Tamil Nadu Open University
Regulations and Overview for M.Sc., Mathematics (Semester) in ODL System

[w.e.f Academic Year 2020-2021]

Department of Mathematics

School of Science

Tamil Nadu Open University

Chennai- 600 015

MASTER OF SCIENCE IN MATHEMATICS
REGULATIONS

1. Progrmme Objectives

The recent developments in physical sciences, has been included in the enriched M.Sc., (Mathematics) Syllabus to meet out the present day needs of academic and Research, Institutions and Industries.

2. Programme Outcomes

PO1: Inculcate critical thinking to carry out scientific investigation objectively without being biased with preconceived notions.

PO2: Equip the student with skills to analyze problems, formulate a hypothesis, evaluate and validate results, and draw reasonable conclusions thereof.

PO3: Prepare students for pursuing research or careers in industry in mathematical sciences and allied fields

PO4: Imbibe effective scientific and/or technical communication in both oral and writing.

PO5: Continue to acquire relevant knowledge and skills appropriate to professional activities and demonstrate highest standards of ethical issues in mathematical sciences.

PO6: Create awareness to become an enlightened citizen with commitment to deliver one's responsibilities within the scope of bestowed rights and privileges.

3. Programme Specific Outcomes

PSO1: Understanding of the fundamental axioms in mathematics and capability of developing ideas based on them.

PSO2: Inculcate mathematical reasoning.

PSO3: Prepare and motivate students for research studies in mathematics and related fields.

PSO4: Provide knowledge of a wide range of mathematical techniques and application of mathematical methods/tools in other scientific and engineering domains.

PSO5: Provide advanced knowledge on topics in pure mathematics, empowering the students to pursue higher degrees at reputed academic institutions.

PSO6: Strong foundation on algebraic topology and representation theory which have strong links and application in theoretical Mathematics, in particular string theory.

PSO7: Good understanding of number theory which can be used in modern online cryptographic technologies.

PSO8: Nurture problem solving skills, thinking, creativity through assignments, project work.

PSO9: Assist students in preparing (personal guidance, books) for competitive exams e.g. NET, GATE, etc.

4. Programme Learning Outcomes

PLO 1: Knowledge: Apply knowledge and technical expertise gained in their field of specialization to provide mathematical ideas to modern real valued problems.

PLO 2: Research: Demonstrate Skills of critical thinking to analyze and apply research-based knowledge to collect, organize, and analyze data to order to address applied research problems.

PLO3: Communication Skills: Develop communicative skills to disseminate mathematical ideals to others.

PLO 4: Problem Solving Skills: Develop competence to apply knowledge skills to solve mathematical problems.

PLO 5: Science and Society: Evaluate different issues related to the society and propose solutions to promote the welfare of the society.

PLO 6: Life-Long Learning: Demonstrate preparedness for life long leaning by adapting to self-learning and online learning techniques .

PLO 7: Modern Tool Usage: Learn Modern techniques and tools to solve problems.

PLO 8: Project Management: To propose research projects based on fundamental

concepts in mathematics and develop writing skills .

PLO 9: Environment and Sustainability: Emerge as responsible citizens committed to the cause of nation building by serving the society and saving the environment.

5. Mapping

Course Code / Programme Learning Outcomes	MMSS - 11	MMSS - 12	MMSS - 13	MMSS-EL1	MMSS-EL2	MMSS - 21	MMSS - 22	MMSS - 23	MMSS-EL3	MMSS-EL4	MMSS - 31	MMSS - 32	MMSS - 33	MMSS - 34	MMSS-EL5	MMSS-41	MMSS-42	MMSS-43	MMSS-44	MMSS-EL6
Knowledge	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Research	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Communication skills	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Problem Solving skills	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Science and Society	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Life-Long Learning	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Modern Tool Usage	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Project Management	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Environment and Sustainability	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

6. Eligibility

A candidate who has passed the B.Sc., Degree Examination in Branch III Mathematics Main or / Any B.Sc., degree with specialization Applied Mathematics, Applied, B.E (Mechanical, Civil, EEE, ECE and CSE) or an examination of some other university accepted by the syndicate as equivalent thereto shall be permitted to appear and qualify for the M.Sc. Mathematics Degree Examination of this University after a course of two academic years. Admissions performed in both academic year and calendar year.

5. Duration of the Course and Medium:

The course for the degree of Master of Science (Mathematics) shall consist of Two academic years (Four Semester) and the medium of instruction is English only.

6. Course of Study

The course of study shall comprise instruction in the following subjects according to the syllabus

I YEAR	
I Semester	1. Major I 2. Major II 3. Major III 4. Elective-1 5. Elective-2
II Semester	6. Major IV 7. Major V 8. Major VI 9. Elective-3 10. Elective-4
II YEAR	
III Semester	11. Major VII 12. Major VIII 13. Major IX 14. Major X 15. Elective-5
IV Semester	16. Major XI 17. Major XII 18. Major XIII 19. Major XIV 20. Elective -6

7. Examinations:

The examination for the M.Sc. Degree shall consist of theory Papers only.

(i) Theory Examinations: The theory examination shall be of three hours duration to each paper and conducted at the end of each Semester. The candidates who failing in any subject(s) will be permitted to appear for each failed subject(s) in the subsequent examinations.

8. Scheme of Examinations:

Course	Course Code	Course Title	Evaluation			Credits
			CIA	TEE	Total	
I Year - Semester - I						
Core I	MMSS - 11	Abstract Algebra	30	70	100	4
Core II	MMSS - 12	Advanced Calculus	30	70	100	4
Core III	MMSS - 13	Real Analysis	30	70	100	4
Elective- 1	MMSSE 1	Differential Geometry	30	70	100	3
Elective -2	MMSSE 2	Programming in C++	30	70	100	3
I Year -Semester - I						
Core IV	MMSS - 21	Applied Mechanics	30	70	100	4
Core V	MMSS - 22	Complex Analysis	30	70	100	4
Core VI	MMSS - 23	Linear Algebra	30	70	100	4
Elective -3	MMSSE 3	Partial Differential Equations	30	70	100	3
Elective- 4	MMSSE 4	Mathematical Statistics	30	70	100	3
II Year - Semester – III						
Core VII	MMSS - 31	Topology	30	70	100	4
Core VIII	MMSS - 32	Functional Analysis	30	70	100	4
Core IX	MMSS - 33	Ordinary Differential Equations	30	70	100	4
Core X	MMSS - 34	Numerical Analysis	30	70	100	4
Elective -5	MMSSE 5	Graph Theory	30	70	100	3
II Year - Semester - IV						
Core XI	MMSS-41	Integral Transforms and Calculus of Variations	30	70	100	4
Core XII	MMSS - 42	Probability and Random Processes	30	70	100	4
Core XIII	MMSS - 43	Continuum Mechanics	30	70	100	4
Core XIV	MMSS - 44	Mathematical Methods	30	70	100	4
Elective 6	MMSSE 6	Optimization Techniques	30	70	100	3
		Total	**600**	**1400**	**2000**	**74**

9. Question Pattern:

Max. Marks: 70 Time: 3 hours

PART - A ($5 \times 5 = 25$ marks)

Answer any Five questions out of Eight Questions in 300 words

All questions carry equal marks

1. From Unit - I
2. From Unit - II
3. From Unit - III
4. From Unit - IV
5. From Unit - V
6. From any unit
7. From any unit
8. From any unit

PART - B ($3 \times 15 = 45$ marks)

Answer any Three questions out of Five Questions in 1000 words.

All questions carry equal marks.

9. From Unit - I
10. From Unit - II
11. From Unit - III
12. From Unit – IV
13. From Unit – V

12. Passing Minimum:

For theory examination: The candidate shall be declared to have passed the examination if the candidate secures not less than 32 marks in the Term End Examinations (TEE) of each theory paper and secures not less than 13 marks in the Continuous Internal Assessment(CIA)and overall aggregated marks is 50 in both the external and internal taken together.

Continuous Internal Assessment (CIA)		Term End Examination (TEE)		Overall Aggregated Marks	Maximum Marks
Minimum Pass Mark	Maximum Mark	Minimum Pass Mark	Maximum Mark	CIA + TEE	
13	30	32	70	50	100

13. Classification of Successful Candidates:

Candidates who pass all the courses prescribed and who secure 60% and above in the aggregate of marks in Core courses will be placed in the First Class. Those securing 50% and above but below 60% in the aggregated will be placed in the Second Class. All other successful candidates will be placed in the Third Class.

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M.Sc., Mathematics - Syllabus – I year – I Semester (Distance Mode)

COURSE TITLE : ABSTRACT ALGEBRA

COURSE CODE : MMSS 11

COURSE CREDIT : 4

COURSE OBJECTIVES

While studying the **ABSTRACT ALGEBRA**, the Learner shall be able to:

CO 1: Discuss the class equation and Cauchy's theorem

CO 2: Study about the relationship between a finite ablelian group and its sylow subgroups

CO 3: Represent content of the polynomial and greatest common divisor

CO 4: Discuss the fundamental theorem of Galois theory.

CO 5: Describe the solvable groups and commutator subgroups

COURSE LEARNING OUTCOMES

After completion of the **ABSTRACT ALGEBRA**, the Learner will be able to:

CLO 1: To enrich the knowledge to find the number of Sylow subgroups.

CLO 2: Describe the non isomorphic abelian groups and able to find the number of such non isomorphic abelian groups.

CLO 3: Enable to find the roots of a polynomial and splitting field, Galois group of the given polynomial

CLO 4: Demonstrate an understanding about Galois group of the given polynomial

CLO 5: Demonstrate an understanding to check whether the given polynomial is solvable by radicals or not

BLOCK I: SYLOW'S THEOREM

Another Counting Principle – 1st, 2nd and 3rd parts of Sylow's Theorems – double coset – the normalizer of a group.

BLOCK II : FINITE ABELIAN GROUPS

External and Internal direct Products – structure theorem for finite abelian groups – non iso-morphic abelian groups - polynomial rings.

BLOCK III : SPLITTING FIELD

Polynomials over rational fields – the Eisenstein criterion - extension fields – roots of polynomials – splitting fields.

BLOCK IV : GALOIS THEORY

More about roots – simple extension – separable extension – fixed fields – symmetric rational functions – normal extension - Galois group – fundamental theorem of Galois theory.

BLOCK V : SOLVABILITY BY RADICALS

Solvable group – the commutator subgroup – Solvability by radicals - finite fields- Wedderburn Theorem.

