

## DEPARTMENT OF MATHEMATICS

### PREAMBLE

**UG** : Programme Profile and the syllabi of courses offered in the V and VI semester along with evaluation components III&IV (With effect from 2018-2021batch onwards)

### PROGRAMME PROFILE B.Sc., Mathematics

#### PROGRAMME SPECIFIC OUTCOMES (PSO)

**Upon Completion of the Programme, the Students will able to**

- Interpret the effective use of mathematical skills to solve quantitative problems from a wide array of authentic contexts.
- Ability to apply rigorous mathematical arguments in axiomatic and non-axiomatic systems.
- Demonstrate the effective written communication of mathematical concepts.
- Formulate and develop mathematical arguments in a logical manner.

Semester	Part	Category	Course code	Course Title	Previous course code	Contact Hrs/week	Credit
							Min/Max
<b>I</b>	I	Language	UTAL105/ UTAL106/ UHIL102/ UFRL102	Basic Tamil-I/Advanced Tamil-I/Hindi-I / French-I	UTAL103/ UTAL104/ UHIL101/ UFRL101	4	2/3
	II	English	UENL107/ UENL108	General English-I/ Advanced English-I	UENL106	5	3/4
	III	Core I	UMAM107	Fundamentals of Mathematics	UMAM103	2	1
	III	Core II	UMAM104	Differential Calculus	-	5	4
	III	Core III	UMAM106	Analytical Solid Geometry	UMAM105	6	5
	III	Allied	UMAA111	Mathematical Statistics	-	6	5
	IV	Value Education				2	1
<b>TOTAL</b>						<b>30</b>	<b>21/23</b>
<b>II</b>	I	Language	UTAL205/ UTAL206/ UHIL202/ UFRL202	Basic Tamil II/ Advanced Tamil-II/ Hindi-II /French-II	UTAL203/ UTAL204/ UHIL201/ UFRL201	4	2/3
	II	English	UENL207/ UENL208	General English II/ Advanced English II	UENL 206	5	3/4
	III	Core IV	UMAM204	Integral Calculus	-	5	5
	III	Core V	UMAM205	Graph Theory	UMAM402	5	4
	III	Core VI	UMAM206	Discrete Mathematics	UMAM606	5	4
	IV	Non Major				4	2
	IV	Soft Skill				2	1

	V	Extension Programme/ Physical Education				-	1/2
<b>TOTAL</b>						<b>30</b>	<b>22/25</b>
<b>III</b>	I	Language	UTAL305/ UTAL306/ UHIL302/ UFRL302	Basic Tamil III/ Advanced Tamil-III/ Hindi-III /French-III	UTAL303/ UTAL304/ UHIL301/ UFRL301	4	2/3
	II	English	UENL307/ UENL308	Basic English III/ Advanced English III	UENL306	5	¾
	III	Core VII	UMAM306	Differential Equation	UMAM302/ UMAM301	5	4
	III	Core VIII	UMAM307	Introduction to Probability Theory	-	5	5
	III	Allied	UCSA303	Mathematical Programming in C	-	3	3
	III	Allied Practical	UCSR305	Mathematical Programming in C Practical	-	3	2
	IV	Online Course (NPTEL/ SP)	UMAV381			3	1/2
IV	Value Education				2	1	
<b>TOTAL</b>						<b>30</b>	<b>21/24</b>
<b>IV</b>	I	Language	UTAL405/ UTAL406/ UHIL402/ UFRL402	Basic Tamil IV/ Advanced Tamil-IV/ Hindi-IV/French-IV	UTAL403/ UTAL404/ UHIL401/ UFRL401	4	2/3
	II	English	UENL407/ UENL408	Basic English IV/ Advanced English IV	UENL406	5	3/4
	III	Core IX	UMAM405	Applications of Transforms	-	4	3
	III	Core X	UMAM406	Mechanics	UMAM401	4	4
	III	Core XI	UMAM404	Mathematical modeling	-	4	4
	III	Core XVI	UMAP501 / UMAR511	Project/ R Programming	-	2	-
	III	Allied	UPHA402	Electronics for Mathematics	-	3	3
		Allied Practical	UPHR402	Electronics for Mathematics Practical	-	2	2
	IV	Soft Skill				2	1
V	Extension programme/ Physical Education				-	-/2	
<b>TOTAL</b>						<b>30</b>	<b>22/26</b>
<b>V</b>	III	Core XII	UMAM507	Modern Algebra	UMAM501	6	5
	III	Core XIII	UMAM512	Real Analysis I	UMAM508	6	5
	III	Core XIV	UMAM506	Number Theory	UMAM502	6	5
	III	Core XV	UMAM510	Numerical Methods	-	6	5
	III	Core XVI	UMAP501/ UMAR511	Project/ R Programming	-	4	4/5
	IV	Value				2	1

