Under Graduate Program in Mathematics

Course of Study, Schemes of Examinations & Syllabi
(Choice Based Credit System)

PG & Research Department of Mathematics

H.H. The Rajahs' College
(Autonomous)

Re-Accredited with B^{+} by NAAC

Pudukkottai- 622 001.

2021 – 2022

Under – Graduate Programme in Mathematics

Eligibility

A pass in Higher Secondary Examination / Junior College with a first class in both Mathematics and Physics.

Structure of the Curriculum

Parts of the Curriculum	No. of Courses	Credits
Part – I : Language	4	12
Part – II : English	4	12
Part – III		
Major		
Core	14	62
Elective	3	15
Allied		
Allied (Physics)	3	12
Allied (Chemistry)	3	10
Part – IV		
	3	6
SBEC	2	4
NMEC	1	2
Env. Studies	1	1
SBC		

Part – V		
Extension Activities	1	1
Gender Studies	1	1
Total		

List of Core Courses

1. Calculus and Trigonometry

2. Theory of equations and Theory of number

3. Analytical Geometry 3D and Vector calculus

4. Sequence and series

5. Differential equations and Laplace Transforms

6. Algebra

7. Mathematical statistics –I

8. Real Analysis

9. Linear Algebra

10. Mechanics

11. Mathematical statistics – II

12. Numerical Analysis

13. Complex Analysis

14. Operations Research

List of Elective Courses:

1. Programing in C

2. Astronomy

3. Graph Theory

Learning Outcomes of Under-Graduate Programme in Mathematics

General Outcomes	Specific Outcomes
On successful completion of the programme, the student will be	After the successful completion of the under-graduate programme in Mathematics, the student is expected to
1. Improving learning environment and academic resources.	1. gain knowledge in foundational areas of mathematics
2. Involving students in discussions, problem-solving and out of box thinking about various ideas of mathematics and their applicability, which may lead to empowerment and enhancement of the social welfare at large.	2. communicate mathematics accurately, precisely and effectively
	3. develop mathematical thinking;
	4. apply mathematical knowledge;
3. Motivating the learners to understand various concepts of mathematics keeping in view the regional context.	5. be able to analyse any data using statistical tools
	6. be able to develop codes using MATLAB & C-language for simple problems
	7. be able to solve mathematical problems using technology.

B.Sc. Mathematics – Programme Description

(For the students admitted from the year 2021 onwards)

S.I. No.	Sem	Sub. Code	Course Title	Ins. Hrs /Week	Credit	Exam Hrs	Marks		Total
							Int	Ext	
1	I		Part –I	6	3	3	25	75	100
2			Part – II	6	3	3	25	75	100
3		21UMAT1	Major – I: Calculus and Trigonometry	5	5	3	25	75	100
4		21UMAT2	Major – II: Theory of equations and Theory of number	5	4	3	25	75	100
5			Allied paper – I*	3					
6			Allied Paper – II (Practical)*	3					
7			EVS - Environmental studies	2	2	3	25	75	100
8	II		Part – I	6	3	3	25	75	100
9			Part –II	6	3	3	25	75	100
10		21UMAT3	Major – III: Analytical Geometry 3D and Vector calculus	6	5	3	25	75	100
11			Allied Paper – I*	3	5	3	25	75	100
12			Allied Paper – II (Practical)*	3	5	3	25	75	100
13			SBE – I - Mathematics for Competitive Examinations – I	4	4	3	25	75	100
14			VE - Value of Education	2	2	3	25	75	100
15			Part – I	6	3	3	25	75	100
16			Part – II	6	3	3	25	75	100
17		21UMAT4	Major– IV: Sequence and series	5	4	3	25	75	100

No.	Part	Course Code	Title						
	III								
18		21UMAT5	Major – V: Differential equations and Laplace Transforms *	3					
19			Allied Paper – III*	3					
20			Allied Paper – IV*(Practical)	3					
21			Non- Major Elective – I History of Mathematics (Objective Type)	4	2	3	25	75	100
22			Part – I	6	3	3	25	75	100
23			Part – II	6	3	3	25	75	100
24	IV	21UMAT5	Major – V: Differential equations and Laplace Transforms *	3	4	3	25	75	100
25		21UMAT6	Major –VI: Algebra	5	4	3	25	75	100
26			Allied Paper – III*	3	5	3	25	75	100
27			Allied Paper – IV*(Practical)	3	5	3	25	75	100
28			SBE– II - Mathematics for Competitive Examinations – II	4	4	3	25	75	100
29		21UMAT7	Major – VII: Mathematical statistics –I	4	4	3	25	75	100
30		21UMAT8	Major – VIII: Real Analysis	5	4	3	25	75	100
31	V	21UMAT9	Major– IX: Linear Algebra	5	4	3	25	75	100
32		21UMAT10	Major – X: Mechanics	5	4	3	25	75	100
33			Elective –I: Programming in C	5	5	3	25	75	100

No	Sem	Code	Title						
34			Non- Major Elective – II	2	2	3	25	75	100
35			Skill Based Elective-III - Mathematics for Competitive Examinations – III	4	4	3	25	75	100
36		21UMAT11	Major – XI: Mathematical statistics – II	5	4	3	25	75	100
37		21UMAT12	Major – XII: Numerical Analysis	5	5	3	25	75	100
38	VI	21UMAT13	Major – XIII: Complex Analysis	5	5	3	25	75	100
39		21UMAT14	Major – XIV: Operations Research	5	4	3	25	75	100
40			Elective - II: Astronomy	5	5	3	25	75	100
41			Elective – III : Graph Theory	4	4	3	25	75	100
42			Gender Studies	1	1	3	25	75	100
			Extension Activities		1				
				180	140				3700
			* Exams will be held at the end of even semester						

B.Sc. Mathematics

SEMESTER- I

Core Course : CALCULUS AND TRIGONOMETRY

Objectives :

To get the knowledge about Differentiation, Integration and expansion of functions and to acquire the knowledge of problem solving ability.
• To inculcate the basic knowledge of differentiation, their applications.
• To introduce the notion of envelopes, curvatures and polar co-ordinates.

UNIT I
Successive Differentiation: Methods of Successive Differentiation – Leibnitz's Theorem and its applications.
Vol: 1 Chapter: III

UNIT II
Homogeneous functions - Partial derivatives of a function of two functions – Maxima and Minima of function of two variables.
Envelopes, Curvature of plane curves: Curvature-radius of curvature in Cartesian and polar forms-evolutes and envelopes.
Chapter: X - Sections 1.1 – 1.3 and 2.1 – 2.6

UNIT III
Reduction formulae: Reduction formulae (Upto $\int sin^m x cos^n x \, dx$) - simple problems –Bernoulli's formula.
Multiple Integrals: evaluation of double and triple integrals- simple problems- Change of order of integration in double integrals.
Beta and Gamma integrals-their properties, relation between them- evaluation of multiple integrals using Beta and Gamma functions.

Vol: 2 Chapter: I - Sections 13, 14, Chapter: V - Section 2.1, 2.2 and 4, Chapter VII [Section 2.1-2.3, 3, 4, 5]

UNIT IV:
Trigonometry: Expression of sinnθ, cosnθ, tannθ, $\sin^n θ$, $\cos^n θ$ and $\tan^n θ$ - Expansions of sinθ, cosθ and tanθ in powers of θ.
Chapter: III

UNITV:
Hyperbolic functions and Logarithm of complex Numbers.
Chapter: IV and Chapter: V – Sections 5.1, 5.2 and 5.3.

Text books :

1. S. Narayanan and T.K.M. Pillay, "**Calculus volume 1 and volume 2**",Viswanathan Publishers.

2. S. Narayanan and T.K.M. Pillay, "**Trigonometry**", Viswanathan Publishers.

Reference Books:

1. S. Arumugam and others, Calculus, Scitech Publication, India.
2. S. Arumugam and others, Trigonometry, Scitech Publication, India.
3. Shanthi Narayan (2001) Differential Calculus, Shyamlal Charitable Trust, New Delhi.
4. P.R. Vittal, **Calculus**, Margham Publications, Chennai.

