in

" Calculus of Finite Differences and Numerical Analysis" by P. Kandasamy and K. Thilagavathy, S. Chand and Co Pvt.Ltd.

Reference:

1. " Numerical Analysis " by B. D. Gupta, Konark Publishing.
2. "Numerical methods in Science and Engineering" by M. K. Venkataraman, National Publishing House, Chennai.

e-Resources:

1. https://nptel.ac.in
2. https://www.encyclopediaofmath.org/index.php/Finite-difference_calculus

SECOND SEMESTER

CORE PAPER III-TRIGONOMETRY (SM22A)

Course Objectives:

Students will acquire Knowledge

- About the expansions of Trigonometric Functions, Hyperbolic Functions
- To find the sum of trigonometric series.
- To find complex index.

Unit 1

Expansions of powers of $\sin\theta$, $\cos\theta$ - Expansions of $\cos^n\theta$, $\sin^n\theta$,$\cos^m\theta\sin^n\theta$

Chapter 2, Section 2.1, 2.1.1, 2.1.2,2.1.3

Unit 2

Expansions of sinnθ, cosnθ, tan nθ - Expansions of tan($\theta_1+\theta_2+\ldots\ldots..+\theta_n$) - Expansions of sin x, Cosx, tanx in terms of x-Sum of roots of trigonometric equations – Formation of equation with trigonometric roots.

Chapter 3, Section 3.1 to 3.6

Unit 3

Hyperbolic functions-Relation between circular and hyperbolic functions - Formulas in hyperbolic functions – Inverse hyperbolic functions

Chapter 4, Section 4.1 to 4.7 .

Unit 4

Inverse function of exponential functions – Values of Log (u+iv) - Complex index.

Chapter 5, Section 5.1 to 5.3

Unit 5

Sums of Trigonometric series – Applications of binomial, exponential, , logarithmic and Gregory's series - Difference method.

Chapter 6, Section 6.1 to 6.6.3

Learning Outcomes:

Student will be able

- To solve the trigonometric functions and hyperbolic functions.
- To find the sum of trigonometric series
- To solve the difference methods.

Content and treatment as in

Trigonometry by P. Duraipandian and KayalalPachaiyappa, Muhil Publishers.

Reference:-

1.Trigonometry, Calculus , Dr. P.R. Vittal , Margham Publications, Chennai.
2. Trigonometry by T.K. Manickavachagam Pillay.S.Viswanathan (Printers and Publishers) Pvt. Ltd.

e-Resources:

1. http://mathworld.wolfram.com
2. http://ocw.mit.edu/courses/mathematics/

CORE PAPER IV- INTEGRAL CALCULUS AND VECTOR ANALYSIS (SM22B)

Course Objectives:

Students will acquire Knowledge about

- **Integration and its geometrical applications, double, triple integrals**
- **Vector differentiation and Vector integration.**
- **Properties and relation between Beta Gamma functions**

Students will acquire Knowledge

- To get an idea of integration using reduction formula.
- To understand multiple integrals.
- About Vector Calculus.

Unit 1

Reduction formulae– Types, $\int x^n e^{ax} dx$, $\int x^n cosaxdx$, $\int x^n sinaxdx$, $\int cos^n xdx$, $\int sin^n xdx$, $\int sin^m xcos^n xdx$, $\int tan^n xdx$, $\int cot^n xdx$, $\int sec^n xdx$, $\int cosec^n xdx$, $\int x^n (\log x)^m dx$-Bernoulli's formula.

Chapter 1 Section 13, 13.1 to 13.10,14,15.1.

Unit 2

Multiple Integrals- definition of the double integrals- evaluation of the double integrals- double integrals in polar coordinates – triple integrals – applications of multiple integrals – volumes of solids of revolution – areas of curved surfaces – change of variables – Jacobians.

Chapter 5 Section 1, 2.1, 2.2, 3.1, 4, 6.1, 6.2, 6.3, 7
Chapter 6 Section 1.1, 1.2, 2.1 to 2.4.

Unit 3

Beta and Gamma functions - infinite integral – definitions – recurrence formula of Γ functions - properties of β-functions - relation between β and Γ functions.
Chapter 7 Sections 1.1 to 1.4 , 2.1, 2.3, 3, 4, 5.

Unit 4

Introduction - directional derivative- Gradient- divergence- curl- Laplacian Differential Operator.

Chapter 2 Sections 2.1 - 2.13.

Unit 5

Line, surface and volume integrals - Integral Theorems - Gauss, Greens and Stokes (Without proof) – Problems.

Chapter 3 Sections 3.1 to 3.6 and

Chapter 4 Sections 4.1 to 4.5.

Learning outcomes:

Students will be able to

- Get an idea of integration using reduction formula.
- Understand multiple integrals.
- Know about Vector Calculus.

Content and treatment as in

1. "Calculus", Vol- II by S. Narayanan and T.K. Manicavachagampillay - S. Viswanathanpublishers– 2007 for Unit 1 , Unit 2 , Unit 3.
2. "Vector Analysis" by P.Duraipandian and KayalalPachaiyappa, S.ChandFor Unit 4, Unit 5.

Reference:-

1. Integral Calculus and differential equations : Dipak Chatterjee (TATA McGraw Hill Publishing companyLtd.).
2. Vector Algebra and Analysis by Narayanan and T.K.Manickvachagam Pillay S .Viswanathan Publishers.
3. Vector Analysis: Murray Spiegel (Schaum Publishing Company, NewYork).

e-Resources:

1. http://mathworld.wolfram.com.
2. http://www.sosmath.com.

Allied paper –II CALCULUS OF FINITE DIFFERENCES AND NUMERICAL ANALYSIS-II (SM3AF)

Course Objectives

Students will acquire knowledge about

- Numerical techniques used as powerful tools in scientific computing.
- Numerical Differentiation , Numerical Integration and Difference Equations.
- The basic facts of theory of difference equations.

Unit 1

Numerical Differentiation: Derivatives using Newton's forward and backward difference formulae- Derivatives using Stirling's formula- Derivatives using divided difference formula- Maxima and Minima using the above formulae.
Chapter 7 :Section 7.1- 7.4, 7.6.

Unit 2

Numerical Integration: General Quadrature formula- Trapezoidal rule-Simpson's one-third rule-Simpson's three-eighth rule- Weddle's rule- Euler-Maclaurin Summation formula-
Stirling's formula for n!.
Chapter 7 :Section 7.7- 7.9, 7.13- 7.15.

Unit 3

Difference equations:Linear homogenous and nonhomogenous difference equation with constant coefficients- particular integrals for $a^u x^m, x^m, sinkx, coskx$.

Chapter 8 :Section 8.1- 8.4, 8.6

Unit 4

Numerical solution of Ordinary Differential Equations (I order only):
Taylor's series method- Picard's method- Euler's method- Modified Euler's method.
Chapter 9: Section 9.5-9.7, 9.9.

Unit 5

Numerical solution of Ordinary Differential Equations (I order only):
Runge-kuttamethod(fourth order only)- Predictor-Corrector method- Milne's method - Adams-Bashforth method.
Chapter 9 : Section 9.10 - 9.14.

Learning Outcomes:

Students will be able

- To derive Numerical methods of various mathematical operations such as integration differentiation
- To find the solutions of linear and non linear equations and the solutions of difference equations
- To evaluate the derivative at a value using an appropriate numerical method.