		Education					
					<b>TOTAL</b>	<b>30</b>	<b>25/26</b>
<b>VI</b>	III	Core XVII	UMAM614	Linear Algebra	UMAM610	5	5
	III	Core XVIII	UMAM615	Real Analysis II	UMAM611	6	6
	III	Core XIX	UMAM602	Complex Analysis	UMAM509	6	6
	III	Core XX	UMAM613	Operations Research	UMAM608	6	6
	III	Major Elective	UMAO607	Mathematics in Space Science	UMAM612	5	4
			UMAO606	Mathematics for Construction Craft	-		
	III	Comprehensive Viva	UMAM601			-	1
	IV	Soft Skill				2	1
V	Extension programme/ Physical Education				-	-/2	
<b>TOTAL</b>						<b>30</b>	<b>29/31</b>
<b>GRAND TOTAL</b>						<b>180</b>	<b>140/155</b>

### COURSES OFFERED TO OTHER DEPARTMENTS-UG ALLIED

Class & Major	Semester	Category	Course Code	Course Title	Previous course code	Contact Hrs/ week	Credit
							Min/Max
I B Com & I B Com (CA)	I	Allied	UMAA112	Business Mathematics	-	5	4
I B.Sc PHY			UMAA114/ UMAA312	Allied Mathematics I	UMAA106	5	5
I BCA			UMAA110	Mathematical Methods I	-	5	4
I B.Sc (CS)			UMAA113	Statistical Methods	-	6	4
I B.Sc (CS)	II		UMAA218	Mathematics for Computer Science	-	6	4
II BCA			UMAA216	Mathematical Methods II		5	4
I B.Sc PHY			UMAA222	Allied Mathematics II	UMAA212	5	5
II B.Sc Chem	III		UMAA312/ UMAA114	Allied Mathematics I	UMAA310	5	5
II B.Sc BIO			UMAA305	Bio-Statistics	-	5	4
II BBA/ II B.Com/ II B.Com CA			UMAA301	Business Statistics	UMAA211/ UMAA403/ UMAA107	5	4
II B.Sc Chem	IV		UMAA406	Integral Calculus, Laplace Transform And Ordinary Differential Equations	-	5	5
II BBA			UMAA410	Quantitative techniques for Business	UMAA505	5	4

## NON-MAJOR ELECTIVE

Semester	Part	Category	Course Code	Course Title	Previous course code	Contact Hrs/ week	Credit
II	IV	Non Major Elective	UMAE204	Basic Mathematics for Science	-	4	2
			UMAE202	Mathematics for Business and Decision Making	-	4	2
			UMAE206	Numerical Methods using C++	UIDE302/ UMAE302	4	2
			UMAE209	Operations Research for Managers	UMAE306/ UMAE402	4	2
			UMAE207	Statistical Data Analysis through SPSS	UMAA501/ UMAE305	4	2
			UMAE208	Applied Mathematics	UMAE309/ UMAE502	4	2

## EXTRA CREDIT EARNING PROVISION

Semester	Part	Category	Course code	Course Title	Contact Hrs/ week	Credit	
						Min	Max
II	III	Self Study paper	UMAI201	Summer Internship	-	-	1
IV	III	Self Study paper	UMAI401	Summer Internship	-	-	1
VI	III	Self Study paper	UMAS601 UMAS602 UMAS603 UMAS604	Fourier Transforms Simulation Number Theory Project	2	-	2

## EXPERIENTIAL LEARNING (Mandatory)

Course Mapping				Collaborating Agency – MSME		
Semester	Course code	Course Title	Assessment	Course Title	Hours/ Days/ Month	Mode of Evaluation
I	UMAA111	Mathematical Statistics	Component IV	Applied Statistics Certification	2 Days	Reflection

**SKILL ORIENTATION PROGRAMME (Only for Interested students) –  
Extra Credit Earning Provision**

Sem	Category	Course Code	Course Title	Collaborating Agency	Hours/Days/Month	Mode of Evaluation	Credits (Min/Max)
II	Core	UMAT201	Statistics Process Control	MSME	4 Days	Reflection	1

**MODERN ALGEBRA**

UMAM507

**Semester : V**

**Category : Core XII**

**Class & Major: III B.Sc Mathematics**

**Credits : 5**

**Hours/Week : 6**

**Total Hours : 78**

**Objectives:**

**To enable the students**

- Understand the Algebraic structures such as Groups, Rings and Ideals
- Compare the operations of Group structures with Rings and Ideals.
- Solve the problems based on the basic algebraic structures.

**Learning Outcomes:**

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

- Write the abstract mathematical proofs in a clear and logical manner.
- Locate and use theorems to solve problems in number theory and theory of polynomials over a field.
- Present the Relationships between abstract algebraic structures with familiar numbers.
- Demonstrate capacity for mathematical reasoning through analyzing, proving, and explaining concepts.

**UNIT-I GROUP**

**15 Hrs**

Definition of a Group – Some Preliminary Lemmas – Subgroups.

**Chapter-2:** Sec 2.1 – 2.4

**UNIT-II NORMAL SUBGROUPS**

**15 Hrs**

Counting Principle, Normal subgroups and quotient groups, Homomorphism.

**Chapter-2:** Sec 2.5 – 2.7

**UNIT-III AUTOMORPHISMS**

**15 Hrs**

Automorphisms - Cayley theorem - Permutation Groups.

**Chapter-2:** Sec 2.8 – 2.10

**UNIT-IV RINGS**

**18 Hrs**

Definition and examples – Some special classes of Rings – Integral Domain – Homomorphisms of Rings- Ideals and Quotient Rings- More Ideals and Quotient Rings.

