DEPARTMENT OF MATHEMATICS

UG SYLLABUS
Effective from the Academic Year 2018-2019

H.H. The Rajahs' College

(Autonomous)

Accredited at B+ by NAAC

Pudukkottai.

S.I.	Sem	Course Title	Ins.Hrs	Cre	Exam	Marks	Total

No.			/Week	dit	Hrs	Int	Ex	
1	I	Part –I	6	3	3 Hrs	25	75	100
2	I	Part – II	6	3	3 Hrs	25	75	100
3	I	Major – I: Calculus and Trigonometry	5	5	3 Hrs	25	75	100
4	I	Major – II: Theory of equations and Theory of number	5	4	3 Hrs	25	75	100
	I	Allied paper – I*	3					
		Allied Paper – II (practical)*	3					
5	I	EVS - Environmental studies	2	2	3 Hrs	25	75	100
6	II	Part – I	6	3	3 Hrs	25	75	100
7	II	Part –II	6	3	3 Hrs	25	75	100
8	II	Major – III:Analytical Geometry 3D and Vector calculus	6	5	3 Hrs	25	75	100
9	II	Allied Paper – I*	3	5	3 Hrs	25	75	100
10	II	Allied Paper – II (practical)*	3	5	3 Hrs	25	75	100
11	II	SBE – I - Mathematics for Competitive Examinations - I	4	4	3 Hrs	25	75	100
12	II	VE - Value of Education	2	2	3 Hrs	25	75	100
13	III	Part – I	6	3	3 Hrs	25	75	100
14	III	Part – II	6	3	3 Hrs	25	75	100
15	III	Major– IV: Sequence and series	5	4	3 Hrs	25	75	100
	IV	Major – V: Differential equations and Laplace Transforms *	3					
	III	Allied Paper – III*	3					
	III	Allied Paper – IV*(Practical)	3					
16	III	Non- Major Elective – I History of Mathematics (Objective Type)	4	2	3 Hrs	25	75	100
17	IV	Part – I	6	3	3 Hrs	25	75	100
18	IV	Part – II	6	3	3 Hrs	25	75	100
19	IV	Major – V: Differential equations and Laplace Transforms *	3	4	3 Hrs	25	75	100
20	IV	Major –VI: Algebra	5	4	3 Hrs	25	75	100
21	IV	Allied Paper – III*	3	5	3 Hrs	25	75	100
22	IV	Allied Paper – IV*(Practical)	3	5	3 Hrs	25	75	100
23	IV	SBE– II - Mathematics for Competitive Examinations – II	4	4	3 Hrs	25	75	100
24	V	Major – VII: Mathematical statistics –I	4	4	3 Hrs	25	75	100

25	V	Major – VIII: Real Analysis	5	4	3 Hrs	25	75	100
26	V	Major– IX: Linear Algebra	5	4	3 Hrs	25	75	100
27	V	Major – X: Mechanics	5	4	3 Hrs	25	75	100
28	V	Elective –I: Programming in C	5	5	3 Hrs	25	75	100
29	V	Non- Major Elective – II	2	2	3 Hrs	25	75	100
30	V	Skill Based Elective- III - Mathematics for Competitive Examinations – III	4	4	3 Hrs	25	75	100
31	VI	Major – XI: Mathematical statistics – II	5	4	3 Hrs	25	75	100
32	VI	Major – XII: Numerical Analysis	5	5	3 Hrs	25	75	100
33	VI	Major – XIII: Complex Analysis	5	5	3 Hrs	25	75	100
34	VI	Major – XIV: Operations Research	5	4	3 Hrs	25	75	100
35	VI	Elective - II: Astronomy	5	5	3 Hrs	25	75	100
36	VI	Elective – III : Graph Theory	4	4	3 Hrs	25	75	100
37	VI	Gender Studies	1	1	3 Hrs	25	75	100
		Extension Activities		1				
			180	140				3700
		* Exams will be held at the end of even semester						

Programme Educational Objectives (PEO) for B.Sc. Mathematics

The objectives of this programme is to equip/prepare the students

PEO 1	Provide students with a thorough knowledge of fundamental mathematical facts, and solve problems which can be analyzed mathematically.
PEO 2	Provide high quality and relevant education in the field of Mathematics
PEO 3	Provide grounding in a coherent body of knowledge, a board coverage of related academic skills, personal development and social skills.
PEO 4	Develop confidence to appear for SSC (CGL), IBPS, RRB and Civil services exam and will occupy higher posts in administrative level.
PEO 5	Expose them to various contemporary issues which will enable them become ethical and responsible towards themselves, co-workers, the Society and the Nation

Programme Specific Outcomes (PSO) for B.Sc. Mathematics

On the successful completion of B.Sc. Mathematics, the students will be able to

PSO 1	Communicate mathematics effectively using various instructional strategies.
PSO 2	Demonstrate a computational ability in solving a wide array of mathematical problems.
PSO 3	Develop mathematical ideas from basic axioms and analyze valid mathematical reasoning.
PSO 4	Utilize mathematical skills to solve theoretical and applied problems.
PSO 5	Identify applications of mathematics in various disciplines and society.