Course Outcomes:

On the successful completion of the course, student will be able to:
- Find successive differentiation of the nth derivatives of Standard result, trigonometrical transformation of functions and Leibnitz formula for the nth derivative of a product.
- Find maxima and minima of function of two variables.
- Understand the concepts of Beta and Gamma functions, methods to find curvature, circle and radius of curvature.
- Expansion of $\sin n\theta$, $\cos n\theta$, $\tan n\theta$ and powers of sines and cosines in terms of functions of multiples of θ.
- Define and illustrate the concept of hyperbolic functions and logarithms of complex numbers.

B.Sc. Mathematics
Hard Core:THEORY OF EQUATIONS AND THEORY OF NUMBERS

Theory of Equations:

Unit I:
Remainder Theorem-Relation between the roots and coefficients of equations – symmetric function of the roots of the equation f(x)=0 – sum of the powers of the roots of an equation.
Volume: I Chapter: 6 Sec. 1 - 14

Unit II:
Transformations of equation – roots with sign change - roots multiplied by a given number – Reciprocal equation -standard form of reciprocal equations - to increase and decrease the roots of a given equation by a given quantity - removal of terms.
Volume: I Chapter: 6 Sec. 15 – 17, 19, 21

Unit III:
The general transformation -location and nature of the roots of an equation – Descarte's rule of signs – Rolle's theorem – Deductions from Rolle's theorem – Multiple roots – Strum's theorem (Proof not needed) – Newton's method of finding integral roots of an equations – Horner's method.
Volume: I Chapter: 6 Sec. 21-22,24 –26,28- 30

Theory of Numbers:

Unit IV:
Theory of Numbers – Divisibility in Z – division algorithm – Euclidean algorithm – Prime and composite numbers – Properties of prime numbers – Unique factorization theorem – division of a given number – Euler's φ – functions – value of $\varphi(n)$ – integral part of a real number – simple problems – product of r consecutive integer is divisible by r!.
Volume: II Chapter: 5 Sec. 1 – 11

Unit V:
Congruence – Properties of congruence – criteria of divisibility of a number – simple problems – numbers in Arithmetic progression – residue classes – linear congruence – simultaneous congruence – Chinese reminder theorem – Fermat's theorem – Wilson's theorem – Lagrange's theorem – simple problems.
Volume: II Chapter: 5 Sec. 12 - 18

Text books:
1. S. Narayanan & Others, Algebra vol. I and vol. II, Viswanathan Publishers.

Reference Books:

1. S. Arumugam and others, Theory of Equations and Theory of Numbers, Scitech Publication, India.
2. P.Kandasamy, K.Thilagavathy, Mathematics for B.Sc. Vol. – I,II,III AND IV, S.Chand&Com. Ltd,New Delhi -55.

Course Outcomes:

On completion of this course, the learner will

1. know continuous discrete random variables, their probability functions and distribution functions.
2. know the definition and properties of standard discrete distributions and their applications in analyzing data.
3. know methods of finding correlation and regression co-efficients between two data sets and their applications.

B.Sc. Mathematics

EVS - ENVIRONMENTAL STUDIES

Objective:

1. To implement environmental studies in order to bring about awareness among the students

UNIT –I

Nature of environment and environmental studies: Definition – scope and importance: need for public awareness – Renewable and non- nonrenewable resources and their management – A preliminary knowledge on the following resources: forest, water, mineral, food and energy.

UNIT II

Concept of an ecosystem, structure of an ecosystem, producers, consumers and decomposers – Energy flow in the ecosystem, food chains, food webs and ecological pyramids.

UNIT III

Biodiversity and its conservation – introduction – definition genetic – species and ecosystem diversity – Biogeographical classification of India, value of biodiversity : consumptive use, productive use social, ethical, aesthetic and option values – Threats to biodiversity : habitat loss, poaching of wildlife, man-wildlife conflicts – Endangered and endemic species of India, conservation of biodiversity.

UNIT IV

Environmental pollution – Definition, causes, effects control measures of Air pollution, water pollution and Soil pollution, Marine pollution, Noise pollution. Thermal and nuclear pollution: - Solid waste management: causes, effects and control measures of urban and industrial wastes.

UNIT V

Social issues and problems from unsustainable to sustainable development, urban problems related to energy conservation – Population growth, variation among nations – population explosion - Family welfare programme – Environment and human health, Human rights, value education, HIV/ AIDS, women and child welfare.

B.Sc. Mathematics

SEMESTER- II

Core Course: ANALYTICAL GEOMETRY 3D AND VECTOR CALCULUS

Objectives
- Emphasis to enhance student knowledge in three dimensional analytical geometry and the geometrical aspects of three dimensional figs, viz, sphere and cone.
- To enhance basic skills in the areas of vector calculus.

Objectives:
  • To study three dimensional Cartesian Co-ordinates system.
  • To introduce the basic concepts of Vector Calculus

Analytical Geometry 3D

UNIT I
Direction cosine of a line: Direction cosine of a line– **Plane**: Standard equation of a plane – intercept form-normal form-plane passing through given points – angle between planes –plane through the line of intersection of two planes. **Equation of the straight line**: The plane and the straight line – coplanar lines – problems.
Chapter: I and II, (Chapter III (Sections 1 to 7)).

UNIT II
Equation of the straight line: The plane and the straight line - Shortest distance between two skew lines- Equation of the line of shortest distance.
Chapter: III
Sphere: Standard equation –Length of a tangent from any point-Sphere passing through a given circle – intersection of two spheres – Tangent plane.
Chapter: IV

UNIT III
Sphere: Standard equation –Length of a tangent from any point-Sphere passing through a given circle – intersection of two spheres – Tangent plane.
Chapter: IV
Cone: Cone – Equation of a cone – cone whose vertex is at the origin – Quadric cone whose vertex is at the origin – General quadric cone – Problems. Chapter 6 (Sections 6.1 to 6.5)

Vector Calculus:

UNIT IV
Differentiation: Scalar and vector fields – Differentiation of vectors – Gradient, Divergence and Curl.

Unit V:
Integration: Integration of vectors – line integral – surface integral – Green's theorem in the plane – Gauss divergence theorem – Strokes theorem – (Statements only) - verification of the above said theorems.

TEXT BOOK(S)
1. Manicavachagam Pillay. T.K., and T. Natarajan, A Text Book of Analytical Geometry Part – II Three Dimensions, Re Print 2000, S.Viswantan Pvt. Ltd.(for unit I and II)
1. T.K.ManickavasagamPillai& others, Analytical Geometry, S.V Publications - 1985
2. Duraipandian, P. and Lakshmi Durai Pandian, D Muhilan, Analytical Geometry 3 Dimensional, Emerald Publishers, Chennai, Re Print 2004. (for unit V)
2. P.DuraiPandian and Lakshmi Duraipandian, Analytical Geometry 3D, Emerald Publishers, Chennai 1975.
3. T.K.ManickavasagamPillai& others, Vector Analysis, S.V. Publications.

Reference Books:

1. S. Arumugam and others, "**Analytical Geometry 3D and Vector Calculus**", Scitech Publication, India.
2. P.DuraiPandian and Lakshmi Duraipandian, Analytical Geometry 3D, Emerald Publishers, Chennai 1975.

3. P.R. Vittal, "**Analytical Geometry 3D and Vector Calculus**", Margham Publications, Chennai.2003

Course Outcomes:

On the successful completion of the course, student will be able to:
- Gain knowledge about the regular geometrical figures and their properties.
- Analyze condition of tangency and find the tangent plane to the sphere.
- Examine the condition for the general equation of the cone.
- Understand the concept of vector differentiation.
- Acquire the basic knowledge of vector integration.

Skill Based Elective - I

MATHEMATICS FOR COMPETITIVE EXAMINATIONS – I

Objectives :

• To learn the problem solving techniques for aptitude problems.

