

# **GURU NANAK COLLEGE (AUTONOMOUS)**

(Affiliated to University of Madras and Re-Accredited at 'A' Grade by NAAC)

Guru Nanak Salai, Velachery, Chennai – 600042.



## **B.Sc. Mathematics**

(SEMESTER PATTERN WITH CHOICE BASED CREDIT SYSTEM)

## **Syllabus**

(For the candidates admitted in the Academic year 2020-21 and thereafter)

## **Vision**

To create an integrated teaching-learning, research and outreach unit on par with global standards that demonstrates the enhancement achievable in all spheres of life through mathematics education.

## **Mission**

- ▣ To provide an ambience where students can learn, build on their skills and become competent users of Mathematics.
- ▣ To develop critical mathematical thinking and utilize it to solve challenging problems in various applications.
- ▣ To involve students in numerous projects this will expand their core subject interest, and help improve their analytical and logical reasoning skills.
- ▣ To conduct pedagogical training, workshops and conferences for faculty facilitating self-progression.
- ▣ To conduct outreach programs for socially excluded financially backward students and special children.
- ▣ To educate students the importance of moral values and develops self-discipline, self-reliance.
- ▣ To impart the essence of mathematics and to become frontiers in the field.

## **PROGRAMME OUTCOME**

*After completion of the programme, the student will be able to*

**PO 1:** Demonstrate ability to formulate most suitable mathematical problems for real-time occurrences

**PO 2:** Enhanced critical thinking, analytical and computational skills necessary in today's society

**PO 3:** Develop the ability to understand, develop the mathematical concepts both numerically and graphically and enhance problem solving skills.

**PO 4:** Provide for professional cadres in the field of mathematics to support national development programs within public and higher education institutes.

**PO 5:** Build ability to contemplate latest scientific research techniques in the field

## **PROGRAMME SPECIFIC OUTCOME**

*The students at the time of graduation will be able to*

**PSO 1:** Students will possess subject knowledge and skills required for progression in terms of higher education in mathematical/ applied fields or professional cadres.

**PSO 2:** Students will develop the ability to think independently and be able to cater to the needs of the society in local and global levels.

**GURU NANAK COLLEGE (AUTONOMOUS)**  
**VELACHERY, CHENNAI – 42.**  
**B.Sc., DEGREE COURSE IN MATHEMATICS**  
**Course Structure for 2020 – 2023 batch**

Sem.	Part	Course Component	Subject Code	Subject Name	Hours	Credits	CIA	ESE	Total
I	I	Language	19UTAM141/19UHN141	Tamil - I / Hindi - I	6	3	50	50	100
	II	Language	19UENG241	English - I	6	3	50	50	100
	III	Core I	19UMAT301	Algebra	4	4	50	50	100
			19UMAT302	Differential Calculus	4	4	50	50	100
			19UCHE331	Chemistry - I	5	3	50	50	100
			19UCHE332P	Chemistry Practical	3	*	*	*	*
	IV	NME	19UNME401C	Functional Mathematics - I	2	2	50	50	100
Soft Skill		19UGSL401	Soft Skill - I		3	50	50	100	
<b>Total Hours = 30</b>					<b>Total credits = 22</b>				
II	I	Language	19UTAM142 / 19UHN142	Tamil – II/Hindi - II	6	3	50	50	100
	II	Language	19UENG242	English - II	6	3	50	50	100
	III	Core II	19UMAT303	Trigonometry and Number Theory	4	4	50	50	100
			19UMAT304	Analytical Geometry	4	4	50	50	100
			19UCHE335	Chemistry - II	5	3	50	50	100
			19UCHE332P	Chemistry Practical	3	4	50	50	100
	IV	NME	19UNME402C	Functional Mathematics - II	2	2	50	50	100
Soft Skill		19UGSL402	Soft Skill - II		3	50	50	100	
<b>Total Hours = 30</b>					<b>Total credits = 26</b>				
III	I	Language	19UTAM143/19UHN143	Tamil – III/Hindi - III	6	3	50	50	100
	II	Language	19UENG243	English–III	6	3	50	50	100
	III	Core III	19UMAT305	Differential Equations and Laplace Transforms	4	4	50	50	100
			19UMAT306	Integral calculus and Vector Analysis.	4	4	50	50	100
			19UPHY331	Physics - I	5	3	50	50	100

			19UPHY332P	Physics Practical	3	*	*	*	*
	IV	EVS	19UNME402C	Environmental Studies	2	*	*	*	*
		Soft Skill	19UGSL402	Soft Skill - III		3	50	50	100

**Total Hours = 30**

**Total credits = 20**

IV	I	Language	19UTAM142 / 19UHIN142	Tamil – IV/Hindi - IV	6	3	50	50	100	
	II	Language	19UENG242	English–IV	6	3	50	50	100	
	III	Core IV		19UMAT303	Mathematical Statistics	4	4	50	50	100
				19UMAT304	Statics	4	4	50	50	100
				19UCHE335	Physics –II	5	3	50	50	100
				19UCHE332P	Physics Practical	3	4	50	50	100
	IV	EVS	19UNME402C	Environmental Studies	2	2	50	50	100	
Soft Skill		19UGSL402	Soft Skill - IV		3	50	50	100		

**Total Hours = 30**

**Total credits = 28**

V	III	Core V	19UMAT309	Algebraic Structures	6	4	50	50	100
			19UMAT310	Real Analysis-I	6	4	50	50	100
			19UMAT311	Dynamics	6	4	50	50	100
			19UMAT312	Programming Language C with Practical's	6	4	50	50	100
			19UIDE303	Numerical Analysis	6	5	50	50	100
	PIV Common	19UVED401	Value Education		2	50	50	100	
		Internship			2				

**Total Hours = 30**

**Total credits = 23**

VI	III	Core VI	19UTAM143/19UHIN143	Linear Algebra	6	4	50	50	100
			19UENG243	Real Analysis-II	6	4	50	50	100
			19UMAT305	Complex Analysis	6	4	50	50	100
			19UMAT306	Operations Research	6	5	50	50	100
			19UPHY331	Graph Theory	6	5	50	50	100
	V			Extension Activities		1			

**Total Hours = 30**

**Total credits = 23**

**OVERALL CREDITS TOTAL = 142**

**SEMESTER - I**

## CORE THEORY - 1: ALGEBRA

<b>SUBJECT CODE: 19UMAT301</b>	<b>THEORY</b>	<b>MARKS: 100</b>
<b>SEMESTER - I</b>	<b>CREDITS: 4</b>	<b>TOTAL HOURS: 60</b>

**Objectives:**

*To develop the knowledge on linear, polynomial, exponential, and logarithmic functions, matrices and systems of equations with an emphasis on problem solving and multiple representations.*

**UNIT I** **(12 hrs)**

**Matrices:** Symmetric; Skew Symmetric; Hermitian; Skew Hermitian; Orthogonal and Unitary Matrices; Rank of a matrix; Consistency and solutions of Linear Equations.

**UNIT II** **(12 hrs)**

**Matrices:** Cayley-Hamilton theorem; Eigen values; Eigen Vectors; Similar matrices; Diagonalization of a matrix.

**UNIT III** **(12 hrs)**

**Theory of Equations:** Polynomial equations; Imaginary and irrational roots; Symmetric functions of roots in terms of coefficients; sum of  $r^{th}$  powers of roots; Reciprocal equations. Transformations of equations.

**UNIT IV** **(12 hrs)**

**Theory of Equations:** Descartes' rule of signs: Approximate solutions of roots of polynomials by Newton-Raphson method- Horner's method; Cardan's method of solution of a cubic polynomial

**UNIT V** **(12 hrs)**

**Summation of series:** Binomial, Exponential and Logarithmic series (theorems without proof); Summation of finite series using method of differences- Simple problems.