REFERENCE BOOKS :

1.I.N. Herstein, Topics in Algebra, 2nd Edition, John Wiley and Sons, New York, 1975.

UNIT	Chapter(s)	Sections
I	2	2.11 & 2.12
II	2 & 3	2.13, 2.14, 3.9
III	3 & 5	3.10, 5.1, 5.3
IV	5	5.5 & 5.6
V	5 & 7	5.7, 7.1

2. S. Lang, "*Algebra*", 3rd Edition, Addison-Wesley, Mass, 1993.

3. John B. Fraleigh, "*A First Course in Abstract Algebra*", Addison Wesley, Mass, 1982.

4. M. Artin, "*Algebra*", Prentice-Hall of India, New Delhi, 1991.

5. V. K. Khanna and S.K. Bhambri, "*A Course in Abstract Algebra*", Vikas Publishing House Pvt Limited, 1993.

Web Resource:

https://www.youtube.com/watch?v=lJdsi1tSDDU

https://www.youtube.com/watch?v=_DKNh4nWxcI

https://www.youtube.com/watch?v=E_2TTbUpDqM

https://www.youtube.com/watch?v=_qzjOPERCX8

https://www.youtube.com/watch?v=7W4t1zDCFKo

https://www.youtube.com/watch?v=uB4kvZ7w-Wk

https://www.youtube.com/watch?v=OK6-FRGN-WQ

https://www.youtube.com/watch?v=5EarRJKDCBc

https://www.youtube.com/watch?v=nZG7Xl72hAQ

https://www.youtube.com/watch?v=Bo3Vw9ZotFE

https://www.youtube.com/watch?v=kV6xvRS3eKE

https://www.youtube.com/watch?v=IzB0P5WD4TA

https://www.youtube.com/watch?v=0XZFaA3Gqqk

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M.Sc., Mathematics - Syllabus – I year – I Semester (Distance Mode)

COURSE TITLE : ADVANCED CALCULUS

COURSE CODE : MMSS 12

COURSE CREDIT : 4

COURSE OBJECTIVES

While studying the **ADVANCED CALCULUS**, the Learner shall be able to:

CO 1: Discuss the relationship between continuous functions and differentiable functions.

CO 2: Review about the notion of Jacobian.

CO 3: Represent Taylor's expansion of given function.

CO 4: Predict the applications of line integrals.

CO 5: Describe surface integrals.

COURSE LEARNING OUTCOMES

After completion of the **ADVANCED CALCULUS**, the Learner will be able to:

CLO 1:Interpret and able to derive basic mean value theorem which is of fundamental importance in the theory of partial differentiation

CLO 2: Describe the concept of functional dependence of two functions.

CLO 3: Enable to determine extrema of functions of two and three variables

CLO 4: Demonstrate an understanding about the knowledge about Green's theorem which provides a formula connecting a line integral over its boundary with a double integral over a region.

CLO 5: Demonstrate an understanding to apply change of variable in evaluating multiple integrals.

BLOCKI: PARTIAL DIFFERENTIATION

Functions of several variables - Homogeneous functions - Total derivative - Higher order Derivatives, Equality of cross derivatives - Differentials - Directional Derivatives.

BLOCK II:IMPLICIT FUNCTIONS AND INVERSE FUNCTIONS

Implicit functions - Higher order derivatives - Jacobians - Dependent and independent variables - The inverse of a transformation - Inverse function theorem - Change ofvariables - Implicit function theorem - Functional dependence - Simultaneous equations.

BLOCK III: TAYLOR'S THEOREM AND APPLICATIONS

Taylor's theorem for functions of two variables - Maxima and Minima of functions of two and three variables - Lagrange Multipliers.

BLOCK IV:LINE AND SURFACE INTEGRALS

Definition of line integrals - Green's theorem - Applications - Surface integrals - Gauss theorem - Verification of Green's and Gauss theorems.

BLOCK V:TRANSFORMATION AND LINE INTEGRALS IN SPACE

Change of variables in multiple integrals - Definition of line integrals in space - Stoke'stheorem - Verification of Stoke's theorem.

REFERENCE BOOKS :

1. Widder D.V.,"Advanced Calculus", Prentice Hall of India, New Delhi, 12th Print, SecondEdition, 2002.

2. Kaplan W., "Advanced Calculus", Addison Wesley (Pearson Education, Inc.), Fifth Edition,2003.

3. Malik S.C., "Mathematical Analysis", New Age International Publishers, New Delhi, 1992.

4. Burkill J.C. and Burkill H., "A Second course in Mathematical Analysis", Cambridge University Press, New York, 2002.

5. Apostol T.M., "Mathematical Analysis", Second Edition, Narosa Publishing House, New Delhi,2013.

Web Resource:

https://www.youtube.com/watch?v=s7rd9YPJrNc

https://www.youtube.com/watch?v=n_XvNd37YHg

https://www.youtube.com/watch?v=WUbRYAikFRg

https://www.youtube.com/watch?v=3hl6OKRmC1Y

https://www.youtube.com/watch?v=B-lreG2iuG0

https://www.youtube.com/watch?v=NpR91wexqHA

https://www.youtube.com/watch?v=1c5mCr8QFRA

https://www.youtube.com/watch?v=RHAgDW707so

https://www.youtube.com/watch?v=UOG3mOhv5Xo

https://www.youtube.com/watch?v=vZGvgru4TwE

https://www.youtube.com/watch?v=1TCqZbcyJ-U

https://www.youtube.com/watch?v=ms4JjH0BANU

https://www.youtube.com/watch?v=7G89w1ecYD8

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M.Sc., Mathematics - Syllabus – I year – I Semester (Distance Mode)

COURSE TITLE : REAL ANALYSIS

COURSE CODE : MMSS 13

COURSE CREDIT : 4

COURSE OBJECTIVES

While studying the **REAL ANALYSIS**, the Learner shall be able to:

CO 1: Discuss the concepts of compactness and its properties.

CO2:Review about the concept of term by term differentiation for uniform convergence.

CO 3: Represent essential supremum of measurable functions.

CO 4: Discuss the derivation of Lebesgue's monotone convergence theorem.

CO 5: Describe the application of Radon-Nikodym theorem.

COURSE LEARNING OUTCOMES

After completion of the **REAL ANALYSIS**, the Learner will be able to:

CLO1: Interpret the difference between monotonically increasing and monotonically decreasing.

CLO2: Enable to distinguish between uniformly pointwise bounded sequence of functions and pointwise bounded sequence of functions.

CLO 3: Enable to explain the concept of measure space and its properties.

CLO 4: Demonstrate an understanding of the treatment of Integration in the sense of both Riemann and Lebesgue.

CLO5:Represent the methods of Decomposing signed measures which has applications in probability theory and Functional Analysis.

BLOCK I:CONTINUITY AND RIEMANN - STIELTJES INTEGRAL

Limit – Continuity - Connectedness and Compactness - Definition and existence of

the integral - Properties of the integral - Integration and Differentiation.

BLOCK II:SEQUENCES AND SERIES OF FUNCTIONS

Pointwise convergence - Uniform convergence - Uniform convergence and continuity -Uniform convergence and Integration, Uniform Convergence and differentiation. Equi – continuous families of functions, Weierstrass and Stone-Weierstrass theorem.

BLOCK III:MEASURE AND MEASURABLE SETS

Lebesgue Outer Measure - Measurable Sets - Regularity - Measurable Functions - Abstract Measure - Outer Measure - Extension of a Measure - Measure Spaces.

BLOCK IV:LEBESGUE INTEGRAL

Integrals of simple functions - Integrals of Non Negative Functions - Fatou's Lemma, Lebesgue monotone convergence Theorem - The General Integral - Riemann and Lebesgue Integrals - Integration with respect to a general measure - Lebesgue Dominated Convergence Theorem.

BLOCK V:LEBESGUE DECOMPOSITION

Signed measures and Hahn Decomposition - Radon-Nikodym Theorem and Lebesgue Decomposition Theorem - Riez Representation Theorem for L1 and Lp .

REFERENCE BOOKS :

1. Rudin, W., "Principles of Mathematical Analysis", Mc Graw-Hill, Third Edition, 1984.

2. G. de Barra, "Measure Theory and Integration", New Age International Pvt. Ltd, SecondEdition, 2013.

3. Avner Friedman, "Foundations of Modern Analysis", Hold Rinehart Winston, 1970.

4. Rana I. K., "An Introduction to Measure and Integration", Narosa Publishing House Pvt.Ltd., Second Edition, 2007.

5. Royden H. L., "Real Analysis", Prentice Hall of India Pvt. Ltd., Third Edition, 1995.

Web Resource:

https://www.youtube.com/watch?v=Pv48Z_k30hc

https://www.youtube.com/watch?v=h4XohuM2iK4

https://www.youtube.com/watch?v=GPo4RnXi5tI

https://www.youtube.com/watch?v=ASCWNjLdUds

https://www.youtube.com/watch?v=390jIE75aso

https://www.youtube.com/watch?v=vnYNKzbl3P4

https://www.youtube.com/watch?v=OmDWTmi-F0g

https://www.youtube.com/watch?v=Db9ccq4cNPU

https://www.youtube.com/watch?v=JOvne7aC5bU

https://www.youtube.com/watch?v=ID_hbquGmn4

https://www.youtube.com/watch?v=12kFDeN6xuI

https://www.youtube.com/watch?v=w3GrdEm2O6I

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M.Sc., Mathematics - Syllabus – I year – I Semester (Distance Mode)

COURSE TITLE : DIFFERENTIAL GEOMETRY

COURSE CODE : MMSSE 1

COURSE CREDIT : 3

COURSE OBJECTIVES

While studying the **DIFFERENTIAL GEOMETRY**, the Learner shall be able to:

CO 1: Find the spherical indicatrix of the tangent, principal normal and binormal.

CO 2: Represent the parametric curves in the theory of surfaces.

CO 3: Predict Special intrinsic curves which are related to straight line in Euclidean space.

CO 4: Review the concept of geometric interpretation of the second fundamental form.

CO 5: Describe the concept of compact surfaces

COURSE LEARNING OUTCOMES

After completion of the **DIFFERENTIAL GEOMETRY,** the Learner will be able to:

CLO 1: Empower the knowledge to calculate the curvature and torsion of any space curve interms of parameters.

CLO 2: Describe the relationship between the fundamental coefficients.

CLO 3: Enable to derive on a general surface, the necessary and sufficient condition for the parametric curve to be geodesic.

CLO 4: Evaluate the first and the second fundamental forms of surface.

