# DONBOSCOARTS&SCIENCECOLLEGE
## ANGADIKADAVU

*(AffiliatedtoKannur UniversityApproved byGovernment ofKerala)*

**ANGADIKADAVUP.O.,IRITTY,KANNUR–670706**

# COURSEPLAN

# M.Sc.Mathematics

**(2021 - 23)**

## SEMESTER-I

## ACADEMICYEAR2021-22

| I Semester M.Sc. Mathematics (2021-23) | | | |
|---|---|---|---|
| **Sl. No.** | **Name of Subjects with Code** | **Name of the Teacher** | **Duty Hours Per Week** |
| **1.** | **MAT1C01 Basic Abstract Algebra** | **Athulya P** | **6** |
| **2.** | **MAT1C02 Linear Algebra** | **Remya Raj** | **6** |
| **3.** | **MAT1C03 Real Analysis** | **Najumunnisa K** | **6** |
| **4.** | **MAT1C04 Basic Topology** | **Ajeena Joseph** | **6** |
| **5.** | **MAT1C05 Differential Equations** | **Anil M V & Noble Philip** | **6** |
| | **Name of Class In-charge** | **Ajeena Joseph** | |

## TIMETABLE

| Day | 09.50 Am - 10.45 Am | 10.45 Am -11.40 Am | 11.55 Am -12.50 Pm | 01.40 Pm - 02.35 Pm | 02.35 Pm - 03.30 Pm |
|---|---|---|---|---|---|
| 1 | MAT 1C03 Real Analysis | MAT 1C04 Basic Topology | MAT1C05 Differental Equations | MAT1C02 Linear algebra | MAT1C01 Abstract Algebra |
| 2 | MAT 1C04 Basic Topology | MAT1C01 Abstract Algebra | MAT 1C03 Real Analysis | MAT1C05 Differental Equations | MAT1C02 Linear algebra |
| 3 | MAT1C02 Linear algebra | MAT 1C04 Basic Topology | MAT1C01 Abstract Algebra | MAT 1C03 Real Analysis | MAT1C05 Differental Equations |
| 4 | MAT1C01 Abstract Algebra | MAT 1C03 Real Analysis | MAT 1C04 Basic Topology | MAT1C05 Differental Equations | MAT1C02 Linear algebra |
| 5 | MAT1C05 Differental Equations | MAT 1C04 Basic Topology | MAT 1C03 Real Analysis | MAT1C02 Linear algebra | MAT1C01 Abstract Algebra |
| 6 | MAT1C02 Linear algebra | MAT1C05 Differental Equations | MAT1C01 Abstract Algebra | MAT 1C04 Basic Topology | MAT 1C03 Real Analysis |

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| **Subject Code:** | **MAT1C01** |
| **Subject Name:** | **Basic Abstract Algebra** |
| **No. of Credits:** | **4** |
| **No. of Contact Hours:** | **90** |
| **Hours per Week:** | **6** |
| **Name of the Teacher:** | **Athulya P** |

**SYLLABUS**

# MAT1C01 Basic Abstract Algebra

**Text Book**: John. B. Fraleigh – A First Course in Abstract Algebra (7th Edition), Narosa (2003)

**Unit I**

Direct Products and finitely generated Abelian Groups, Group Action on a Set, Applications of Sylow Theorems. (Chapter-2: Section 11; Chapter-3: Section 16; Chapter-7: Sections 36, 37)

**Unit II**

Field of Quotients of the Integral Domain, Isomorphism Theorems, Series of Groups, Free Abelian Groups, Field of Quotients of the Integral Domain (Chapter-4: Section 21, Chapter-7: Section 34, 35, 38).

**Unit III**

Ring of Polynomials, Factorization of Polynomials over a Field, Homomorphisms and Factor Rings, Prime and Maximal Ideals (Chapter-4: Section 22, 23; Chapter-5: Section 26, 27).

**Reference:**


1. I. N. Herstein: Topics in Algebra.Wiley India Pvt. Ltd, 2006.
2. D. S. Malik, John. N. Merdson, M. K. Sen: Fundamentals of Abstract Algebra Mc Graw-Hill Publishing Co., 1996.
3. Clark, Allen: Elements of Abstract Algebra. Dover Publications, 1984.
4. David M. Burton: A First course in Rings and Ideals.Addison-Wesley Educational Publishers Inc., 1970.
5. Joseph. A. Gallian: Contemporary Abstract Algebra. Narosa, 1999.
6. M. Artin: Algebra Addison Wesley; 2nd edition, 2010.