**Chapter-3:** Sec 3.1 – 3.4

**UNIT-V IDEALS**

**15 Hrs**

The field of an integral domain – Euclidean ring- Polynomial rings.

**Chapter-3:** Sec 3.5 – 3.7

### Text Book

- Herstein, I.N. (2013). *Topics in Algebra*. John Wiley & Sons Publishers. (2<sup>nd</sup> ed.), Asia.

### Reference Books

- Santiago, M.L. (2001). *Modern Algebra*. Tata McGraw-Hill Publishing Co. Chapters 1-4 except the section 2.3 and 2.12
- John Fraleigh, B. (2003). *A first course in Abstract Algebra*. Addison Wesley publishing Co. (7<sup>th</sup> ed.).

### E- Resources

- <http://matterhorn.dce.harvard.edu/engage/ui/index.html#/1999/01/82345>
- <https://ocw.mit.edu/courses/mathematics/18-703-modern-algebra-spring-2013/lecture-notes/>

## REAL ANALYSIS I

UMAM512

Semester : V

Category : Core XIII

Class & Major: III B.Sc Mathematics

Credits : 5

Hours/Week : 6

Total Hours : 78

### Objectives:

#### To enable the students

- Gain the Knowledge of Sequences and Series of real numbers.
- Understand the concept of Metric Spaces and, differentiate the sets and functions defined on it
- Illustrate the Sequences and Series, and analyze them.

### Learning Outcomes:

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

- Describe the Fundamental Properties of the real numbers.
- Demonstrate an understanding of the sequence and series, continuity etc
- Apply the theory in the course to solve a variety of problem at an appropriate level of difficulty
- Using skills in communicating mathematics.

### UNIT-I FUNCTIONS

15 Hrs

Functions – Real valued functions – Equivalence – Countability and Real numbers – Least Upper Bound.

Chapter 1: Sec: 1.4 to 1.7

### UNIT-II LIMITS OF SEQUENCES

15 Hrs

Definition – Subsequence – Limit of a Sequence – Convergent Sequence – Divergent Sequence – Bounded Sequence – Monotone Sequence.

Chapter 2: Sec: 2.1 to 2.6.

**UNIT-III CONVERGENT SEQUENCES AND SERIES** **16 Hrs**

Operations on Convergent Sequence - Operations on Divergent Sequence – Limit Superior and Limit Inferior – Cauchy Sequence.

Series: Convergence and Divergence – Series with Non- negative terms – Alternating Series – Conditional Convergence and Absolute Convergence.

**Chapter 2:** Sec: 2.7 to 2.10 **Chapter 3:** Sec: 3.1 to 3.4

**UNIT-IV REARRANGEMENT OF SERIES** **16 Hrs**

Rearrangement of series – Tests for Absolute Convergence – Series whose terms form a Non – decreasing sequence – Summation by parts. Limits and Metric Spaces: Limit of a function of the real line – Metric space – Limits in metric spaces.

**Chapter 3:** Sec: 3.5 to 3.8 **Chapter 4:** Sec: 4.1 to 4.3

**UNIT-V CONTINUOUS FUNCTIONS ON METRIC SPACES** **16 Hrs**

Functions continuous at a point on the real line – Reformulation - Functions Continuous on a Metric Spaces – Open Sets – Closed Sets.

**Chapter 5:** Sec: 5.1 to 5.5

**Text Book**

- Goldberg,R. (2009). *Methods of Real Analysis*. Oxford & IBH Publishing Co. New Delhi.

**Reference Books**

- Tom Apostol, M. (2004). *Mathematical Analysis*. Addison –Wesley New York (4<sup>th</sup> ed.,).
- Malik,S.C. and Savita Arora. (2010). *Mathematical Analysis*.Wiley Eastern Limited New Delhi.
- Sanjay Arora and Bansilal. (2000). *Introduction to Real Analysis*. SatyaPrakashan. New Delhi.

**E- Resources**

- <http://nptel.ac.in/courses/122104017/>

**NUMBER THEORY**

UMAM506

**Semester : V**

**Category : Core XI**

**Class &Major: III B.Sc Mathematics**

**Credits : 5**

**Hours/Week : 6**

**Total Hours : 52**

**Objectives:**

**To enable the students**

- Acquire basic knowledge in Number System.
- Apply the properties of various functions of Number System.
- Apply the concepts of Number theory in the field of Algebra and Cryptography.

**Learning Outcomes:**

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

- Construct Mathematical Proofs and Statements and find counterexamples to false statements

- Collect and use numerical data to form conjectures about the integers
- Express the concept and results
- Apply Euclid's Algorithm

**UNIT-I THE FUNDAMENTAL THEOREM OF ARITHMETIC 10 Hrs**

Introduction – Divisibility - Greatest common divisor - Prime numbers – The fundamental theorem of arithmetic- The series of reciprocals of the primes – The Euclidean algorithm - The greatest common divisor of more than two numbers.

Chapter-1. Section:1.1-1.8.

**UNIT-II ARITHMETICAL FUNCTIONS 10 Hrs**

Introduction – The mobius function  $(n)$  – The Euler totient function  $\mu(n)$  – A  $\phi$  relation connecting  $\phi$  and  $\mu$  – A product formula for  $\mu(n)$  – The Dirichlet of arithmetical  $\phi$  functions – Dirichlet inverses and the mobius inversion formula - Multiplicative functions.