CLO 5: Demonstrate an understanding tocalculate the Gaussian curvature, the mean curvature, the curvature lines, the asymptotic lines, the geodesics of a surface

BLOCKI : SPACE CURVES

Definition of a space curve – Arc length – Tangent – Normal and binormal – Curvature and torsion – Contact between curves and surfaces – Tangent surface – Involutes and evolutes – Intrinsic equations – Fundamental existence theorem for space curves – Helics.

BLOCKII: INTRINSIC PROPERTIES OF A SURFACE

Definition of a surface – Curves on a surface – Surface of revolution – Helicoids – Metric – Direction coefficients – Families of curves – Isometric correspondence – Intrinsic properties.

BLOCKIII: GEODESICS

Geodesics – Canonical geodesic equations – Normal property of geodesics – Existence theorems – Geodesic parallels – Geodesics curvature- Gauss-Bonnet Theorem – Gaussian curvature – Surface of constant curvature.

BLOCKIV: NON INTRINSIC PROPERTIES OF A SURFACE

The second fundamental form – Principal curvature – Lines of curvature – Developable - Developable associated with space curves and with curves on surface – Minimal surfaces – Ruled surfaces.

BLOCKV: DIFFERENTIAL GEOMETRY OF SURFACES

Compact surfaces whose points are umblics – Hilbert's lemma – Compact surface of constant curvature –Complete surface and their Characterization – Hilbert's Theorem – Conjugate points on geodesics.

REFERENCE BookS :

1. T.J. Willmore, "*An Introduction to Differential Geometry*", Oxford University press, (17th Impression), New Delhi, 2002. (Indian Print)

UNIT	Chapter(s)	Sections
I	I	1 – 9
II	II	1 – 9
III	II	10 – 18
IV	III	1 – 8
V	IV	1 – 8

2. D.T. Struik, "*Lectures on Classical Differential Geometry*", Addition –Wesley,

Mass, 1950.

3. S. Kobayashi and K. Nomizu, "*Foundations of Differential Geometry*", Interscience Publishers, 1963.

4. W. Klingenberg, "*A Course in Differential Geometry*", Graduate Texts in Mathematics,Springer – Verlag 1979.

5. C.E.Weatherburn, "*Differential Geometry of Three Dimensions*",University Press, Cambridge, 1930.

6. Polynomial, Newton Interpolation Polynomial,Divided differencetable, Interpolation with equidistance points, Spline interpolation

Web Resource:

https://www.youtube.com/watch?v=CNJbSDg0Kqs

https://www.youtube.com/watch?v=_wSCsMPa97Y

https://www.youtube.com/watch?v=BSoNw1IOFLs

https://www.youtube.com/watch?v=gVfAfuk6rLw

https://www.youtube.com/watch?v=Gm-In_0ApUw

https://www.youtube.com/watch?v=EkcUjqo4pEg

https://www.youtube.com/watch?v=YoBYpT3DCYM

https://www.youtube.com/watch?v=ssY_CZbGYS0

https://www.youtube.com/watch?v=UewzuzaPlxA

https://www.youtube.com/watch?v=gt_H7mjvr9k

https://www.youtube.com/watch?v=c7M7ohon3iU

https://www.youtube.com/watch?v=AaL6U1-wmi0

https://www.youtube.com/watch?v=tlACZllBsnQ

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M.Sc., Mathematics - Syllabus – I year – I Semester (Distance Mode)

COURSE TITLE : PROGRAMMING IN C++

COURSE CODE : MMSSE 2

COURSE CREDIT : 3

COURSE OBJECTIVES

While studying the **PROGRAMMING IN C++**, the Learner shall be able to:

CO 1: Develop programming skills in C++ and its object oriented concepts

CO 2: Review about the inline functions

CO 3: Represent arrays in C++

CO 4: Predict the uses of constructors and destructors.

CO 5: Describe the existing classes.

COURSE LEARNING OUTCOMES

After completion of the **PROGRAMMING IN C++**, the Learner will be able to:

CLO 1: Interpret the concept of control structures and able to write simple programs using class concepts.

CLO 2: Describe the uses of function overloading.

CLO 3: Enable to write moderate level programs using Object concept.

CLO 4:Demonstrate and understanding to apply operator overloading concept.

CLO 5:Enable to efficiently use the techniques, skills, and computational skills to solve real time numerical problems

BLOCK I: INTRODUCTION

Beginning with C++ & Tokens, Expressions and Control Structures, Applications of C++– A simple C++ Program–– An Example with Class– Structure of C++ Program–

Creating the Source File– Compiling and Linking–Introduction– Token and Keyword.

BLOCK II: Functions in C++ and classes

Introduction– the Main Function– Function Prototyping– Call by Reference–Return by Reference– Inline Function– Defaults Arguments– const Arguments– Function Overloading– Friend and Virtual Functions– C Structures Revisited– Specifying a Class– Defining Membership Functions– A C++ Program with Class– Making an Outside Function Inline– Nesting of Member Functions– Private Member Functions– Arrays with an Class

BLOCK III: Objects & Constructors

Introduction– – Memory Allocation for Objects– Static Data Member– Static Member Functions–Arrays of Objects– Objects as Function Arguments– Friendly Functions– Returning Objects– const Member Functions– Pointers of Members– Local Classes– Constructors–Parameterized Constructors– Multiple constructors in a class– Constructors with Default Arguments.

BLOCK IV: Destructors & Operator Overloading and Types Conversions

Introduction –– Dynamic Initialization of Objects– Copy Constructor– Dynamic Constructors–Constructing Two–Dimensional Arrays– const Objects –Destructors– Introduction– Defining Operator Overloading– Overloading Unary Operators– Overloading Binary Operators– Overloading Binary Operators Using Friends– Manipulation of Strings Using Operators– Rules For Overloading Operators– Type Conversions.

BLOCK V: Inheritance: Extending Classes and Pointers, Virtual Functions and Polymorphism

Introduction–Defining Derived Classes– Single Inheritance–Making a Private Member Inheritance–Making a Private Member Inheritable– Multilevel Inheritance– Multiple Inheritance–Hierarchical Inheritance–Hybrid Inheritance–Virtual Base Classes–Abstract Classes– Constructors in Derived Classes– Member Classes: Nesting of Classes–Introduction– Pointers to Objects–this Pointer–Pointers to Derived Classes–Virtual Functions– Pure Virtual Functions.

REFERENCE BOOKS:

1. E.Balagurusamy, Object Oriented Programming with C++, 4th Edition, The McGraw–Hill CompanyLtd, New Delhi, 2008.
2. V. Ravichandran, Programming with C++, Second Edition Tata McGraw – Hill, New Delhi, 2006.
3. H.Schildt,The complete Reference of C++, Tata–McGraw–Hill publishing Company Ltd. New Delhi, 2003.
4. S.B. Lipman and J.Lafer, C++ Primer, Addition Wesley, Mass., 1998.
5. Ashok N.Kamthane, Object Oriented Programming with ANSI and TURBO C++, Pearson Education(P) Ltd, 2003.
6. BjarmeStroustrup, The C++ Programming Language, AT & T Labs, Murray Hills, NewJersey, 1998.

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https://www.youtube.com/watch?v=aaSUdT52QlY

https://www.youtube.com/watch?v=yaevAzFSo-Q

https://www.youtube.com/watch?v=jAtJNR85azo

https://www.youtube.com/watch?v=aJyDLrdY_zg

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https://www.youtube.com/watch?v=h7c8pNyFUIg

https://www.youtube.com/watch?v=acEkaZvnjCg

https://www.youtube.com/watch?v=JU8DbwBvOWE

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Tamil Nadu Open University
Department of Mathematics
School of Science,
Chennai – 15

M.Sc., Mathematics - Syllabus – I year – IISemester (Distance Mode)

COURSE TITLE : APPLIED MECHANICS

COURSE CODE : MMSS 21

COURSE CREDIT : 4

COURSE OBJECTIVES

While studying the **APPLIED MECHANICS**, the Learner shall be able to:

Tostudythe fundamentals of wave mechanics.

CO 1: Discuss the kinetic energy of a rigid body with respect to a fixed point.

CO 2: Review about the principles of Angular momentum

CO 3: Represent analytical Method to describe the motion.

CO4: Predict the non-holonomic system with moving constraints through Lagrange'sequation.

CO 5: Describe Hamilton's principle of applied mechanics.

COURSE LEARNING OUTCOMES

After completion of the **APPLIED MECHANICS**, the Learner will be able to:

CLO 1: Enable to find the angular momentum of a rigid body.

CLO 2: Describe the general motion of a rigid body.

CLO 3: Enable to describe the steady precession of a spinning top.

CLO 4: Demonstrate an understanding of intermediate applied mechanics topics such as conservative system, ignorable coordinates, Lagrange's mechanics and Hamilton's mechanics

CLO 5: Evaluate the motion of macroscopic objects from projectiles to the pass of machinery as well as astronomical objects on the qualitative structure of phase space

BLOCK I:KINEMATICS

Kinematics of a particle and a rigid body - Moments and products of inertia - Kinetic energy -Angular momentum.

BLOCK II:METHODS OF DYNAMICS IN SPACE

Motion of a particle - Motion of a system - Motion of a rigid body.

BLOCK III:APPLICATIONS OF DYNAMICS IN SPACE

Motion of a rigid body with a fixed point under no forces - Spinning top - General motion of top.

BLOCK IV:EQUATIONS OF LAGRANGE AND HAMILTON

Lagrange's equation for a particle - Simple dynamical system - Hamilton's equations.

BLOCK V:HAMILTONIAN METHODS

Natural Motions - Space of events - Action - Hamilton's principle - Phase space - Liouville's theorem.

REFERENCE BOOKS :

1. Synge L. and Griffith B.A., "Principles of Mechanics", Tata McGraw Hill, 1984.

2. Rana N.C. and Joag P.S., "Classical Mechanics", Tata McGraw Hill, 1991.

3. Berger V.D. and Olsson M.G., "Classical Mechanics - a modern perspective", Tata McGraw Hill International,1995.

4. Bhatia V.B., "Classical Mechanics with introduction to non-linear oscillations and chaos",Narosa Publishing House, 1997.

5. Sankara Rao K. "Classical Mechanics", Prentice Hall of India Pvt. Ltd., New Delhi, 2005.

6. Greenwood D. T., "Principles of Dynamics", Prentice Hall of India Pvt. Ltd., New Delhi, 1988.

7. David Morin, "Introduction to Classical Mechanics with problems and solutions", Cambridge University Press, New Delhi, 2007.