• To enable the students prepare themselves for various competitive examinations.

Unit I
Numbers – HCF – LCM
(Chapters 1 & 2)

Unit II
Decimal Fractions and Simplification
(Chapter 3 & 4)

Unit III
Square and Cubic roots and Average
(Chapter 5 & 6)

Unit IV
Problem on numbers and Problems on ages
(Chapters 7 & 8)

Unit V
Surds and Indices and Percentage
(Chapters 9 & 10)

Text Book:

1. Scope and treatment as in "Quantitative Aptitude" by R. S. Aggarwal, S.Chand& Company Ltd., Ram Nagar, New Delhi (2004)

B.Sc. Mathematics

VE - VALUE EDUCATION

Objective:
1. To educate the students on various concepts of Values and also to develop Ethics in them and build their personality.

UNIT I
Meaning and nature of value education: Meaning and concepts of value education- origin – nature – classification of values- view of eminent thinkers- meaning of value education- need for value education.

UNIT II
Objectives and development of human value: Role of school and colleges in the development of human values – objectives of value oriented education, Ethical and social values Gandhiji'snon violence – Gokak committee.

UNIT III
Strategies and approaches to value education: Role of education in school, family,. Teacher for the personal value development –conceptional frame work-strategy suggested by J.R.Frankel-NCERT approach to value Education- Role play technique in value education- value based curriculum – teacher's role.

UNIT IV
Sources of values: Sources of values – Traditional Indian values, sources of values- culture, Education, Religion- Hinduism, Christianism, Islam, Buddhism- Indian constitutions as source for democratic values- equality- secularism, democracy- Research and resources in value education.

UNIT V
Methods of teaching and documents on Human value education: methods of teaching value education – Guidelines for developing value among students. Problems in promoting value Education – Documents of value education – Recommendation of the committee appointed by the central advisory Board of Education- Recommendation of the university education commission 1964 – 1966. National policy on Education 1986 -1992.

REFERENCES

1. J.C.Aggarwal, Education for values Environment and Human Rights, Shipra publications, New Delhi 2005.
2. Dube S.C. Modernization and development, the search for an alternative paradigm, zee books ltd. London : 1988.
3. Mansell R and When U, knowledge societies: Information Technology for sustainable , Development, Oxford University press, New York.

4. World bank knowledge for Development world development report, Oxford Unit press, New York.

B.Sc. Mathematics
Hard Core: SEQUENCES AND SERIES

Unit I:
Inequalities: Inequalities – Triangle Inequalities – The Arithmetic, Geometric, and Harmonic Means – Cauchy-Schwarz Inequality – Some More Inequalities.
Chapter: II Section: 1 – 6

Unit II:
Sequences: sequences, bounded sequences, monotonic sequences, convergent sequences, divergent and oscillating sequences.
Chapter: III Section: 1 – 5

Unit III:
Algebra of limits -Behaviour of monotonic sequences – some theorems on limits.
Chapter: III Section: 6 – 8

Unit VI:
Subsequences - limit points - Cauchy sequences – The upper and lower limits of a sequence.
Chapter: III Section: 9 – 12

Unit V:
Series of positive terms: infinite series - comparison test - Kummer's test - Root test and condensation test.
Chapter: IV Section: 1 – 4

Unit V:
Alternative series - absolute converges - test for convergence of series of arbitrary terms.
Chapter: V Section: 1 - 4

Text book:
1. S. Arumugam and others, Sequences and series,New Gamma publishing house.

References :
1.   Richard R. Goldberg, Methods of Real analysis, Oxford and IBH Publishing co., New Delhi.
2.   T. K. Manicavachagompillay and others, Algebra Volume - **1**

Course Outcomes:

Students will have:

(i) an ability to work within an axiomatic framework;
(ii) a detailed understanding of how Cauchy's criterion for the convergence of real and complex sequences and series follows from the completeness axiom for RR, and the ability to explain the steps in standard mathematical notation;
(iii) knowledge of some simple techniques for testing the convergence of sequences and series, and confidence in applying them;
(iv) familiarity with a variety of well-known sequences and series, with a developing intuition about the behaviour of new ones;
(v) an understanding of how the elementary functions can be defined by power series, with an ability to deduce some of their easier properties.

B.Sc. Mathematics

Core Course: DIFFERENTIAL EQUATIONS AND LAPLACE TRANSFORMS

Objectives :
    1. To study DEs and PDEs of first and second order.
    2. To study Fourier series and application of Laplace transforms in solving
    DEs.

Unit I:

Differential Equations of the first order: Equation of first order and of first degree – Exact differential equations - conditions for the equations to be exact – working rule for solving it – problem – Equations of first order and higher degree – equations solvable for $x, y, \frac{dy}{dx}$ - Clairaut's equations.- Integrating factor – Linear Equations – Bernouli's Equations – Equations of First and Higher Degree.
Chapter 1 : Section: 1.1 – 1.7

Unit II:

Linear Differential Equations with constant coefficients: second and higher order linear differential equations with constant coefficients - Homogenous linear equations with variable coefficients – Equations reducible to the homogenous linear form – Variation of parameters.
Chapter: II Section: 1 – 4 and 8 – 10.

Linear Equations of Higher Order
Linear equation with constant coefficients – Methods of finding complementary functions- Methods of finding particular integrals – Homogeneous linear equations
Chapter 2 : Sections 2.1 – 2.4

Unit III:
Simultaneous equations: Simultaneous equations - necessary and sufficient condition of integrability of Pdx+Qdy+Rdz=0. Rule for solving it – Simultaneous linear differential equations with constant coefficients – Total differential equations.
Chapter: III Section: 1- 7

Linear Equations of Higher Order
Linear equations with variable coefficients – simultaneous linear differential equations – Total differential equations
Chapter 2: Sections 2.5 – 2.7

Unit IV:

Partial Differential Equations: Partial differential equations formation of partial differential equation by the elimination of constant formation of partial differential equations by the elimination of arbitrary   functions – general, particular and complete integrals of PDE standard forms – Langrage's method.
Chapter: IV Section: 1- 6

Partial Differential Equations:: Fotmation of Partial Differential Equations – First order partiela differential equations – Methods of solving first order partial differential equations – Some standard forms – Charpit's method
Chapter 4: Sections 4.1 – 4.5

Unit V:

Laplace Transforms: Laplace transforms theorems – Evaluation of integrals – inverse Laplace transform – solving ordinary differential equations with constant coefficients and variable coefficients.
Chapter: V Section: 1- 8

Laplace Transform: Laplace transform – Inverse Laplace transform – Solutions of differential equation using laplace transforms
Chapter 3: Sections 3.1 – 3.3

Text Book:
1. S. Narayanan and T.K.M. Pillay, Calculus vol. 3, Viswanathan Publishers.

2. Arumugam.S, Isaac, **"Differential Equations and Applications",**New Gamma Publishing House, 1993

Reference Books:

1. S. Arumugam and others, Differential Equations and Applications, New Gamma Publishing House – 20.
2. J.N. Sharma R.K. Gupta, Differential Equations, Krishna PrakashanMandirMeerd.
3.. Narayanan and T.K.M. Pillay, Calculus vol. 3, Viswanathan Publishers.

Course Outcomes:
   The student will be able to

   1. Solve first-order ordinary differential equations
   2. Solves higher differential equations
   3. Solve the Higher order differential equations
   4. solve differential and integral equations using Laplace transforms.

B.Sc, Mathematics

Non Major Elective – I - History of Mathematics

Objective:
1. To know about the History of Mathematics
2. To study about some Great Mathematicians and his life.

Unit 1

Primitive Counting - A Sense of Number - Notches as Tally Marks - The Peruvian Quipus: Knots as Numbers - Number Recording of the Egyptians and Greeks - The History of Herodotus - Hieroglyphic Representation of Numbers - Egyptian Hieratic Numeration .