Content and Treatment as in

" Calculus of Finite Differences and Numerical Analysis" by P. Kandasamy and K. Thilagavathy, S. Chand and Co. Pvt.Ltd.

Reference:

1) " Numerical Analysis " by B. D. Gupta, Konark Publishing.
2) "Numerical methods in Science and Engineering" by M. K. Venkataraman, National Publishing House, Chennai.

e-Resources:

1. https://nptel.ac.in
2. https://www.encyclopediaofmath.org/index.php/Finite-difference_calculus

SEMESTER III

CORE PAPER V- INTEGRAL CALCULUS (TAM3A)

Course Objectives:

Students will acquire Knowledge about

- **Integration and its geometrical applications, double, triple integrals**
- **Vector differentiation and Vector integration.**
- **Properties and relation between Beta Gamma functions**

Unit 1

Reduction formulae– Types, $\int x^n e^{ax} dx$, $\int x^n cosaxdx$, $\int x^n sinaxdx$, $\int cos^n xdx$, $\int sin^n xdx$, $\int sin^m xcos^n xdx$, $\int tan^n xdx$, $\int cot^n xdx$, $\int sec^n xdx$, $\int cosec^n xdx$, $\int x^n (\log x)^m dx$-Bernoulli's formula.

Chapter 1 Section 13, 13.1 to 13.10, 14.15.1.

Unit 2

Multiple Integrals- definition of the double integrals- evaluation of the double integrals- double integrals in polar coordinates – triple integrals – applications of multiple integrals – volumes of solids of revolution – areas of curved surfaces – change of variables – Jacobians.

Chapter 5 Section 1, 2.1, 2.2, 3.1, 4, 6.1, 6.2, 6.3.7
Chapter 6 Section 1.1, 1.2, 2.1 to 2.4.

Unit 3

Beta and Gamma functions - indefinite integral – definitions – Convergence of Γ(n)- recurrence formula of Γ functions - properties of β-functions - relation between β and Γ functions.
Chapter 7 Sections 1.1 to 1.4 , 2.1 to 2.3, 3, 4, 5.

Unit 4

Introduction - directional derivative- Gradient- divergence- curl, Unit normal to a surface. Solenoidal and irrotational Laplacian Differential Operator.

Chapter 2 Sections 2.3 - 2.8.

Unit 5

Line, surface and volume integrals - Integral Theorems - Gauss, Greens and Stokes (Without proof) – Problems.

Chapter 3 Sections 3.1 to 3.8 and

Chapter 4 Sections 4.1 to 4.8.

Learning outcomes:

Students will be able to

- Get an idea of integration using reduction formula.
- Understand multiple integrals.
- Know about Vector Calculus.

Content and treatment as in

1. Calculus Vol- II by S. Narayanan and T.K. Manicavachagam pillay - S. Viswanathan publishers – 2007 for Unit 1 , Unit 2 , Unit 3
2. Content and treatment as in Vector Analysis by P.Duraipandian and Laxmi Duraipandian. Emerald Publishers. For Unit 4, Unit 5

Reference:-

3. Integral Calculus and differential equations : Dipak Chatterjee (TATA McGraw Hill Publishing companyLtd.).

4. Vector Algebra and Analysis by Narayanan and T.K.Manickvachagam Pillay S .Viswanathan Publishers.
4. Vector Analysis: Murray Spiegel (Schaum Publishing Company, NewYork).

e-Resources:

3. http://mathworld.wolfram.com.
4. http://www.sosmath.com.

CORE PAPER-VI-DIFFERENTIAL EQUATIONS(TAM3B)

Course Objectives:

Student will acquire knowledge to

- Identify the type of a given differential equation
- Select and apply the appropriate analytical technique for finding the solution of first and higher order ordinary differential equations.
- Understand partial differential equations.

Unit 1

Homogenous equations. Exact equations. Integratic factor. Linear equations, Reduction of order.

Chapter 2 Sections 7-11

Unit 2

Second order linear differential equations introduction .General solution of homogenous equations. The use of known solution to find another. Homogeneous equation with constant coefficients- Method of undetermined coefficients; Method of variation of parameters;

Chapter 3 Sections 14-19

Unit 3

System of first order equations-Linear systems. Homogeneous linear systems with constant coefficients.(Omit non-homogeneous system of equations)

Chapter 10 Sections 55 and 56

Unit 4

Formation of P.D.E by eliminating arbitrary constants and arbitrary functions; complete integral; Singular integral; general integral: Lagrange's equations Pp + Qq=R.

Chapter 0 Sections 0.4 and 0.5

Unit 5

Charpit‟s method and Special types of first order equations.

Chapter 0 Sections 0.11, 0.11.1

Learning Outcomes:

Student will be able to

- Classify differential equation with respect to the order and linearity .
- Convert separable and homogeneous equations to exact differential equations by integrity factor
- Solve linear first order and second order differential equation by using various methods.

Contents and treatment as in

1. Differential equations with Applications and Historical Notes by George F. Simmons Second Edition,Tata Mcgraw Hill Publications. Unit 1, 2 and 3
2. Introduction to Partial Differential Equations Second Edition(2009) by K.Sankara Rao, PHI Learning Private Limited. Unit 4 and 5

Reference:

1. Differential equations by Simmons.
2. Partial Differential Equations by Sneddon.
3. Ordinary and partial differential equations by Dr.M.D.Raisinghania S.Chand

e-Resources:

1.http://mathworld.wolfram.com
2. http://www.analyzemath.com/calculus/Differential_Equations/applications. html

Allied Paper – III MATHEMATICAL STATISTICS – I (SBAOA)

Course Objectives:

Students will acquire knowledge about

- The laws of Probability and Baye's theorem.
- Measures of Location, Dispersion, Correlation and Regression
- The Discrete and Continuous Probability Distributions.

Unit 1

Statistics – Definition- functions-applications-complete enumeration-sampling methods- measures of central tendency – measures of dispersion – skewness – kurtosis.

Unit 2

Sample space- Events- Definition of Probability (Classical,Statstical& Axiomatic)- Addition and Multiplication laws of Probability- Independence- Conditional Probability- Baye's theorem – Simple Problems.

Unit 3

Random Variables (Discrete and Continuous) Distribution function- Expected values and Moments-Moment generating function – Probability generating function- Examples.Characteristic function-Uniqueness and Inversion theorems (Statements and applications only)-Cumulants - Chebychev's Inequality – Simple Problems.

Unit 4

Concepts of bivariate distributions- Correlation: Rank Correlation coefficient-Concepts of partial and multiple correlation coefficients- Regression: Method of Least squares for fitting linear, quadratic and exponential curves - Simple problems.

Unit 5

Standard Distributions – Binomial, Hyper geometric, Poisson, Normal and Uniform distributions-Geometric, Exponential, Gamma ,Beta distributions, Inter relationship among distributions.

Learning Outcomes:

Students will be able to

- Familiarise the laws of probability and Bayes's theorem
- Solve problems in Correlation - partial and multiple, regression Equation
- Understand discrete and continuous Probability distributions.

Reference:.