Program Outcomes (POs)

On successful completion of the B.Sc. Mathematics programme, the students will be able to:

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PO 1	Students are empowered with analytical and logical skills-to formulate results and construct mathematical argument.
PO 2	Ability to organize, analyze and interpret data accurately in both academic and non -academic context.
PO 3	Demonstrate effective communication of mathematical ideas and creative thinking skills to facilitate solving real world problems as a team andindependently.
PO 4	Appreciate and identify the connections between Mathematics and otherdisciplines.
PO 5	Competency to obtain employment in education, public and private sectors..
PO 6	Identify the area of interest for extended learning from the understanding gainedfrom domain and allied areas of Mathematics.
PO 7	Develop mathematical aptitude and make critical observations.

QUESTION PAPER PATTERN

CHOICE BASED CREDIT CUM SEMESTER PATTERN
(Effective from the academic year 2018-19 onwards)

B.Sc.Mathematics

External Pattern   **Duration of Examination: 3 Hours**

Part – A Answer ALL the Questions 10 x 2 = 20 marks		Part – B Answer ALL the Questions Internal Choice Type 5 x 5 = 25 marks		Part – C Answer any THREE Questions 3 x 10 = 30 marks	
Questions		**Questions**		**Questions**	
1 – 2	– Unit I	11(a) or 11(b)	– Unit I	16	– Unit I
3 – 4	– Unit II	12(a) or 12(b)	– Unit II	17	– Unit II
5 – 6	– Unit III	13(a) or 13(b)	– Unit III	18	– Unit III
7 – 8	– Unit IV	14(a) or 14(b)	– Unit IV	19	– Unit IV
9 – 10	– Unit V	15(a) or 15(b)	– Unit V	20	– Unit V

Elective Course   **Non Major Elective course**

1. a)   1. a) (Objective type)
    (or)   (or)
   b)   b)

2. (a)   2. a) Descriptive type
    (or)   (or)
   b)   b)

Internal Pattern

1. Internal Test – 1   - 50 marks
2. Internal Test – 2   - 75 marks

3. Assignment – 1   - 15 marks
4. Assignment – 2   - 10 marks

    Total   **- 150 marks***

*Total marks to be converted into 25 marks

B.Sc. Mathematics

Core Course: CALCULUS AND TRIGONOMETRY

Objectives:
- To inculcate the basic knowledge of differentiation, expansion of functions and 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.
Volume: 1 Chapter: III

UNIT II:
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- problems–**Multiple Integrals**: evaluation of double and triple integrals- Change of order of integration in double integrals.
Vol: 2 Chapter: I - Sections 13, 14, Chapter: V - Section 2.1, 2.2 and 4.

UNIT IV:
Trigonometry: Expression of $\sin n\theta$, $\cos n\theta$, $\tan n\theta$, $\sin^n\theta$, $\cos^n\theta$ and $\tan^n\theta$ - Expansions of $\sin\theta$, $\cos\theta$ and $\tan\theta$ 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:

CO1: Find successive differentiation of the nth derivatives of Standard result, trigonometrical transformation of functions and Leibnitz formula for the nth derivative of a product.

CO2: Find maxima and minima of function of two variables.

CO3: Understand the concepts of Beta and Gamma functions, methods to find curvature, circle and radius of curvature.

CO4: Expansion of sin nθ, cos nθ, tan nθ and powers of sines and cosines in terms of functions of multiples of θ.

CO5: Define and illustrate the concept of hyperbolic functions and logarithms of complex numbers.