Unit 2

The Greek Alphabetic Numeral System - Number Recording of the Babylonians - Babylonian Cuneiform Script - The Babylonian Positional Number System .

Unit 3

Mathematics in Early Civilizations - The Rhind Papyrus - Egyptian Mathematical Papyri- A Key to Deciphering: The Rosetta Stone. Egyptian Arithmetic Early Egyptian Multiplication

Unit 4

Egyptian Arithmetic Early Egyptian Multiplication
The Unit Fraction Table - Representing Rational Numbers - Four Problems from the Rhind Papyrus - The Method of False Position .

Unit 5

Egyptian Mathematics as Applied Arithmetic - Egyptian Geometry - Approximating the Area of a Circle - The Volume of a Truncated Pyramid - Speculations About the Great Pyramid - Babylonian Mathematics.

Text books:
1. **The History of Mathematics An Introduction** –David M. Burton- Seventh Edition – The Mc Graw Hill Companies.

B.Sc. Mathematics
Core Course: ABSTRACT ALGEBRA

Objectives:
- To introduce Algebra from the basic concepts of set theory, Functions, etc.
- To introduce and delve deeply into the concepts of Group theory.

Unit I:
Definition and examples – Equivalent definitions of a group - elementary properties of group - Permutations groups..
Chapter: III Section: 3.1 – 3.4

Unit II:
Subgroups – cyclic groups – order of an element- Cosets and Langrange's theorem – Normal subgroups and quotient group.
Chapter: III Section: 3.5– 3.9

Unit III:
Isomorphism - Homomorphisms
Chapter: III Section: 3.10 – 3.11

Unit IV:
Rings: Definition and examples – elementary properties of ring – Types of rings – characteristic of a ring-**Subrings.**
Chapter: IV Section: 4.1 – 4.6

Unit V:
Ideals – quotient rings – Maximal and prime ideals – homomorphism of rings – Field of quotients of an integral domain-**Ordered Integral domain-Unique Factorization Theorem(U.F.D).**
Chapter: IV Section: 4.7 – 4.13

Text book:
1. S.Arumugam and others, Modern Algebra, Scitech Publication, India. 2013.

Reference Books:
1. M.L. KHANNA, **Modern Algebra**, JaiPrakashNarth& co.
2. S.G. Venkatachalapathy, "**Modern Algebra**", Margham Publications – 2003.
3. Dr.AloknathChakabarti, "**A first course in Linear Algebra**", Vijay Nicole imprints p. Ltd.

Course Outcomes

On completion of the course, the student will be able to identify different algebraic structures, isomorphic and non-isomorphic structure.

MATHEMATICS FOR COMPETITIVE EXAMINATIONS – II

Objectives :

 • To learn the problem solving techniques for aptitude problems.

 • To enable the students prepare themselves for various competitive examinations.

Unit I:
Profit and loss and Ratio and proposition
(Chapter 11 & 12)

Unit II:
Partnership and Chain rule
(Chapters 13 & 14)

Unit III:
Time and Work, Time and Distances
(Chapters 15 & 17)

Unit IV:
Problems on trains and Problems on Boats and streams
(Chapters 18 & 19)

Unit V:
Simple Interest and compound interest
(Chapters 21 & 22)

Text Book:
Scope and treatment as in "**Quantitative Aptitude**" by R. S. Aggarwal, S.Chand& Company Ltd., Ram Nagar, New Delhi (2004)

B.Sc. Mathematics
Core Course: MATHEMATICAL STATISTICS – II

Objectives:
   • To make the students gain wide knowledge in probability which plays a main role

    in solving real life problems.
   • To apply these techniques to real life problems.

Unit I:
Probability: Probability - conditional probability - Baye's theorem.
Chapter 11

Unit II:
Random variables: Discrete random variables - continuous random variables - Mathematical Expectations - moment generating functions.
Chapter 12

Unit III:
Probability distributions: Binomial–Paisson and normal distributions.
Chapter 13

Unit IV:
Test of significance (Large sample): Sample, Sampling distributions, testing hypothesis, Test of significance for proposition or percentage, Test of significance for mean, Test of significance standard deviations, Test of significance for correlations.
Chapter 14

Unit IV:
Test of significance (small sample): t-test, F-test.
Chapter 15
Unit V:
Analysis of Variance,One criterion of classification,Two criteria of classification
Chapter 17 ,17.0 -17.2
Text book:
S.Arumugam and others, "**Statistics**", New Gamma publishing house - 2009.
Reference:
S.C. Gupta and V.K. Kapoor, **Fundamental of Mathematical Statistics**, S.Chand.
Course outcome:
At the end of this course the students must able to
1. Know the clear cut idea about Probability, Conditional Probability and Baye's theorem.
2. Gather the knowledge about Random variables, Mathematical Expectations and Moment generating functions.
3. Know the uses and properties of probability Distributions
4. Must know how to use the t-test and F-test
5. Gather the Knowledge and applications of ANOVA table

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B.Sc. Mathematics
Core Course: REAL ANALYSIS

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Objectives:

    1. To study the real number system and its properties.

    2. To study the properties of functions defined on the Real line.

Unit I:

Sets and functions: countable sets - uncountable sets - inequalities of Holder's and Minkowsi.

Chapter: I Section: 1.1- 1.4

Unit I:

Metric spaces: Definition and examples – Bounded sets in a metric space – open ball in a metric space – open sets – subspaces – interior of a set- closed set – closure – limit point – Dense set.

Chapter: II

Unit II:

Complete Metric space: Completeness – Baire's category theorem.

Chapter: III

Unit III:

Continuity: Continuity -homeomorphism - uniform continuity. Connected: Definition and examples – connected subset of R – connectedness and continuity

Chapter: IV section: 4.1-4.3; Chapter: V section: 5.1-5.3

Unit IV :

Connectedness:

Introduction : Definition and examples – Connected subsets of R – Connectedness and continuity

Chaper V: Sections 5.0 – 5.2

Unit V:

Compactness: Compact space – compact subset of R – equivalent characterization for compactness – compactness and continuity.

Chapter: VI

Text book:

    S. Arumugam and others, "**Modern Analysis"**, New Gamma publications, 2012.

Reference Books:

    Richard R. Goldberg, **Methods of Real analysis**, Oxford and IBH Publishing co., New Delhi.

    Tom M.Apostal, **Mathematical Analysis**, 2nd Edition, Addison-Weseley Publishing Company, New York.

Course Outcomes

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

1.	analyse continuity, derivability, integrability of given real valued function and find derivatives, integrals of given real valued function through limits.
2.	analyse the structure of the real line.

B.Sc. Mathematics
Core Course: LINEAR ALGEBRA

Objectives:
- To facilitate a better understanding of Functional Analysis
- To develop analytical thinking

Unit I:
Vector spaces: Definition and examples – subspaces – Linear transformations – span of sets.
Chapter: V Section 5.1 – 5.4

Unit II:
Linear Independence – basis and dimension – rank and nullity – Matrix of a Linear transformation - simple problems.
Chapter: V Section 5.5 – 5.8

Unit III:
Inner Product spaces: Definition and examples – orthogonality – orthogonal complement.
Chapter: VI Section 6.1 – 6.3

Unit IV:
Theory of Matrices: - Algebra of matrices – Type of matrices – The inverse of a matrix – elementary transformations – Rank of a Matrix.
Chapter: VII Section 7.1 – 7.5

Unit V:
Simultaneous Linear equations – Characteristic Equation and Cayley Hamilton theorem – Eigen values and Eigen vector,bilinear forms
Chapter: VII Section 7.6 – 7.8,8.1,8.2

Text book:
    S.Arumugam and others, "**Modern Algebra**" , Scitech Publication, India. 2013

Reference Books:
1.   S.G. Venkatachalapathy, "**Modern Algebra**", Margham Publications – 2003.
2.   Dr.AloknathChakabarti, "**A first course in Linear Algebra**", Vijay Nicole imprints p. Ltd.
3.   M.L. KHANNA, **Modern Algebra**, JaiPrakashNarth& co.