Contents and treatment as in **Algebra- Volume I and II** by T.K.Manikavasagam Pillai and others (S.Viswanathan publishers)

**Reference Books:**

1. Algebra: S.Arumugam ( New Gama Publishing house, Palayamkottai)
2. Higher Algebra: H.S Hall and S.R.Knight (HM Publications-1994)
3. Algebra, Analytical Geometry (2D) and Trigonometry: Dr.S.Sudha (Emerald Publishers)
4. Algebra and Trigonometry (I&II): P.R.Vittal (Margham Publishers)

**Question paper pattern:**

<b>Section</b>	<b>Question Component</b>	<b>Numbers</b>	<b>Marks</b>	<b>Total</b>
<b>Section A</b>	<b>Definition/Principles</b> Answer any 10 out of 12 questions	1 – 12	3	<b>30</b>
<b>Section B</b>	<b>Short Answer</b> Answer any 5 out of 7 questions	13 – 19	6	<b>30</b>
<b>Section C</b>	<b>Essay Answer</b> Answer any 4 out of 6 questions	20 – 25	10	<b>40</b>
<b>TOTAL MARKS</b>				<b>100</b>

**Distribution of Questions:**

<b>Sections</b>	<b>Units</b>	<b>No. of Questions</b>	
		<b>Theory</b>	<b>Problems</b>
<b>Section A</b>	Unit– 1	2	
	Unit– 2	2	
	Unit– 3	2	
	Unit– 4	2	
	Unit– 5	2	
	Any Unit	2	
<b>Section B</b>	Unit– 1	1	
	Unit– 2	1	
	Unit– 3	1	
	Unit– 4	1	
	Unit– 5	1	
	Any Unit	2	
<b>Section C</b>	Unit– 1	1	
	Unit– 2	1	
	Unit– 3	1	
	Unit– 4	1	
	Unit– 5	1	
	Any Unit	1	

## CORE THEORY – 2 : DIFFERENTIAL CALCULUS

<b>SUBJECT CODE: 19UMAT302</b>	<b>THEORY</b>	<b>MARKS: 100</b>
<b>SEMESTER - I</b>	<b>CREDITS: 4</b>	<b>TOTAL HOURS: 60</b>

**Objectives:**

*Introduction to fundamental concepts of Calculus*

**UNIT I** **(12 hrs)**

**Differential Calculus:**  $n^{th}$  Derivative; Leibnitz's theorem (without proof) and its applications; Partial differentiations. Total differentials; Jacobians;

**UNIT II** **(12 hrs)**

**Differential Calculus:** Maxima and Minima of functions of two independent variables Necessary and sufficient conditions (without proof); Lagrange's method (without proof)- Simple problems on these concepts.

**UNIT III** **(12 hrs)**

**Curvature:** Curvature; radius of curvature in Cartesian and polar coordinates; p-r equations; Simple Problems.

**UNIT IV** **(12 hrs)**

Centre of curvature, circle of curvature, envelopes, evolutes and simple problems.

**UNIT V** **(12 hrs)**

**Asymptotes:** Methods (without proof) of finding asymptotes of rational algebraic curves with special cases.

Contents and Treatment as in **Calculus** by S.Narayanan, T.K.Manickavachagom Pillai Volume I (Viswanathan Publishers).

**Reference Books:**

1. Calculus: Dr.S.Sudha (Emerald Publishers)
2. Calculus(I&II): P.R.Vittal (Margham Publishers)



**Question paper pattern:**

<b>Section</b>	<b>Question Component</b>	<b>Numbers</b>	<b>Marks</b>	<b>Total</b>
<b>Section A</b>	<b>Definition/Principles</b> Answer any 10 out of 12 questions	1 – 12	3	<b>30</b>
<b>Section B</b>	<b>Short Answer</b> Answer any 5 out of 7 questions	13 – 19	6	<b>30</b>
<b>Section C</b>	<b>Essay Answer</b> Answer any 4 out of 6 questions	20 – 25	10	<b>40</b>
<b>TOTAL MARKS</b>				<b>100</b>

**Distribution of Questions:**

<b>Sections</b>	<b>Units</b>	<b>No. of Questions</b>	
		<b>Theory</b>	<b>Problems</b>
<b>Section A</b>	Unit– 1	2	
	Unit– 2	2	
	Unit– 3	2	
	Unit– 4	2	
	Unit– 5	2	
	Any Unit	2	
<b>Section B</b>	Unit– 1	1	
	Unit– 2	1	
	Unit– 3	1	
	Unit– 4	1	
	Unit– 5	1	
	Any Unit	2	
<b>Section C</b>	Unit– 1	1	
	Unit– 2	1	
	Unit– 3	1	
	Unit– 4	1	
	Unit– 5	1	
	Any Unit	1	

**NON - MAJOR ELECTIVE: FUNCTIONAL MATHEMATICS - I**

<b>SUBJECT CODE: 19UNME401C</b>	<b>THEORY</b>	<b>MARKS: 100</b>
<b>SEMESTER - I</b>	<b>CREDITS: 2</b>	<b>TOTAL HOURS: 30</b>

**UNIT I** **(6 hrs)**

Ratio and Proportion  
Chapter 12

**UNIT II** **(6 hrs)**

Percentages  
Chapter 10

**UNIT III** **(6 hrs)**

Profit and Loss, Discounts.  
Chapter 11

**UNIT IV** **(6 hrs)**

Simple Interest and Compound Interest  
Chapters 21, 22.

**UNIT V** **(6 hrs)**

Solutions of Simultaneous equations and problems on ages and two digit numbers.  
Chapters 7,8.

**Book for Reference:** Quantitative Aptitude R. S. Agarwal.

# **SEMESTER - II**

### CORE THEORY– 3: TRIGONOMETRY AND NUMBER THEORY

<b>SUBJECT CODE: 19UMAT303</b>	<b>THEORY</b>	<b>MARKS: 100</b>
<b>SEMESTER - II</b>	<b>CREDITS: 4</b>	<b>TOTAL HOURS: 60</b>

#### **Objectives:**

*The student will have developed the ability to recognize and correctly manipulate trigonometric expressions, identities, equations, prime numbers, congruence's , Euler-Fermat's and Wilson's theorems to prove relations involving prime numbers.*

#### **UNIT I (12 hrs)**

**Trigonometry:** Expansions of  $\sin x$ ,  $\cos x$ ,  $\tan x$  in terms of  $x$ ; Expansion of  $\sin nx$ ,  $\cos nx$ ,  $\tan nx$ ,  $\sin^n x$ ,  $\cos^n x$ ,  $\sin^m x \cos^n x$  hyperbolic and inverse hyperbolic functions-Simple Problems.

#### **UNIT II (12 hrs)**

**Summation of series:** Sums of sines and cosines of  $n$  angles which are in A.P.; Summation of trigonometric series using telescopic method, C+iS method.

#### **UNIT III (12 hrs)**

Logarithms of Complex numbers.

#### **UNIT IV (12 hrs)**

**Number Theory:** Prime number; Composite Number; decomposition of a composite number as a product of primes uniquely(without proof); divisors of a positive integer  $n$ ; congruence modulo  $n$ .

#### **UNIT V (12 hrs)**

**Number Theory:** Euler function(without proof); highest power of a prime number  $p$  contained in  $n!$ ; Fermat's and Wilson's theorems-Simple problems.

Contents and treatment as in **Algebra- Volume I and II** by T.K.Manikavasagam Pillai and others (S.Viswanathan publishers)

#### **Reference Books:**

1. Trigonometry: P.Duraipandian (Emerald Publishers)
2. Plane Trigonometry Part 2: S.L.Loney
3. Algebra and Trigonometry(I&II): P.R.Vittal (Margham Publishers)

**Question paper pattern:**

Section	Question Component	Numbers	Marks	Total
Section A	<b>Definition/Principles</b> Answer any 10 out of 12 questions	1 – 12	3	<b>30</b>
Section B	<b>Short Answer</b> Answer any 5 out of 7 questions	13 – 19	6	<b>30</b>
Section C	<b>Essay Answer</b> Answer any 4 out of 6 questions	20 – 25	10	<b>40</b>
<b>TOTAL MARKS</b>				<b>100</b>

**Distribution of Questions:**

Sections	Units	No. of Questions	
		Theory	Problems
Section A	Unit– 1	2	
	Unit– 2	2	
	Unit– 3	2	
	Unit– 4	2	
	Unit– 5	2	
	Any Unit	2	
Section B	Unit– 1	1	
	Unit– 2	1	
	Unit– 3	1	
	Unit– 4	1	
	Unit– 5	1	
	Any Unit	2	
Section C	Unit– 1	1	
	Unit– 2	1	
	Unit– 3	1	
	Unit– 4	1	
	Unit– 5	1	
	Any Unit	1	

## CORE THEORY– 4: ANALYTICAL GEOMETRY

<b>SUBJECT CODE: 19UMAT304</b>	<b>THEORY</b>	<b>MARKS: 100</b>
<b>SEMESTER - II</b>	<b>CREDITS: 4</b>	<b>TOTAL HOURS: 60</b>

**Objectives:**

*To enable vivid description of 2D & 3D geometry graphically and correlate the same algebraically.*

**UNIT I** **(12 hrs)**

**Conics:**

Parabola: pole, polar, conormal points, concyclic points.