Online Sources:

1. https://en.wikipedia.org/wiki/Calculus

2. https://www.tutorialspoint.com/search/CALCULUS

3. https://en.wikipedia.org/wiki/Trigonometry

4. https://www.tutorialspoint.com/search/TRIGONOMETRY

Mapping with programme outcomes

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
CO 1	9	6	9	9	3	9	6
CO 2	9	6	9	9	3	6	3
CO 3	9	6	3	6	9	6	3
CO 4	9	9	9	6	3	6	3
CO 5	9	9	9	9	9	9	9

*9-Strong; 6-Medium; 3-Low

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B.Sc. Mathematics

Core Course:THEORY OF EQUATIONS AND THEORY OF NUMBERS
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Objectives:
1. To attain the basic knowledge about inequalities and to solve equations in different methods.
2. To introduce the concept of Theory of Numbers.

Theory of Equations:
Unit I:
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. 24 – 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 φ(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 book:
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 the successful completion of the course, student will be able to:

CO 1: Know continuous discrete random variables, their probability functions and distribution functions.

CO 2: Know the definition and properties of standard discrete distributions and their applications in analyzing data.

CO 3: Know methods of finding correlation and regression co-efficients between two data sets and their applications.

CO 4: Understand the concept of prime and composite numbers and also Unique factorization Theorem.

CO 5: Analyze the concept of congruence and its properties.

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

1. https://en.wikipedia.org/wiki/Theory_of_equations

2. https://en.wikipedia.org/wiki/Number_theory

Mapping with programme outcomes

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
CO 1	9	6	9	9	9	9	6
CO 2	6	9	9	3	6	3	3
CO 3	9	6	6	6	9	3	6
CO 4	9	6	6	6	6	9	6
CO 5	9	9	9	9	6	9	9

*9-Strong; 6-Medium; 3-Low

B.Sc. Mathematics

Core Course: ANALYTICAL GEOMETRY 3D AND 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.
Chapter: I and II.

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

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

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. T.K.ManickavasagamPillai& others, Analytical Geometry, S.V Publications - 1985
2. 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:
CO 1: Gain knowledge about the regular geometrical figures and their properties.
CO 2: Analyze condition of tangency and find the tangent plane to the sphere.
CO 3: Examine the condition for the general equation of the cone.
CO 4: Understand the concept of vector differentiation.
CO 5: Acquire the basic knowledge of vector integration.

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

1. https://en.wikipedia.org/wiki/Analytic_geometry

2. https://www.whitman.edu/mathematics/calculus_online/chapter16.html

3. https://en.wikipedia.org/wiki/Vector_calculus

4. https://open.umn.edu/opentextbooks/textbooks/91

Mapping with programme outcomes

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
CO 1	9	9	6	9	9	9	9
CO 2	9	9	6	6	6	6	9
CO 3	6	6	6	6	6	6	6
CO 4	9	3	3	3	9	9	9
CO 5	9	9	9	9	9	3	3

*9-Strong; 6-Medium; 3-Low

B.Sc. Mathematics

Core Course: SEQUENCES AND SERIES

Objectives:
- To lay a good foundation for classical analysis.
- To study the behavior of sequence and series.

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

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

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

Unit IV:
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. Manicavachagampillay and others, Algebra Volume - **1**

Course Outcomes

On the successful completion of the course, Student will be able to:

CO 1: An ability to work within an axiomatic framework;

CO 2: 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;

CO 3: Knowledge of some simple techniques for testing the convergence of sequences and series, and confidence in applying them;

CO 4: Familiarity with a variety of well-known sequences and series, with a developing intuition about the behaviour of new ones;

CO 5: An understanding of how the elementary functions can be defined by power series, with an ability to deduce some of their easier properties.

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

1.   https://en.wikipedia.org/wiki/Category:Sequences_and_series

2.   https://www.cuemath.com/sequences-and-series-formulas/

3.   https://www.math.toronto.edu/preparing-for-calculus/9_sequences/we_1_sequences.html

4.   http://www.supermath.info/CalcChapter11p271_297.pdf

Mapping with programme outcomes

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
CO 1	9	9	6	9	9	9	9
CO 2	9	9	6	6	6	6	9
CO 3	6	6	6	6	6	6	6
CO 4	9	3	3	3	9	9	9
CO 5	9	9	9	9	9	3	3

*9-Strong; 6-Medium; 3-Low

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.

Chapter: I Section: 1 – 6.

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.

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

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

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

Text Book:

S. Narayanan and T.K.M. Pillay, Calculus vol. 3, Viswanathan Publishers.

Reference Books:

1. S. Arumugam and others, Differential Equations and Applications, New Gamma Publishing House – 20.
   J.N. Sharma R.K. Gupta, Differential Equations, Krishna PrakashanMandirMeerd.

Course Outcomes

On the successful completion of the course, Student will be able to:

CO 1: Solve first-order ordinary differential equations.