Chapter-2. Section:2.1-2.9.

**UNIT-III DIRICHLET MULTIPLICATIONS 12 Hrs**

Multiplicative functions and Dirichlet Multiplication -The inverse of a completely multiplicative function – Liouville's function - The division function-Generalised convolutions - Formal power series - The bell series of an arithmetical functions - Bell series and Dirichlet multiplication. - Derivatives of arithmetical functions - The Selberg identity.

Chapter-2. Section:2.10-2.19.

**UNIT –IV CONGRUENCES 10 Hrs**

Congruences - Definition and basic properties of Congruences – Linear congruence - Reduced residue systems and The Euler-Fermat theorem - Polynomial Congruences modulo  $p$  Lagrange theorem - Application of Lagrange's theorem - Simultaneous linear congruences - The Chinese remainder theorem - Applications of the Chinese remainder theorem.

Chapter-5. Section:5.1-5.8.

**UNIT-V QUADRATIC RESIDUES AND DIRICHLET SERIES 10 Hrs**

Quadratic residues and the quadratic reciprocity lemma - Evaluation of  $(-1/p)$  and  $(2/p)$  - Gauss lemma - The quadratic reciprocity law - introduction - The half-plane of absolute convergence of a Dirichlet series - The function defined by a Dirichlet series - Multiplication of Dirichlet series.

Chapter-9. Section:9.3-9.5 Chapter-11. Section:11.1-11.4.

**Text Book**

- Tom Apostol, M. (2000). *Introduction to Analytic Number Theory*. Springer-Verlag. New York.

**Reference Books**

- Neal Koblitz. (1987). *A Course in Number Theory and Cryptography*. Springer-Verlag. New York.
- John Stillwell.(2006). *Elements of Number Theory*. Springer – Verlag. New York.



- Ivan Niven Herbert Zuckerman,S. and Hugh Montgomery,L. (2008). *An Introduction to the Theory of numbers*.Wiley ,(5<sup>th</sup> ed.,). India.

## NUMERICAL METHODS

UMAM510

**Semester** :V  
**Category** :XV  
**Class & Major:** III B.Sc Mathematics

**Credits** : 5  
**Hours/Week:** 6  
**Total Hours:** 78

### Objectives:

#### To enable the students

- Introduce the basic concepts of algebraic and transcendental equations.
- Understand the numerical techniques of differentiation and integration.
- Acquaint the knowledge of various techniques and methods of solving ordinary and partial differential equations.

### Learning Outcomes:

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

- Demonstrate understanding of numerical methods and how they are used to obtain approximate solutions.
- Apply numerical methods to find out solution of algebraic equations using different methods under different conditions, and numerical solution of system of algebraic equations.
- Work out numerical differentiation and integration whenever and wherever routine methods are not applicable.
- Apply various interpolation methods and finite difference concepts

### UNIT-I SOLUTION OF ALGEBRAIC AND TRANSCENDENTAL EQUATIONS 15 Hrs

Solution of algebraic and transcendental equations - Fixed point iteration method – Newton Raphson method.

Chapter: 3

### UNIT- II SOLUTION OF LINEAR SYSTEM EQUATIONS & EIGENVALUE

#### PROBLEMS

**16 Hrs**

Solution of linear system of equations - Gauss Elimination method –Pivoting - Gauss-Jordan methods -Iterative methods of Gauss-Jacobi and Gauss-Seidel -Matrix Inversion by Gauss-Jordan method – Eigen values of a matrix by Power method and by Jacobi`s method.

Chapter : 4,13 (Sec 13.1-13.2)

### UNIT- III INTERPOLATION AND APPROXIMATION

**15 Hrs**

Interpolation with unequal intervals - Lagrange interpolation – Newton`s divided difference interpolation – Cubic Splines - Interpolation with equal intervals – Newton`s forward and backward difference formulae – Least square method - Linear curve fitting.

Chapter: 7 & 8

#### **UNIT- IV NUMERICAL DIFFERENTIATION AND INTEGRATION 16 Hrs**

Approximation of derivatives using interpolation polynomials - Numerical integration using Trapezoidal, Simpson's 1/3 and Simpson's 3/8 rules – Romberg's method - Two point and three point Gaussian quadrature formulae – Evaluation of double integrals by Trapezoidal and Simpson's rules.

Chapter : 9

#### **UNIT-V INITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS**

**16 Hrs**

Single step-methods – Taylor's series method – Euler's method - Modified Euler's method -Fourth order Runge - Kutta method for solving first and second order equations - Multi-step methods – Milne's and Adams-Bash forth predictor-corrector methods for solving first order equations.

Chapter:11

#### **Text Books**

- Grewal, B.S. and Grewal, J.S. (2007). *Numerical methods in Engineering and Science*. Khanna Publishers.(9<sup>th</sup> ed.,).India.
- Kandasamy, P.Thilagavathy, K.and Gunavathy, K. (2009). *Numerical Methods*. S.Chand & Company limited. New Delhi.