- Hogg R.V. & Craig A.T. (1988) : Introduction to Mathematical Statistics, McMillan.
- Mood A.M. &Graybill F.A. &Boes D.G. (1974): Introduction to theory of Statistics, McGraw Hill.
- Snedecor G.W. & Cochran W.G(1967) : Statistical Methods, Oxford and IBH.

e-Resources:

1. https://nptel.ac.in
2. https://www.wikipedia.org.
3. http://ebooks.lpude.in.statistics.

SEMESTER-IV

CORE PAPER VII TRANSFORM TECHNIQUES (TAM4A)

Course Objectives:

Students will acquire knowledge

- About Laplace Transforms and its inverse
- To solve Ordinary Differential Equations with constant coefficients and simultaneous Ordinary Differential Equations.
- To solve problems in Fourier series and Fourier transforms**.**

UNIT I:

Introduction – Properties of Laplace transform- Laplace transform of elementary functions-Problems using properties-Laplace transform of special function, unit step function and Dirac delta function - Laplace transform of derivatives and Integrals – Evaluation of integral using Laplace Transform - Initial Value Theorem – Final Value Theorem and problems –Laplace Transform of periodic function

Chapter 2 : Section 2.1 to 2.20

UNIT II:

Introduction, Properties of inverse Laplace transform, Problems (usual types); Convolution Theorem - Inverse Laplace Transform using Convolution theorem

Chapter 3, Section 3.1 to 3.11

UNIT III:

Introduction, Expansions of periodic function of period 2π ; expansion of even and odd functions; half range cosine and sine series – Fourier series of change of interval.

Chapter 1, Section 1.1 to 1.11

UNIT IV:

Introduction of Fourier transform - Properties of Fourier Transforms - Inverse Fourier transform – Problems, Fourier sine and cosine transforms and their inverse Fourier transform – Problems, Convolution theorem, Parseval's identity and problems using Parseval's identity.

Chapter 4, Section 4.1 to 4.12

UNIT V:

Applications of Laplace transform to solution of first and second order linear differential equations (constant coefficients) and simultaneous linear ordinary differential equations – Application of Laplace transform to partial differential equations. Application of Laplace Transform and Fourier transform to Initial and Boundary Value Problems.

Chapter 5 Section 5.1, 5.3, 5.7 to 5.11

Learning Outcomes:

Students will be able to

- Solve Laplace Transform and inverse Laplace transform problems.
- Solve Fourier Transforms and inverse Fourier transform problems.
- Apply Laplace transform and Fourier transform to solve initial and boundary value problem.

Contents and treatment as in

"Fourier Series and Integral Transforms" – Dr. S. Sreenath, S.Ranganatham, Dr. M.V.S.S.N.Prasad and Dr. V. Ramesh Babu. S.Chand and Company Ltd

Reference Books

1. Engineering Mathematics volume 3 : M.K. Venkataraman(National Publishing Co.)

2. Engineering Mathematics volume 3 : P.Kandasamy and others(S.Chand and Co.)

3. Advanced Engineering Mathematics : Stanley Grossman and William R.Devit (Harper and Row publishers)

e-Resources:

1. http://mathworld.wolfram.com.
2. http://www.sosmath.com.

CORE PAPER- VIII – STATICS (TAM4B)

Course Objectives:

Students will acquire knowledge about

- Particles or body in rest under the given forces.
- Forces, equilibrium of a particle and centre of mass of various bodies.
- Resultant of coplanar forces and virtual work.

Unit 1

Newton's laws of motion - resultant of two forces on a particle- Equilibrium of a particle- Limiting Equilibrium of a particle on an inclined plane
Chapter 2 - Section 2 .1 , 2.2 , Chapter 3 - Section 3.1 and 3.2

Unit 2

Forces on a rigid body – moment of a force – general motion of a rigid body- equivalent systems of forces – parallel forces – forces along the sides of a triangle – couples
Chapter 4 - Section 4 .1 to 4.6

Unit 3

Resultant of several coplanar forces- equation of the line of action of the resultant- Equilibrium of a rigid body under three coplanar forces – Reduction of coplanar forces into a force and a couple.- problems involving frictional forces
Chapter 4 - Section 4.7 to 4.9 , Chapter 5 - Section 5.1, 5.2

Unit 4

Centre of mass – finding mass centre – a hanging body in equilibrium – stability of equilibrium – stability using differentiation
Chapter 6 - Section 6.1 to 6.3 , Chapter 7 - Section 7.1, 7.2

Unit 5
Virtual work – hanging strings- equilibrium of a uniform homogeneous string – suspension bridge
Chapter 8 - Section 8.1, Chapter 9 - Section 9.1, 9.2

Learning Outcomes:

Students will be able to

- Realize the concept about forces, resultant forces, parallel forces
- Find the center of mass.
- Solve frictional forces problems

Contents and treatment as in
"Mechanics" by P. Duraipandian ,LaxmiDuraipandian , MuthamizhJayapragasham, S. Chand and Co limited 2008 .

Reference:
1.Dynamics – K. ViswanathaNaik and M. S. Kasi, Emerald Publishers.
2.Dynamics – A. V. Dharmapadam, S. Viswanathan Publishers.
3.Mechanics – Walter Grenier.

e-Resources:

1. https://www.wikipedia.org/
2. https://physics.info

Allied Paper – IV MATHEMATICAL STATISTICS II (SBAOB)

Course Objectives

Students will acquire knowledge about

- The foundation of statistical analysis used in varied applications.
- Sampling methods, Tests of significance and testing of hypothesis.
- The various estimation procedures.

Unit 1

Sampling theory – Sampling Distributions – Concept of Standard error – Sampling distribution based on normal distribution- t, Chi Square and F distributions.

Unit 2

Point estimation – Concepts of unbiasedness – consistency – efficiency and sufficiency- Cramer Rao inequality – Methods of estimation- Maximum likelihood- moments - minimum square and their properties (Statement only).

Unit 3

Test of significance – Standard error- Large sample test, Exact test based on normal, t, chi-square and F distribution with respect to population mean/means, proportion/proportions, variance and correlation coefficient. Test of independence of attributes based on contingency tables- Goodness of fit based on chi-square.

Unit 4

Analysis of Variance: One way, two way classification concepts &Problems. Interval estimation – Confidence intervals for population mean/means- Proportion/proportions and variances based on Normal, t, Chi-Square and F.

Unit 5

Test of hypothesis- Type I and II errors- Power of test – Neymann Pearson lemma- Likelihood ratio test- concepts of most powerful test-(statements and results only)-simple problems.

Learning Outcomes:

Student will be able

- To analyze the methods of testing statistical hypothesis.
- To estimate sample size and apply ANOVA.
- To apply test of significance, Contingency table, goodness of fit, tests based on normal, 't' and 'F' distributions.

Reference:

- Hogg R.V. & Craig A.T. (1988): Introduction to Mathematical Statistics, McMillan.
- Mood A.M. &Graybill F.A. &Boes D.G. (1974): Introduction to theory of Statistics, McGraw Hill.
- Snedecor G.W. & Cochran W.G(1967) : Statistical Methods, Oxford and IBH.
- Hoel P.G. (1971) : Introduction to Mathematical Statistics, Wiley.
- Wilks S.S. Elementary Statistical Analysis, Oxford and IBH.

e-Resources:

1. https://nptel.ac.in

2.https://www.wikipedia.org.
3.http://ebooks.lpude.in.statistics.