CO 2: Solves higher differential equations.

CO 3: Solve the Higher order differential equations.

CO 4: Solve partial differential equations and Lagrange's Method.

CO 5: Solve differential and integral equations using Laplace transforms.

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

1. https://en.wikipedia.org/wiki/Differential_equation
2. https://www.mathsisfun.com/calculus/differential-equations.html
3. https://www.britannica.com/science/differential-equation
4. https://en.wikipedia.org/wiki/Laplace_transform
5. https://tutorial.math.lamar.edu/classes/de/LaplaceIntro.aspx

Mapping with programme outcomes

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
CO 1	9	9	6	9	9	9	9
CO 2	6	3	3	3	6	9	9
CO 3	9	6	3	6	3	9	9
CO 4	9	6	6	3	9	6	6
CO 5	9	9	9	9	9	6	6

*9-Strong; 6-Medium; 3-Low

B.Sc, Mathematics

Non Major Elective – I - History of Mathematics

Objectives:
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 :
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.

Course outcomes
On the successful completion of the course, Student will be able to:

CO1: Know the clear cut idea about a sense of number and notches as Tally marks.
CO 2: Gather the knowledge about the Greek Alphabetic numeral system.
CO 3: Know the uses Egyptian Arithmetic and early Egyptian Multiplication.
CO 4: Must know the unit Fraction table and representing rational numbers
CO 5: Gather the Knowledge of Egyptian Mathematics as applied arithmetic

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

1. https://en.wikipedia.org/wiki/History_of_mathematics

2. https://www.storyofmathematics.com/

3. https://mathshistory.st-andrews.ac.uk/HistTopics/History_overview/

4. https://www.maa.org/sites/default/files/HistoryMathCourses.pdf

Mapping with programme outcomes

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
CO 1	9	9	9	3	9	9	3
CO 2	9	6	3	9	6	6	6
CO 3	9	8	9	6	9	9	3
CO 4	9	9	9	3	3	9	6
CO 5	9	9	9	9	9	6	6

*9-Strong; 6-Medium; 3-Low

B.Sc. Mathematics
Core Course: 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:
Groups: Definition and examples – elementary properties of group - Permutations groups – subgroups – cyclic groups – order of an element.
Chapter: III Section: 3.1, 3.2, 3.4 – 3.7

Unit II:
Cosets and Langrange's theorem – Normal subgroups and quotient group
Chapter: III Section: 3.8 – 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.
Chapter: IV Section: 4.1 – 4.5

Unit V:
Ideals – quotient rings – Maximal and prime ideals – homomorphism of rings – Field of quotients of an integral domain.
Chapter: IV Section: 4.7 – 4.11

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 the successful completion of the course, Student will be able to:

CO 1: Recall the properties and extend group structure to finite permutation groups.
CO 2: Explain the concepts of homomorphism, isomorphism and automorphism.
CO 3: Demonstrate abstract thinking capacity and ability to prove theorems.
CO 4: Compare features of different algebraic structures.
CO 5: Examine the properties of algebraic structures and their role in applied contexts.

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

1. https://en.wikipedia.org/wiki/Abstract_algebra
2. http://abstract.ups.edu/
3. https://faculty.math.illinois.edu/~r-ash/Algebra.html
4. https://www.socratica.com/subject/abstract-algebra

Mapping with programme outcomes

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
CO 1	6	9	9	9	9	9	9
CO 2	9	6	6	6	3	6	9
CO 3	6	9	6	3	6	6	9
CO 4	9	3	3	6	6	3	3
CO 5	9	9	9	9	9	3	3

*9-Strong; 6-Medium; 3-Low

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

Objectives:
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.
Chapter: IX

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 the successful completion of the course, Student will be able to:

> CO1: Know the clear cut idea about Mean, median and quartiles.
> CO 2: Gather the knowledge about range, quartile, mean deviation
> and Moment generating functions.
> CO 3: Know the uses correlations and rank correlations.
> CO 4: Must know independence and association of data.
> CO 5: Gather the Knowledge Index number - consumer price index number

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

1. https://stat.ethz.ch/~geer/mathstat.pdf

2. https://en.wikipedia.org/wiki/Mathematical_statistics

3. http://www.icoachmath.com/math_dictionary/Statistics

4. https://www.oreilly.com/library/view/examples-and-problems/9781118605837/

Mapping with programme outcomes

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
CO 1	9	9	9	3	9	9	3
CO 2	6	6	3	9	9	3	3
CO 3	9	3	6	6	9	9	3
CO 4	9	9	9	3	3	6	6
CO 5	9	9	9	9	9	6	9

*9-Strong; 6-Medium; 3-Low

B.Sc. Mathematics
Core Course: REAL ANALYSIS

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

Unit IV:
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 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 the successful completion of the course, Student will be able to:

CO 1: Analyse continuity, derivability, integrability of given real valued function and find derivatives, integrals of given real valued function through limits.