Ellipse : pole, polar, conormal points, conjugate lines, conjugate diameters.

**UNIT II** **(12 hrs)**

**Hyperbola:** Co normal points, asymptotes, conjugate diameters.

Rectangular Hyperbola: co normal points, concyclic points.

**UNIT III** **(12 hrs)**

**Planes:** Planes; General equation of a plane; normal form; intercept form; intersection of planes; angle between planes.

**UNIT IV** **(12 hrs)**

**Straight Lines:** Straight Lines; symmetric form; coplanar lines; shortest distance; image of a point and a line on a plane.

**UNIT V** **(12 hrs)**

**Sphere:** Equation of a sphere; general equation; section of a sphere by a plane; tangent plane; orthogonal spheres.

Contents and treatment as in **Analytical Geometry (2D & 3D)** : T.K.Manikavasagam Pillai (Viswanathan Publishers)

**Reference Books:**

1. Analytical Geometry of 2 dimensions: P.Duraipandian
2. Coordinate Geometry: Dr.P.Balasubramanian and Others(McGraw Hill publishers)
3. Calculus and coordinate geometry of two dimensions: P.R.Vittal (Margham Publishers)
4. Coordinate Geometry of 3 Dimensions and probability: P.R.Vittal (Margham Publishers)

**Question paper pattern:**

<b>Section</b>	<b>Question Component</b>	<b>Numbers</b>	<b>Marks</b>	<b>Total</b>
<b>Section A</b>	<b>Definition/Principles</b> Answer any 10 out of 12 questions	1 – 12	3	<b>30</b>
<b>Section B</b>	<b>Short Answer</b> Answer any 5 out of 7 questions	13 – 19	6	<b>30</b>
<b>Section C</b>	<b>Essay Answer</b> Answer any 4 out of 6 questions	20 – 25	10	<b>40</b>
<b>TOTAL MARKS</b>				<b>100</b>

**Distribution of Questions:**

<b>Sections</b>	<b>Units</b>	<b>No. of Questions</b>	
		<b>Theory</b>	<b>Problems</b>
<b>Section A</b>	Unit– 1	2	
	Unit– 2	2	
	Unit– 3	2	
	Unit– 4	2	
	Unit– 5	2	
	Any Unit	2	
<b>Section B</b>	Unit– 1	1	
	Unit– 2	1	
	Unit– 3	1	
	Unit– 4	1	
	Unit– 5	1	
	Any Unit	2	
<b>Section C</b>	Unit– 1	1	
	Unit– 2	1	
	Unit– 3	1	
	Unit– 4	1	
	Unit– 5	1	
	Any Unit	1	

**NON - MAJORELECTIVE: FUNCTIONAL MATHEMATICS – II**

<b>SUBJECT CODE:19UNME402C</b>	<b>THEORY</b>	<b>MARKS: 100</b>
<b>SEMESTER - II</b>	<b>CREDITS: 2</b>	<b>TOTAL HOURS: 30</b>

**UNIT I** **(6 hrs)**

Time and work – pipes and cisterns – Problem.  
Chapters 15, 16.

**UNIT II** **(6 hrs)**

Time and distance – Relative speeds – Problems on Races.  
Chapter 17, 26.

**UNIT III** **(6 hrs)**

Boats and Streams, Problems on Trains  
Chapter 18,19.

**UNIT IV** **(6 hrs)**

Mensuration  
Chapters 24, 25.

**UNIT IV** **(6 hrs)**

Stocks & Shares  
Chapter 29

**Book for Reference:** Quantitative Aptitude R. S. Agarwal.



# **SEMESTER - III**

## CORE THEORY– 5: DIFFERENTIAL EQUATIONS AND LAPLACE TRANSFORMS

<b>SUBJECT CODE: 19UMAT305</b>	<b>THEORY</b>	<b>MARKS: 100</b>
<b>SEMESTER - III</b>	<b>CREDITS: 4</b>	<b>TOTAL HOURS: 60</b>

### Objectives:

To determine how differential equations can be used in solving many applicable oriented problems and Laplace transformation as a tool for solving it.

### UNIT I (12 hrs)

**Ordinary Differential Equations:** First order but of higher degree equations- solvable for p, solvable for x, solvable for y, Clairaut's form- simple problems.

### UNIT II

(12 hrs)

**Ordinary Differential Equations:** Second order differential equations with constant coefficients with particular integrals for  $e^{ax} x^m$ ,  $e^{ax} \sin mx$ ,  $e^{ax} \cos mx$ . Second order differential equations with variable coefficients  $ax^2 \frac{d^2y}{dx^2} + bx \frac{dy}{dx} + cy = q(x)$ , Method of variation of parameters.

### UNIT III

(12 hrs)

**Partial Differential Equations:** Formation of PDE by eliminating arbitrary constants and arbitrary functions; Lagrange's equations  $Pp+Qq=R$ -Simple problems.

### UNIT IV

(12 hrs)

**Partial Differential Equations:** complete integral; singular integral; general integral; Charpit's method and standard types  $f(p,q)=0$ ,  $f(x,p,q)=0$ ,  $f(y,p,q)=0$ ,  $f(z,p,q)=0$ ,  $f(x,p)=f(y,q)$ ; Clairaut's form

### UNIT I

(12 hrs)

**Laplace transform:** Laplace transform; inverse Laplace transform (usual types); applications of Laplace transform to solution of first and second order linear differential equations (constant coefficients) and simultaneous linear differential equations-simple problems.

Contents and treatment as in

1. Engineering Mathematics volume 3: M.K.Venkataraman (National Publishing Co.)
2. Engineering Mathematics volume 3: P.Kandasamy and others (S.Chand and Co.)

### Reference Books:

1. Integral Calculus and differential equations: Dipak Chatterjee (TataMcGraw Hill Publishing Comp Ltd)
2. Advanced Engineering Mathematics:Erwin Kreyszig (John Wiley and sons New York 1999)
3. Calculus: Narayanan and others (S.Viswanathan Publishers)
4. Differential Equations and Integral Transforms: Dr.S.Sudha(Emerald Publishers)

**Question paper pattern:**

Section	Question Component	Numbers	Marks	Total
Section A	<b>Definition/Principles</b> Answer any 10 out of 12 questions	1 – 12	3	<b>30</b>
Section B	<b>Short Answer</b> Answer any 5 out of 7 questions	13 – 19	6	<b>30</b>
Section C	<b>Essay Answer</b> Answer any 4 out of 6 questions	20 – 25	10	<b>40</b>
<b>TOTAL MARKS</b>				<b>100</b>

**Distribution of Questions:**

Sections	Units	No. of Questions	
		Theory	Problems
Section A	Unit– 1	2	
	Unit– 2	2	
	Unit– 3	2	
	Unit– 4	2	
	Unit– 5	2	
	Any Unit	2	
Section B	Unit– 1	1	
	Unit– 2	1	
	Unit– 3	1	
	Unit– 4	1	
	Unit– 5	1	
	Any Unit	2	
Section C	Unit– 1	1	
	Unit– 2	1	
	Unit– 3	1	
	Unit– 4	1	
	Unit– 5	1	
	Any Unit	1	

## CORE THEORY – 6: INTEGRAL CALCULUS AND VECTOR ANALYSIS

<b>SUBJECT CODE: 19UMAT306</b>	<b>THEORY</b>	<b>MARKS: 100</b>
<b>SEMESTER - III</b>	<b>CREDITS: 4</b>	<b>TOTAL HOURS: 60</b>

### Objectives:

To expose the students to various techniques of vector calculus, Fourier series and Fourier transforms

### UNIT II (12 hrs)

Bernoulli's formula, Reduction Formula for

$\int_0^{\frac{\pi}{2}} \sin^m x \cos^n x dx$ ,  $\int_0^{\frac{\pi}{2}} \cos^m x \cos^n x dx$ ,  $\int_0^{\frac{\pi}{2}} \cos^m x \sin^n x dx$ ,  $\int x^m (\log x)^n dx$  and simple Problems. Beta and Gamma functions, properties and simple problems.

### UNIT II (12 hrs)

Multiple Integrals: Double integrals, Change of order of integration, triple integrals, area and volume using Cartesian coordinates.

### UNIT III (12 hrs)

**Fourier Series:** Introduction, Expansions of periodic function of period  $2\pi$ ; expansion of even and odd functions; half range cosine and sine series.