MATHEMATICAL STATISTICS I & II (PRACTICALS) (SBA01)

1. Construction of Univariate and Bivariate frequency distribution with samples of size not exceeding 200.
2. Diagrammatic and graphical representation on data and frequency distribution.

3. Cumulative frequency distribution – Ogive curves and Lorenz curves.

4. Measures of Location and dispersion (absolute and relative), skewness and Kurtosis.

5. Numerical problem involving derivation of Marginal and Conditional distributions and related measures of moments.

6. Fitting of Binomial, Poisson and Normal distribution and test of goodness of fit.

7. Curve fitting by the method of least squares

a) $y = ax+b$
b) $y = ax^2 + bx + c$
c) $y = ae^{bx}$
d) $y = ax^b$

8. Computation of Correlation coefficients and Regression lines for raw and grouped data – Rank correlation coefficient.

9. Asymptotic and exact test of significance with regard to population mean, proportion, variance and coefficient of correlation.

10. Test of independence of attributes based on contingency table.

11. Confidence interval based on normal, t, chi – square statistics.

NOTE:

- Use of scientific calculator may be permitted for mathematical statistics practical examination.
- Statistical and Mathematical tables are to be provided to the students at the examination hall.

SEMESTER-V

CORE PAPER- IX ALGEBRAIC STRUCTURES (TAM5A)

Course objectives:

Students will acquire knowledge

- To study the basic algebraic structures such as group and rings

- To understand the properties and extend group structure to finite permutation groups.
- To study the concepts of homomorphism, isomorphism and automorphism .

Unit 1

Introduction to groups- Subgroups- cyclic groups and properties of cyclic groups- Lagrange's Theorem- A counting principle.

Chapter 2 Section 2.4 and 2.5.

Unit 2

Normal subgroups and Quotient group- Homomorphism- Automorphism.

Chapter 2 Section 2.6 to 2.8.

Unit 3

Cayley's Theorem- Permutation groups.

Chapter 2 Section 2.9 and 2.10.

Unit 4

Definition and examples of ring- Some special classes of rings- homomorphism of rings- Ideals and quotient rings- More ideals and quotient rings.

Chapter 3 Section 3.1 to 3.5.

Unit 5

The field of quotients of an integral domain- Euclidean Rings- The particular Euclidean ring.

Section 3.6to 3.8.

Learning Outcomes:

Student will be able to have concrete knowledge about

- The abstract thinking in Group Theory, Rings.
- Understand theorems based on finite groups and its application.
- Understand theorems on Rings and evaluating simple problems based on rings.

Contents and treatment as in

"Topics in Algebra" – I. N. Herstein, Wiley Eastern Ltd.

Reference:

1.Modern Algebra by M.L.Santiago, McGraw Hill Education India pvt Ltd.

2.Modern Algebra by S. Arumugam and others, New Gamma publishing House, Palayamkottai.

3.Modern Algebra by Visvanathan Nayak, Emerald Publishers, Reprint 1992.

e-Resources:

1. https://nptel.ac.in
2. http://garsia.math.yorku.ca/~sdenton/algstruct.

CORE PAPER-X- REAL ANALYSIS –I (TAM5B)

Course Objectives:

Students will acquire knowledge to

- Apply Mathematical concepts and Principles to perform numerical and symbolic computations.
- Understand and perform simple proofs.
- Know how abstract ideas and rigorous methods in Mathematical Analysis can be applied to practical problems.

Unit 1

Sets and elements; Operations on sets; functions; real valued functions; equivalence; countability ; real numbers; least upper bounds.

Chapter 1 Section 1. 1 to 1.7

Unit 2

Definition of a sequence and subsequence; limit of a sequence; convergent sequences; divergent sequences; bounded sequences; monotone sequences.

Chapter 2 Section 2.1 to 2.6

Unit 3

Operations on convergent sequences; operations on divergent sequences; limit superior and limit inferior; Cauchy sequences. Chapter 2 Section 2.7 to 2.10.

Unit 4

Convergence and divergence; series with non-negative numbers; alternating series; conditional convergence and absolute convergence; tests for absolute convergence; series whose terms form a non - increasing sequence - the class l^2

Chapter 3 Section 3.1 to 3.4, 3.6, 3.7 and 3.10

Unit 5

Limit of a function on a real line;. Metric spaces; Limits in metric spaces.Function continuous at a point on the real line, reformulation, Function continuous on a metric space.

Chapter 4 Section 4.1 to 4.3 Chapter 5 Section 5.1-5.3

Learning Outcomes:

Students will be able to

- Apply Mathematical concepts and Principles to perform numerical and symbolic computations.
- Understand and perform simple proofs.
- Know how abstract ideas and rigorous methods in Mathematical Analysis can be applied to practical problems

Contents and Treatment as in

"Methods of Real Analysis" : Richard R. Goldberg (Oxford and IBH Publishing Co.).

Reference:

1. Principles of Mathematical Analysis by Walter Rudin,TataMcGrawHill.
2. Mathematical Analysis Tom M Apostol, Narosa Publishing House.

e-Resources:

1. https://mathcs.org/analysis/reals/numseq/sequence.html.
2. http://www-groups.mcs.st-andrews.ac.uk/~john/analysis/index.html
3. http://www.phengkimving.com.

CORE PAPER- XI- DYNAMICS (TAM5C)

Course Objectives:

Students will acquire knowledge of

- The motion of bodies under the influence of forces.
- Rectilinear motion of particles, Projectiles, Impact and Moment of Inertia of Particles.
- To understand the notions of impact between two smooth spheres.

Unit 1

Basic units – velocity – acceleration- coplanar motion – rectilinear motion under constant forces – acceleration and retardation – thrust on a plane – motion along a vertical line under gravity – line of quickest descent - motion along an inclined plane – motion of connected particles.
Chapter 1 - Section 1.1 to 1.4, Chapter 10 - Section 10.1 to 10.6

Unit 2

Work, Energy and power – work – conservative field of force – power – Rectilinear motion under varying Force simple harmonic motion (S.H.M.) – S.H.M. along a horizontal line- S.H.M. along a vertical line – motion under gravity in a resisting medium.
Chapter 11 - Section 11.1to 11.3 , Chapter 12 - Section 12.1 to 12.4

Unit 3

Forces on a projectile- projectile projected on an inclined plane- Enveloping parabola or bounding parabola – impact – impulse force - impact of sphere - impact of two smooth spheres – impact of a smooth sphere on a plane – oblique impact of two smooth spheres
Chapter 13 - Section 13.1 to 13.3, Chapter 14 - Section 14.1, 14.5

Unit4

Circular motion – Conical pendulum – motion of a cyclist on a circular path – circular motion on a vertical plane – relative rest in a revolving cone – simple pendulum – central orbits -general orbits - central orbits- conic as centered orbit.
Chapter 15 - Section 15.1 to 15.6, Chapter 16 - Section 16.1 to 16.3

Unit 5

Moment of inertia. Two dimensional motion of a rigid body –equations of motion for two dimensional motion – theory of dimensions- definition of dimensions. Chapter 17 -Section 17.1, Chapter 18 - Section 18.1, 18.2, Chapter 19 - Section 19.1

Learning Outcomes:

Students will be able to

- Motion of bodies under the influence of forces.
- Rectilinear motions and projectiles
- Impact and moment of inertia of particles

Contents and treatment as in

"Mechanics" – P. Duraipandian, LaxmiDuraipandian ,Muthamizh Jayapragasham, S. Chand and Co limited 2008 .