Course Outcomes

1. analyze the solution set of a system of linear equations.

2. express some algebraic concepts (such as binary operation, group, field).

3. do elemantary matrix operations.

4. express a system of linear equations in a matrix form.

5. do the elementary row operations for the matrices and systems of linear equations.

B.Sc. Mathematics
Core Course : MECHANICS

Objectives :
• To provide a basic knowledge of the behavior of various types of forces.
• To give enough working knowledge to handle practical problems.

Statics

Unit I:
Force acting at a point: Forces acting at a point – resultant and components – Parallelogram law of forces – Triangle law of forces – converse – Lami's theorem
Chapter 2

Unit II
Paraller Forces and Moments: To find the Resultant of two like parallel forces acting on a rigid body – to find the resultant of two unlike parallel forces acting on a rigid body Moment of a force – Varigon's Theorem of moments – Principle of Moments
Chapter – 3

Unit II:
Couples: Couples -equilibrium of three forces acting on a rigid body.
Chapter 4 and 5

Unit III:
Friction: Friction – Law of friction – Cone of friction – angle of friction – some simple problems.
Chapter 7

Dynamics
Objectives :
      • To provide a basic knowledge of the behavior of objects in motion.
      • To develop a working knowledge to handle practical problems

Unit IV:
Projectiles: Projectiles – Path of projectile is a parabola – range – range of a particle projected on an inclined plane.
Chapter 6

Unit V:
Impulsive forces: Impact - Impulse – Impact in a fixed plane – direct and oblique impact.
Chapter 7

Text books:
1. M.K. Venkatraman, "**Statics",** Agasthiar Publications.
2. M.K. Venkatraman, "**Dynamics"**, Agasthiar Publications.

Reference Books:

1. S.G.Venkatachalapathy, **Mechanics,**MarghamPublications,Chennai 2012.
2. P.duraipandian, **Mechanics,** Emerald Publishers, Chennai.

Course Outcome

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

1. know various methods of finding the resultant of a finite number of forces and methods of resolving forces.
2. be able to understand the effect of different types of forces acting at a point in equilibrium.
3. know the various properties of motion of a projectile, a simple harmonic motion and orbital motion.
4. resolve a given force and find equation of catenary
5. analyse the motion of a projectile.
   6. analyse simple harmonic and orbital motions.

B.Sc. Mathematics
Elective Course I :PROGRAMMING IN C

Objectives :
- To introduce the techniques of C programming.
- To solve numerical problems using C.

UNIT I:

Introduction – Importance of C- Basic structure of C program - Character set - Constants – Keywords and identifiers – Variables Data types – Declaration of variables –Defining symbolic constants.

UNIT II:

Arithmetic operators - Relational operators - logical operators – assignment operators –increment and decrement operates –Conditional operators – Arithmetic expressions –Evaluation of expressions –Precedence of arithmetic operators.

UNIT III:

Decision making with IF statement – Simple IF statement – The if ELSE statement - Nesting of IF…..ELSE statement – The ELSE IF ladder. The Switch statement –The GOTO statement.

UNIT IV:

The WHILE statement - the DO statement the FOR statement –Jumps in loops.

UNIT V:

One, Two dimensional arrays – Initiating two dimensional arrays – Multidimensional arrays –Declaring and initializing string variables –reading strings from terminal – Writing strings on the screen – Arithmetic operations on characters.

TEXT BOOK:

1. E.Balagurusamy"Programming in ANSI C" Second Edition – Tata McGraw – Hill PublishingCompany limited, New Delhi.

REFERENCE BOOKS:

1.Byron Gottfried "Programming with C"(Schaum's outline series)-Tata McGrawHill publishingcompany -1998.

2. Ashok N.Kamthane "Programming with Ansi and Turbo C", Pearson Education publishers,2002

3.HentryMullish and Herbert L cooper , "The spirit of C" Jaico publisher , 1996.

4.THE ANSI C, Second edition , October 1992.

5. BRIAN W.KERNIGHAN,DENNIS M.RITCHIEPublished by Prentice- Hall of India Privated Limited, M-97,New Delhi- 110001.

5.ANSI C: With Microsoft C 5.1 and Quick C 2.0 C.Balasubramanian.1992, Tata McGraw-HillPublishing Company limited, New Delhi.

6. "PROGRAMMING IN C ", Kris A.Jamsa 1992, Galgotia Publications Pvt.ltd.

Course Outcomes

After the completion of this course, the students will be able to develop applications.

MATHEMATICS FOR COMPETITIVE EXAMINATIONS – III

Objectives :

 • To learn the problem solving techniques for aptitude problems.

 • To enable the students prepare themselves for various competitive examinations.

Unit I:
Logarithms and areas
(Chapters 23& 24)

Unit II:
Volume and Surface areas; Races and games of skill
(Chapter 25 & 26)

Unit III:
Calendar and clocks
(Chapter 27 & 28)

Unit IV:
Stock and Shares; True Discount
(Chapter 29 & 30)

Unit V:
Banker's discount and odd man out and series
(Chapter 31 & 32)

Text book

1. Scope and treatment as in "**Quantitative Aptitude**" byR.S.Aggarwal, S.Chand& Company Ltd., Ram Nagar, New Delhi (2004)

B.Sc. Mathematics

Core Course: NUMERICAL ANALYSIS
[In all the units the value of a root may be calculated up to 3 decimal accuracy only]

Objectives:
1. To introduce the exciting world of programming to the students through numerical methods.

UNIT I
Algebraic & Transcendental equations: **:** Errors in Numerical Calculations: Errors and their computations - A general error formula - Error in a series.-Finding a root of the given equation (Derivation of the formula not needed) using Bisection Method, Method of False Position, Newton Raphson Method, Iteration method – Types of errors.
Chapter 2 section 2.1 to 2.5

UNIT II
Interpolation: Finite differences –Forward , Backward & Central differences –Their symbolic relations –Newton's forward & backward difference interpolation formulae – Interpolation with unevenly spaced intervals –Application of Lagrange's interpolating Polynomial (Proof not needed) – Divided differences and their properties – Application of Newton's General Interpolating formula. (Proof not needed).
Chapter 3 Sections 3.1, 3.3, 3.6, 3.9, 3.9.1, 3.11, 3.11.1

Unit III: 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: General Quadrature Formula - Trapezoidal Rule - Simpson's 1/3 Rule - Simpson's 3/8 Rule.

UNIT III
Numerical differentiation and Integration: Numerical differentiation - Numerical Integration using Trapezoidal rule & Simpson's 1/3&3/8 rules - Theory & problems.
Chapter 5 Sections 5.1- 5.2, 5.4.1 – 5.4.3

UNIT IV
Solutions to Linear Systems: Gaussian Elimination Method – Jacobi & Gauss Siedal iterative methods – Theory & problems**.**
Chapter 6 Sections 6.3.2 & 6.4

UNIT V

Numerical solution of ODE: Solution by Taylor Series Method , Picard's method, Euler's Method , Modified Euler's Method , RungeKutta 2nd and 4th order methods (Derivation of the formula not needed). - Milne's Predictor -Corrector Method.

Chapter 7 Sections 7.1 – 7.5

TEXT BOOK(S)

1. S.S.Sastry, **Introductory Methods of Numerical Analysis**, Prentice Hall of India Pvt.Limited, 2000.

REFERENCE(S)

[1] S. Narayanan & Others, **Numerical Analysis**, S. Viswanathan Publishers, 1994.
[2] S.Arumugam ,**Numerical Methods**, New Gamma Publishing, Palamkottai, 2003.
[3] A.Singaravelu, **Numerical Methods**, Meenakshi Agency, Chennai, 2004.

Course Outcomes

1. To Know how to find our solution of algebraic equations using different methods under different conditions, and numerical solution of system of algebraic equations.
2. To learn how to interpolate the given set of values.
3. How to works numerical differentiation whenever and wherever routine methods are not applicable.
4. To understand the curve fitting for various polynomials
5. To know how to solve the numerical solution of differential equations.