### UNIT IV (12 hrs)

**Vector Differentiation:** Gradient, divergence, curl, directional derivative, unit normal to a surface, vector identities.

### UNIT V (12 hrs)

**Vector Integration:** Line, Surface and volume integrals; theorems of Gauss, Stoke's and Green (without proof) -problems.

Contents and treatment as in

1. Contents and Treatment as in **Calculus** by S.Narayanan, T.K.Manickavachagom Pillai Volume II (Viswanathan Publishers).
2. Engineering Mathematics volume 3: M.K.Venkataraman (National Publishing Co.)
3. Engineering Mathematics volume 3: P.Kandasamy and others (S.Chand and Co.)

### Reference Books:

1. Vector Analysis: Murray Spiegel (Schaum Publishing Company, New York)
2. Vector Analysis: P.Duraipandian and Laxmi Duraipandian (Emerald Publishers)

**Question paper pattern:**

Section	Question Component	Numbers	Marks	Total
<b>Section A</b>	<b>Definition/Principles</b> Answer any 10 out of 12 questions	1 – 12	3	<b>30</b>
<b>Section B</b>	<b>Short Answer</b> Answer any 5 out of 7 questions	13 – 19	6	<b>30</b>
<b>Section C</b>	<b>Essay Answer</b> Answer any 4 out of 6 questions	20 – 25	10	<b>40</b>
<b>TOTAL MARKS</b>				<b>100</b>

**Distribution of Questions:**

Sections	Units	No. of Questions	
		Theory	Problems
<b>Section A</b>	Unit– 1	2	
	Unit– 2	2	
	Unit– 3	2	
	Unit– 4	2	
	Unit– 5	2	
	Any Unit	2	
<b>Section B</b>	Unit– 1	1	
	Unit– 2	1	
	Unit– 3	1	
	Unit– 4	1	
	Unit– 5	1	
	Any Unit	2	
<b>Section C</b>	Unit– 1	1	
	Unit– 2	1	
	Unit– 3	1	
	Unit– 4	1	
	Unit– 5	1	
	Any Unit	1	

# **SEMESTER - IV**

## CORE THEORY – 7: MATHEMATICAL STATISTICS

<b>SUBJECT CODE: 19UMAT307</b>	<b>THEORY</b>	<b>MARKS: 100</b>
<b>SEMESTER - IV</b>	<b>CREDITS: 4</b>	<b>TOTAL HOURS: 60</b>

### **Objectives:**

*To understand the fundamental concept of Statistics and to learn the real life application of statistics..*

### **UNIT I (12 hrs)**

Statistics: Introduction, measures of central tendency- measures of dispersion- skewness-kurtosis.

### **UNIT II (12 hrs)**

Sample space – Events, Definition of probability ( Classical, Statistical & Axiomatic) – Addition and multiplication laws of probability- Independence- Conditional probability- Bayes theorem- Simple problems.

### **UNIT I (12 hrs)**

Random Variables ( Discrete and continuous), Distribution function- Expected values , variance Moment generating function- probability generating function- Examples. Characteristic function – Uniqueness and inversion theorems ( Statements and applications only) – Cumulates, Chebychev’s inequality- Simple problems.

### **UNIT I (12 hrs)**

Correlation: Rank correlation coefficient- Concepts of partial and multiple correlation coefficients- Regression: Method of Least squares for fitting Linear, Quadratic and exponential curves – Simple problems.

### **UNIT I (12 hrs)**

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

Contents and treatment as in “ **Elements of Mathematical Statistics**” by S.C Gupta and V.K Kapoor ( S.Chand Publishers)

### **Reference Books:**

1. Hogg R.V. & Craig A.T. 1988): Introduction to Mathematical Statistics, Mcmillan..
2. Mood A.M & Graybill F.A & Boes D.G (1974) : Introduction to theory of Statistics, Mcgraw Hill.
3. Dr.P.R.Vittal, Mathematical Statistics, Margham publications.

**Question paper pattern:**

<b>Section</b>	<b>Question Component</b>	<b>Numbers</b>	<b>Marks</b>	<b>Total</b>
<b>Section A</b>	<b>Definition/Principles</b> Answer any 10 out of 12 questions	1 – 12	3	<b>30</b>
<b>Section B</b>	<b>Short Answer</b> Answer any 5 out of 7 questions	13 – 19	6	<b>30</b>
<b>Section C</b>	<b>Essay Answer</b> Answer any 4 out of 6 questions	20 – 25	10	<b>40</b>
<b>TOTAL MARKS</b>				<b>100</b>

**Distribution of Questions:**

<b>Sections</b>	<b>Units</b>	<b>No. of Questions</b>	
		<b>Theory</b>	<b>Problems</b>
<b>Section A</b>	Unit– 1	2	
	Unit– 2	2	
	Unit– 3	2	
	Unit– 4	2	
	Unit– 5	2	
	Any Unit	2	
<b>Section B</b>	Unit– 1	1	
	Unit– 2	1	
	Unit– 3	1	
	Unit– 4	1	
	Unit– 5	1	
	Any Unit	2	
<b>Section C</b>	Unit– 1	1	
	Unit– 2	1	
	Unit– 3	1	
	Unit– 4	1	
	Unit– 5	1	
	Any Unit	1	



## CORE THEORY – 8: STATICS

<b>SUBJECT CODE: 19UMAT308</b>	<b>THEORY</b>	<b>MARKS: 100</b>
<b>SEMESTER - IV</b>	<b>CREDITS: 4</b>	<b>TOTAL HOURS: 60</b>

**Objectives:**

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

**UNIT I** **(12 hrs)**

Newton's laws of motion - resultant of two forces on a particle- Equilibrium of a particle- Limiting Equilibrium of a particle on an inclined plane

Chapter 2 - Section 2 .1 , 2.2 , Chapter 3 - Section 3.1 and 3.2

**UNIT II** **(12 hrs)**

Forces on a rigid body – moment of a force – general motion of a rigid body- equivalent systems of forces – parallel forces – forces along the sides of a triangle – couples

Chapter 4 - Section 4 .1 to 4.6

**UNIT III** **(12 hrs)**

Resultant of several coplanar forces- equation of the line of action of the resultant- Equilibrium of a rigid body under three coplanar forces – Reduction of coplanar forces into a force and a couple.-problems involving frictional forces

Chapter 4 - Section 4.7 to 4.9 , Chapter 5 - Section 5.1, 5.2

**UNIT IV** **(12 hrs)**

Centre of mass – finding mass centre – a hanging body in equilibrium – stability of equilibrium – stability using differentiation

Chapter 6 - Section 6.1 to 6.3 , Chapter 7 - Section 7.1, 7.2

**UNIT I** **(12 hrs)**

Virtual work – hanging strings- equilibrium of a uniform homogeneous string – suspension bridge Chapter 8 - Section 8.1, Chapter 9 - Section 9.1, 9.2(12 hrs)

Contents and treatment as in “**Mechanics** – P. Duraipandian , Laxmi Duraipandian , Muthamizh Jayapragasham, S. Chand and Co limited 2008 .

**Reference Books:**

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

**Question paper pattern:**

<b>Section</b>	<b>Question Component</b>	<b>Numbers</b>	<b>Marks</b>	<b>Total</b>
<b>Section A</b>	<b>Definition/Principles</b> Answer any 10 out of 12 questions	1 – 12	3	<b>30</b>
<b>Section B</b>	<b>Short Answer</b> Answer any 5 out of 7 questions	13 – 19	6	<b>30</b>
<b>Section C</b>	<b>Essay Answer</b> Answer any 4 out of 6 questions	20 – 25	10	<b>40</b>
<b>TOTAL MARKS</b>				<b>100</b>

**Distribution of Questions:**

<b>Sections</b>	<b>Units</b>	<b>No. of Questions</b>	
		<b>Theory</b>	<b>Problems</b>
<b>Section A</b>	Unit– 1	2	
	Unit– 2	2	
	Unit– 3	2	
	Unit– 4	2	
	Unit– 5	2	
	Any Unit	2	
<b>Section B</b>	Unit– 1	1	
	Unit– 2	1	
	Unit– 3	1	
	Unit– 4	1	
	Unit– 5	1	
	Any Unit	2	
<b>Section C</b>	Unit– 1	1	
	Unit– 2	1	
	Unit– 3	1	
	Unit– 4	1	
	Unit– 5	1	
	Any Unit	1	

# **SEMESTER - V**

## CORE THEORY– 9: ALGEBRAIC STRUCTURES

<b>SUBJECT CODE: 19UMAT309</b>	<b>THEORY</b>	<b>MARKS: 100</b>
<b>SEMESTER - V</b>	<b>CREDITS: 4</b>	<b>TOTAL HOURS: 90</b>

### **Objectives:**

*To provide fundamentals of Mechanical systems that are rudiments for the theory of relativity.*

### **UNIT I (18 hrs)**

Introduction to groups. Subgroups, cyclic groups and properties of cyclic groups; Lagrange's Theorem; A counting principle  
Chapter 2 Section 2.4 and 2.5

### **UNIT II (18 hrs)**

Normal subgroups and Quotient group; Homomorphism; Automorphism.  
Chapter 2 Section 2.6 to 2.8

### **UNIT III (18 hrs)**

Cayley's Theorem; Permutation groups.  
Chapter 2 Section 2.9 and 2.10

### **UNIT I (18 hrs)**

Definition and examples of ring- Some special classes of rings; homomorphism of rings; Ideals and quotient rings; More ideals and quotient rings.  
Chapter 3 Section 3.1 to 3.5

### **UNIT I (18 hrs)**

The field of quotients of an integral domain; Euclidean Rings; The particular Euclidean ring.  
Section 3.6 to 3.8

Contents and treatment as in "**Topics in Algebra**" – I. N. Herstein, Wiley Eastern Ltd.