Reference :

1. Dynamics – K. ViswanathaNaik and M. S. Kasi, Emerald Publishers.
2. Dynamics – A. V. Dharmapadam, S. Viswanathan Publishers.
3. Mechanics – Walter Grenier

e-Resources:

1. https://nptel.ac.in
2. https://www.wikipedia.org

CORE PAPER- XII- DISCRETE MATHEMATICS (TAM5D)

Course Objectives:

Students will acquire knowledge

- About the tools and ideas in Mathematics for solving applied Problems.
- To understand the construction of simple mathematical proofs.
- To Evaluate Boolean functions and to express a logic sentence in terms of predicates, quantifiers, and logical connectives.

Unit 1

Set, some basic properties of integers, Mathematical induction, divisibility of integers, representation of positive integers.
Chapter 1 - Sections 1.1 to 1.5

Unit 2

Boolean algebra, two element Boolean algebra, Disjunctive normal form, Conjunctive normal form Chapter 5 - Sections 5.1 to 5.4

Unit 3

Application, Simplication of circuits, Designing of switching circuits, Logical Gates and Combinatorial circuits. Chapter 5 - Section 5.5, 5.6.

Unit 4

Sequence and recurrence relation, Solving recurrence relations by iteration method, Modeling of counting problems by recurrence relations, Linear (difference equations) recurrence relations with constant coefficients, Generating functions, Sum and product of two generating functions, Useful generating functions, Combinatorial problems. Chapter 6 - Section 6.1 to 6.6

Unit 5

Introduction, Walk, Path and cycles, Euler circuit
Chapter 7 - Sections 7.1 to 7.3

Learning Outcomes:

Student will be able

- To apply tools and ideas in Mathematics for solving applied Problems.
- To Evaluate Boolean functions.
- To express a logic sentence in terms of predicates, quantifiers, and logical connectives.

Contents and treatment as in

"Introduction to Discrete Mathematics", 2nd edition, 2002 by M. K. Sen and B. C. Chakraborty, Books and Allied Private Ltd., Kolkata.

Reference:-

1. Discrete mathematics for computer scientists and mathematicians by J. L. Mertt,AbrahamKendel and T. P. Baker prentice-hall, India.
2. Discrete mathematics for computer scientists by John Truss-Addison Wesley.
3. Elements of Discrete Mathematics, C. L. Liu, New York Mcgraw-Hill, 1977.

e-Resources:

1. https://brilliant.org/wiki/discrete-mathematics/.
2. https://www.tutorialspoint.com/discrete_mathematics/.

Elective paper -I Programming Language 'C' With Practicals (TEM5A)

Course Objectives:

Students will acquire knowledge

- To gain proficiency with a programming language C
- To compose programs in C and to solve the problems.
- To learn critical thinking methods.

Unit 1

Introduction. Constants-Variables-Data-types (Fundamental and user defined) Operators-Precedence of operators – Library functions –Input ,Output statements-Escape sequences-Formatted outputs – Storage classes -Compiler directives.
Chapter 2 Sections 2.1 - 2.8 , Chapter 3 Sections 3.1 – 3.7, 3.12 ,Chapter 4 Sections 4.2 – 4.5

Unit 2

Decision making and branching: Simple if, if e lse, nested if, else if ladder and switch statement –conditional operator – go to statement. Decision making and looping : while, do while and for statement – nested for loops – continue and break statements.
Chapter 5 Sections 5.1 – 5.9 ,
Chapter 6 Sections 6.1 – 6.5

Unit 3

Arrays : One dimensional and 2 dimensional arrays – declarations – initialization of arrays– Operation on strings-String handling functions.
Chapter 7 Sections 7.1 – 7.4 ,
Chapter 8 Sections 8.1 – 8.8

Unit 4

Functions : Function definition and declaration – Categories of functions – recursion – Concept of pointers. Function call by reference - call by value.

Chapter 9 Sections 9.1 – 9.13

Chapter 11 Sections11.1-11.5

Unit 5

Files : Definition, operations on files- file operation functions.

Chapter 12, Sections 12.1 – 12..

Learning Outcomes:

Student will be able

- To know the basic concepts and structure of 'C' program
- To write simple programs with Mathematical Applications.
- To apply concepts of Branching, Looping and Arrays in programming.

Content and Treatment as in

Programming in ANSI C 2nd edition by E.Balagurusamy, Tata-Mcgraw Hill Publishing Company.

Reference:-

1. Venugopal, programming in C
2. Gottfied, B.S : programming with C , Schaum"s outline series, TMH 2001
3. Yashvant Kanitkar, Let us „C" BPB Publications

e-Resources:

1.https://www.w3schools.in/c-tutorial.

2.https://en.cppreference.com/w/c.

PRACTICALS(TEM51)

Writing 'C' programs for the following:

1. To convert Centigrade to Fahrenheit
2. To find the area, circumference of a circle
3. To convert days into months and days
4. To solve a quadratic equation
5. To find sum of n numbers
6. To find the largest and smallest numbers
7. To generate Pascal's triangle, Floyd's triangle
8. To find the trace of a matrix
9. To add and subtract two matrices
10. To multiply two matrices

11. To generate Fibonacci series using functions
12. To compute factorial of a given number, using functions
13. To add complex numbers using functions
14. To concatenate two strings using string handling functions
15. To check whether the given string is a palindrome or not using string handling functions.

SEMESTER-VI
CORE PAPER-XIII – LINEAR ALGEBRA (TAM6A)

Course Objectives:

Students will acquire knowledge

- About vector Spaces, Dual spaces, Inner product spaces and linear transformations
- To Construct, or give examples of, mathematical expressions that involve vectors, matrices, and linear systems of linear equations.
- To Evaluate mathematical expressions to compute quantities that deal with linear systems and eigenvalue problems.

  .

Unit 1
Vector spaces. Elementary basic concepts- linear independence and bases
Chapter 4 Section 4.1 and 4.2.

Unit 2
Dual spaces
Chapter 4 Section 4.3.

Unit 3
Inner product spaces.
Chapter 4 Section 4.4.

Unit 4
Algebra of linear transformations- characteristic roots.
Chapter 6 Section 6.1 and 6.2.

Unit 5
Matrices- canonical forms- triangular forms.
Chapter 6 Section 6.3 and 6.4.

Learning Outcomes :

Student will be able

- To analyze the solution set of a system of linear equations.

- To generalize the concepts of a real (complex) vector space to an arbitrary finite-dimensional vector space.
- To investigate properties of vector spaces and subspaces using by linear transformations.

Content and Treatment as in
"Topics in Algebra" – I. N. Herstein-Wiley Eastern Ltd.

Reference:

1. University Algebra – N. S. Gopalakrishnan – New Age International Publications, Wiley Eastern Ltd.
2. First course in Algebra – John B. Fraleigh, Addison Wesley.
3. Text Book of Algebra – R. Balakrishna and N. Ramabadran, Vikas publishing Co.
4. Algebra – S. Arumugam, New Gamma publishing house, Palayamkottai.

e-Resources:

1. https://nptel.ac.in.
2. http://ebooks.lpude.in.linearalgebra.