#### **References**

- Sastry, S.S.(2002). *Introducing Methods of Numerical Analysis*. Prentice Hall of India. (3<sup>rd</sup>.,). New Delhi.
- Brian Bradie. (2007). *Friendly Introduction to Numerical Analysis*. Pearson Education.(1sted.,). Asia.
- Gerald, C.F. and Wheatley, P.O.(2006). *Applied Numerical Analysis*. Pearson Education. (6th ed.,). New Delhi.

#### **E-Resources:**

- <http://textofvideo.nptel.iitm.ac.in/video.php?courseid=111101003&p=3>
- <http://textofvideo.nptel.iitm.ac.in/video.php?courseid=111101003&p=1>
- <http://textofvideo.nptel.iitm.ac.in/video.php?courseid=111101003&p=1>
- <http://textofvideo.nptel.iitm.ac.in/video.php?courseid=111101003&p=4>
- <http://freevideolectures.com/Course/3277/Numerical-methods-of-Ordinary-and-Partial-Differential-Equations>

## PROJECT

UMAP501

Semester : V  
Category : Core X  
Class & Major: III B.Sc Mathematics

Credits : 5  
Hours/Week : 2+4  
Total Hours : 78

### Objectives:

#### To enable the students

- Acquire knowledge in Mathematical research.
- Develop problem solving and decision making skills.

### Learning Outcomes:

#### On Completion of the course, the students will be able to

- Identify practical problem, solve using the Mathematical techniques.
- Provide students a hands-on experience of Designing, Performing, and Analyzing results from a Application Oriented project.

### Guidelines

- Project is offered for final year B.Sc Mathematics students in Semester VI.
- Project can be done according to area of interest.
- Project should do either as individual or as group with maximum of three /four students.
- Project can be field study, survey, extraction of components from Real life and application oriented.
- Evaluation scheme for the project will be Internal 60 and External40.

### Assessment

S. No	Internal		External	
	Component	Marks	Component	Marks
1	Review of the Literature	10	Dissertation	10
2	Area of Research	10	Presentation	20
3	Methodology	10	Viva - voce	10
4	Statistical Tool	10		-
5	Result and Discussion	10		-
6	Report preparation	10		-
	<b>Total</b>	<b>60</b>		<b>40</b>
	Maximum marks		100	

# LINEAR ALGEBRA

UMAM614

Semester : VI

Category : Core XVII

Class & Major: III B.Sc Mathematics

Credits : 5

Hours/Week : 5

Total Hours : 65

## Objectives:

### To enable the students

- Understand the concepts of Vector spaces, linear transformations and Matrix Algebra.
- Solve system of linear equations and assess the nature of solutions.
- Compute determinants and canonical forms of a matrix.

## Learning Outcomes:

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

- Do elementary matrix operations
- Recognize and use equivalent statements regarding invertible matrices, pivot positions, and solutions of homogeneous systems.
- Interpret existence and uniqueness of solutions geometrically.
- Perform common matrix operations such as addition, scalar multiplication, multiplication and transposition.

## UNIT-I VECTOR SPACES & DUAL SPACES

13 Hrs

Elementary Basic Concepts – Linear Independence and bases- Dual Spaces- Inner Product Spaces.

## UNIT-II INNER PRODUCT SPACES & LINEAR TRANSFORMATION

13Hrs

Modules-The Algebra of Linear Transformation- Characteristic Roots.

## UNIT-III MATRIX & CANONICAL FORMS

13Hrs

Matrix -Canonical forms: Triangular forms-Nilpotent Transformations- Decomposition of  $V$ :Jordon forms.

## UNIT-IV MATRIX OPERATIONS

13Hrs

Trace and Transpose – Determinants.

## UNIT-V HERMITIAN-UNITARY & NORMAL TRANSFORMATIONS

13Hrs

Hermitian-Unitary & Normal Transformations-Real Quadratic forms

## Text Book

- Devi Prasad. (2016). *Elementary linear Algebra*. Narosa publishing company. (3<sup>rd</sup> ed.,).

## Reference Books

- Kumaresan, S. (2000). *Linear Algebra A geometric Approach*. PHI Learning Private Limited.(10<sup>th</sup> ed.,). New Delhi.
- Herstein,I.N. (2013). *Topics in Algebra*. John Wiley & Sons inc.(2<sup>nd</sup> ed.,).
- Kenneth Hoffmann, and Ray Kunze.(2014). *Linear Algebra*. (2<sup>nd</sup> ed.,).
- John Fraleigh,B. (2003). *A first course in Abstract Algebra*. Addison Wesley publishing Co. (7<sup>th</sup> ed.,).

### E- Resources

- <http://nptel.ac.in/courses/111106051/>
- <https://www.khanacademy.org/math/linear-algebra>

## REAL ANALYSIS II

UMAM615

<b>Semester</b>	<b>: VI</b>	<b>Credits</b>	<b>: 6</b>
<b>Category</b>	<b>: Core XVIII</b>	<b>Hours/Week</b>	<b>: 6</b>
<b>Class &amp; Major:</b>	<b>III B.Sc Mathematics</b>	<b>Total Hours</b>	<b>:78</b>

### Objectives:

#### To enable the students to

- Understand the sequence and series of functions, and fundamental properties of real numbers.
- Construct rigorous mathematical proofs of basic results in real analysis.
- Apply principles of real analysis to perform Riemann integration.