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https://www.youtube.com/watch?v=gUPZy98njK0

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Tamil Nadu Open University

Department of Mathematics
School of Science,
Chennai – 15

M.Sc., Mathematics - Syllabus – I year- II Semester (Distance Mode)

COURSE TITLE : COMPLEX ANALYSIS

COURSE CODE : MMSS- 22

COURSE CREDIT : 4

COURSE OBJECTIVES

While studying the **COMPLEX ANALYSIS**, the Learner shall be able to:

CO 1: Review the singular points.

CO 2: Discuss the concept of multiple connected region.

CO 3: Represent Weierstrass theorem on entire functions.

CO 4: Identify the applications of Harnack Principle.

CO 5: Describe the concept of canonical basis.

COURSE LEARNING OUTCOMES

After completion of the **COMPLEX ANALYSIS**, the Learner will be able to:

CLO 1: Interpret the Cauchy's integral formula, identify them to solve a problem by using Cauchy's integral formula.

CLO 2: Describe the concept of mean value property and properties of harmonic functions.

CLO 3: Enable to extend the Riemann zeta function to the whole complex plane.

CLO 4:Demonstrate and identify that the unit disk can be mapped conformally onto any simply connected region in the plane, other than the plane itself.

CLO 5: Demonstrate and identify the Weierstrass function, then able to prove the differential equation satisfied by Weierstrass function.

BLOCK I: COMPLEX INTEGRATION

Fundamental Theorems: Cauchy's Theorem for a Rectangle- Cauchy's Theorem in a Disk. Cauchy's Integral Formula: The Index of a point with respect to a closed curve

– The Integral formula – Higher derivatives. Local Properties of analytical Functions:Removable Singularities-Taylors's Theorem – Zeros and poles – The local Mapping – The Maximum Principle.

BLOCK II: COMPLEX INTEGRATION

The Genral Form of Cauchy's Theorem: Chains and cycles- Simple Continuity - Homology - The General statement of Cauchy's Theorem - Proof of Cauchy's theorem - Locally exact differentials- Multilply connected regions - Residue theorem - The argument principle. Evaluation of Definite Integrals and Harmonic Functions: Evaluation of definite integrals - Definition of Harmonic function and basic properties - Mean value property - Poisson formula.

BLOCK III: SERIES AND PRODUCT DEVELOPMENTS

Partial Fractions and Entire Functions: Partial fractions - Infinite products – Canonical products – Gamma Function- Jensen's formula – Hadamard's Theorem

Riemann Theta Function and Normal Families: Product development – Extension of $\zeta(s)$ to the whole plane – The zeros of zeta function – Equicontinuity – Normality and compactness – Arzela's theorem – Families of analytic functions – The Classical Definition.

BLOCK IV: CONFORMAL MAPPINGS

Riemann mapping Theorem: Statement and Proof – Boundary Behaviour – Use of the Reflection Principle. Conformal mappings of polygons: Behaviour at an angle – Schwarz-Christoffel formula – Mapping on a rectangle. Harmonic Functions: Functions with mean value property – Harnack's principle.

BLOCK V: ELLIPTIC FUNCTIONS

Simply Periodic Functions : Representation by Exponentials-The Fourier Development - Functions of Finite Order. Doubly Periodic Functions:The Period Module-Unimodular Transformations - The Caninical Basis-General Properties of Elliptic Functions. Weierstrass Theory: The Weierstrass $\wp$-function – The functions $\zeta(s)$ and $\sigma(s)$ – The differential equation – The modular equation $\lambda(\tau)$ – The Conformal mapping by $\lambda(\tau)$.

REFERENCE BOOKS:

1. Lars F. Ahlfors, Complex Analysis, (3rd Edition) McGraw Hill Book Company, NewYork, 1979.

2.H.A. Presfly, Introduction to complex Analysis, Clarendon Press, oxford, 1990.

3.J.B. Corway, Functions of one complex variables, Springer - Verlag, International student Edition, Narosa Publishing Co.

4.E. Hille, Analytic function Thorey (2 vols.), Gonm& Co, 1959.

5.M.Heins, Complex function Theory, Academic Press, NewYork,1968.

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https://www.youtube.com/watch?v=awHcEvjMTSI

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https://www.youtube.com/watch?v=vFMs2IcqMxU

https://www.youtube.com/watch?v=Vmp4bWnvGJU

https://www.youtube.com/watch?v=4BldK5lKVjY

https://www.youtube.com/watch?v=4mpy3VxXRDc

https://www.youtube.com/watch?v=FMJUm6z_Nrg

https://www.youtube.com/watch?v=K3yMlbcxkP4

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Tamil Nadu Open University
Department of Mathematics
School of Science,
Chennai – 15

M.Sc., Mathematics - Syllabus – I year – II Semester (Distance Mode)

COURSE TITLE : LINEARALGEBRA

COURSE CODE : MMSS- 23

COURSE CREDIT : 4

COURSE OBJECTIVES

While studying the **LINEARALGEBRA**, the Learner shall be able to:

CO 1: Discuss the concept of null space and range of a linear transformation.

CO 2: Review the concept of a algebra over a field.

CO 3: Represent linear transformation on a vector space by matrices.

CO 4: Describe the concept of direct sum and interior direct sum.

CO 5:Review the concept of companion matrix.

COURSE LEARNING OUTCOMES

After completion of the **LINEARALGEBRA**, the Learner will be able to:

CLO 1: Interpret the idea of linear transformation, identify them to represent the linear transformation by matrices.

CLO 2: Describe the prime factorization of a polynomial and write each polynomial as the product of prime polynomials.

CLO 3: Enable to find the characteristic value and characteristic vectors of a linear transformation.

CLO 4: Interpret the idea of linear transformation; identify them to represent the ordered basis by triangular matrix.

CLO 5: Interpret the ideas of Jordan forms and rational forms of real matrices.

BLOCK I: LINEAR TRANSFORMATIONS

Linear transformations – Isomorphism of vector spaces – Representations of linear transformations by matrices – Linear functionals.

BLOCK II: ALGEBRA OF POLYNOMIALS

The algebra of polynomials –Polynomial ideals - The prime factorization of a polynomial - Determinant functions.

BLOCK III: DETERMINANTS

Permutations and the uniqueness of determinants – Classical adjoint of a (square) matrix – Inverse of an invertible matrix using determinants – Characteristic values – Annihilating polynomials.

BLOCK IV: DIAGONALIZATION

Invariant subspaces – Simultaneous triangulations – Simultaneous diagonalization – Direct-sum decompositions – Invariant direct sums – Primary decomposition theorem.

BLOCK V: THE RATIONAL AND JORDAN FORMS

Cyclic subspaces – Cyclic decompositions theorem (Statement only) – Generalized Cayley – Hamilton theorem - Rational forms – Jordan forms.

REFERENCE BOOKS :

1. Kenneth M Hoffman and Ray Kunze, Linear Algebra, 2nd Edition, Prentice-Hall of India Pvt. Ltd, New Delhi, 2013.

UNIT	Chapter(s)	Sections
I	3	3.1 – 3.5
II	4 & 5	4.1, 4.2, 4.4, 4.5 and 5.1, 5.2
III	5 & 6	5.3, 5.4 and 6.1 – 6.3
IV	6	6.4 – 6.8
V	7	7.1 – 7.3

2. M. Artin, "*Algebra*", Prentice Hall of India Pvt. Ltd., 2005.

3. S.H. Friedberg, A.J. Insel and L.E Spence, "*Linear Algebra*", 4th Edition, Pritice-Hall of India Pvt. Ltd., 2009.
4. I.N. Herstein, "*Topics in Algebra*", 2nd Edition, Wiley Eastern Ltd, New Delhi, 2013.
5. J.J. Rotman, "*Advanced Modern Algebra*", 2nd Edition, Graduate Studies in Mathematics, Vol. 114, AMS, Providence, Rhode Island, 2010.
6. G. Strang, "*Introduction to Linear Algebra*", 2ndEdition, Prentice Hall of India Pvt. Ltd,2013.

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https://www.youtube.com/watch?v=Yaijk7zegFg

https://www.youtube.com/watch?v=9pqhfDyzbhw

https://www.youtube.com/watch?v=ZvL9aDGNHqA

https://www.youtube.com/watch?v=NHTI0SOpEpU

https://www.youtube.com/watch?v=3ROzG6n4yMc

https://www.youtube.com/watch?v=7gWP96bL9jw

https://www.youtube.com/watch?v=Fg7_mv3izR0

https://www.youtube.com/watch?v=XF55ilf9ZpQ

https://www.youtube.com/watch?v=aRewVVUzJ2c

https://www.youtube.com/watch?v=r9smdgQcpC8

https://www.youtube.com/watch?v=sJV0QyHoRio

https://www.youtube.com/watch?v=GR4TTzq12Uk

https://www.youtube.com/watch?v=MWYifkq9hWs

https://www.youtube.com/watch?v=btLbluS_Qp4

Tamil Nadu Open University
Department of Mathematics
School of Science,
Chennai – 15

M.Sc., Mathematics - Syllabus – I year – II Semester (Distance Mode)

COURSE TITLE : PARTIAL DIFFERENTIAL EQUATIONS

COURSE CODE : MMSSE 3

COURSE CREDIT : 3

COURSE OBJECTIVES

While studying the **PARTIAL DIFFERENTIAL EQUATIONS**, the Learner shall be able to:

CO 1: Develop an understanding of formation of partial differential equations.

CO 2: Discuss the method of separation of variables to solving partial differential equations.

CO 3: Describe about to find the elementary solutions of Laplace equation.

CO 4: Represent the motion of the string is governed by one-dimensional wave equation.

CO 5: Solve the diffusion equation by using Integral transform technique.

COURSE LEARNING OUTCOMES

After completion of the **PARTIAL DIFFERENTIAL EQUATIONS**, the Learner will be able to:

CLO 1: Apply and analyse to describe real world system using Partial Differential Equations

CLO 2: Master the basic ideas and ability to solve the physical problems.

CLO 3: Analyze the theory of Green's function for Laplace equation.

CLO 4: Obtain the general solution for wave equation.

CLO 5: Obtain the basic knowledge of diffusion equation and find the solution of diffusion equation in cylindrical coordinates and spherical coordinates.