CORE PAPER – XIV- REAL ANALYSIS –II (TAM6B)

Course Objectives:

Students will acquire knowledge

- To expose the students to the fundamental concepts of open and closed sets.
- To provide deeper understanding of the complete spaces, compactness, connectedness, and uniform continuity etc. in a metric space.
- To understand the concepts of the differentiability of real functions and related theorems, pointwise convergence and uniform convergence.

Unit 1
Open sets; closed sets; Discontinuous function on R1 . More about open sets; Connected sets :
Chapter 5 Section 5.4 to 5.6
Chapter 6 Section 6.1 and 6.2

Unit 2
Bounded sets and totally bounded sets: Complete metric spaces- compact metric spaces, continuous functions on a compact metric space, continuity of inverse functions, uniform continuity.
Chapter 6 Section 6.3 to 6.8

Unit 3
Sets of measure zero, definition of the Riemann integral, existence of the Riemann integral-properties of Riemann integral.
Chapter 7 Section 7.1 to 7.4

Unit 4

Derivatives- Rolle's theorem, Law of mean, Fundamental theorems of calculus.

Chapter 7 Section 7.5 to 7.8

Unit 5

Taylor's theorem- Pointwise convergence of sequences of functions, uniform convergence of sequences of functions.

Chapter 8 Section 8.5 Chapter 9 Section 9.1 and 9.2

Learning Outcomes:

Students will be able to

- Know the basic concepts of the real numbers and the analytic properties of real-valued functions.
- Know the analytic concepts of connectedness, compactness, completeness and calculus.
- Solve problems based on Pointwise convergence and Uniform convergence.

Content and Treatment as in

"Methods of Real Analysis"- Richard R. Goldberg (Oxford and IBH Publishing Co)

Reference:-

1. Principles of Mathematical Analysis by Walter Rudin,TataMcGrawHill.
2. Mathematical Analysis Tom M Apostal,Narosa Publishing House.

e-Resources:

1. https://nptel.ac.in.
2. https://mathonline.wikidot.com.
3. https://en.wikipedia.org/wiki/Metric_space.

CORE PAPER XV – COMPLEX ANALYSIS (TAM6C)

Course Objectives:

Students will acquire knowledge

• To understand limits, differentiability and continuity for complex number system.
• To solve Taylors and Laurents series expansion problems.
• To understand Cauchy residue theorem, singularities and poles and to solve definite integral problems.

Unit 1

Functions of a complex variable - mappings, limits - theorems on limits, continuity ,derivatives, differentiation formulae - Cauchy-Riemann equations - sufficient conditions for

differentiabilityCauchy-Riemann equations in polar form - Analytic functions - Harmonic functions.
Chapter 2 Section 2.9 to 2.12, 2.14 to 2.20 and 2.22

Unit 2
Linear functions - The transformation w = 1/z - linear fractional transformations - an implicit form - exponential and logarithmic transformations – transformation w = sin z - Preservation of angles. Chapter 8 Section 8.68 to 8.71 and 8.73, 8.74 Chapter 9 : 9.79
Unit 3
Complex Valued functions- contours - contour integrals - Anti derivatives - Cauchy-Goursat theorem. Cauchy integral formula - derivatives of analytic function - Liouvillie‟s theorem and fundamental theorem of algebra -maximum moduli of functions.
Chapter 4 Section 4.30 to 4.42

Unit 4
Convergence of sequences and series - Taylor‟s series -Laurent‟s series - zeros of analytic functions.
Chapter 5 Section 5.43 to 5.47

Unit 5
Residues - Residue theorems- Three types of isolated singular points- Residues at poles- Zeros and poles of order „m‟ - Evaluation of improper integrals – Improper integrals involving sines and cosines - Definite integrals involving sines and cosines – Argument principle and Rouche‟s theorem.
Chapter 6 Section 6.53 to 6.57 and Chapter 7 Section 7.60 to 7.65.

Learning Outcomes:

Student will be able

- To apply Cauchy Riemann equation for differentiability and to find bilinear transformation
- To solve analytic functions, limits and differentiability.
- To apply the methods of complex analysis to evaluate definite integrals and infinite series.

Content and treatment as in
Complex variables and Applications (Sixth Edition) by James Ward Brown and Ruel V.Churchill, Mc.Grawhill Inc.

Reference:

1. Theory and problems of Complex Variables – Murray R.Spiegel, Schaum outline series
2. Complex Analysis – P.Duraipandian
3. Introduction to Complex Analysis S. Ponnuswamy , Narosa Publishers 1993.

e-Resources:

1. http://ebooks.lpude.in.complexanalysis.
2. https://nptel.ac.in.

Elective paper -II GRAPH THEORY (TEM6B)

Course Objectives:

Students will acquire knowledge

- To define the basic concepts of graphs
- To describe some basic algorithms for graph
- To improve the proof writing skills

Unit 1
Graphs, sub graphs, degree of a vertex, isomorphism of graphs, independent sets and coverings, intersection graphs and line graphs, adjacency and incidence matrices, operations on graphs, Chapter 2 Sections 2.0 – 2.9

Unit 2
Degree sequences and graphic sequences – simple problems. Connectedness, walks, trails, paths, components, bridge, block, connectivity – simple problems. Chapter 3 Sections 3.0 – 3.2 , Chapter 4 Sections 4.0 – 4.4

Unit 3
Eulerian and Hamiltonian graphs
Chapter 5 Sections 5.0 – 5.2

Unit 4
Trees – simple problems. Planarity : Definition and properties, Characterization of planar graphs. Chapter 6 Sections 6.0 – 6.2 ,Chapter 8 Sections 8.0 – 8.2

Unit 5
Digraphs and matrices, tournaments, some application connector problem Chapter 10 Sections 10.0 – 10.4 ,Chapter 11 Sections 11.0 – 11.1

Learning Outcomes:

Student will be able

- To apply the fundamental concepts in graph theory
- To apply graph theory based tools in solving practical problems.

- Do model real world problems using graph theory.

Content and treatment as in

Invitation to Graph Theory by S.Arumugam and S.Ramachandran, New Gamma Publishing House, Palayamkottai

Reference Books

1. A first book at graph theory by John Clark and Derek Allan Holton, Allied publishers
2. Graph Theory by S.Kumaravelu and Susheela Kumaravelu,Publishers authors C/o 182 Chidambara Nagar, Nagarkoil

e-Resources:

1.https://nptel.ac.in.
2.https://mathonline.wikidot.com.
3.http://ebooks.lpude.in.graphtheory.

Elective paper -III. OPERATIONS RESEARCH (TEM6C)

Course Objectives:

Students will acquire knowledge in

- Solving Linear Programming Problems.
- Sequencing the jobs to be carried out based on Cost Optimization.
- Solving assignment and transportation problems and Queuing Theory Models.

Unit 1

Linear programming: Formulation – graphical solution. Simplex method. Big-M method. Duality-primal-dual relation.

Chapter 6 Sections 6.1 – 6.13, 6.20 – 6.31

Unit 2

Transportation problem: Mathematical Formulation. Basic Feasible solution. North West Corner rule, Least Cost Method, Vogel's approximation. Optimal Solution. Unbalanced Transportation Problems. Degeneracy in Transportation problems.