B.Sc. Mathematics
Core Course:COMPLEX ANALYSIS

Objectives:

      • To study the behavior of complex-valued functions.

      • To train the students in the operative techniques on complex–valued functions.

UNIT I

Functions of a Complex variable: Limits-Theorems on Limits –Continuous functions – Differentiability – Cauchy-Riemann equations – Analytic functions – Harmonic functions.
Chapter 2 section 2.1 to 2.8

UNIT II

Elementary transformations: Bilinear transformations – Cross ratio.
Chapter 3 Sections 3.1 to 3.3

UNIT III

Complex integration: definite integral – Cauchy's Theorem –Cauchy's integral formula –Higher derivatives.
Chapter 6 sections 6.1 to 6.4

UNIT IV

Series expansions: Taylor's series –Laurant's Series – Zeroes of analytic functions.
Chapter 7 Sections 7.1 to 7.3

UNIT V

Residues: Cauchy's Residue Theorem –Evaluation of definite integrals.
Chapter 8 Sections 8.1 to 8.3

Text Book:

[1] S.Arumugam,A.Thangapandi Isaac& A.Somasundaram, **Complex Analysis**, New Scitech Publications (India) Pvt Ltd, 2002.

Reference Books:

[1] P.P Gupta – Kedarnath&Ramnath, **Complex Variables**, Meerut -Delhi

[2] J.N. Sharma, Functions of a **Complex variable**, Krishna PrakasanMedia (P) Ltd, 13th Edition, 1996-97.

   [3] T.K.ManickavachaagamPillai, **Complex Analysis**, S.Viswanathan Publishers Pvt. Ltd,1994.

Course Outcomes

On completion of this course, the learner will

1. know the definition of analytic functions and understand their properties.
2. know bilinear transformations and understand its properties.
3. be able to understand integration of complex valued functions and their higher derivatives.
4. be able to understand zeros and singularities of an analytic function and to apply their properties in the evaluation of definite integrals.

B.Sc. Mathematics
Core Course : OPERATIONS RESEARCH

Objectives:
- To introduce the various techniques of Operations Research.
- To make students solve real life problems in Business and Management.

UNIT I
Introduction to Operations Research: Elementary treatment of Linear Programming – Operation Research – An overview - Simplex Method – Artificial variable – Big-M method – Two Phase Method.
[1]Chapter 1 (Preliminaries only), Chapter 3: Sections 3.1 – 3.5

UNIT II
Linear Programming Problem : – Big-M method – Two Phase Method.- Duality in LPP -Dual Simplex Method
[1]Chapter 3: Section 3.6,3.7,3.9 and 3.10

UNIT III
Transportation problems: Application to Transportation problem –Transportation algorithm –Degeneracy algorithm –Degeneracy in Transportation Problem, Unbalanced transportation problem- Mathematical Formulation of Transportation Problem – Degeneracy of Transportaion Problem
[1]Chapter 4: Section 4.1 – 4.2

UNIT IV
Assignment problems: Assignment algorithm – Unbalanced Assignment problem.- Mathematical Formulation of Assisgnment Problem – Solution to Assighment Problems
Chapter 10 Section: 10.1 to 10.3
[1]Chapter 5: Sections 5.1 – 5.2

UNIT V
PERT CPM network: PERT CPM network – Critical & sub Critical jobs – Determining the Critical Path – Network Calculation of PERT networks – Probability of PERT.
[2]Chapter 20 Section: 20.1 to 20.8

TEXT BOOK(S)
[1] Arumugam.S, Isaac, "Topics in Operations Research- Linear Programming", New Gamma Publishing House, ,Marchi 2015
[2] KantiSwarop, Gupta.P.K&Manmohan, **Operations Research**, Sultan Chand & Co.

REFERENCE(S)
[1] Hamdy A. Taha, **Operations Research** (7th Edn.), Prentice Hall of India,2002.
[2] Richard Bronson, **Theory and Problems of Operations Research**, Tata McGraw Hill Publishing Company Ltd, New Delhi, 1982.

Course Outcomes

1. Identify and develop operational research models from the verbal description of the real system.
2. Understand the mathematical tools that are needed to solve optimisation problems.
3. To solve the Linear programming:
4. Understand the OR models and Solve them towards optimality by applying appropriate simplex methods.
5. Apply the Transportation algorithm to reduce transportation cost.
6. Apply the Assignment algorithm to allocate the job in such a way that to reduce the total cost for that job.
7. Apply the concepts of PERT and CPM for decision making and optimally managing projects.
8. Analyze and covert the real life problems in Business and Management to the operations research model and solve them towards optimality by applying suitable OR methods.
9. To draw a Network flows and find the PERT

B.Sc. Mathematics

Soft Core:ASTRONOMY

UNIT I
Relevant properties of a sphere & relevant formulae for spherical trigonometry(All without Proof) –Celestial sphere – Diurnal motion.
Chapters 1 & 2

UNIT II
Earth – Dip of the horizon - Twilight
Chapter 3 Section 1 , 2, 5 , 6

UNIT III
Twilight – Astronomical refraction –Tangent &Cosine's formula – Properties & simple problems applying them.
Chapter 4 Sections 117 to 120, 129, 130

UNIT IV
Kepler's Laws of Planetary motion (statement only) –Newton's deductions from them –Three anomalies of the Earth and relation between them – Time- Equation of time –Seasons
Chapter 6

UNIT V
Time- Equation of time –Seasons-Calender- Conversion of Time
Chapter 6 and 7

UNIT V
Moon (except Moon's liberations)-Motions of planet (assuming that orbits arecircular - Eclipses.
Chapter 12

Text Book:
1. S. Kumaravelu and SusheelaKumaravelu, Astronomy, SKV Publications,2004.

Reference Books:
[1] V. Thiruvenkatacharya, A Text Book of Astronomy, S. Chand and Co., Pvt Ltd.,1972.

Course Outcomes

1. Be inspired to continue and share their interest in astronomical advances and discoveries throughout their lives.

2. Have a solid grounding in many areas of modern astronomy and their basic underlying physical principles.

3. Know about and understand the observed properties of physical systems that comprise the known universe, on various scales.

4. Demonstrate the ability to design, make, analyze, and interpret quantitative observations of celestial objects.

B.Sc. Mathematics
Elective III: GRAPH THEORY

Objectives :
1. To introduce the notion of graph theory and its applications.
2. To introduce some of the most important notions of Graph Theory and develop their skills and solving basic exercises.

Unit I:
Definition of graph – Application of graph – Finite and infinite graphs – incidence and degree– isolated vertex – pendant vertex and null graph – sub graphs – walks – paths – circuits – connected graphs –disconnected graph and components.
Chapter 1: 1.1 – 1.5

Unit II:
Euler graph – Operation on graphs - more on Euler graphs – Hamiltonian paths and circuits.
Chapter 2: 2.2, 2.4 – 2.9

Unit III:
Trees – Properties of trees – spanning trees – fundamental circuits – spanning trees in a weighted graph.
Chapter 3: 3.1 – 3.4, 3.7. 3.8, 3.10

Unit IV:
Cut sets – properties – fundamental circuits and cut sets – connecting and separability.
Chapter 4: 4.1 – 4.5

Unit V:
Planar graphs– Kuratowoski's two graphs – different representation of a planar graph – detection of planarity – geometric dual.
Chapter 5: 5.2 – 5.6, 5.8

Unit :V
Coloring,Covering and Partitioning
Chromatic Number – Chromatic Partitionning – Chromatic Polynomial – Matching –
Covering – The four Colour Problem.
Chapter 8: 8.1 – 8.6

Text book:
    NarsinghDeo, **Graph theory with Application to Engineering and computer Science,** Prertice, Hall of India P.Ltd., New Delhi 2001.