BLOCKI: PARTIAL DIFFERENTIAL EQUATIONS OF THE FIRST ORDER

Partial Differential Equations – Origins of First Order Differential Equations – Cauchy's

Problem for first order equations – Linear Equations of the first order – Nonlinear partial differential equations of the first order – Cauchy's method of characteristics – Compatible system of First order Equations – Solutions satisfying Given Condition, Jacobi's method

BLOCK II: PARTIAL DIFFERENTIAL EQUATIONS OF THE 2nd ORDER

The Origin of Second Order Equations – Linear partial Differential Equations with constant coefficients – Equations with variable coefficients – Separation of variables – The method of Integral Transforms – Non – linear equations of the second order.

BLOCK III: LAPLACE'S EQUATION

Elementary solutions of Laplace equation – Families of Equipotential Surfaces – Boundary value problems – Separation of variables – Surface Boundary Value Problems – Separation of Variables – Problems with Axial Symmetry – The Theory of Green's Function for Laplace Equation.

BLOCK IV: THE WAVE EQUATION

The Occurrence of the wave equation in Physics – Elementary Solutions of the One – dimensional Wave equations – Vibrating membrane, Application of the calculus of variations – Three dimensional problem – General solutions of the Wave equation.

BLOCK V: THE DIFFUSION EQUATION

Elementary Solutions of the Diffusion Equation – Separation of variables – The use of Integral Transforms – The use of Green's functions

REFERENCE BOOKS :

1. Ian Sneddon – Elements of Partial Differential Equations – McGrawHill International Book Company, New Delhi, 1983

2. M.D. Raisinghania Advanced Differential Equations S. Chand and Company Ltd., New Delhi, 2001

3. K. Sankara Rao, Introduction to Partial Differential Equations, Second edition –

Prentice – Hall of India, New Delhi 2006

4. J.N. Sharma & K. Singh Partial Differential Equations for Engineers & Scientists, Narosa Publishing House, 2001

5. R. Dennemeyer, Introduction to Partial Differential Equations and Boundary value Problems, McGraw Hill Book Company, New York, 1968.

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https://www.youtube.com/watch?v=2ZNuu-ZfjuA

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https://www.youtube.com/watch?v=dqLlKRk1G8c

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https://www.youtube.com/watch?v=eZ74Ob1dHKM

https://www.youtube.com/watch?v=EtGadk3_whU

https://www.youtube.com/watch?v=J0VG0kbBSIM

https://www.youtube.com/watch?v=qNmB1qNjZ0k

https://www.youtube.com/watch?v=gVnGx254yFE

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Tamil Nadu Open University
Department of Mathematics
School of Science,
Chennai – 15

M.Sc., Mathematics - Syllabus – I year – II Semester (Distance Mode)

COURSE TITLE : MATHEMATICAL STATISTICS

COURSE CODE : MMSSE 4

COURSE CREDIT : 3

COURSE OBJECTIVES

While studying the **MATHEMATICAL STATISTICS,** the Learner shall be able to:

CO 1: Demonstrate the concept of t distribution and F distribution.

CO 2: To impart knowledge about simple hypothesis, alternative hypothesis, Type I errors, Type II errors and critical regions.

CO 3: Explain the relationship between correlation analysis and regression analysis.

CO 4: To impart knowledge about to solve the problems in analysis of variance in one way and two way classifications, completely randomized design, randomized block design and Latin Square design.

CO 5: Summarize the partitioning the covariance matrix, sample mean vector and covariance matrix.

COURSE LEARNING OUTCOMES

After completion of the **MATHEMATICAL STATISTICS**, the Learner will be able to:

CLO 1: Familiarize with sampling distribution and to find estimators for the parameters

CLO 2: Analyze and compare the tests based on normal, t distribution, Chi-square distribution and F distribution for testing of mean, variance and population.

CLO 3: Demonstrate the problems in partial correlation, multiple correlation and multiple regression.

CLO 4: Explain the difference between Completely Randomized Design,

Randomized Block Design and Latin Square Design.

CLO 5: To impart the knowledge of the concept of multivariate normal distribution, multivariate normal density and its properties.

BLOCK I:SAMPLING DISTRIBUTIONS AND ESTIMATION THEORY

Sampling distributions - Characteristics of good estimators - Method of Moments - Maximum

Likelihood Estimation - Interval estimates for mean, variance and proportions.

BLOCK II:TESTING OF HYPOTHESIS

Type I and Type II errors - Tests based on Normal, t, □2 and F distributions for testing of mean, variance and proportions - Tests for Independence of attributes and Goodness of fit.

BLOCK III:CORRELATION AND REGRESSION

Method of Least Squares - Linear Regression - Normal Regression Analysis - Normal Correlation Analysis - Partial and Multiple Correlation - Multiple Linear Regression.

BLOCK IV:DESIGN OF EXPERIMENTS

Analysis of Variance - One-way and two-way Classifications - Completely Randomized Design - Randomized Block Design - Latin Square Design.

BLOCK V:MULTIVARIATE ANALYSIS

Mean Vector and Covariance Matrices - Partitioning of Covariance Matrices - Combination ofRandom Variables for Mean Vector and Covariance Matrix - Multivariate, Normal Density and its Properties - Principal Components: Population principal components - Principal components from standardized variables.

REFERENCE BOOKS :

1. Freund J.E.," Mathematical Statistics", Prentice Hall of India, Fifth Edition, 2001.

2. Johnson R.A. and Wichern D.W., "Applied Multivariate Statistical Analysis", PearsonEducation Asia, Sixth Edition, 2007.

3. Gupta S.C. and Kapoor V.K.," Fundamentals of Mathematical Statistics", Sultan Chand &Sons, Eleventh Edition, 2003.

4. Devore J.L. "Probability and Statistics for Engineers", Brooks/Cole (Cengage Learning),First India Reprint, 2008.

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https://www.youtube.com/watch?v=mgd4Sn9-FwI

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https://www.youtube.com/watch?v=Pf9X_2CzGBU

https://www.youtube.com/watch?v=P8hT5nDai6A

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https://www.youtube.com/watch?v=lPqKhLF4s-A

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https://www.youtube.com/watch?v=YgExEVji7xs

https://www.youtube.com/watch?v=eZjKQADScJU

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Tamil Nadu Open University
Department of Mathematics
School of Science,
Chennai – 15

M.Sc., Mathematics - Syllabus – II year – III Semester (Distance Mode)

COURSE TITLE : TOPOLOGY

COURSE CODE : MMSS 31

COURSE CREDIT : 4

COURSE OBJECTIVES

While studying the **TOPOLOGY,** the Learner shall be able to:

CO 1: Give an introduction about the basic notion of a topological space and basis for a topology.

CO 2: Familiarize the notion of closed set, closure of a set and limit point.

CO 3: Analysis and interpret the concept of connectedness and compactness of a subset of a topological space.

CO 4: Analysis and able to differentiate between first countability axiom and second countability axiom.

CO 5: Gaining the knowledge to prove Urysohn metrization theorem and Tychonoff theorem.

COURSE LEARNING OUTCOMES

After completion of the **TOPOLOGY**, the Learner will be able to:

CLO 1: Demonstrate an understanding of the concepts of metric spaces and topological spaces and their role in mathematics.

CLO 2: Gain the knowledge of structure of topological space by using continuous functions and homeomorphism.

CLO 3: Evaluate the characterization of compact subspaces of $\mathbb{R}^n$.

CLO4: Represent separation axiom and use them to prove the many properties.

CLO 5: Apply theoretical knowledge of topology to prove the Urysohn metrisation theorem and imbedding theorem.

BLOCKI: TOPOLOGICAL SPACES

Topological spaces - Basis for a topology - Product topology on finite Cartesian products – Subspace topology.

BLOCK II: CLOSED SETS AND CONTINUOUS FUNCTIONS

Closed sets and Limit points - Continuous functions - Homeomorphism - Metric Topology – Uniform limit theorem.

BLOCK III: CONNECTEDNESS AND COMPACTNESS

Connected spaces - Components - Path components - Compact spaces - Limit point compactness - Local compactness.

BLOCK IV: COUNTABILITY AND SEPARATION AXIOMS

Countability axioms - T1-spaces - Hausdorff spaces - Completely regular spaces - Normal spaces.

BLOCK V: URYSOHN LEMMA AND TYCHONOFF THEOREM

Urysohn lemma - Urysohn metrization theorem - Imbedding theorem - Tietze extension theorem - Tychonoff theorem.

REFERENCE BOOKS :

1. Munkres J.R., "Topology", Prentice-Hall of India, New Delhi, Second Edition, 2003.

2. Simmons G.F., "Introduction to Topology and Modern Analysis", International Student Edition,Tata McGraw Hill Kogakusha Ltd., 1983.

3. Murdeshwar M.G., "General Topology", Wiley Eastern, Second Edition, 1990.

4. Kelly J.L., "General Topology", Van Nostrand, 1955.

5. Dugundji J., "Topology", University Book Stall, New Delhi, 1990.

6. Joshi K. D., "Introduction to General Topology", New Age International, New Delhi, 2000.

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https://www.youtube.com/watch?v=lkz21KFaAfg

https://www.youtube.com/watch?v=AtSd_igSm30

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Tamil Nadu Open University
Department of Mathematics
School of Science,
Chennai – 15

M.Sc., Mathematics - Syllabus – II year – III Semester (Distance Mode)

COURSE TITLE : FUNCTIONAL ANALYSIS

COURSE CODE : MMSS- 32

COURSE CREDIT : 4

COURSE OBJECTIVES

While studying the **FUNCTIONAL ANALYSIS,** the Learner shall be able to:

CO 1: To highlight the relationship between algebraic structures and distance structures.

CO 2: Understand the fundamental results of normed linear spaces and able to prove the theorems.

CO 3: Recognize Hilbert space and its properties.

CO 4: To impart knowledge about adjoint operator on a Hilbert space.

CO 5: To introduce Operator theory and its application to finite dimensional Spectral Theory.

COURSE LEARNING OUTCOMES

After completion of the **FUNCTIONAL ANALYSIS**, the Learner will be able to:

CLO 1: To learn to recognize the fundamental properties of normed spaces and of the transformations between them.

CLO 2: Ability to prove open mapping theorem, closed graph theorem and uniform boundedness theorem.

CLO 3: Develop the ideas of orthogonal complement and prove Gram-Schmidt orthogonalization process.

CLO 4: Discuss the concept of projection, self-adjoint operators, normal and unitary operators.

CLO 5: Analysis and ability to prove the fixed point theorems.

BLOCK I: BANACH SPACES

Banach Spaces - Definition and Examples - Continuous linear transformations

BLOCK II: FUNDAMENTAL THEOREMS IN NORMED LINEAR SPACES

The Hahn-Banach theorem - The natural imbedding of N in N** - The open mapping theorem -Closed graph theorem - The conjugate of an operator - Uniform boundedness theorem.