### **Reference Books:-**

1. Modern Algebra by M.L.Santiago
2. Modern Algebra by S. Arumugam and others, New Gamma publishing House, Palayamkottai.
3. Modern Algebra by Visvanathan Nayak.

**Question paper pattern:**

Section	Question Component	Numbers	Marks	Total
Section A	<b>Definition/Principles</b> Answer any 10 out of 12 questions	1 – 12	3	<b>30</b>
Section B	<b>Short Answer</b> Answer any 5 out of 7 questions	13 – 19	6	<b>30</b>
Section C	<b>Essay Answer</b> Answer any 4 out of 6 questions	20 – 25	10	<b>40</b>
<b>TOTAL MARKS</b>				<b>100</b>

**Distribution of Questions:**

Sections	Units	No. of Questions	
		Theory	Problems
Section A	Unit– 1	2	
	Unit– 2	2	
	Unit– 3	2	
	Unit– 4	2	
	Unit– 5	2	
	Any Unit	2	
Section B	Unit– 1	1	
	Unit– 2	1	
	Unit– 3	1	
	Unit– 4	1	
	Unit– 5	1	
	Any Unit	2	
Section C	Unit– 1	1	
	Unit– 2	1	
	Unit– 3	1	
	Unit– 4	1	
	Unit– 5	1	
	Any Unit	1	

## CORE THEORY– 10: REAL ANALYSIS I

<b>SUBJECT CODE: 19UMAT310</b>	<b>THEORY</b>	<b>MARKS: 100</b>
<b>SEMESTER - V</b>	<b>CREDITS: 4</b>	<b>TOTAL HOURS: 90</b>

### **Objectives:**

*To introduce the fundamentals concepts of Mathematical analysis and to develop the mathematical concepts in advanced level.*

### **UNIT I (18 hrs)**

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

Chapter 1 Section 1. 1 to 1.7

### **UNIT II (18 hrs)**

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

Chapter 2 Section 2.1 to 2.6

### **UNIT III (18 hrs)**

Operations on convergent sequences; operations on divergent sequences; limit superior and limit inferior; Cauchy sequences.

Chapter 2 Section 2.7 to 2.10

### **UNIT IV (18 hrs)**

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

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

### **UNIT V (18 hrs)**

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

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

Contents and Treatment as in “**Methods of Real Analysis**” : Richard R. Goldberg (Oxford and IBHPublishing Co.)

### **Reference Books :-**

1. Principles of Mathematical Analysis by Walter Rudin
2. Mathematical Analysis Tom M Apostol.

**Question paper pattern:**

<b>Section</b>	<b>Question Component</b>	<b>Numbers</b>	<b>Marks</b>	<b>Total</b>
<b>Section A</b>	<b>Definition/Principles</b> Answer any 10 out of 12 questions	1 – 12	3	<b>30</b>
<b>Section B</b>	<b>Short Answer</b> Answer any 5 out of 7 questions	13 – 19	6	<b>30</b>
<b>Section C</b>	<b>Essay Answer</b> Answer any 4 out of 6 questions	20 – 25	10	<b>40</b>
<b>TOTAL MARKS</b>				<b>100</b>

**Distribution of Questions:**

<b>Sections</b>	<b>Units</b>	<b>No. of Questions</b>	
		<b>Theory</b>	<b>Problems</b>
<b>Section A</b>	Unit– 1	2	
	Unit– 2	2	
	Unit– 3	2	
	Unit– 4	2	
	Unit– 5	2	
	Any Unit	2	
<b>Section B</b>	Unit– 1	1	
	Unit– 2	1	
	Unit– 3	1	
	Unit– 4	1	
	Unit– 5	1	
	Any Unit	2	
<b>Section C</b>	Unit– 1	1	
	Unit– 2	1	
	Unit– 3	1	
	Unit– 4	1	
	Unit– 5	1	
	Any Unit	1	

## CORE THEORY– 11: DYNAMICS

<b>SUBJECT CODE: 19UMAT311</b>	<b>THEORY</b>	<b>MARKS: 100</b>
<b>SEMESTER - V</b>	<b>CREDITS: 4</b>	<b>TOTAL HOURS: 90</b>

### **Objectives:**

*To provide cogent knowledge on the basic principles and applications of varied dynamical systems in real life*

### **UNIT I (18 hrs)**

Basic units – velocity – acceleration- coplanar motion – rectilinear motion under constant forces – acceleration and retardation – thrust on a plane – motion along a vertical line under gravity – line of quickest descent - motion along an inclined plane – motion of connected particles.

Chapter 1 - Section 1.1 to 1.4, Chapter 10 - Section 10.1 to 10.6

### **UNIT II (18 hrs)**

Work, Energy and power – work – conservative field of force – power – Rectilinear motion under varying Force simple harmonic motion ( S.H.M.) – S.H.M. along a horizontal line- S.H.M. along a vertical line – motion under gravity in a resisting medium.

Chapter 11 - Section 11.1 to 11.3 , Chapter 12 - Section 12.1 to 12.4

### **UNIT III (18 hrs)**

Forces on a projectile- projectile projected on an inclined plane- Enveloping parabola or bounding parabola – impact – impulse force - impact of sphere - impact of two smooth spheres – impact of a smooth sphere on a plane – oblique impact of two smooth spheres

Chapter 13 - Section 13.1 to 13.3, Chapter 14 - Section 14.1, 14.5

### **UNIT IV (18 hrs)**

Circular motion – Conical pendulum – motion of a cyclist on a circular path – circular motion on a vertical plane – relative rest in a revolving cone – simple pendulum – central orbits -general orbits - central orbits- conic as centered orbit.

Chapter 15 - Section 15.1 to 15.6, Chapter 16 - Section 16.1 to 16.3

### **UNIT V (18 hrs)**

Moment of inertia. Two dimensional motion of a rigid body –equations of motion for two dimensional motion – theory of dimensions- definition of dimensions.(18 hrs)

Chapter 17 -Section 17.1, Chapter 18 - Section 18.1, 18.2, Chapter 19 - Section 19.

Contents and treatment as in “**Mechanics**” – P. Duraipandian , Laxmi Duraipandian , Muthamizh Jayapragasham, S. Chand and Co limited 2008 .