CO 2: Analyse the structure of the real line.

CO 3: Know about the concept of completeness and Baire's category theorem.

CO 4: Understand the definition of homeomorphism and connectedness and continuity.

CO 5: Learn the concept of compactness and continuity.

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

1. https://en.wikipedia.org/wiki/Real_analysis
2. https://ocw.mit.edu/courses/mathematics/18-100c-real-analysis-fall-2012/
3. http://ramanujan.math.trinity.edu/wtrench/texts/TRENCH_REAL_ANALYSIS.PDF
4. http://www.math.louisville.edu/~lee/RealAnalysis/

Mapping with programme outcomes

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
CO 1	9	9	9	9	9	9	9
CO 2	6	9	9	3	6	9	9
CO 3	9	9	3	3	6	6	9
CO 4	6	9	3	9	3	3	3
CO 5	6	3	9	9	9	6	3

*9-Strong; 6-Medium; 3-Low

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.
Chapter: VII Section 7.6 – 7.8

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

On the successful completion of the course, Student will be able to:

CO 1: Analyze the solution set of a system of linear equations.

CO 2: Express some algebraic concepts (such as binary operation, group, field).

CO 3: Do elemantary matrix operations.

CO 4: Express a system of linear equations in a matrix form.

CO 5: Do the elementary row operations for the matrices and systems of linear equations.

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

1. https://en.wikipedia.org/wiki/Linear_algebra
2. https://joshua.smcvt.edu/linearalgebra/
3. https://www.math.ucdavis.edu/~linear/linear-guest.pdf
4. https://secure.math.ubc.ca/~carrell/NB.pdf

Mapping with programme outcomes

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
CO 1	6	9	9	9	9	9	9
CO 2	9	9	6	6	9	9	9
CO 3	9	9	6	9	3	3	3
CO 4	3	9	6	6	6	6	6
CO 5	9	9	9	9	9	3	6

*9-Strong; 6-Medium; 3-Low

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 and 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 Outcomes

On the successful completion of the course, Student will be able to:

CO 1: Know various methods of finding the resultant of a finite number of forces and methods of resolving forces.

CO 2: Be able to understand the effect of different types of forces acting at a point in equilibrium.

CO 3: Know the various properties of motion of a projectile, a simple harmonic motion and orbital motion.

CO 4: Resolve a given force and find equation of catenary

CO 5: Analyse the motion of a projectile.

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]
1. https://en.wikipedia.org/wiki/Mechanics
2. https://www.fsps.muni.cz/emuni/data/reader/book-2/05.html

Mapping with programme outcomes

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
CO 1	6	9	9	9	9	9	9
CO 2	9	9	6	6	9	9	9
CO 3	9	9	6	9	3	3	3
CO 4	3	9	6	6	6	6	6
CO 5	9	9	9	9	9	3	6

*9-Strong; 6-Medium; 3-Low

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 programme - Character set - Constants – Keywords and identifiers – Variables Data types – Declaration of variables – Assigning values to variables –Defining symbolic constants.

UNIT II:
Arithmetic operators - Relational operators - logical operators – assignment operators – increment and decrement operates –Conditional operators – Special 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 ? Operator –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:
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.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

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

CO 1: Understand the importance of C and basic structure of C program.

CO 2: Know about the C-tokens and types of operators.

CO 3: Explain the decision making and looping statements.

CO 4: Demonstrate the concept of Array and its types.

CO 5: Write the C-Program using pointers and structure concepts.

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

1. https://en.wikipedia.org/wiki/C_(programming_language)

2. https://www.javatpoint.com/c-programming-language-tutorial

3. https://www.tutorialspoint.com/cprogramming/index.htm

4. https://www.unf.edu/~wkloster/2220/ppts/cprogramming_tutorial.pdf

Mapping with programme outcomes

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
CO 1	9	9	9	9	9	9	9
CO 2	9	6	6	6	9	9	9
CO 3	9	9	3	9	6	3	3
CO 4	9	9	9	9	3	6	6
CO 5	9	9	9	9	9	3	6

*9-Strong; 6-Medium; 3-Low

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 V:
Test of significance (small sample): t-test, F-test.
Chapter 15

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 outcomes
On the successful completion of the course, Student will be able to:

CO1: Know the clear cut idea about Probability, Conditional Probability and Baye's theorem.