### Learning Outcomes:

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

- Determine the Riemann integrability and the Riemann-Stieltjes integrability of a bounded function and prove a selection of theorems concerning integration
- Recognize the difference between point wise and uniform convergence of a sequence of functions,
- Illustrate the effect of uniform convergence on the limit function with respect to continuity, differentiability, and integrability
- Illustrate the convergence properties of power series.

### UNIT-I CONNECTEDNESS, COMPLETENESS 15 Hrs

More about Open sets, Connected Sets – Bounded Sets and Totally Bounded Sets – Complete Metric Spaces.

**Chapter 4** : Sec 6.1 to 6.4

### UNIT-II COMPACTNESS 15 Hrs

Compact Metric Space – Continuous Functions on Compact Metric Spaces – Continuity of Inverse Functions – Uniform Continuity.

**Chapter 6**: Sec 6.5 to 6.8

### UNIT-III RIEMANN INTEGRATION 16 Hrs

Definition of the Riemann Integral – Existence of Riemann integral(Statement only)- Properties of the Riemann Integral – Derivatives – Rolle's Theorem – The Law of the Mean – Fundamental Theorem of Calculus.

**Chapter 7**: Sec 7.2 to 7.8

### UNIT-IV IMPROPER RIEMANN INTEGRATION 16 Hrs

Improper integrals – Cauchy's Principle Value -Taylor's Theorem: Taylor's formula with Different Forms of Remainder – The Binomial Theorem – L'Hospitals Rule.

**Chapter 7** :Sec 7.9 & 7.10 **Chapter 8** : Sec 8.5 to 8.7

## UNIT-V SEQUENCES AND SERIES OF FUNCTIONS

16 Hrs

Pointwise Convergence of Sequence of Functions – Uniform Convergence of Sequence of Functions – Consequence of Uniform Convergence – Convergence and Uniform Convergence of Series of Functions.

Chapter 9 :Sec 9.1 to 9.4

### Text Book

- Richard Goldberg.(2009). *Methods of Real Analysis*.Oxford & IBH Publishing Co. New Delhi.

### Reference Books

- Tom Apostol, M.(2004). *Mathematical Analysis*. Addison-Wesley publishing Company Inc.(2<sup>nd</sup> ed.,). New York.
- Malik, S.C. and SavitaArora. (2010). *Mathematical Analysis*.Wiley Eastern Limited. New Delhi.
- Sanjay Arora and Bansilal.(2000). *Introduction to Real Analysis*. Sathya Prakashan. New Delhi.

### E- Resources

- <https://nptel.ac.in/syllabus/111106053/>

## COMPLEX ANALYSIS

UMAM602

Semester : VI

Category : Core XIV

Class & Major: III B.Sc Mathematics

Credit : 6

Hours/Week: 6

Total Hours :65

### Objectives:

#### To enable the students

- Understand imaginary value and concept winding around imaginary numbers.
- Apply the methods to solve problems in pure as well as in applied mathematics.

### Learning Outcomes:

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

- Define the concepts of derivation of analytic functions.
- Define the concept of sequences and series of the complex functions.
- Express concepts of convergence sequences and series of the complex functions.
- Express concepts of Residue theorem.

## UNIT-I FUNCTIONS

13 Hrs

Function of a complex Variable – Mappings – Limits - Theorems on Limits - Limits involving the Point at Infinity - Continuity – Derivatives - Differentiation Formulas – Cauchy-Riemann Equations – Sufficient Conditions for Differentiability – Polar Coordinates – Analytic Functions - Harmonic Functions.

Chapter 2: Sec:9-20, 22

## **UNIT-II LINEAR TRANSFORMATIONS** **13 Hrs**

Linear Transformations – The Transformation  $w=1/z$  – Linear Fractional Transformations – An Implicit Form - Mappings of the upper Half Plane – Exponential and Logarithmic Transformations – The Transformation  $w=\sin z$  – Preservation of Angles – Further Properties.

**Chapter 8:** Sec 68-74

**Chapter 9:** Sec 79, 80

## **UNIT-III CONTOURS** **12 Hrs**

Contours – Contours Integrals – Examples - Cauchy–Goursat’s Theorem (without proof) - Simply and Multiply connected Domains (Theorems without proof) – Cauchy’s Integral Formula – Derivatives of Analytic Functions – Maximum Moduli of Functions.

**Chapter 4:** Sec 31-33,36,38-40,42

## **UNIT- IV RESIDUES & POLES** **14 Hrs**

Taylor’s Series – Examples - Laurent’s Series – Examples – Residues – Residue theorems – The Three Types of Isolate Singular Points – Residues at Poles – Zeros and poles of Order  $m$ .

**Chapter 5:** Sec 44-47 **Chapter 6:** Sec 53-56

## **UNIT-V IMPROPER INTEGRALS** **13 Hrs**

Evaluation of Improper Integrals – Improper Integrals Involving Sines and Cosines – Steady Temperatures – Steady Temperatures in a Half Plane – A Related Problem – Temperatures in a Quadrant – Electrostatic Potential – potential in a Cylindrical Shape.

**Chapter 7:** Sec 60,61 154

**Chapter 8:** Sec 84-89

### **Text Book**

- Churchill, R.V. and Brown, J.W. (1984). *Complex Variables and Applications*. Mc Gra Hill International Book Co., Singapore.  
Sections 8 to 20, 29 to 39, 41, 43 to 46, 54 to 60, 63 to 68, 70, 74.