### **Reference Books:**

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



**Question paper pattern:**

Section	Question Component	Numbers	Marks	Total
Section A	<b>Definition/Principles</b> Answer any 10 out of 12 questions	1 – 12	3	<b>30</b>
Section B	<b>Short Answer</b> Answer any 5 out of 7 questions	13 – 19	6	<b>30</b>
Section C	<b>Essay Answer</b> Answer any 4 out of 6 questions	20 – 25	10	<b>40</b>
<b>TOTAL MARKS</b>				<b>100</b>

**Distribution of Questions:**

Sections	Units	No. of Questions	
		Theory	Problems
Section A	Unit– 1		2
	Unit– 2		2
	Unit– 3		2
	Unit– 4		2
	Unit– 5		2
	Any Unit		2
Section B	Unit– 1		1
	Unit– 2		1
	Unit– 3		1
	Unit– 4		1
	Unit– 5		1
	Any Unit		2
Section C	Unit– 1		1
	Unit– 2		1
	Unit– 3		1
	Unit– 4		1
	Unit– 5		1
	Any Unit		1

## CORE THEORY– 12: PROGRAMMING LANGUAGE ‘C’ WITH PRACTICALS

<b>SUBJECT CODE: 19UMAT312</b>	<b>THEORY</b>	<b>MARKS: 100</b>
<b>SEMESTER - V</b>	<b>CREDITS: 4</b>	<b>TOTAL HOURS: 90</b>

### Objectives:

*The main objective of this course is to learn how to write C-programs and used to develop the technological concepts.*

### UNIT I (12 hrs)

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

### UNIT II (12 hrs)

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

### UNIT III (12 hrs)

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

### UNIT IV (12 hrs)

**Functions :** Function definition and declaration – Categories of functions – recursion –  
Concept of pointers. Function call by reference - call by value.  
Chapter 9 Sections 9.1 – 9.13  
Chapter 11 Sections 11.1-11.5

### UNIT V (12 hrs)

**Files :** Definition, operations on files- file operation functions.  
Chapter 12, Sections 12.1 – 12.

Content and Treatment as in  
Programming in **ANSI C 2<sup>nd</sup> edition** by **E.Balagurusamy**, Tata-Mcgraw Hill  
Publishing Company.

### Reference Books:

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

## **PRACTICALS**

**(30 hrs)**

Writing „C“ programs for the following:

1. To convert centigrade to Fahrenheit
2. To find the area, circumference of a circle
3. To convert days into months and days
4. To solve a quadratic equation
5. To find sum of n numbers
6. To find the largest and smallest numbers
7. To generate Pascal's triangle, Floyd's triangle
8. To find the trace of a matrix
9. To add and subtract two matrices
10. To multiply two matrices
11. To generate Fibonacci series using functions
12. To compute factorial of a given number, using functions
13. To add complex numbers using functions
14. To concatenate two strings using string handling functions
15. To check whether the given string is a palindrome or not using string handling functions.

**Question paper pattern:**

<b>Section</b>	<b>Question Component</b>	<b>Numbers</b>	<b>Marks</b>	<b>Total</b>
<b>Section A</b>	<b>Definition/Principles</b> Answer any 10 out of 12 questions	1 – 12	3	<b>30</b>
<b>Section B</b>	<b>Short Answer</b> Answer any 5 out of 7 questions	13 – 19	6	<b>30</b>
<b>Section C</b>	<b>Essay Answer</b> Answer any 4 out of 6 questions	20 – 25	10	<b>40</b>
<b>TOTAL MARKS</b>				<b>100</b>

**Distribution of Questions:**

<b>Sections</b>	<b>Units</b>	<b>No. of Questions</b>	
		<b>Theory</b>	<b>Problems</b>
<b>Section A</b>	Unit– 1	2	
	Unit– 2	2	
	Unit– 3	2	
	Unit– 4	2	
	Unit– 5	2	
	Any Unit	2	
<b>Section B</b>	Unit– 1	1	
	Unit– 2	1	
	Unit– 3	1	
	Unit– 4	1	
	Unit– 5	1	
	Any Unit	2	
<b>Section C</b>	Unit– 1	1	
	Unit– 2	1	
	Unit– 3	1	
	Unit– 4	1	
	Unit– 5	1	
	Any Unit	1	

**ELECTIVE: IDE – INTER DISCIPLINARY ELECTIVE NUMERICAL ANALYSIS**

<b>SUBJECT CODE: 19UIDE303</b>	<b>THEORY</b>	<b>MARKS: 100</b>
<b>SEMESTER - V</b>	<b>CREDITS: 5</b>	<b>TOTAL HOURS: 90</b>

**Objectives:**

*To find numerical solutions to problems where the exact relationship between the variables are not known*

**UNIT I (18 hrs)**

Solutions of algebraic and transcendental equations, Bisection method, Iteration method, Regula false method, Newton - Raphson method.

Chapter 1: Sections 1.1- 1.4

**UNIT II (18 hrs)**

Solutions of simultaneous linear equations: Gauss - elimination method, Gauss – Jordan method, Gauss – Seidal method, Croute’s method.

Chapter 2: Sections 2.1 – 2.3

**UNIT III (18 hrs)**

E - Operators and relation between them, Differences of a polynomial, Factorial polynomials differences of zero, summation series.

Chapter 3: Sections 3.1- 3.7

**UNIT IV (18 hrs)**

Newton’s forward and backward interpolation formulae, Central differences formulae – Gauss forward and backward formulae, Sterling’s formula and Bessel’s formula.

Chapter 4: Sections 4.1- 4.3, Chapter 5: Sections 5.1 – 5.6

**UNIT V (18 hrs)**

Interpolation with unequal intervals: Divided differences and Newton’s divided differences formula for interpolation and Lagrange’s formula for interpolation; Inverse interpolation – Lagrange’s method, Reversion of series method.

Chapter 6: Sections 6.1 – 6.8

Content and treatment as in **Calculus of finite differences and Numerical analysis**–by P. Kandalama, Thilagavathy.K ;S. Chand Publications.

**Books for reference:**

1. Numerical methods – S. Arumugam, A. Thangapandi Isaac, A. somasundaram, SciTech publications.
2. Numerical methods – E. Balagurusamy, McGraw Hill Education.
3. Numerical methods – S Kalavathy, Joice Punitha
4. Numerical methods – G. Bajaj.

**Question paper pattern:**

Section	Question Component	Numbers	Marks	Total
Section A	<b>Definition/Principles</b> Answer any 10 out of 12 questions	1 – 12	3	<b>30</b>
Section B	<b>Short Answer</b> Answer any 5 out of 7 questions	13 – 19	6	<b>30</b>
Section C	<b>Essay Answer</b> Answer any 4 out of 6 questions	20 – 25	10	<b>40</b>
<b>TOTAL MARKS</b>				<b>100</b>

**Distribution of Questions:**

Sections	Units	No. of Questions	
		Theory	Problems
Section A	Unit– 1	2	
	Unit– 2	2	
	Unit– 3	2	
	Unit– 4	2	
	Unit– 5	2	
	Any Unit	2	
Section B	Unit– 1	1	
	Unit– 2	1	
	Unit– 3	1	
	Unit– 4	1	
	Unit– 5	1	
	Any Unit	2	
Section C	Unit– 1	1	
	Unit– 2	1	
	Unit– 3	1	
	Unit– 4	1	
	Unit– 5	1	
	Any Unit	1	

# **SEMESTER - VI**

## CORE THEORY- 13: LINEAR ALGEBRA

<b>SUBJECT CODE: 19UMAT313</b>	<b>THEORY</b>	<b>MARKS: 100</b>
<b>SEMESTER - VI</b>	<b>CREDITS: 4</b>	<b>TOTAL HOURS: 90</b>

### Objectives:

*To strengthen the knowledge on vector spaces and linear transformations.*

### **UNIT I** **(18 hrs)**

Vector spaces. Elementary basic concepts; linear independence and bases  
Chapter 4 Section 4.1 and 4.2

### **UNIT II** **(18 hrs)**

Dual spaces  
Chapter 4 Section 4.3

### **UNIT III** **(18 hrs)**

Inner product spaces.  
Chapter 4 Section 4.4

### **UNIT IV** **(18 hrs)**

Algebra of linear transformations; characteristic roots.  
Chapter 6 Section 6.1 and 6.2

### **UNIT V** **(18 hrs)**

Matrices; canonical forms; triangular forms.  
Chapter 6 Section 6.3 and 6.4

Treatment and content as in “**Topics in Algebra**” – I. N. Herstein-Wiley Eastern Ltd.