Assignment problem: Mathematical Formulation. Comparison with Transportation Model. Hungarian Method. Unbalanced Assignment problems

Chapter 9 Sections 9.1 – 9.12 ,Chapter 8 Sections 8.1 – 8.5

Unit 3

Sequencing problem: n jobs on 2 machines – n jobs on 3 machines – two jobs on m machines – n jobs on m machines.

Game theory : Two-person Zero-sum game with saddle point – without saddle point – dominance – solving 2 x n or m x 2 game by graphical method.

Chapter 10 Sections 10.1 – 10.6 ,Chapter 12 Sections 12.1 – 12.15

Unit 4

Queuing theory: Basic concepts. Steady state analysis of M / M / 1 and M / M / S models with finite and infinite capacities.

Chapter 5 Sections 5.1 – 5.18

Unit 5

Network: : Project Network diagram – CPM and PERT computations. (Crashing excluded)
Chapter 13
Sections 13.1 – 13.10

Learning Outcomes:

Students will be able to

- Solve Linear Programming Problem.
- Solve Transportation Problem.
- Understand the basic concepts of Queueing theory and Network problems.

Content and treatment as in

Operations Research, by R.K.Gupta , Krishna Prakashan India (p),Meerut Publications.

Reference:

1.Gauss S.I. Linear programming , McGraw-Hill Book Company.

2. Gupta P.K. and Hira D.S., Problems in Operations Research ,S.Chand& Co.

3.KantiSwaroop, Gupta P.K and Manmohan , Problems in Operations Research,Sultan Chand & Sons.

4. Ravindran A., Phillips D.T. and Solberg J.J., Operations Research, John wiley & Sons.

5. Taha H.A. Operation Research, Macmillan pub. Company, New York.

6. Linear Programming, Transporation, Assignment Game by Dr.Paria, Books and Allied(p) Ltd.,1999.

7. V.Sundaresan,K.S. GanapathySubramaian and K.Ganesan,Resource Management Techniques..A.R Publications.

e-Resources:

1. http://ebooks.lpude.in.operationsresearch.
2. https://ocw.mit.edu.

UNIVERSITY OF MADRAS

UG – NON-MAJOR ELECTIVE COURSE

OFFERED IN THE DEPARTMENT OF MATHEMATICS

SYLLABUS WITH EFFECT FROM 2020-2021

NME-I: FUNCTIONAL MATHEMATICS-I

SUB. CODE: SM5AA SEM: I YEAR/CLASS: I/ I B.Sc PHYSICS

COURSE OBJECTIVE:

1. To enhance problem solving skills
2. To improve basic mathematical skills
3. To help students prepare for competitive exams.

UNIT I

Ratio and Proportion

UNIT II

Percentages

UNIT III

Profit and Loss,

UNIT IV

Simple Interest and Compound interest

UNIT V

Solutions of Simultaneous equations, Problems on Ages and Numbers.

COURSE OUTCOME:

1. Students learn to solve problems on ratio, percentage.
2. To do problems on profit and loss, simple and compound interest.
3. To solve problems on numbers and problems on age.

Reference:

Quantitative Aptitude- R.S. Agarwal

UNIVERSITY OF MADRAS

UG – NON-MAJOR ELECTIVE COURSE

OFFERED IN THE DEPARTMENT OF MATHEMATICS

SYLLABUS WITH EFFECT FROM 2020-2021

NME-II: FUNCTIONAL MATHEMATICS-II

SUB. CODE: SM5AB SEM: II YEAR/CLASS: I/ I B.Sc PHYSICS

COURSE OBJECTIVE:

1. To enhance problem solving skills
2. To improve basic mathematical skills
3. To help students prepare for competitive exams.

UNIT I

Time and work – Pipes and cisterns- Problem

UNIT II

Time and Distance, Relative speeds- Problems on Races, Boats and Trains.

UNIT III

Mensuration – Problems.

UNIT IV

Polygons – Interior angles- Number of diagonals- Regular Polygons- Problems

UNIT V

Stocks and Shares – Problems

COURSE OUTCOME:

1. Students learn to solve problems on time and work, distance and speed.

2. To do problems on trains, races, pipes and cisterns and mensuration.

3. To solve problems on stocks and shares, polygons.

Reference:

1.Quantitative Aptitude- R.S. Agarwal

2. Functional Mathematics, M. Sivananda Rani, Margham Publications, Chennai.

ALLIED MATHEMATICS PAPERS FOR OTHER BRANCHES OF B.Sc. DEGREE COURSES (For I B. Sc Physics, Physics with Computer Application, Chemistry, Bio-Chemistry, Electronic Science, Geophysics and Computer Science, Bachelor of Computer Application (BCA) Major only)

SYLLABUS

Semester I - Mathematics –I (SM3AA)

(Effective from the Academic Year 2020-2021)

COURSE OBJECTIVES:

1. To enable students to learn basic concepts of Algebra and Numerical methods.
2. To enable students to understand Matrices and Theory of equations.
3. To learn circular, hyperbolic and inverse hyperbolic functions and to understand differential calculus and its applications.

.**Unit 1**

Algebra And Numerical Methods:

Algebra: Summation of series - simple problems.

Numerical Methods: Operators E,Δ,∇ difference tables- Newton-Raphson method- Newton's forward and backward interpolation formulae for equal intervals, Lagrange's interpolation formula.

Chapter 2, Section 2.1.3, 2.2, 2.2.1, 2.3, 2.3.3
Chapter 3, Section 3.4.1 and Chapter 5, Section 5.1 and 5.2.

Unit 2

Matrices: Symmetric, Skew-Symmetric, Orthogonal, Hermetian, Skew-Hermetian and Unitary matrices. Eigen values and Eigen-vectors, Cayley-Hamilton theorem (without proof) – verification- Computation of inverse of matrix using Cayley - Hamilton theorem.

Chapter 4, Section 4.1.1 to 4.1.6, 4.5, 4.5.2, 4.5.3.

Unit 3

Theory Of Equations: Polynomial equations with real coefficients, irrational roots, complex roots, symmetric functions of roots, transformation of equation by increasing or decreasing roots by a constant, reciprocal equation-simple problems.

Chapter 3, Section 3.1 to 3.4.1(omit section 3.2.1)

Unit 4

Trigonometry:Expansions of $\sin(n\theta)$ and $\cos(n\theta)$ in a series of powers of $\sin\theta$ and $\cos\theta$ - Expansions of $\sin^n\theta$, $\cos^n\theta$, $\tan^n\theta$ in a series of sines, cosines and tangents of multiples of "θ" - Expansions of $\sin\theta$, $\cos\theta$ and $\tan\theta$ in a series of powers of "θ" – Hyperbolic and inverse hyperbolic functions .

Chapter 6, Section 6.1 to 6.3.

Unit 5

Differential Calculus:Successive differentiation, n^{th} derivatives, Leibnitz theorem (without proof) and applications, Jacobians, Curvature and radius of curvature in Cartesian co-ordinates, maxima and minima of functions of two variables- Simple problems

Chapter 1, Section 1.1 to 1.3.1 and 1.4.3.