### **Reference Books:**

- Durai pandian, P. and Laxmi Duraipandian.(1976). *Complex analysis*. Emerald Publishers. Chennai.
- Ponnusamy, S.(2000). *Foundations of Complex Analysis*. Narosa Publishing House. New Delhi.

# OPERATIONS RESEARCH

UMAM613

Semester : VI  
Category : Core XVI  
Class & Major: III B.Sc Mathematics

Credits : 6  
Hours/Week : 6  
Total Hours : 65

## Objectives:

### To enable the students

- Gain the knowledge of optimization techniques
- Analyze the systems of queuing and networking
- Solve real life problems in Business and Management.

## Learning Outcomes:

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

- Formulate and solve problems as networks and graphs.
- Develop linear programming (LP) models for shortest path, maximum flow, minimal spanning tree, critical path, minimum cost flow, and transshipment problems.
- Construct linear integer programming models and discuss the solution techniques.
- Propose the best strategy using decision making methods under uncertainty and game theory.

## UNIT-I LINEAR PROGRAMMING PROBLEM

15 Hrs

Linear Programming problem - Mathematical formulation of the problem - Graphical solution method – Some exceptional cases- Simplex method problem- Simplex Algorithm. Artificial Variable techniques - Big - M method, two phase method.

**Chapter 2 :**Section 2.1-2.4

**Chapter 3:**Section 3.1- 3.4

**Chapter 4:** Section 4.1, 4.3, 4.4

## UNIT-II TRANSPORTATION AND ASSIGNMENT PROBLEMS

13 Hrs

Transportation problem - The Transportation Algorithm - Degeneracy in Transportation problem-Unbalanced Transportation problem.The Assignment problem - The Assignment algorithm, Simple problems.

**Chapter 10:** Section 10.1-10.3, 10.5, 10.6, 10.8-10.10, 10.12-10.13

**Chapter 11:** Section 11.1 -11.4

## UNIT-III SEQUENCING PROBLEM AND GAME THEORY

13 Hrs

Sequencing problem - n jobs through 2 machines, n jobs through k machines - Two jobs through k machines, Simple problems. Game Theory - Two persons Zero sum game - The maximinminimax principle - Saddle points - Games without saddle points - Mixed Strategies - Graphical solution of 2 x n and m x 2 games - Dominance property.

**Chapter 12:** Section 12.1-12.6

**Chapter 17:** Section 17.1-17.7



#### UNIT-IV QUEUING THEORY

14 Hrs

Queuing Theory- Queuing system- Elements of Queuing system-Operating Characteristic of a queuing system- Deterministic Queuing system-Probability distributions in Queuing systems-Classification of queuing models- Definition of Transient and steady state-Poisson Queuing systems (upto Model –VI)

**Chapter 21:** section 21.1-21.9

#### UNIT-V PERT AND CPM

10 Hrs

Introduction-Basic components-Logical Sequencing Rules of Network construction-Concurrent Activities-Critical Path analysis –Probability consideration in PERT.

**Chapter 25:** Section 25.1-25.7

#### Text Book

- Kanti Swaroop, Gupta, P.K. and Manmohan. (2010). *Problems in Operation Research*. Sultan Chand & Sons. Delhi.

#### Reference Books

- Sharma, J.K. (2001). *Operations Research Theory and Applications*. Macmillan. Delhi.
- Ravindran, A. Philips, D.T. and Solberg, J.J. (1987). *Operation Research*. John Wiley & Sons. New York.
- Taha, H.A. (2003). *Operations Research*. Macmillan publishing Company. New York.

### MATHEMATICS FOR CONSTRUCTION

UMAO606

**Semester : VI**

**Credits : 4**

**Category : Major Optional**

**Hours/Week: 5**

**Class & Major: III B.Sc Mathematics**

**Total Hours :65**

#### Objectives:

##### To enable the students

- Understand Concept of transposition and evaluation of formulae of construction
- Apply principles of area and volume for calculating concrete mix, flooring, painting
- Design setting-outs for a simple building site

#### Learning Outcomes:

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

- Produce creative works that demonstrate innovation in concepts.
- Describe, analyze and interpret the problem.
- Create original objects of art in a specific medium.
- Select appropriate media relative to concepts and forms of art.

#### UNIT - I CONVERSION AND EVALUATION OF FORMULAE

12 Hrs

Introduction - Length – Conversion factors – Use of the graphical method – Mass-Area volume and capacity – Temperature – Transpositions of formulae – Evaluation of formulae.

**Chapter 9:** Section 9.1-9.5.

**Chapter 6:** Section 6.1-6.2.

## **UNIT - II AREAS AND VOLUMES OF STRUCTURES**

**14 Hrs**

Introduction – Area of triangles-Area of quadrilaterals – Area of circles – Application of area to practical problems- Cavity walls- Volumes introduction- Volume of Prism, Cylinders, Pyramids and Cones- Mass, Volume and Density- concrete mix and its constituents.