# TEACHING SCHEDULE

| No of Weeks | Dates | Session | Topic |
|---|---|---|---|
| 1 | 06-10-2021 To 09-10-2021 | 1 | Unit 1- introduction |
| | | 2 | Direct products |
| | | 3 | Theorem |
| | | 09 October | Second Saturday |
| 2 | 11-10-2021 To 16-10-2021 | 4 | Theorem |
| | | 5 | Example |
| | | 6 | Class Test |
| | | 14 October | Mahanavami |
| | | 15 October | Vijayadashami |
| | | 7 | Definition |
| 3 | 18-10-2021 To 23-10-2021 | 8 | Examples |
| | | 19 October | Nabidinam |
| | | 9 | Fundamental theorem of Finitely generated Abelian groups |
| | | 10 | Applications |
| | | 11 | Thorem |
| | | 12 | Thorem |
| 4 | 25-10-2021 To 30-10-2021 | 13 | Group action on a set |
| | | 14 | Class Test |
| | | 15 | Examples |
| | | 16 | Isotropy subgroups |
| | | 17 | Theorem |
| | | 18 | Orbits |
| 5 | 01-11-2021 To 06-11-2021 | 19 | Theorem |
| | | 20 | Sylow theorems- introduction. |
| | | 21 | Cauchys theorem |
| | | 04 November | Diwali |
| | | 22 | Definition, Lemma |
| | | 23 | First sylow theorem |
| 6 | 08-11-2021 To 13-11-2021 | 24 | Sylow p subgroup |
| | | 25 | Second sylow theorem |
| | | 26 | Third sylow theorem |
| | | 27 | Class Test |
| | | 28 | Examples |
| | | 13 November | Second Saturday |
| 7 | 15-11-2021 To 20-11-2021 | 29 | Applications of sylow theory |
| | | 30 | Class equation |
| | | 31 | Theorem |
| | | 32 | Lemma |

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| | | 33 | Examples |
| | | 34 | Unit 2- introduction. |
| **8** | 22-11-2021 To 27-11-2021 | 35 | The construction |
| | | 36 | Class Test |
| | | 37 | Seminar |
| | | 38 | Field of quotients of an integral domain |
| | | 39 | Theorem |
| | | 40 | Isomorphism theorems- introduction |
| **9** | 29-11-2021 To 04-12-2021 | 41 | First isomorphism theorem |
| | | 42 | Lemma |
| | | 43 | Second isomorphism theorem |
| | | 44 | Third isomorphism theorem |
| | | 45 | Class Test |
| | | 46 | Subnormal and normal series |
| **10** | 06-12-2021 To 11-12-2021 | 47 | Examples |
| | | 48 | Examples |
| | | 49 | Definitions |
| | | 50 | Lemma |
| | | 51 | Example |
| | | 11 December | Second Saturday |
| **11** | 13-12-2021 To 18-12-2021 | 52 | Zassenhaus lemma |
| | | 53 | Schreier theorem |
| | | 54 | Definition & Examples |
| | | 55 | Jordan Holder theorem |
| | | 56 | Seminar |
| | | 57 | Seminar |
| **12** | 20-12-2021 To 25-12-2021 | 58 | Seminar |
| | | 59 | Class Test |
| | | 60 | Seminar |
| | | 61 | Seminar |
| | | 62 | Seminar |
| | | 24 December | |
| | | 25 December | |
| **13** | 27-12-2021 To 01-01-2022 | 27 December | |
| | | 28 December | |
| | | 29 December | |
| | | 30 December | |
| | | 31 December | |
| | | 01 January | |
| **14** | 03-01-2022 To 08-01-2022 | 63 | I Internal Examination |
| | | 64 | I Internal Examination |
| | | 65 | I Internal Examination |
| | | 66 | Unit 3 -Rings of polynomials |