BLOCK III: HILBERT SPACES

Hilbert Spaces - Definition and Properties - Schwarz inequality - Orthogonal complements -Orthonormal sets - Bessel's inequality - Gram–Schmidt orthogonalization process - The conjugate space H*- Riesz - Representation theorem.

BLOCK IV: OPERATOR ON A HILBERT SPACE

The adjoint of an operator - Self-adjoint operators - Normal and unitary operators - Projections.

BLOCK V: SPECTRAL AND FIXED POINT THEOREMS

Matrices - Determinants and the spectrum of an operator - Spectral theorem - Fixed point theorems and some applications to analysis.

REFERENCE BOOKS:

1. Simmons G.F., "Introduction to Topology and Modern Analysis", Tata Mc-Graw Hill Pvt.Ltd., New Delhi, 2011.

2. Kreyszig E.," Introductory Functional Analysis with Applications, John Wiley & Sons, New York, 2007.

3. Limaye B. V.," Functional Analysis", New Age International Ltd., Publishers, Second Edition, New Delhi,1996.

4. Coffman C. and Pedrick G., "First Course in Functional Analysis", Prentice-Hall of India, New Delhi, 1995.

5. Conway J.B., "A Course in Functional Analysis", Springer-Verlag, New York, 2008.

6. Bollobas B., "Linear Analysis", Cambridge University Press, Indian Edition, New York, 1999.

7.. Nair M.T., "Functional Analysis, A First course", Prentice Hall of India, New Delhi, 2010

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Tamil Nadu Open University
Department of Mathematics
School of Science,
Chennai – 15

M.Sc., Mathematics - Syllabus – II year – III Semester(Distance Mode)

COURSE TITLE : ORDINARY DIFFERENTIAL EQUATIONS

COURSE CODE : MMSS-33

COURSE CREDIT : 4

COURSE OBJECTIVES

While studying the **ORDINARY DIFFERENTIAL EQUATIONS,** the Learner shall be able to:

CO 1: have in-depth knowledge of mathematical techniques for solving higher order ordinary differential equations

CO 2: To solve non homogeneous equation of order *n*.

CO 3: Learn methods for solving variable coefficients and apply them to solve problem.

CO 4: To introduce mathematical techniques for solving higher order ordinary differential equations using special function

CO 5: Understand the method to solve first order equations and solve physical problems.

COURSE LEARNING OUTCOMES

After completion of the **ORDINARY DIFFERENTIAL EQUATIONS**, the Learner will be able to:

CLO 1: Analysis and able to classify ODE and understand linear dependence and linear independence of solutions.

CLO 2: Understand the conditions for the existence and uniqueness of solutions for Initial and Boundary value problems

CLO 3: Develop skilled to solve the equations with variable coefficients.

CLO 4: solve the differential equations with regular singular points.

CLO 5: Recognize condition for convergence and Lipschitz condition for convergence of successive approximations.

BLOCKI:LINEAR EQUATIONS WITH CONSTANT COEFFICIENTS

Introduction - Second order homogenous equations - Initial value problem for second order equations - Linear dependence and independence - A formula for Wronskian

BLOCK II:LINEAR EQUATIONS WITH CONSTANT COEFFICIENTS(Cont'd.)

The Non- homogenous equations of order two-homogenous and Non - homogenous equations of order n - Initial value problems for n^{th} order equations- Annihilator method to solve non- Homogenous equation.

BLOCK III:LINEAR EQUATIONS WITH VARIABLE COEFFICIENTS

Initial value problem - Existence and uniqueness theorem - The Wronskian and linear independence - Reduction of the order of a homogenous equation - The non-Homogenous equation - Homogenous equations with analytic coefficients - The Legendre equations .

BLOCK IV: LINEAR EQUATIONS WITH REGULAR SINGULAR POINTS

The Euler equations - Second order equations with regular singular points - Exceptional cases - The Bessel equation – The Bessel equation contd.

BLOCK V: EXISTENCE AND UNIQUENESS OF SOLUTIONS TO FIRST ORDER EQUATIONS

Equations with variable separated - Exact equations - The method of successive approximation - The Lipschitz Condition - Convergence of the successive approximation - Non-local existence of solutions - Approximations to and uniqueness of solutions.

REFERENCE BOOKS :

1. Earl A. Coddington, An Introduction to Oridinary DifferentialEquations – Prentice – Hall of India Private Limited, New Delhi2008.

2. Williams E. Boyce and Richard C. Diprima Elementary Differential Equations and Boundary Value Problems, 10th edition John Wileyand Sons, New York 2012

3.M.D. Raisinghania, Advanced Differential Equations, S. Chand & CompanyLtd., New Delhi 2012

4.George F. Simmons, Differential Equations with Application And HistoricalNotes, Tata McGraw Hill, New Delhi 1974

5.B. Rai, D.P. Choudhury and H.I. Freedman, A Course in Ordinary Differential Equations, Narosa Publishing House Pvt. Ltd, New Delhi2012.

6. Ravi P. Agarwal and Ramesh C. Gupta, Essentials of Ordinary Differential Equations, McGraw Hill, New York, 1991.

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https://www.youtube.com/watch?v=HUN1E0899XE

https://www.youtube.com/watch?v=8uQUFLTGsCg

https://www.youtube.com/watch?v=ebzo_KzAJig

https://www.youtube.com/watch?v=tQLsT7xo2xU

https://www.youtube.com/watch?v=lxCCqj6cfq8

https://www.youtube.com/watch?v=_MKhnZ_n3PY

https://www.youtube.com/watch?v=w5VyOSNKDxQ

Tamil Nadu Open University
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M.Sc., Mathematics - Syllabus – II year – III Semester (Distance Mode)

COURSE TITLE : NUMERICAL ANALYSIS

COURSE CODE : MMSS- 33

COURSE CREDIT : 4

COURSE OBJECTIVES

While studying the **NUMERICAL ANALYSIS,** the Learner shall be able to:

CO 1: Use the concepts of Eigen value problems to solve real life problems.

CO 2: Interpret and apply the concepts of interpolation, to solve mathematical problems arising in various fields.

CO 3: Discuss the concept of least square approximation polynomial.

CO 4: Find the solution of ordinary differentia equation numerically.

CO 5: Solve the Numerical solution of partial differential equation.

COURSE LEARNING OUTCOMES

After completion of the **NUMERICAL ANALYSIS**, the Learner will be able to:

CLO 1: Evaluate errors while solving equations and effectively use methods like matrix inversion, Gauss elimination and Gauss Seidel Method to solve linear equations.

CLO 2: Apply knowledge of numerical differentiation and numerical techniques to solve applied mathematics problems.

CLO 3: Gaining the knowledge about approximation with Chebyshev polynomials, Piecewise Linear and Cubic Spline approximation.

CLO 4: Understand various computational techniques to solve ordinary differential equation.

CLO 5: Enriched the knowledge to solve the partial differential equations arising in Science and Engineering numerically.

BLOCKI: SYSTEMS OF LINEAR EQUATIONS AND ALGEBRAIC EIGENVALUE PROBLEMS

Direct Method: Gauss elimination method - Error Analysis - Iterative methods: Gauss-Jacobi and Gauss-Seidel - Convergence considerations - Eigenvalue Problem: Power method.

BLOCK II:INTERPOLATION, DIFFERENTIATION AND INTEGRATION

Interpolation: Lagrange's and Newton's interpolation - Errors in interpolation - Optimal points for interpolation - Numerical differentiation by finite differences - Numerical Integration: Trapezoidal, Simpson's and Gaussian quadratures - Error in quadratures.

BLOCK III: APPROXIMATION OF FUNCTIONS

Norms of functions - Best Approximations: Least squares polynomial approximation – Approximation with Chebyshev polynomials - Piecewise Linear & Cubic Spline approximation.

BLOCK IV:ORDINARY DIFFERENTIAL EQUATIONS

Single-Step methods: Euler's method - Taylor series method - Runge-Kutta method of fourth order - Multistep methods: Adams-Bashforth and Milne's methods – Stability considerations - Linear Two point BVPs: Finite Difference method.

BLOCK V:PARTIAL DIFFERENTIAL EQUATIONS

Elliptic equations: Five point finite difference formula in rectangular region - Truncation error; One dimensional - Parabolic equation: Explicit and Crank-Nicholson schemes; Stability of the above schemes - One-dimensional Hyperbolic equation: Explicit scheme.

REFERENCE BOOKS :

1. Atkinson K.E., "An Introduction to Numerical Analysis", Wiley, 1989.

2. Conte S.D. and Carl de Boor, "Elementary Numerical Analysis", Tata McGraw-Hill Publishing Company, Third Edition, 2005.

3. Kincaid D. and Chenney W., "Numerical Analysis: Mathematics of Scientific Computing", AMS, University Press, Hyderabad, Third Edition, 2009.

4. Isaacson E. and Keller, H.B., "Analysis of Numerical Methods" , Dover Publication, 1994.

5. Philips G.M and Taylor P.J., "Theory and Applications of Numerical Analysis", Elsevier, New Delhi, Second Edition, 2006.

6. Jain M.K., Iyengar S.R.K. and Jain R.K., "Numerical Methods for Scientific and Engineering", New Age International Pub. Co., Third Edition, 1993.

7. Iserles, A., "A first course in the Numerical Analysis of Differential Equations", Cambridge University press, New Delhi, 2010.

8. Brian Bradie., "A Friendly Introduction to Numerical Analysis", Pearson Education, New Delhi, First edition, 2007

9. C. E. Froberg., "Introduction to Numerical Analysis", Addison-Wesley Publishing Company, Second Edition, 1969.Web Resource:

https://www.youtube.com/watch?v=gxy6VI1hEfs

https://www.youtube.com/watch?v=OQ5mav3CDyo

https://www.youtube.com/watch?v=1v8eySzgKEU

https://www.youtube.com/watch?v=EG62xCOdLLA

https://www.youtube.com/watch?v=TPKyT3hu71c

https://www.youtube.com/watch?v=6pAc3wtrrKY

https://www.youtube.com/watch?v=fp6n7x55tkQ

https://www.youtube.com/watch?v=nmIwSQJmX2M

https://www.youtube.com/watch?v=iiUM1i77hbQ

https://www.youtube.com/watch?v=Lw_Obk39UzE

https://www.youtube.com/watch?v=Gd53_TdkmSU

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Tamil Nadu Open University
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M.Sc., Mathematics - Syllabus – II year – III Semester (Distance Mode)

COURSE TITLE : GRAPH THEORY

COURSE CODE : MMSSE 5

COURSE CREDIT : 3

COURSE OBJECTIVES

While studying the **GRAPH THEORY,** the Learner shall be able to:

CO 1: Develop an understanding the fundamental ideas and concepts of graph theory.