CO 2: Gather the knowledge about Random variables, Mathematical Expectations and Moment generating functions.

CO 3: Know the uses and properties of probability Distributions

CO 4: Must know how to use the t-test and F-test

CO 5: Gather the Knowledge and applications of ANOVA table.

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

1. https://stat.ethz.ch/~geer/mathstat.pdf

2. https://en.wikipedia.org/wiki/Mathematical_statistics

3. http://www.icoachmath.com/math_dictionary/Statistics

4. https://www.oreilly.com/library/view/examples-and-problems/9781118605837/

Mapping with programme outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
CO 1	9	9	9	3	9	9	3
CO 2	6	6	3	9	9	3	3
CO 3	9	3	6	6	9	9	3
CO 4	9	9	9	3	3	6	6
CO 5	9	9	9	9	9	6	9

*9-Strong; 6-Medium; 3-Low

<div align="center">

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]

</div>

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

UNIT I
Algebraic & Transcendental equations: 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 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).
Chapter 7 Sections 7.1 – 7.5

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

REFERENCE(S):
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

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

CO 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.

CO 2: To learn how to interpolate the given set of values.

CO 3: How to works numerical differentiation whenever and wherever routine methods are not applicable.

CO 4: To understand the curve fitting for various polynomials

CO 5: To know how to solve the numerical solution of differential equations.

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

1. https://en.wikipedia.org/wiki/Numerical_analysis
2. http://www.scholarpedia.org/article/Numerical_analysis
3. https://web.njit.edu/~jiang/math614/atkinson1.pdf
4. https://www.worldscientific.com/doi/pdf/10.1142/9789813220027_0001

Mapping with programme outcomes

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
CO 1	9	6	6	9	9	9	9
CO 2	6	3	9	6	9	9	9
CO 3	9	9	6	3	3	3	3
CO 4	9	9	9	3	3	6	9
CO 5	9	9	9	9	9	9	6

*9-Strong; 6-Medium; 3-Low

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 analyticfunctions.
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 the completion of the course the student will be able to:

CO 1: Know the definition of analytic functions and understand their properties.
.

CO 2: Know bilinear transformations and understand its properties .

CO 3: Be able to understand integration of complex valued functions and their higher derivatives.

CO 4: Be able to understand zeros and singularities of an analytic function.

CO 5: Explain the Cauchy's Residue Theorem and to apply their properties in the evaluation of definite integrals.

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]
1. https://en.wikipedia.org/wiki/Complex_analysis
2. https://www.coursera.org/learn/complex-analysis
3. https://complex-analysis.com/
4. https://www.ictp.it/research/math/math-diploma/complex-analysis.aspx

Mapping with programme outcomes

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
CO 1	9	9	9	9	9	9	9
CO 2	9	6	6	6	9	9	9
CO 3	9	9	3	3	6	3	3
CO 4	9	9	9	9	3	6	9
CO 5	9	9	9	9	9	9	6

*9-Strong; 6-Medium; 3-Low

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 –
Simplex Method – Artificial variable – Big-M method – Two Phase Method.
Chapter 1 (Preliminaries only), Chapter 2 and Chapter 3

UNIT II
Duality in Linear Programming: Dual Simplex Method – Integer Programming Problem.

Chapter 4 Section:4.1 to 4.6

UNIT III
Transportation problems: Application to Transportation problem –Transportation
algorithm –Degeneracy algorithm –Degeneracy in Transportation Problem, Unbalanced
transportation problem-
Chapter 9 Section: 9.1 to 9.9

UNIT IV
Assignment problems: Assignment algorithm – Unbalanced Assignment problem.
Chapter 10 Section: 10.1 to 10.3

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

TEXT BOOK:
[1] 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

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

CO 1: Identify and develop operational research models from the verbal description of the real system.

CO 2: Understand the mathematical tools that are needed to solve optimisation problems.

CO 3: Understand the OR models and Solve them towards optimality by applying appropriate simplex methods.

CO 4: Apply the Transportation algorithm to reduce transportation cost.

CO 5: Apply the concepts of PERT and CPM for decision making and optimally managing projects.