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| | | 67 | Class Test |
| | | 68 | Polynomial in an indeterminate |
| **15** | 10-01-2022 To 15-01-2022 | 69 | Definition |
| | | 70 | Example |
| | | 71 | The Evaluation Homomorphisms |
| | | 72 | Factorization of polynomial over a field |
| | | 73 | Factor theorem |
| | | 74 | Example |
| **16** | 17-01-2022 To 22-01-2022 | 75 | Corollary |
| | | 76 | Irreducible polynomials |
| | | 77 | Definition and examples |
| | | 78 | Theorem |
| | | 79 | Homomorphisms |
| | | 80 | Theorem |
| **17** | 24-01-2022 To 29-01-2022 | 81 | Factor rings |
| | | 82 | Exam |
| | | 26 January | Republic Day |
| | | 83 | Prime and maximal ideals |
| | | 84 | Examples |
| | | 85 | Revision |
| **18** | 31-01-2022 To 05-02-2022 | 86 | II Internal Examination |
| | | 87 | II Internal Examination |
| | | 88 | II Internal Examination |
| | | 89 | II Internal Examination |
| | | 90 | II Internal Examination |
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| **Subject Code:** | **MAT1C03** |
| **Subject Name:** | **REAL ANALYSIS** |
| **No. of Credits:** | **4** |
| **No. of Contact Hours:** | **90** |
| **Hours per Week:** | **6** |
| **Name of the Teacher:** | **Najumunnisa .K** |

**SYLLABUS**

# MAT1C03 REAL ANALYSIS

**Text Book I**: Walter Rudin: Principles ofMathematical Analysis; 3rd EditionMcGraw-Hill International
**Text Book 2**: T.M Apostol: Mathematical Analysis 2nd Edition; Narosa Publications (1973)

**Unit-I**
Basic Topology: Finite, Countable and Uncountable Sets, Metric Spaces, Compact Sets Perfect Sets, Connected Sets, Continuity: Limits of Functions, Continuous Functions, Continuity and Compactness, Continuity and Connectedness, Discontinuities, Monotonic Functions, Infinite limits and Limits at Infinity.
(Text Book1; Chapter-2, All sections: Chapter-4, All sections)

**Unit-II**
Differentiation: The derivative of Real Function, Mean Value Theorems, The Continuity of Derivatives, L 'Hospital' s Rule, Derivatives of Higher Order Taylor's Theorem, Differentiation of Vector-Valued Functions. The Riemann-Stieltjes Integral: Definition and Existence of the Integral, Properties of the Integral.
(Text Book 1: Chapter-5; All sections; Chapter-6; sections 6.1 to 6.19)

**Unit-III**
The Riemann-Stieltjes Integral (Continued); Integration and Differentiation, Integration of Vector-Valued Functions,
(Text Book 1: Chapter-6; Sections 6.20 to 6.25;)
Functions of Bounded Variations and Rectifiable Curves.
(Text Book2; Chapter-6; Sections 6.1 to 6.12)

**Reference:**
1. R.G Bartle and D.R Sherbert; Introduction to Real Analysis; John Wiley Bros. 1982
2. L.M Graves; The Theory of functions of real variable; Tata McGraw-Hill Book Co.
3. M.H Porter and C.B Moraray;A first Course in Real Analysis; Springer Verlag UTM 1977.
4. S.C Sexena and S.M Shah: Introduction to Real Variable Theory, Intext Educational Publishers, San Francisco
5. S.R Ghopade and B.V Limaye; A Course in Calculus and Real Analysis, Springer.
6. N.L Carothers- Real Analysis Cambridge University Press.

# TEACHING SCHEDULE

| No of Weeks | Dates | Session | Topic |
|---|---|---|---|
| 1 | 06-10-2021 To 09-10-2021 | 1 | Definition |
| | | 2 | Examples |
| | | 3 | Finite sets-definitions. |
| | | 09 October | |
| 2 | 11-10-2021 To 16-10-2021 | 4 | Countable and Uncountable Sets- definitions. |
| | | 5 | Examples,theorem. |
| | | 6 | Theorems |
| | | 14 October | Mahanavami |
| | | 15 October | Vijayadashami |
| | | 7 | Examples |
| 3 | 18-10-2021 To 23-10-2021 | 8 | Compact sets |
| | | 19 October | Nabidinam |
| | | 9 | Theorems |
| | | 10 | Theorems |
| | | 11 | Class Test |
| | | 12 | Perfect Sets |
| 4 | 25-10-2021 To 30-10-2021 | 13 | Theorems |
| | | 14 | Theorems |
| | | 15 | Connected Sets-definitions. |
| | | 16 | Exercise questions. |
| | | 17 | Continuity: Limits of Functions-definitions. |
| | | 18 | Theorems |
| 5 | 01-11-2021 To 06-11-2021 | 19 | Class test. |
| | | 20 | Continuous Functions ,Theorems |
| | | 21 | Continuity and Compactness-definitions. |
| | | 04 November | Diwali |
| | | 22 | Continuity and Connectedness-definitions. |
| | | 23 | Theorems |
| 6 | 08-11-2021 To 13-11-2021 | 24 | Theorems |
| | | 25 | Discontinuities Definition |
| | | 26 | Theorems |
| | | 27 | Monotonic Functions |
| | | 28 | Theorems |
| | | 13 November | Second Saturday |
| 7 | 15-11-2021 To 20-11-2021 | 29 | Infinite limits |
| | | 30 | Theorems |
| | | 31 | Limits at Infinity |
| | | 32 | Theorems |