COURSE OUTCOMES:

1.Student gain knowledge to find the summation of series and to solve problems in Numerical methods.
2.Student will be able to find the Eigen values, Eigen vectors, apply Cayley Hamilton theorem to find inverse of a Matrix, Powers of a Matrix and to solve polynomial equations.
3.Student will be able to evaluate circular, Hyperbolic, inverse hyperbolic functions and to find higher derivatives of functions and its applications.

Content and treatment as in

Allied Mathematics, Volume I and II, by P. Duraipandian and S. Udayabaskaran, S. Chand Publications

Reference:-

1. S.Narayanan and T.K. Manickavasagam Pillai – Ancillary Mathematics, S. Viswanathan Printers, 1986, Chennai.
2. Allied Mathematics by Dr. A. Singaravelu, Meenakshi Agency.

e-Resources:

1. http://www.themathpaage.com
2. http://nptel.ac.in

ALLIED MATHEMATICS PAPERS FOR OTHER BRANCHES OF B.Sc. DEGREE COURSES (For I B. Sc Physics, Physics with Computer Application, Chemistry, Bio-Chemistry, Electronic Science, Geophysics and Computer Science, Bachelor of Computer Application (BCA) Major only)

SYLLABUS

Semester II - Mathematics –II (SM3AE)

(Effective from the Academic Year 2020-2021)

COURSE OBJECTIVES:

1. Enable the students to know Integration using Recurrence relation and Fourier series for circular functions.
2. To understand Differential equations, Laplace transforms and its applications
3. To know the derivatives in Vector and Vector integration.

Unit 1

Integral Calculus: Bernoulli formula – Reduction formulae-$\int_0^{\pi/2} sin^n x\, dx$, $\int_0^{\pi/2} cos^n x\, dx$,$\int_0^{\pi/2} sin^m x cos^n x dx$(m,n being positive integers), Fourier series for functions in $(0,2\pi)$, $(-\pi, \pi)$.

Chapter 2: Section 2.7 & 2.9 , Chapter 4: Section 4.1.

Unit 2

Differential Equations:

Ordinary Differential Equations: second order non- homogeneous differential equations with constant coefficients of the form ay" +by'+ cy = X where X is of the form $e^{\alpha x}\, cos\, cos\, \beta x$ and $e^{\alpha x}\, sin\, sin\, \beta x$ -Related problems only.

Partial Differential Equations: Formation, complete integrals and general integrals, four standard types and solving Lagrange's linear equation P p +Q q= R.

Chapter 5: Section 5.2.1, Chapter 6: Section 6.1 to 6.4

Unit 3:

Laplace Transforms: Laplace transformations of standard functions and simple properties, inverse Laplace transforms, Application to solution of linear differential equations up to second order- simple problems.

Chapter 7: Section 7.1.1 to 7.1.4 & 7.2 to 7.3

Unit 4:

Vector Differentiation: Introduction, Scalar point functions, Vector point functions, Vector differential operator Gradient, Divergence, Curl, Solenoidal, irrotational, identities.

Chapter 8, Section 8.1 to 8.4.4

Unit 5:

Vector Integration: Line, surface and volume integrals, Gauss, Stoke's and Green's theorems (without proofs). Simple problems on these.

Chapter 8, Section 8.5 to 8.6.3.

COURSE OUTCOMES:

1. Students will be able to apply reduction formulae to evaluate integrals and to find Fourier series of a given periodic function.
2. Student will be able to solve differential equations and to apply Laplace transform to solve differential and integral equations.
3. To find derivatives of vector functions and to evaluate Line ,surface and Volume integrals using Greens, Stokes & Gauss divergence theorem and vertifying the same.

Content and treatment as in

Allied Mathematics, Volume I and II , P. Duraipandian and S. Udayabaskaran, S. Chand Publications.

Reference:-

1. S. Narayanan and T.K. Manickavasagam Pillai – Ancillary Mathematics, S. Viswanathan Printers, 1986, Chennai.
2. Allied Mathematics by Dr. A. Singaravelu, Meenakshi Agency.

e-Resources:

1. **http://www.sosmath.com**
2. **http://www.analyzemath.com/Differential_Equations/applications.html**

B.C.A

SYLLABUS

NUMERICAL AND STATISTICAL METHODS

SUB CODE: SAZ3C **SEMESTER / YEAR: III / II**

COURSE OBJECTIVES

1.To understand and implement various concepts of numerical analysis and statistics to solve real life problem

2. To Understand the various approaches dealing the data using theory of probability.

3. To solve problems based on least squares and regression

Unit-1: Introduction- Mathematical Preliminaries- Errors: Computations, Formula - Errors in a Series Approximation- Roots of Equations- Linear Equations: Bisection , False Position Methods- Newton-Raphson Method- Secant Method- Muller's Method- Lin-Bairstow's Method- Simultaneous Linear Equations: Matrix Inversion Method- Gauss Elimination, Gauss-Jordan, LU Decomposition Methods- Gauss-Seidel Method.

Unit-2: Numerical Differentiation- Errors in Numerical Differentiation- Cubic Spline Method- Numerical Integration- Trapezoidal Rule- Simpson's 1/3 and 3/8 Rules- Romberg Integration- Ordinary Differential Equations- Taylor's Series Method- Euler's MethodRunge-Kutta 2nd and 4th Order Methods-Predictor-Corrector Methods.

Unit-3: Sampling- Frequency Distribution- Cumulative Frequency Function- Grouped Sample- Measures of Central Tendency: Mean, Median and Mode- Geometric MeanHarmonic Mean – Dispersion: Range, Mean Deviation, Variance and Standard DeviationMoments- Computation of Moments

Unit-4: Probability- Characteristics: Addition, Multiplication and Conditional Probability Laws- Discrete Distributions: Random Variable- Density and Distribution Functions.- Binomial Distribution- Poisson Distribution- Hypergeometric Distribution- Mathematical Expectation.

Unit-5: Correlation and Regression Analysis: Linear Least Squares Fit- Nonlinear Fit- Fitting a Polynomial Function- Coefficient of Correlation- Properties- Multiple Correlation – Partial Correlation- Rank Correlation- Tests of Significance- Chi square Test- Goodness of Fit, Algorithm and Analysis of Contingency Tables- t-Test and F-Test.

LEARNING OUTCOMES:

1.To solve system of linear equations numerically using direct and iterative methods.

2. Develop a framework for estimating and predicting the different sample of data for handling the uncertainties

3. Analyze the different samples of data at different level of significance using various hypothesis testing.

Recommended Texts:

1. S.S.Sastry, 2005,Introductory Methods of Numerical Analysis, 4th Edition, Prentice- Hall of India Pvt. Ltd..

2.E.Balagurusamy , 2000, Computer Oriented Statistical and Numerical Methods- Macmillan India Ltd. V. Rajaraman,2005,

3.Computer Oriented Numerical Methods K. S. Trivedi,2005,

4.Probability and Statistics with Reliability, Queuing and Computer Science Applications, Prentice-Hall of India Pvt. Ltd.E. Balagurusamy,1999,

5.Numerical Methods, Tata McGraw-Hill Publishing Co. Ltd. P. Niyogi,2003

6. Numerical Analysis and Algorithms, Tata McGraw-Hill Publishing Co. Ltd..

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