Course Outcomes
1. To understand and apply the fundamental concepts in graph theory
2. To apply graph theory based tools in solving practical problems
3. To improve the proof writing skills.
4. The students will be able to apply principles and concepts of graph theory in practical situations

ASTRONOMY (For Physics)

Objectives:
- To introduce the exciting world of astronomy to the students.
- To help the students to study about the celestial objects.

Unit I:
Sphere – great circles and small circles – formulae on spherical trigonometry (without proof) – Naiper's rule.
Chapter I: section 1-7, 12, 13, 20-23, 25-32

Unit II:
Celestial sphere – first point of aries – equinoxes and solstices – four systems of celestial co-ordinates – relation between R.A. and longitude of the sun – sidereal time – $t = \alpha \pm h$ - latitude of a place – to find the azimuth of a star at rising – circumpolar stars.
Chapter II: Section: 39 – 58, 60 – 63, 66, 68 – 70, 75 – 78, 80 – 82

Unit III:
The earth – variations in the duration of day – dip of horizon – refraction – tangent formula.
Chapter III: Section: 87 – 90, 106, 107, 109, 110.
  Chapter IV: Section: 117 – 123

Unit IV:
Kepler's law – to fix the position of a planet in its orbit – anomalies – equation of time – seasons.
Chapter VI: Section: 146 – 149, 156 – 163, 173, 174

Unit V:
The moon – harvest moon – metonic cycle – eclipses ecliptic limits – planetary phenomena – sidereal period – stationary points – direct and retrograde motion.

Chapter XII: Section: 229 -242, 250
Chapter XIII: section 256 – 262, 269, 271, 272, 273
Chapter XIV: section: 285 – 287, 300

Text book
1. S. Kumaravelu and SusheelaKumaravelu, Astronomy, SKV Publications, 2004.

Course Outcomes

1. Be inspired to continue and share their interest in astronomical advances and discoveries throughout their lives.

2. Have a solid grounding in many areas of modern astronomy and their basic underlying physical principles.

3. Know about and understand the observed properties of physical systems that comprise the known universe, on various scales.

4. Demonstrate the ability to design, make, analyze, and interpret quantitative observations of celestial objects.

NMEC2 – Non Major Elective – II: Arithmetic Aptitude (for English)

Unit I:
Profit and loss.
Chapter: 11

Unit II:
Ratio and Proportion
Chapter: 12

Unit III:
Time and work - time and distance.
Chapter: 15 &17

Unit IV:
Simple and compound interest.
Chapter: 21&22

Unit V:
Area – volume - weight and measure (elementary).
Chapter: 25

Text book

Scope and treatment as in "**Quantitative Aptitude**" by R. S. Aggarwal, S.Chand& Company Ltd., Ram Nagar, New Delhi (2004).

For B.Sc., Computer science

CCA1: Allied Paper I:
NUMERICAL ANALYSIS
[In all the units, Derivation of the formula not needed and the value of a root may be calculated up to 3 decimal accuracy only]
PREREQUISITE:
    Basic Mathematics

SUBJECT OBJECTIVES:
    Prepare students to impart the knowledge of finding approximate solutions of polynomial, simultaneous algebraic equations, Interpolation, Differentiation and Integration, ODEs by various Numerical techniques. To motivate students how to solve mathematical modelling problems using Numerical analysis.

UNIT I: Solution of Algebraic & Transcendental Equations:
    Finding a root of the given equation (Derivation of the formula not needed) using Bisection Method, Method of False Position, Iteration method, Newton Raphson Method, Graeffe's Root Squaring Method.
Chapter 2 Section 2.1 to 2.5 and 2.9

UNIT II: Interpolation:
    Forward Differences and Backward differences –Newton's formulae forward & backward difference for Interpolation – Lagrange's interpolation interpolating Polynomial (Proof not needed) Formula, Inverse Interpolation.
Chapter 3 Sections 3.3.1, 3.3.2, 3.6, 3.9.1 and 3.11.

UNIT III: Numerical Differentiation and Integration:
    Introduction - Numerical differentiation - Numerical Integration - Trapezoidal rule & Simpson's 1/3 rule & Simpson's 3/8 rule.
Chapter 6 Sections 6.1- 6.2, 6.4.1 – 6.4.3.

UNIT IV: Solutions to Linear Systems:
    Solution of Linear systems – Direct Methods - Gaussian Elimination Method – Necessity for pivoting – Gauss – Jordan method – Solution of Linear Systems – Iterative methods - Jacobi & Gauss Siedal iterative methods.
Chapter 7 Sections 7.5.1 to 7.5.3 and 7.6

UNIT V: Numerical solution of ODE:
    Solution by Taylor Series Method, Euler's Method , Modified Euler's Method , Runge Kutta 2nd and 4th order methods (Derivation of the formula not needed), Predictor and Corrector Methods.
Chapter 8 Sections 8.2, 8.5 and 8.6

Text Book:
1. S.S.Sastry, Introductory Methods of Numerical Analysis, Fifth Edition, Prentice Hall of
   India Learning Private Limited, New Delhi, 2012 2000.
(https://rahulpatel121.files.wordpress.com/2018/07/s-s-sastry-introductory-methods-of-numerical-analysis-2012-phi-learning-pvt-ltd.pdf)

Reference Books:
[1] S. Narayanan & Others, Numerical Analysis, S. Viswanathan Publishers, 1994.
[2] S.Arumugam , Numerical Methods, New Gamma Publishing, Palamkottai, 2003.
[3] A.Singaravelu, Numerical Methods, Meenakshi Agency, Chennai, 2004.

Course Outcomes
   Upon completion of this course the student will be able to

   1. Solve Algebraic and Transcendental Equations by applying appropriate methods.
   2. Find the approximate solution to the problems related to Interpolation, Differentiation and Integration.
   3. Choose suitable method to find solution to the linear systems.
   4. Apply appropriate method to find the approximate solution to the ODE.

For B.Sc., Computer science
CCA2: Allied Paper II:

OPERATIONS RESEARCH

PREREQUISITE:
Basic Mathematics and Probability Concepts

SUBJECT OBJECTIVES:
Prepare students to understand the mathematical tool and develop operational research models and apply the appropriate algorithm to solve for optimality.

UNIT I: Introduction to Linear Programming Problem: Introduction to Operations Research:
Meaning of OR – Scope of OR – Features of OR – Limitations of OR - Application of OR - Elementary treatment of Linear Programming – Mathematical Formulation of the Problem – Graphical Solution Method – General LPP - Slack and Surplus Variable – Reformulation of general LPP – Matrix formulation of general LPP - Graphical Method.
Chapter 0 Sections 0.2, 0.4, and 0.9
Chapter 2 Sections 2.2 and 2.3, 2.5 to 2.8

UNIT II: The Simplex Method:
Slack variable – surplus variable - Simplex Method – Simplex Algorithm - Artificial variables – Charnes Method for Penalties – Two – Phase Simplex Method. Big-M method – Two Phase Method.
Chapter 3 Sections 3.3 and 3.5 to 3.7

UNIT III: The Transportation Problem:
Introduction – Matrix form of LPP – The Transportation table – Loops in Transportation table and their properties – Initial Basic Feasible Solution – Moving towards Optimality – Transportation algorithm – Degeneracy algorithm – Degeneracy in Transportation Problems - Unbalanced transportation problems**.**
Chapter 9 Sections 9.1 to 9.9

UNIT IV: Assignment and Routing Problems:
The Assignment problem – The Assignment algorithm – Unbalanced Assignment problem – Routing Problem – Travelling Salesman Problem – Formulation of Travelling Salesman Problem as an Assignment Problem.
Chapter 10 Sections 10.1 to 10.4

UNIT V: Network Scheduling by PERT / CPM: PERT CPM network:
Introduction – Basic Concepts – Constraints in networks – Construction of the Network – Time calculation in Networks – CPM – PERT – PERT Calculations – PERT CPM network –Determining the Critical Path – Network Calculation of PERT networks – Probability of PERT.
Chapter 20 Sections 20.1 to 20.8
Text Book:
[1] Kanti Swarop, Gupta. P.K &Manmohan, Operations Research, Sultan Chand & Sons.