### Reference Books:

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



**Question paper pattern:**

Section	Question Component	Numbers	Marks	Total
<b>Section A</b>	<b>Definition/Principles</b> Answer any 10 out of 12 questions	1 – 12	3	<b>30</b>
<b>Section B</b>	<b>Short Answer</b> Answer any 5 out of 7 questions	13 – 19	6	<b>30</b>
<b>Section C</b>	<b>Essay Answer</b> Answer any 4 out of 6 questions	20 – 25	10	<b>40</b>
<b>TOTAL MARKS</b>				<b>100</b>

**Distribution of Questions:**

Sections	Units	No. of Questions	
		Theory	Problems
<b>Section A</b>	Unit– 1	2	
	Unit– 2	2	
	Unit– 3	2	
	Unit– 4	2	
	Unit– 5	2	
	Any Unit	2	
<b>Section B</b>	Unit– 1	1	
	Unit– 2	1	
	Unit– 3	1	
	Unit– 4	1	
	Unit– 5	1	
	Any Unit	2	
<b>Section C</b>	Unit– 1	1	
	Unit– 2	1	
	Unit– 3	1	
	Unit– 4	1	
	Unit– 5	1	
	Any Unit	1	

## CORE THEORY- 14: REAL ANALYSIS II

<b>SUBJECT CODE: 19UMAT314</b>	<b>THEORY</b>	<b>MARKS: 100</b>
<b>SEMESTER - VI</b>	<b>CREDITS: 4</b>	<b>TOTAL HOURS: 90</b>

**Objectives:**

*To analyse the mathematical concepts and also to develop the mathematical concepts in advanced level.*

**UNIT I** **(18 hrs)**

Open sets; closed sets; Discontinuous function on  $\mathbb{R}^1$ . More about open sets; Connected sets : Chapter 5 Section 5.4 to 5.6  
Chapter 6 Section 6.1 and 6.2

**UNIT II** **(18 hrs)**

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

**UNIT III** **(18 hrs)**

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

**UNIT IV** **(18 hrs)**

Derivatives; Rolle's theorem, Law of mean, Fundamental theorems of calculus.  
Chapter 7 Section 7.5 to 7.8

**UNIT V** **(18 hrs)**

Taylor's theorem; Pointwise convergence of sequences of functions, uniform convergence of sequences of functions.  
Chapter 8 Section 8.5 Chapter 9 Section 9.1 and 9.2

Content and Treatment as in "**Methods of Real Analysis**"- Richard R. Goldberg (Oxford and IBH Publishing Co)

**Reference Books:**

1. Principles of Mathematical Analysis by Walter Rudin
2. Mathematical Analysis Tom M Apostol

**Question paper pattern:**

Section	Question Component	Numbers	Marks	Total
<b>Section A</b>	<b>Definition/Principles</b> Answer any 10 out of 12 questions	1 – 12	3	<b>30</b>
<b>Section B</b>	<b>Short Answer</b> Answer any 5 out of 7 questions	13 – 19	6	<b>30</b>
<b>Section C</b>	<b>Essay Answer</b> Answer any 4 out of 6 questions	20 – 25	10	<b>40</b>
<b>TOTAL MARKS</b>				<b>100</b>

**Distribution of Questions:**

Sections	Units	No. of Questions	
		Theory	Problems
<b>Section A</b>	Unit– 1	2	
	Unit– 2	2	
	Unit– 3	2	
	Unit– 4	2	
	Unit– 5	2	
	Any Unit	2	
<b>Section B</b>	Unit– 1	1	
	Unit– 2	1	
	Unit– 3	1	
	Unit– 4	1	
	Unit– 5	1	
	Any Unit	2	
<b>Section C</b>	Unit– 1	1	
	Unit– 2	1	
	Unit– 3	1	
	Unit– 4	1	
	Unit– 5	1	
	Any Unit	1	

## CORE THEORY- 15: COMPLEX ANALYSIS

<b>SUBJECT CODE: 19UMAT315</b>	<b>THEORY</b>	<b>MARKS: 100</b>
<b>SEMESTER - VI</b>	<b>CREDITS: 4</b>	<b>TOTAL HOURS: 90</b>

### Objectives:

*To enable students to build a strong intuition and support it with appropriate justification in analysing complex numbers, operations, sequences/ functions*

### UNIT I

**(18 hrs)**

Functions of a complex variable - mappings, limits - theorems on limits, continuity, derivatives, differentiation formulae - Cauchy-Riemann equations - sufficient conditions for differentiability - Cauchy-Riemann equations in polar form - Analytic functions - Harmonic functions.

Chapter 2 Section 2.9 to 2.12, 2.14 to 2.20 and 2.22

### UNIT II

**(18 hrs)**

Linear functions - The transformation  $w = 1/z$  - linear fractional transformations - an implicit form - exponential and logarithmic transformations - transformation  $w = \sin z$  - Preservation of angles.

Chapter 8 Section 8.68 to 8.71 and 8.73, 8.74 Chapter 9 : 9.79

### UNIT III

**(18 hrs)**

Complex Valued functions- contours - contour integrals - Anti derivatives - Cauchy-Goursat theorem. Cauchy integral formula - derivatives of analytic function - Liouville's theorem and fundamental theorem of algebra - maximum moduli of functions.

Chapter 4 Section 4.30 to 4.42

### UNIT IV

**(18 hrs)**

sequences and series - Taylor's series - Laurent's series - zeros of analytic functions. Chapter 5 Section 5.43 to 5.47

### UNIT V

**(18 hrs)**

Residues - Residue theorems- Three types of isolated singular points- Residues at poles- Zeros and poles of order 'm' - Evaluation of improper integrals - Improper integrals involving sines and cosines - Definite integrals involving sines and cosines - Argument principle and Rouché's theorem.

Chapter 6 Section 6.53 to 6.57 and Chapter 7 Section 7.60 to 7.65.

Content and treatment as in

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

### Reference Books:

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

**Question paper pattern:**

Section	Question Component	Numbers	Marks	Total
<b>Section A</b>	<b>Definition/Principles</b> Answer any 10 out of 12 questions	1 – 12	3	<b>30</b>
<b>Section B</b>	<b>Short Answer</b> Answer any 5 out of 7 questions	13 – 19	6	<b>30</b>
<b>Section C</b>	<b>Essay Answer</b> Answer any 4 out of 6 questions	20 – 25	10	<b>40</b>
<b>TOTAL MARKS</b>				<b>100</b>

**Distribution of Questions:**

Sections	Units	No. of Questions	
		Theory	Problems
<b>Section A</b>	Unit– 1	2	
	Unit– 2	2	
	Unit– 3	2	
	Unit– 4	2	
	Unit– 5	2	
	Any Unit	2	
<b>Section B</b>	Unit– 1	1	
	Unit– 2	1	
	Unit– 3	1	
	Unit– 4	1	
	Unit– 5	1	
	Any Unit	2	
<b>Section C</b>	Unit– 1	1	
	Unit– 2	1	
	Unit– 3	1	
	Unit– 4	1	
	Unit– 5	1	
	Any Unit	1	

## ELECTIVE- I: OPERATIONS RESEARCH

<b>SUBJECT CODE: 19UMATE01</b>	<b>THEORY</b>	<b>MARKS: 100</b>
<b>SEMESTER - V</b>	<b>CREDITS: 5</b>	<b>TOTAL HOURS: 90</b>

### Objectives:

*The central objective of operations research is optimization. To impart knowledge on formulating mathematical models for quantitative analysis of managerial problems in industry, understand and analyze managerial problems in industry so that they are able to use resources.*

### UNIT II (18 hrs)

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

Chapter 6 Sections 6.1 – 6.13, 6.20 – 6.31

### UNIT II (18 hrs)

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

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

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

### UNIT III (18 hrs)

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

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

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

### UNIT IV (18 hrs)

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

Chapter 5 Sections 5.1 – 5.18

### UNIT V (18 hrs)

Network: : Project Network diagram – CPM and PERT computations. (Crashing excluded)

Chapter 13 Sections 13.1 – 13.10.

Content and treatment as in

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

### Reference Books:

1. Gauss S.I. Linear programming , McGraw-Hill Book Company.
2. .Gupta P.K. and Hira D.S., Problems in Operations Research,Chand& Co.
3. Kanti Swaroop, Gupta P.K and Manmohan, Problems in Operations Research,Sultan Chand & Sons.

4. Ravindran A., Phillips D.T. and Solberg J.J., Operations Research, John Wiley & Sons.
5. Taha H.A. Operation Research, Macmillan pub. Company, New York.
6. Linear Programming, Transpiration, Assignment Game by Dr.Paria, Books and Allied (p) Ltd.,1999.
7. V.Sundaresan,K.S. Ganapathy Subramaian and K.Ganesan,Resource Management Techniques..A.R Publications.