**Chapter 11:** Section 11.1-11.5.

**Chapter 12:** Section 12.1-12.4.

## **UNIT – III SPECIAL STRUCTURES AND MATERIALS**

**15 Hrs**

Introduction - Surface area of a pyramid - Frustum of a pyramid - Surface area of a cone - Frustum of a cone- Costing materials Introduction - Foundations - Cavity walls - Flooring – Painting.

**Chapter 17:** Section 17.1-17.3.

**Chapter 15:** Section 15.1-15.5

## **UNIT - IV ELEVATION AND DEPRESSION**

**12 Hrs**

Introduction - The Trigonometrical ratios - Trigonometric ratios for  $30^\circ$ ,  $45^\circ$ ,  $60^\circ$  - Angles of elevation and Depression - Stairs - Roofs - Excavations and Embankments.

**Chapter 13:** Section 13.1-13.7.

## **UNIT - V SETTING OUT**

**12 Hrs**

Introduction - Setting out a simple building site - Bay windows and curved brickwork - Checking a building for square corners - Circular arches - Elliptical arches.

**Chapter 14:** Section 14.1-14.6.

### **Text Book**

- Surinder Singh Viridi, and Roy Baker,T. (2007).*Construction Mathematics*. Elsevier Publications.

### **Reference Books**

- Lal, D. (2012). *Construction Managements and PWD accounts*. Kataria and sons publishers.(2<sup>nd</sup> ed.,). New Delhi.
- Alfred Webster, and Kathryn bright. (2010). *Mathematics for the carpentering and the construction trade*. Pearson education trust. (2<sup>nd</sup> ed.,).

# MATHEMATICS IN SPACE SCIENCE

UMAO607

Semester : VI  
Category : Major Elective  
Class & Major: III B.Sc Mathematics

Credit : 4  
Hours/Week : 5  
Total Hours : 65

## Objectives:

### To enable the students

- The process of star and planet formation.
- Introduce the exciting world of astronomy to the students.
- Familiarize the students with the moon and stellar Universe.

## Learning Outcomes:

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

- Demonstrate an understanding of our present picture of the cosmos on a large scale.
- Detail the main features and formation theories of the various types of observed Galaxies, in particular the Milky Way.
- Demonstrate an understanding of our present picture of the cosmos on a large scale.
- Demonstrate observations of the universe and to understand some phenomenon of our world.

## UNIT-I CELESTIAL SPHERE

13 Hrs

Celestial sphere – Diurnal motion. Chap 2.

## UNIT-II ZONES OF EARTH

13 Hrs

Zones of Earth – Dip of the Horizon – Twilight – Astronomical refraction – Tangent and Cassinies formulae – Properties and simple problems. Chap 3

## UNIT-III KEPLER`S LAW

13 Hrs

Kepler`s law (statement only) – Newton`s deduction from them – Three Anamalies of the earth and relations between them – Times – Equation of time, Season. Chap 6, 7

## UNIT-IV ABERRATIONS

13 Hrs

Conversion of time – Years and Calendar – Heliocentric Parallax – Geometric Parallax – Annual Parallax – Aberration of light – Simple problems in the above. Chap 7.

## UNIT-VECLIPSES

13 Hrs

Moon (omitting moon liberations), Phases of moon- Harvest moon – Metonic cycle - Lunar mountain - Earth shine - Tides – Eclipses. Chap 12

## Text Book:

- Kumaravelu,S. and SusheelaKumarvelu. (2005). *Astronomy for Degree Classes*. Rainbow Printers. Nagarcoil.

## Reference Books:

- Kartunen,H. (2013). *Fundamental Astronomy*. Content Technologies Publications.
- Prophet Mohammed, (2013). *Astronomy Supplementary Guide*. Core Knowledge Foundation.

**E-Resources:**

- <http://www.astronomy.com/>
- <http://www.theastronomer.org/>

**III & IV EVALUATION COMPONENTS OF CIA**

Semester	Category	Course Code	Course Title	Component – III	Component - IV
V	III	UMAM507	Modern Algebra	Seminar	Assignment
V	III	UMAM512	Real Analysis I	Assignment	Seminar
V	III	UMAM506	Number Theory	Assignment	Seminar
V	III	UMAM510	Numerical Methods	Problem solving	Seminar
VI	III	UMAM614	Linear Algebra	Problem solving	Seminar
VI	III	UMAM615	Real Analysis II	Assignment	Seminar
VI	III	UMAM602	Complex Analysis	Assignment	Seminar
VI	III	UMAM613	Operations Research	Problem solving	Poster Presentation
VI	III	UMAO606	Mathematics for construction craft	Problem solving	Poster Presentation
VI	III	UMAO607	Mathematics in Space Science	Assignment	Poster Presentation

**PROGRAMME PROFILE M.Phil Mathematics**

Semester	Category	Course Code	Course Title	Contact Hrs/week	Credit
I	CORE	MMAM103	Algebra and Analysis	6	5
	CORE	MMAM102	Topology and Differential Geometry	6	5
	CORE	MMAM105	Special Area Study	6	5
	ELECTIVE	MRPE101	Research and Publication Ethics	2	2
II	CORE	MMAD201	Dissertation & Viva-Voce	30	13
<b>TOTAL</b>					<b>30</b>
<b>Paper Presentation (Minimum one) and/ or Publication of articles in Journals (Minimum one) is mandatory for submission of Dissertation</b>					