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]
1. https://en.wikipedia.org/wiki/Operations_research
2. https://www.informs.org/Explore/Operations-Research-Analytics
3. https://towardsdatascience.com/operations-research-what-when-and-how-6dc56c48fed7
4. https://www.britannica.com/topic/operations-research/History

Mapping with programme outcomes

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
CO 1	9	9	9	9	9	9	9
CO 2	9	6	6	6	9	9	9
CO 3	9	9	3	3	6	3	3
CO 4	9	9	9	9	3	6	9
CO 5	9	9	9	9	9	9	6

*9-Strong; 6-Medium; 3-Low

B.Sc. Mathematics
Elective II: ASTRONOMY

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

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

Course Outcomes

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

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

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

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

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

CO 5: Understand the concept of motions of planet.

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

1. https://en.wikipedia.org/wiki/Astronomy
2. https://astronomy.com/
3. https://www.space.com/16014-astronomy.html
4. https://apod.nasa.gov/apod/astropix.html

Mapping with programme outcomes

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
CO 1	9	9	9	9	9	9	9
CO 2	6	6	9	3	6	6	6
CO 3	9	9	3	6	6	3	3
CO 4	6	6	9	9	6	6	9
CO 5	9	9	9	6	9	9	6

*9-Strong; 6-Medium; 3-Low

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

Text book:

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

Course Outcomes

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

    CO 1: To understand and apply the fundamental concepts in graph theory
    CO 2: To apply graph theory based tools in solving practical problems
    CO 3: To improve the proof writing skills.
    CO 4:The students will be able to apply principles and concepts of graph theory in practical situations.
    CO 5: To explain the Planar graphs and Kuratowoski's two graphs.

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]
1. https://en.wikipedia.org/wiki/Graph_theory
2. https://www.geeksforgeeks.org/mathematics-graph-theory-basics-set-1/
3. https://towardsdatascience.com/what-is-graph-theory-and-why-should-you-care-28d6a715a5c2
4. http://www.esi2.us.es/~mbilbao/pdffiles/DiestelGT.pdf

Mapping with programme outcomes

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
CO 1	9	9	9	9	9	9	9
CO 2	6	6	9	3	6	6	6
CO 3	9	9	3	6	6	3	3
CO 4	6	6	9	9	6	6	9
CO 5	9	9	9	6	9	9	6

    *9-Strong; 6-Medium; 3-Low

NMEC1 – Non Major Elective – I:
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

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

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

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

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

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

CO 5: Know about the Kepler's law and anomalies.

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

1. https://en.wikipedia.org/wiki/Astronomy
2. https://astronomy.com/
3. https://www.space.com/16014-astronomy.html

4. https://apod.nasa.gov/apod/astropix.html

Mapping with programme outcomes

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
CO 1	9	9	9	9	9	9	9
CO 2	6	6	9	3	6	6	6
CO 3	9	9	3	6	6	3	3
CO 4	6	6	9	9	6	6	9
CO 5	9	9	9	6	9	9	6

*9-Strong; 6-Medium; 3-Low

For B.Sc., Computer science
CCA1: Allied Paper I:

NUMERICAL ANALYSIS

[In all the units the value of a root may be calculated up to 3 decimal accuracy only]
Objective:
1. To know the basic concepts of Numerical ananlysis
2. To solve the numerical problem in efficiency with various methods

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, Newton Raphson Method, Iteration method.
Chapter 2 section 2.1 to 2.5

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

UNIT III
Numerical Differentiation and Integration: Numerical differentiation - Numerical Integration using Trapezoidal rule & Simpson's 1/3&3/8 rules.
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.
Chapter 6 Sections 6.3.2 & 6.4

UNIT V
Numerical solution of ODE: Solution by Taylor Series Method, Euler's Method , Modified Euler's Method , RungeKutta 2nd and 4th order methods (Derivation of the formula not needed).
Chapter 7 Sections 7.1, 7.2, 7.4 and 7.5

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

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

CO 1: Solve Algebraic and Transcendental Equations by applying appropriate methods.
CO 2: Find the approximate values to the problems related to Interpolation.
CO 3: Find the value of the Differentiation and Integration of the given function using
      appropriate methods.
CO 4: Choose suitable method to find solution to the linear systems.
CO 5: Apply appropriate method to find the approximate solution to the ODE.

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

1. https://en.wikipedia.org/wiki/Numerical_analysis
2. http://www.scholarpedia.org/article/Numerical_analysis
3. https://web.njit.edu/~jiang/math614/atkinson1.pdf
4. https://www.worldscientific.com/doi/pdf/10.1142/9789813220027_0001

Mapping with programme outcomes

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
CO 1	9	9	9	9	9	9	9
CO 2	9	9	6	9	9	3	9
CO 3	6	9	6	3	3	6	6
CO 4	9	6	3	6	9	9	3
CO 5	9	9	9	9	9	9	9

*9-Strong; 6-Medium; 3-Low

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

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: Application of OR - Elementary treatment of Linear Programming – Graphical Method.