CO 2: Gaining the knowledge of 1-isomorphism and 2-isomorphism.

CO 3: Describe about the concept of digraphs, Euler digraphs and Hamiltonian digraphs.

CO 4: Describe the concept of edge and vertex colouring of a graph.

CO 5: Describing coloring and planarity in graphs.

COURSE LEARNING OUTCOMES

After completion of the **GRAPH THEORY**, the Learner will be able to:

CLO 1: Understand and explore the basic ideas of graph theory.

CLO 2: Familiarize the concept of connectivity and edge connectivity.

CLO 3: Develop an idea of matching in graphs and study some applications of matching in day to day life problems.

CLO 4: Emphasis an idea of coloring in graphs.

CLO 5: have learnt a clear idea of characterization of planar graphs.

BLOCKI: INTRODUCTION

An Introduction to graphs: Definitions and basic concepts – Graph Models – Vertex degrees – Isomorphism and Automorphism – Special class of graphs – The pigeonhole principles and Turan's theorem – Walk, Path and Connectedness – Distance, Radius, Diameter and Girth – Subgraphs and Isometric subgraphs –

Operations on Graphs The Adjacency, Incidence and Path matrices – Algorithms – Introduction to Algorithms – Breadth-first search Algorithm – Dijkstra's Algorithm – Ford's Algorithm.

Bipartite Graphs: Characterisations of bipartite graphs – Trees – cut edges and cut vertices – Spanning trees and isometric trees – Cayley's Formula – Binary trees – Algorithms – Spanning tree Algorithm – Kruskal's Algorithm – Prim's Algorithm.

BLOCKII: CONNECTIVITIY AND GRAPHICAL SEQUENCES

Connectivity: Connectivity and edge connectivity – 2-Connected graphs – Menger's Theorem – Separable graphs, 1-Isomorphism and 2-Isomorphism.

Graphic Sequences: Degree sequences – Graphic sequences – Wang and Kleitman's Theorem – Algorithms – Algorithm 1 – Algorithm 2.

BLOCK III: EULERIAN AND HAMILTONIAN GRAPHS

Charecterisations of Eulerian Graphs – Degree Sets – Randomly Eulerian Graphs – Application – Algorithm – Fleury's Algorithm – Further Readings – Enumeration – Hamiltonian Graphs – Hamilton Cycle in Power Graphs and Line Graphs – Hamiltonian Sequences – Application – Algorithms – Two Optimal Algorithm – The Closest Insertion Algorithm – Albertson's Algorithm – Related Parameters.

Matchings: Matching – System of Distinct Representatives and Marriage Problem – Covering – 1-Factor – Stable Matchings – Application – Algorithm – The Hungaria Algorithm – Algorithm for Maximum Matching.

BLOCK IV: INDEPENDENCE

Independent Sets – Edge colourings – Application – Vizing's Theorem – Vertex Colouring – Uniquely Colourable Graphs – Brook's Bound and Improvements – Hajos Conjecture – Mycielski's Construction – Line-distinguishing Colourings – Chromatic Polynomials – Algorithm – Sequential Colouring Algorithm.

BLOCK V: PLANAR GRAPHS

Planar Embedding – Euler's Formula – Maximum Planar Graphs – Geometric dual – Characterisations of Planar Graphs – Algorithm – DMP Planarity Algorithm – Colouring in Planar Graphs – Face Colouring.

Reference Books

1. M.Murugan, Graph Theory and Algorithms, Muthali Publishing House, Annanagar, Chennai, 2003.
2. J.A. Bondy and U.S.R. Murthy, Graph Theory with applications, Macmillan Co., London, 1976.
3. D.B.West, Introduction to graph theory, Prentice Hall of India, 2001.
4. J. Clark and D.A. Holton, A First look at Graph Theory, Allied Publishers, New Delhi, 1995.

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https://www.youtube.com/watch?v=TbzANA0ErDo

https://www.youtube.com/watch?v=1dTaxTwA2so

https://www.youtube.com/watch?v=u1BiIP0zw-c

https://www.youtube.com/watch?v=F4BM6fnLl04

https://www.youtube.com/watch?v=xot2HAa-aME

https://www.youtube.com/watch?v=1IZPpBfJOUc

https://www.youtube.com/watch?v=OZWZpQmGp0g

https://www.youtube.com/watch?v=QsmYbu1hAkk

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https://www.youtube.com/watch?v=sC7XFUArWVs

https://www.youtube.com/watch?v=IBqFYkmmlRI

Tamil Nadu Open University

Department of Mathematics
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Chennai – 15

M.Sc., Mathematics - Syllabus – II year – IV Semester (Distance Mode)

COURSE TITLE	**:**	**INTEGRAL TRANSFORMS AND CALCULUS OF VARIATIONS**
COURSE CODE	**:**	**MMSS- 41**
COURSE CREDIT	**:**	**4**

COURSE OBJECTIVES

While studying the **INTEGRAL TRANSFORMS AND CALCULUS OF VARIATIONS,** the Learner shall be able to:

CO 1: Understand the concept of Laplace transforms and its properties, find Laplace transforms of simple functions.

CO 2: Discuss Fourier sine and Fourier cosine transforms

CO 3: Analysis and apply Laplace transform technique to evaluate certain integrals.

CO 4: Give the basic knowledge of Variation of a functional and its properties.

CO 5: Develop the knowledge about Variation problems with a movable boundary for functionals dependent on one and two functions.

COURSE LEARNING OUTCOMES

After completion of the **INTEGRALTRANSFORMS AND CALCULUS OF VARIATIONS**, the Learner will be able to:

CLO 1: Find the Laplace transform using Bessel function.

CLO 2: Develop the knowledge to find Fourier Transforms and its inverse transforms of simple functions.

CLO 3: Learn about the concept of Fourier transforms and solve heat and wave equations.

CLO 4: Enriched the knowledge about Variational Problems in Parametric form.

CLO5: Develop the mathematical methods of applied mathematics and mathematical physics with an emphasis on calculus of variation and integral transforms.

BLOCKI: LAPLACE TRANSFORMS

Transforms of elementary functions - Unit step and Dirac delta functions - Properties – Differentiation and integration of transforms - Periodic functions - Initial & final value theorems - Inverse Laplace transforms - Convolution theorem - Error function - Transforms involving Bessel functions.

BLOCK II: FOURIER TRANSFORMS

Fourier integral representation - Fourier transform pairs - Properties - Fourier sine and cosine transforms - Transforms and inverse transforms of elementary functions - Convolution theorem - Transforms of derivatives.

BLOCKIII: APPLICATIONS OF TRANSFORMS

Application of Laplace Transforms - Evaluation of integrals - Solution of Linear ODE - Applications of Fourier Transforms – wave equation -Heat equation on infinite and semi-infinite line – Potential problems in half-plane.

BLOCK IV:VARIATIONAL PROBLEMS

Variation of a functional and its properties - Euler's equations - Functionals with several arguments - Higher order derivatives - Functionals dependent on functions of several independent variables - Variational Problems in Parametric form.

BLOCK V:MOVING BOUNDARIES AND DIRECT METHODS IN VARIATIONAL PROBLEMS

Variation problems with a movable boundary for functionals dependent on one and two functions - One-sided variations - Constraints - Isoperimetric Problems - Direct Methods in Variational Problems - Rayleigh-Ritz method and Kantorovich method.

REFERENCE BOOKS :

1. Andrews, L.C. and Shivamoggi, B.K., "Integral Transforms for Engineers", Prentice Hall of India Pvt. Ltd., New Delhi, 2003.

2. Gupta, A.S., "Calculus of Variations with Applications", Prentice Hall of India

Pvt. Ltd., New Delhi, 1997.

3. Sneddon, I.N., “The use of integral Transforms”, Tata Mc-Graw Hill, 1974.

4. Elsgolts,L., “Differential equations and the Calculus of Variations”, MIR Publishers, 1980.

5. Churchill, R.V, " Operational Mathematics", Mc Graw Hill Company, 3rd Edition,1972, U.S.

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https://www.youtube.com/watch?v=oCVHryFWTRw

https://www.youtube.com/watch?v=7haZCrQDHpA

https://www.youtube.com/watch?v=EaPyCNUbu40

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https://www.youtube.com/watch?v=rmziD7nZ2Jg

https://www.youtube.com/watch?v=c6eLdFxIj74

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Tamil Nadu Open University
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M.Sc., Mathematics - Syllabus – II year – IV Semester (Distance Mode)

COURSE TITLE : PROBABILITY AND RANDOM PROCESSES

COURSE CODE : MMSS- 42

COURSE CREDIT : 4

COURSE OBJECTIVES

While studying the **PROBABILITY AND RANDOM PROCESSES,** the Learner shall be able to:

CO 1: To impart the knowledge of fundamental concepts in Probability to solve applied problems.

CO 2: Develop the knowledge to understand the concept of transformation of random variables and their distributions.

CO 3: Discuss about weak law of large number and strong law of large numbers..

CO 4: To impart extended knowledge about Stochastic processes and Markov chain.

CO5: To impart extended knowledge about Poisson processes and pure birth process.

COURSE LEARNING OUTCOMES

After completion of the **PROBABILITY AND RANDOM PROCESSES**, the Learner will be able to:

CLO 1: Analysis and apply the concepts of probability, momentum generating and characteristics to solve the problems.

CLO 2: Analysis the concept of correlation and regression, solve the real life problem.

CLO 3: Understand the concept of central limit theorem.

CLO 4: Explain about the higher transition probability and the Markov chain.

CLO 5: Derive differential equations for time continuous Markov processes with a discrete state space.

BLOCK I: PROBABILITY AND RANDOM VARIABLES

Probability Concepts - Random variables - Bernoulli, Binomial, Geometric, Poisson, Uniform,Exponential, Erlang, Weibull and Normal distributions - Functions of a Random variable - Moments, Moment generating function.

BLOCK II:TWO DIMENSIONAL RANDOM VARIABLES

Joint distributions - Transformation of random variables and their distributions – Conditional expectation - Computing probabilities and expectations by conditioning - Correlation and Regression.

BLOCK III : LIMIT THEOREMS

Modes of convergence - Markov, Chebyshev's and Jensen's inequalities - Weak law of large numbers - Strong law of large numbers - Central limit theorem (i.i.d case).