**Question paper pattern:**

Section	Question Component	Numbers	Marks	Total
<b>Section A</b>	<b>Definition/Principles</b> Answer any 10 out of 12 questions	1 – 12	3	<b>30</b>
<b>Section B</b>	<b>Short Answer</b> Answer any 5 out of 7 questions	13 – 19	6	<b>30</b>
<b>Section C</b>	<b>Essay Answer</b> Answer any 4 out of 6 questions	20 – 25	10	<b>40</b>
<b>TOTAL MARKS</b>				<b>100</b>

**Distribution of Questions:**

Sections	Units	No. of Questions	
		Theory	Problems
<b>Section A</b>	Unit– 1		2
	Unit– 2		2
	Unit– 3		2
	Unit– 4		2
	Unit– 5		2
	Any Unit		2
<b>Section B</b>	Unit– 1		1
	Unit– 2		1
	Unit– 3		1
	Unit– 4		1
	Unit– 5		1
	Any Unit		2
<b>Section C</b>	Unit– 1		1
	Unit– 2		1
	Unit– 3		1
	Unit– 4		1
	Unit– 5		1
	Any Unit		1

## ELECTIVE – II: GRAPH THEORY

<b>SUBJECT CODE: 19UMATE02</b>	<b>THEORY</b>	<b>MARKS: 100</b>
<b>SEMESTER - VI</b>	<b>CREDITS: 5</b>	<b>TOTAL HOURS: 90</b>

### Objectives:

*To translate real life situations to diagrammatic representations to develop problem solving skills and solve real life problems.*

### UNIT I (18 hrs)

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

### UNIT II (18 hrs)

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

### UNIT III (18 hrs)

Eulerian and Hamiltonian graphs  
Chapter 5 Sections 5.0 – 5.2

### UNIT IV (18 hrs)

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

### UNIT V (18 hrs)

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

Content and treatment as in

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

### Reference Books

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



**Question paper pattern:**

Section	Question Component	Numbers	Marks	Total
<b>Section A</b>	<b>Definition/Principles</b> Answer any 10 out of 12 questions	1 – 12	3	<b>30</b>
<b>Section B</b>	<b>Short Answer</b> Answer any 5 out of 7 questions	13 – 19	6	<b>30</b>
<b>Section C</b>	<b>Essay Answer</b> Answer any 4 out of 6 questions	20 – 25	10	<b>40</b>
<b>TOTAL MARKS</b>				<b>100</b>

**Distribution of Questions:**

Sections	Units	No. of Questions	
		Theory	Problems
<b>Section A</b>	Unit– 1	2	
	Unit– 2	2	
	Unit– 3	2	
	Unit– 4	2	
	Unit– 5	2	
	Any Unit	2	
<b>Section B</b>	Unit– 1	1	
	Unit– 2	1	
	Unit– 3	1	
	Unit– 4	1	
	Unit– 5	1	
	Any Unit	2	
<b>Section C</b>	Unit– 1	1	
	Unit– 2	1	
	Unit– 3	1	
	Unit– 4	1	
	Unit– 5	1	
	Any Unit	1	



# **ALLIED MATHEMATICS**

**(For B.Sc., Physics & Chemistry)**

## SYLLABUS FOR ALLIED MATHEMATICS

### ALLIED MATHEMATICS - I (For Physics & Chemistry Students)

<b>SUBJECT CODE: 19UMAT331</b>	<b>THEORY</b>	<b>MARKS: 100</b>
<b>SEMESTER - I</b>	<b>CREDITS: 5</b>	<b>TOTAL HOURS: 90</b>

#### UNIT I (15 hrs)

**Algebra:** Partial Fractions, binomial, exponential and logarithmic series(without proof) summation and approximation-Simple Problems.

#### UNIT II (15 hrs)

**Theory of Equations:** Polynomial equations with real coefficients, irrational roots, complex roots, transformation of equation by increasing or decreasing roots by a constant, reciprocal equations. Newton's method to find a root approximately- Horner's method-simple problems.

#### UNIT III (15 hrs)

**Matrices:** Symmetric, Skew-Symmetric, Hermitian, Skew-Hermitian matrices, Orthogonal and Unitary Matrices. Characteristic roots and characteristic vectors-Cayley- Hamilton theorem(statement only) verification, to find the inverse using the above theorem, Diagonalization of a matrix.

#### UNIT IV (15 hrs)

**Finite Differences:** Operator E, difference tables, Newton's forward and backward interpolation formulae, Lagrange's interpolation formulae.

**Trigonometry:** Expansions of  $\sin n\theta, \cos n\theta, \tan n\theta$ . Expansions of  $\sin^n \theta, \cos^n \theta, \tan^n \theta$ . Hyperbolic and inverse hyperbolic function.

#### UNIT V (30 hrs)

**Differential Calculus:**  $n^{\text{th}}$  derivatives, Leibnitz theorem (without proof) and applications, Jacobians. Curvature and radius of curvature in Cartesian coordinates, maxima and minima of functions of two variables, Lagrange's Multipliers-Simple Problems.

Contents and treatment as in "Ancillary Mathematics: S.Narayanan and T.K.Manickavasagam pillai (Viswanathan Printers)"

#### Reference books:

1. Allied Mathematics Volume I&II: P.Kandasamy and K.Thilagavathi (S.Chand and Co.)
2. Ancillary Mathematics Volume I&II: P.Balasubramanian & K.G.Subramanian.
3. Allied Mathematics: P.R.Vittal (Margham Publications)

**Question paper pattern:**

Section	Question Component	Numbers	Marks	Total
<b>Section A</b>	<b>Definition/Principles</b> Answer any 10 out of 12 questions	1 – 12	3	<b>30</b>
<b>Section B</b>	<b>Short Answer</b> Answer any 5 out of 7 questions	13 – 19	6	<b>30</b>
<b>Section C</b>	<b>Essay Answer</b> Answer any 4 out of 6 questions	20 – 25	10	<b>40</b>
<b>TOTAL MARKS</b>				<b>100</b>

**Distribution of Questions:**

Sections	Units	No. of Questions	
		Theory	Problems
<b>Section A</b>	Unit– 1		2
	Unit– 2		2
	Unit– 3		2
	Unit– 4		2
	Unit– 5		2
	Any Unit		2
<b>Section B</b>	Unit– 1		1
	Unit– 2		1
	Unit– 3		1
	Unit– 4		1
	Unit– 5		1
	Any Unit		2
<b>Section C</b>	Unit– 1		1
	Unit– 2		1
	Unit– 3		1
	Unit– 4		1
	Unit– 5		1
	Any Unit		1

**ALLIED MATHEMATICS - II**  
**(For Physics & Chemistry Students)**

<b>SUBJECT CODE: 19UMAT332</b>	<b>THEORY</b>	<b>MARKS: 100</b>
<b>SEMESTER - II</b>	<b>CREDITS: 5</b>	<b>TOTAL HOURS: 90</b>

**UNIT I** **(15 hrs)**

**Integral Calculus:** Integration of irrational, trigonometric functions, Bernoulli's formula integration by parts, reduction formulae, properties of definite integral and simple problems, Evaluation of double, triple integrals, Fourier series for functions in  $(0, 2\pi)$ ,  $(-\pi, \pi)$ .

**UNIT II** **(15 hrs)**

**Ordinary Differential Equations:** First order and higher degree equations solvable for  $p$ ,  $y$ ,  $x$ . Second order linear differential equations with constant coefficients  $ay'' + by' + cy = F(x)$  where  $F(x) = e^{ax}x^m, e^{ax}\sin mx, e^{ax}\cos mx$ .

**UNIT III** **(30 hrs)**

**Partial Differential Equations:** Formation, complete integrals and general integrals, four standard types of Lagrange's equations.

**UNIT IV** **(15 hrs)**

**Laplace Transforms:** Laplace transformations of standard functions and simple properties, inverse Laplace transforms, Solving Differential equations of second order with constant coefficients using Laplace transform.

**UNIT V** **(15 hrs)**

**Vector Analysis:** Scalar point functions, Vector point functions, gradient, divergence, curl, directional derivatives, normal to a surface. Line and surface integrals, Gauss, Stoke's and Green's theorems (without proof)-Simple Problems.

Contents and treatment as in "**Ancillary Mathematics:** S.Narayanan and T.K.Manickavasagam pillai (Viswanathan Printers)"

**Reference books:**

1. Allied Mathematics Volume I&II: P.Kandasamy and K.Thilagavathi (S.Chand and Co.)
2. Ancillary Mathematics Volume I&II: P.Balasubramanian & K.G.Subramanian.
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<b>TOTAL MARKS</b>				<b>100</b>

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		Theory	Problems
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	Unit– 2	2	
	Unit– 3	2	
	Unit– 4	2	
	Unit– 5	2	
	Any Unit	2	
<b>Section B</b>	Unit– 1	1	
	Unit– 2	1	
	Unit– 3	1	
	Unit– 4	1	
	Unit– 5	1	
	Any Unit	2	
<b>Section C</b>	Unit– 1	1	
	Unit– 2	1	
	Unit– 3	1	
	Unit– 4	1	
	Unit– 5	1	
	Any Unit	1	