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| | | 33 | Class test. |
| | | 34 | Discussion |
| **8** | 22-11-2021 To 27-11-2021 | 35 | Seminar. |
| | | 36 | Seminar. |
| | | 37 | Seminar. |
| | | 38 | Seminar. |
| | | 39 | The derivative of Real Function , Theorems. |
| | | 40 | Mean Value Theorems |
| **9** | 29-11-2021 To 04-12-2021 | 41 | Theorems. |
| | | 42 | The Continuity of Derivatives |
| | | 43 | Assignment . |
| | | 44 | Exercise questions. |
| | | 45 | Class test. |
| | | 46 | L 'Hospital' s Rule |
| **10** | 06-12-2021 To 11-12-2021 | 47 | Theorems. |
| | | 48 | Corollary. |
| | | 49 | Derivatives of Higher Order Taylor's Theorem |
| | | 50 | Theorems. |
| | | 51 | Corollary. |
| | | 11 December | Second Saturday |
| **11** | 13-12-2021 To 18-12-2021 | 52 | Differentiation of vector valued function. |
| | | 53 | The Riemann-Stieltjes Integral |
| | | 54 | Class Test |
| | | 55 | Theorems. |
| | | 56 | Corollary. |
| | | 57 | Exercise questions. |
| **12** | 20-12-2021 To 25-12-2021 | 58 | Seminar. |
| | | 59 | Seminar. |
| | | 60 | Seminar. |
| | | 61 | Seminar. |
| | | 62 | Seminar. |
| | | 24 December | Christmas Holidays |
| | | 25 December | Christmas Holidays |
| **13** | 27-12-2021 To 01-01-2022 | 27 December | Christmas Holidays |
| | | 28 December | Christmas Holidays |
| | | 29 December | Christmas Holidays |
| | | 30 December | Christmas Holidays |
| | | 31 December | Christmas Holidays |
| | | 01 January | Christmas Holidays |
| **14** | 03-01-2022 To 08-01-2022 | 63 | I Internal Examination |
| | | 64 | I Internal Examination |
| | | 65 | I Internal Examination |
| | | 66 | Definition and Existence of the Integral |

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| | | 67 | Corollary. |
| | | 68 | Assignment |
| **15** | 10-01-2022 To 15-01-2022 | 69 | Properties of the Integral |
| | | 70 | Theorems. |
| | | 71 | Discussion |
| | | 72 | The Riemann-Stieltjes Integral (Continued); Theorems. |
| | | 73 | Theorems. |
| | | 74 | Integration of Vector-Valued Functions. |
| **16** | 17-01-2022 To 22-01-2022 | 75 | Corollary. |
| | | 76 | Class test. |
| | | 77 | Functions of Bounded Variations and Rectifiable Curves. |
| | | 78 | Exercise questions. |
| | | 79 | Corollary. |
| | | 80 | Integration and Differentiation, |
| **17** | 24-01-2022 To 29-01-2022 | 81 | Theorems. |
| | | 82 | Corollary. |
| | | 26 January | Republic Day |
| | | 83 | Exercise questions. |
| | | 84 | Class test. |
| | | 85 | Theorems. |
| **18** | 31-01-2022 To 05-02-2022 | 86 | II Internal Examination |
| | | 87 | II Internal Examination |
| | | 88 | II Internal Examination |
| | | 89 | II Internal Examination |
| | | 90 | II Internal Examination |
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| **Subject Code:** | **MAT1CO4** |
| **Subject Name:** | **Basic topology** |
| **No. of Credits:** | **4** |
| **No. of Contact Hours:** | **90** |
| **Hours per Week:** | **6** |
| **Name of the Teacher:** | **Ajeena Joseph** |