BLOCK IV:MARKOV CHAINS

Stochastic processes - Classification - Markov chain - Chapman Kolmogorov equations – Transition probability Matrix - Classification of states - First passage times – Stationary distribution - Mean time spent in a transient state.

BLOCK V:MARKOV PROCESSES

Markov process - Poisson process - Pure birth process - Pure death process - Birth and death process - Limiting probabilities - Non-homogeneous Poisson process - Compound Poisson process.

REFERENCE BOOKS :

1. Ross S.M., "Introduction to Probability Models", Academic Press Inc., Ninth Edition, 2007.

2. Rohatgi V.K. and A.K. Md. Ehsanes Saleh," An introduction to Probability and Statistics",John Wiley & Sons, Inc., Second Edition, 2001.

3. Karlin S and H.M.Taylor, "A First Course in Stochastic Processes", Academic Press,Second Edition,1975, (An imprint of Elsevier).

4.Medhi J, "Stochastic Processes", New Age International (P) Ltd., New Delhi, SecondEdition, 2001.

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https://www.youtube.com/watch?v=TptjhklRnqM

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Tamil Nadu Open University
Department of Mathematics
School of Science,
Chennai – 15

M.Sc., Mathematics - Syllabus – II year – IV Semester (Distance Mode)

COURSE TITLE : CONTINUUM MECHANICS

COURSE CODE : MMSS- 43

COURSE CREDIT : 4

COURSE OBJECTIVES

While studying the **CONTINUUM MECHANICS,** the Learner shall be able to:

CO 1: Develop an understanding of tensors.

CO 2: Discuss the concept of principal strain and rate of deformation.

CO 3: Discuss the concept of stress vector and tensor.

CO 4: Familiarize with the concept of isotropic solid.

CO 5: Develop an idea about the properties of Newtonian fluids.

COURSE LEARNING OUTCOMES

After completion of the **CONTINUUM MECHANICS**, the Learner will be able to:

CLO 1: Analysis and apply various types of tensors to evaluate real life problems.

CLO 2: Derive equations of mass and conservation laws for continuum.

CLO 3: Enriched the knowledge about components of stress tensor and principal stresses.

CLO 4: Derive equations of infinitesimal theory and solve the problems of elastodynamics and elastostatics in real life problems.

CLO 5: Apply and analyze the theoretical knowledge of laminar flows, stream line and irrotational flow for solving problems in real life.

BLOCK I: TENSORS

Summation Convention - Components of a tensor - Transpose of a tensor - Symmetric & antisymmetric tensor - Principal values and directions - Scalar invariants.

BLOCK II: KINEMATICS OF A CONTINUUM

Material and Spatial descriptions - Material derivative - Deformation - Principal Strain - Rate of deformation - Conservation of mass - Compatibility conditions.

BLOCK III:STRESS

Stress vector and tensor - Components of a stress tensor - Symmetry - Principal Stresses – Equations of motion - Boundary conditions.

BLOCK IV:LINEAR ELASTIC SOLID

Isotropic solid - Equations of infinitesimal theory - Examples of elastodynamics and elastostatics.

BLOCK V: NEWTONIAN VISCOUS FLUID

Equations of hydrostatics - Newtonian fluid - Boundary conditions - Stream lines – Examples of laminar flows - Vorticity vector - Irrotational flow.

REFERENCE BOOKS :

1. Lai W.M., Rubin D. and Krempel E., "Introduction to Continuum Mechanics", PergamonUnified Engineering Series, 1974.

2. Hunter S.C., "Mechanics of Continuous Media", Ellis Harwood Series, 1983.

3. Chandrasekaraiah D.S. and Loknath Debnath, "Continuum Mechanics", Prism Books Private Limited, 1994.

3. Chung T.J., "Continuum Mechanics", Prentice Hall, 1988.

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Tamil Nadu Open University
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Chennai – 15

M.Sc., Mathematics - Syllabus – II year – IV Semester (Distance Mode)

COURSE TITLE : MATHEMATICALMETHODS

COURSE CODE : MMSS- 44

COURSE CREDIT : 4

COURSE OBJECTIVES

While studying the **MATHEMATICALMETHODS,** the Learner shall be able to:

CO 1: Familiarize with the types of integral equations.

CO 2: Understand the difference between initial value problem and boundary value problem.

CO 3: Find the Fourier sine and Fourier cosine transforms for simple functions.

CO 4: Discuss the concepts of Hankel transform and its properties.

CO 5: Understand about variation and its properties.

COURSE LEARNING OUTCOMES

After completion of the **MATHEMATICALMETHODS**, the Learner will be able to:

CLO 1: Discuss and interpret between difference between Volterra and Fredholm Integral Equations and apply different methods to solve integral equations.

CLO 2: Apply the skills in application of Integral equation to ordinary integral equations.

CLO 3: Ability to solve the problems using Fourier transformation.

CLO 4: Classify the difference between Fourier transform and Hankel transform.

CLO 5: Apply the skills in application of variational problems in practical problems.

BLOCK I: INTEGRAL EQUATIONS

Types of Integral equations – Integral Fredholm Alternative - Approximate method

– Equation with separable Kernel - Volterra integral equations – Fredholm's theory.

BLOCK II: APPLICATION OF INTEGRAL EQUATIONS TO ORDINARY INTEGRAL EQUATIONS AND SINGULAR INTEGRAL EQUATIONS

Initial value problems Boundary value problems – singular integral equations – Abel Integral equation.

BLOCK III: FOURIER TRANSFORMS

Fourier Transforms, Fourier sine and cosine transforms – Fourier transforms of derivatives - convolution integral – Parseval's Theorem - Solution of Laplace Equations by Fourier transform.

BLOCK IV: HANKELTRANSFORMS

Properties of Hankel Transforms – Hankel transformation of derivatives of functions - The Parseval's relation – relation between Fourier and Hankel transforms - Axisymmetric Dirichlet problem for a half space - Axisymmetric Dirichlet problem for a thick plate.

BLOCK V: CALCULUS OF VARIATIONS

Variation and its properties – Euler's(Euler Lagrange's) equation – functionals dependent on the functions of several independent variables – variational problems in parametric form –applications.

REFERENCE BOOKS :

1. Linear Integral Equations Theory and Technique by R.P.Kanwal,Academic Press, New York, 1971.

2. The Use of Integral Transforms by I.N.Sneddon, McGraw-Hill, NewYork, 1972.

3. Differential Equations and Calculus of Variations by L.Elsgolts, MirPublishers, Moscow, 1970.

4. Integral Equations by Shanti Swarup, Krishna Prakashan Media Ltd,Meerut,1982.

5. Integral Transforms and their Applications by Lokenath Debnath,Dambaru Bhatta, Taylor & Francis Group, London, 2007.

Web Resource:

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https://www.youtube.com/watch?v=ML0eYMyhqOs

https://www.youtube.com/watch?v=UciAwBP0N-4

https://www.youtube.com/watch?v=AczcMLhlXQY

https://www.youtube.com/watch?v=zz-NPztQMBs

https://www.youtube.com/watch?v=1tDkXMDbvDg

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Tamil Nadu Open University
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M.Sc., Mathematics - Syllabus – II year – IV Semester (Distance Mode)

COURSE TITLE : OPTIMIZATION TECHNIQUES

COURSE CODE : MMSSE 6

COURSE CREDIT : 3

COURSE OBJECTIVES

While studying the **OPTIMIZATION TECHNIQUES,** the Learner shall be able to:

CO 1: Familiarize with the basic principles of Network .

CO 2: Discuss Gomory's cutting plane algorithm to solve an integer programming problem.

CO 3: Analysis and apply dynamic programming to find an optimal solution to real life problems.

CO 4: To provide the depth knowledge about inventory control theory and to solve the inventory problems.

CO 5: To acquire the essential concept of non–linear programming problems.

COURSE LEARNING OUTCOMES

After completion of the **OPTIMIZATION TECHNIQUES**, the Learner will be able to:

CLO 1: Draw the network for real life problem and give the solution for the probelm.

CLO 2: Develop a model an integer programming problem and find an optimal solution for the real life situation.

CLO 3: Find an optimal solution to real life problems by using dynamic programming principle.

CLO 4: Identify proper queuing models to solve problems involved in various industries.

CLO 5: Gaining the knowledge to classify non-linear programming problem and

find an optimal solution using different methods.

BLOCK I: LINEARPROGRAMMING – NETWORK PROBLEMS

Preliminary ideas – Network linear programme- ensuring total supply equals total demand – transportation problem – assignment problem – shortest route problem – maximum flow problem cuts in a network.

BLOCK II:I NTEGER PROGRAMMING

Introduction – Integer Programming Formulations – Gomory's construction– Fractional cut method(all integer)–The Cutting – Plane Algorithm – Branch–and–Bound Technique – Zero–One Implicit Enumeration Algorithm.

BLOCK III:DYNAMIC PROGRAMMING

Introduction – Application of Dynamic Programming: Capital Budgeting Problem – Reliability Improvement Problem – Stage–coach Problem – Cargo Leading Problem – Minimizing Total Tardiness in Single Machine Scheduling Problem – Optimal Subdividing Problem – Solution of Linear Programming Problem through Dynamic Programming.

BLOCK IV:INVENTORY AND QUEUING THEORY

Introduction–Inventory Decisions–Cost Associated– with Inventories –Factors Affecting inventory–Economic Order Quantity–Deterministic Inventory Problems with No Shortages–Deterministic inventory Models with shortages–EOQ with Price Breaks–Multi Item Deterministic problems–Inventory Problems with Uncertain Demand.

QUEUING THEORY

Introduction–Queuing System–Elements Of Queuing System–Operating Characteristics of Queuing System–Classification of Queuing Models–Model–I(M/M/1):(∞/FIFO),Model–II(M/M/1) : (N/FIFO), Model–III(M/M/C):(∞/FIFO), Model–IV(M/M/C):(N/FIFO).Problems in above four models.

BLOCK V: NON LINEAR PROGRAMMING

Introduction – Lagrangean Method –Jacobi Method– Kuhn–Tucker Method – Quadratic Programming – Separable Programming – Chance–Constrained Programming or Stochastic Programming.

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Web Resource:

https://www.youtube.com/watch?v=IE7Ea-oAotw

https://www.youtube.com/watch?v=WZIyL6pcItY

https://www.youtube.com/watch?v=c-xCQau5hP8

https://www.youtube.com/watch?v=RAIlwowDZQc

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https://www.youtube.com/watch?v=mdRhjHYfA8A

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