UNIT II
Slack variable – surplus variable - Simplex Method – Artificial variable – Big-M method – Two Phase Method.

UNIT III
Transportation problems: Transportation algorithm –Degeneracy algorithm –Degeneracy in Transportation Problem -Unbalanced transportation problem**.**

UNIT IV
Assignment Problems: Assignment algorithm – Unbalanced Assignment problem.

UNIT V
PERT CPM network:PERT CPM network –Determining the Critical Path – Network Calculation of PERT networks – Probability of PERT.

Text Book:
[1] KantiSwarop, Gupta. P.K &Manmohan, Operations Research, Sultan Chand & Co.

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.For B.Sc., Physics and Chemistry

Course Outcomes

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

CO 1: Understand the OR models and Solve them towards optimality by applying appropriate simplex methods.

CO 2: Apply the Transportation algorithm to reduce transportation cost.

CO 3: Apply the Assignment algorithm to allocate the job in such a way that to reduce the total cost for that job.

CO 4: Apply the concepts of PERT and CPM for decision making and optimally managing projects.

CO 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.

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]
1. https://en.wikipedia.org/wiki/Operations_research
2. https://www.informs.org/Explore/Operations-Research-Analytics
3. https://towardsdatascience.com/operations-research-what-when-and-how-6dc56c48fed7
4. https://www.britannica.com/topic/operations-research/History

Mapping with programme outcomes

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
CO 1	9	9	9	9	9	9	9
CO 2	9	9	6	9	9	3	9
CO 3	6	9	6	3	3	6	6
CO 4	9	6	3	6	9	9	3
CO 5	9	9	9	9	9	9	9

*9-Strong; 6-Medium; 3-Low

For B.Sc., Physics & Chemistry
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 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 book:
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 the completion of the course the student will be able to:

CO 1: Find the eigen values, eigen vectors of a given matrix.
CO 2: Find higher derivatives of given functions.
CO 3: Be able to understand properties of straight lines and spheres.
CO 4: Understand the reduction formula.
CO 5: Know about vector integration and application of Gauss,Green's and Stroke's
Theorem.

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

1. https://en.wikipedia.org/wiki/Matrix_(mathematics)
2. https://www.cliffsnotes.com/study-guides/calculus/calculus/the-derivative/higher-order-derivatives
3. https://en.wikipedia.org/wiki/Integration_by_reduction_formulae
4. https://en.wikipedia.org/wiki/Vector_calculus

Mapping with programme outcomes

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
CO 1	9	9	9	9	9	9	9
CO 2	9	9	6	9	9	3	9
CO 3	6	9	6	3	3	6	6
CO 4	9	6	3	6	9	9	3
CO 5	9	9	9	9	9	9	9

*9-Strong; 6-Medium; 3-Low

For B.Sc., Physics and Chemistry

CCA2: Allied Paper II

DIFFERENTIAL EQUATIONS, LAPLACE TRANSFORMS AND FOURIER SERIES

Objectives :
- To inculcate the basic knowledge of differentiation, expansion of functions and their applications.
- To introduce the notion of envelopes, curvatures and polar co-ordinates.

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

REFERENCE(S):
1. S. Arumugam and others, Trigonometry and Fourier series, New gamma publication

- 51 -

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

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

CO 1: Solve first-order ordinary differential equations
CO 2: Solves higher differential equations
CO 3: Solve the Higher order differential equations
 CO 4: Solve differential and integral equations using Laplace transforms.
CO 5: Find Fourier coefficient for a given periodic function with period 2π

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]
1. https://en.wikipedia.org/wiki/Differential_equation
2. https://www.mathsisfun.com/calculus/differential-equations.html
3. https://www.britannica.com/science/differential-equation
4. https://en.wikipedia.org/wiki/Laplace_transform
5. https://tutorial.math.lamar.edu/classes/de/fourierseries.aspx

Mapping with programme outcomes

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
CO 1	9	9	9	9	9	9	9
CO 2	6	3	9	6	6	3	9
CO 3	9	6	9	3	6	3	3
CO 4	6	3	3	9	9	9	3
CO 5	9	9	9	9	9	9	9

*9-Strong; 6-Medium; 3-Low