Reference Books:
[1] Hamdy A. Taha, Operations Research (7th Edn.), Prentice Hall of India,2002.
[2] Richard Bronson, Theory and Problems of Operations Research, Tata McGraw Hill Publishing Company Ltd, New Delhi, 1982.

Course Outcomes

Upon completion of this course the student will be able to
1. Understand the OR models and Solve them towards optimality by applying appropriate simplex methods.
2. Apply the Transportation algorithm to reduce transportation cost.
3. Apply the Assignment algorithm to allocate the job in such a way that to reduce the total cost for that job.
4. Apply the concepts of PERT and CPM for decision making and optimally managing projects.
5. Analyze and covert the real life problems in Business and Management to the operations research model and solve them towards optimality by applying suitable OR methods.

CCA1: Allied Paper I
ALGEBRA AND CALCULUS

Objectives:
- To introduce Algebra from the basic concepts of set theory, Functions, etc.
- To introduce Vector Calculus basic concepts and its applications

Unit I:
Matrices: Various types of matrices – Characteristic roots of a square matrix – Evaluation of eigen values and eigen vectors – verification of Cayley's Hamilton theorem.
Chapter 5

Unit II:
Derivatives: Higher Derivatives - n^{th} derivative of standard functions – Leibnitz's theorem (statement only) for the nth derivative of product of functions – applicable to suitable problems.
Chapter 8

Unit III:
Reduction formula: Reduction formula for $\int e^{ax} x^n dx$; $\int sin^n x\, dx$; $\int cos^n x\, dx$; where n is a positive integer. Evaluation of $\int_0^\infty e^{ax} x^n dx$; $\int_0^{\frac{\pi}{2}} sin^n x\, dx$; $\int_0^{\frac{\pi}{2}} cos^n x\, dx$, where n is a positive integer.
Chapter 16

Unit III:
Trigonometry: Hyperbolic functions – Euler's formula – Formula for $sin\theta$ and $cos\theta$ in terms of exponential functions – Periodicity of exponential functions – Addition formulae – Hyperbolic functions – Relation Between circular and Hyperbolic functions- Addition formulae in hyperbolic functions – Periods of hyperbolic functions – Inverse Hyperbolic functions.
Chapter 14

Unit IV:
Vector Calculus: Vector differentiation – velocity and acceleration – circular motion – angular velocity vector – scalar and vector fields – Divergence and curl applications.
Chapter 28

Unit V:
Vector integration – application of Gauss, Green's and Stroke's theorem (no proof).
Chapter 29

Text books:
1. Dr.PR. Vittal, **Allied Mathematics**, Margham Publications – 2014.

REFERENCE(S)
1.   T.K. ManickavachaagamPillai and others, **Calculus vol I and vol II**, S.Viswanathan Publishers Pvt. Ltd.
2.   M.L. Khanna, **Vector Calculus**, JaiPrakashNarth&co.

Course Outcomes

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

1. find the eigen values, eigen vectors of a given matrix.
2. find higher derivatives of given functions.
3. be able to understand properties of straight lines and spheres.

CCA2: Allied Paper II
DIFFERENTIAL EQUATIONS, LAPLACE TRANSFORMS AND FOURIER SERIES

Unit I:
Differential equations of first order and higher degree: Equations solvable for p, y and x – Clairaut's equation – Exact equation – Equations reducible to exact form.
Chapter 22

Unit II:
Linear equations with constant coefficients: evaluation of particular integral of the equation for $e^{ax}, \sin ax, \cos ax, \ x^k, e^{ax} f(x)$ where a, k are constants and $f(x)$ is any function of x.
Chapter 23

Unit III:
Formation of equations by elimination of constants and arbitrary functions – definition of general, particular and complete solutions – singular integral (geometrical meaning not expected). Solutions of first order equations in their standard forms.
$F(p, q) = 0; F(x, p, q) = 0; F(y, p, q) = 0; F(z, p, q) = 0; f(x, p) = g(y, q); z = px + qy + f(p, q);$
Lagrange's method of solving the linear equations $Pp + Qq = R$ (Geometrical interpretation not expected).
Chapter 26

Unit IV:
Definition – Laplace transform of functions $e^{at}, \cos at, \sin at, t^n$. First shifting theorem – Laplace transform of $e^{-at} f(t)$ is $\varphi(s + a)$ - Laplace transform of $e^{-at} \cos bt, \ e^{-at} \sin bt,$ and $e^{-at} f(t)$ - Laplace transform of $f'(t), f''(t)$ - Inverse Laplace transform relating to the above standard forms – applications to the solution of ordinary differential equations with constant coefficients involving above transformations.
Chapter 27

Unit V:
Definition of Fourier series – finding Fourier coefficient for a given periodic function with period 2π (odd or even function) – sine and cosine series.
Chapter 21

Text books:
  1. Dr.PR. Vittal, Allied Mathematics, Margham Publications – 2014**.**

REFERENCE(S)

1. S. Arumugam and others, Trigonometry and Fourier series, New gamma publication

2. S. Narayanan and T.K.M. Pillay, Differential equations, S. Viswanathan Publishers.

T.K.ManickavachaagamPillai and others, Calculus vol II, S.Viswanathan Publishers.

Course Outcomes:

The student will be able to

5. Solve first-order ordinary differential equations
6. Solves higher differential equations
7. Solve the Higher order differential equations
8. solve differential and integral equations using Laplace transforms.

B.Sc. Mathematics
Core Course: MATHEMATICAL STATISTICS – I

Objective:
1. To understand the concepts of various discrete and continuous probability distributions.
2. To know about the concepts of correlation and regression, Sampling and applications of chi-square, t-test and F-test.

Unit I:
Central tendencies: Mean–median – quartiles –deciles – percentiles – mode - Geometric mean - Harmonic mean.
Chapter: II Section: 1- 4

Unit II:
Measure of dispersion: Range – quartile - mean deviation - standard deviation – Moments -Skewness and Kurtosis.
Chapter: III & IV

Unit III:
Correlation and regression: correlations - rank correlations - regressions.
Chapter: VI

Unit IV:
Theory of attributes: Attributes - consistency of data - independence and association of data.
Chapter: VIII

Unit V:
Index Number: Index number - consumer price index number - conversion of chain base index number into fixed base index and conversely.

Text book:
S.Arumugam and others, **Statistics**, New Gamma publishing house.

Reference:
S.C. Gupta and V.K. Kapoor, Fundamental of Mathematical Statistics, S.Chand.

Course Outcomes

On completion of this course, the learner will

1. know continuous discrete random variables, their probability functions and distribution functions.
2. know the definition and properties of standard discrete distributions and their applications in analyzing data.
3. know methods of finding correlation and regression co-efficients between two data sets and their applications.
4. the student will be able to analyse discrete and continuous data through measures of central tendency and measures of dispersions.

Non Major Elective for Physical Education

Arithmetic Aptitude

Unit I:
Profit and loss.
Chapter: 11

Unit II:
Ratio and Proportion
Chapter: 12

Unit III:
Time and work - time and distance.
Chapter: 15 &17

Unit IV:
Simple and compound interest.
Chapter: 21&22

Unit V:
Area – volume - weight and measure (elementary).
Chapter: 25

Text book

1. Scope and treatment as in "**Quantitative Aptitude**" by R. S. Aggarwal, S.Chand & Company Ltd., Ram Nagar, New Delhi (2004).

Course Outcomes

On successful completion of the course the students will be able to:

1. Understand the basic concepts of QUANTITATIVE ABILITY
2. Understand the basic concepts of LOGICAL REASONING Skills
3. Acquire satisfactory competency in use of VERBAL REASONING
4. Solve campus placements aptitude papers covering Quantitative Ability, Logical Reasoning and Verbal Ability
5. Compete in various competitive exams like CAT, CMAT, GATE, GRE, GATE, UPSC, GPSC etc.