**SYLLABUS**

## MAT1CO4 Basic topology

**Text: C. Wayne Patty, Foundations of topology, 2nd edition- Johns & Bartlett Pvt. Ltd, New Delhi,2012**

**Unit I**

Topological spaces: The definition and examples, Basis for a topology, closed sets, closures and interior of sets, Metric spaces, Convergence , continuous functions and homeomorphisms.
[ Chapter 1: sections 1.2 to 1.7, excluding theorem 1.46 and theorem 1.51]

**Unit II**

New spaces from old ones: subspaces, the product topology on XxY , the product topology, the weak topology and the product topology.
[ Chapter 2: sections 2.1 to 2.4]

**Unit III**

Connectedness in metric spaces, connected spaces, pathwise and local connectedness, totally disconnected spaces.
[ Chapter 3: sections 3.1 to 3.3 excluding theorem 3.29 and theorem 3.30]

## TEACHING SCHEDULE

| No of Weeks | Dates | Session | Topic |
|---|---|---|---|
| 1 | 06-10-2021 To 09-10-2021 | 1 | Definition of topological spaces |
| | | 2 | Examples |
| | | 3 | Examples |
| | | 09 October | Second Saturday |
| 2 | 11-10-2021 To 16-10-2021 | 4 | Theorem |
| | | 5 | Metrizable spaces |
| | | 6 | Theorem |
| | | 14 October | Mahanavami |
| | | 15 October | Vijayadashami |
| | | 7 | Basis |
| 3 | 18-10-2021 To | 8 | Sub- basis |
| | | 19 October | Nabidinam |
| | | 9 | First countable spaces |

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| | 23-10-2021 | 10 | Theorem |
| | | 11 | Theorem |
| | | 12 | Second countable spaces |
| **4** | 25-10-2021 To 30-10-2021 | 13 | Theorem |
| | | 14 | Theorem |
| | | 15 | Class test |
| | | 16 | Separable sapces |
| | | 17 | Theorem |
| | | 18 | Theorem |
| **5** | 01-11-2021 To 06-11-2021 | 19 | Closed sets |
| | | 20 | Assignment |
| | | 21 | Closure |
| | | 04 November | Diwali |
| | | 22 | Interior of set |
| | | 23 | Theorem |
| **6** | 08-11-2021 To 13-11-2021 | 24 | Convergence |
| | | 25 | Class test |
| | | 26 | Theorem |
| | | 27 | Metric spaces |
| | | 28 | Theorem |
| | | 13 November | Second Saturday |
| **7** | 15-11-2021 To 20-11-2021 | 29 | Homeomorphisms |
| | | 30 | Theorem |
| | | 31 | Theorem |
| | | 32 | Theorem |
| | | 33 | Assignment |
| | | 34 | Theorem |
| **8** | 22-11-2021 To 27-11-2021 | 35 | Theorem |
| | | 36 | Subspaces |
| | | 37 | Theorem |
| | | 38 | Theorem |
| | | 39 | Class test |
| | | 40 | Theorem |
| **9** | 29-11-2021 To 04-12-2021 | 41 | Examples |
| | | 42 | Product topology |
| | | 43 | Box topology |
| | | 44 | Examples |
| | | 45 | Theorem |
| | | 46 | Theorem |
| **10** | 06-12-2021 To 11-12-2021 | 47 | Product topology basis |
| | | 48 | Weak topology |
| | | 49 | Assignment |
| | | 50 | Theorem |

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|---|---|---|---|
| | | 51 | Theorem |
| | | 11 December | Second Saturday |
| **11** | 13-12-2021 To 18-12-2021 | 52 | Theorem |
| | | 53 | Seminar |
| | | 54 | Seminar |
| | | 55 | Class test |
| | | 56 | Theorem |
| | | 57 | Theorem |
| **12** | 20-12-2021 To 25-12-2021 | 58 | Theorem |
| | | 59 | Connectedness |
| | | 60 | Examples |
| | | 61 | Examples |
| | | 62 | Assignment |
| | | 24 December | |
| | | 25 December | |
| **13** | 27-12-2021 To 01-01-2022 | 27 December | |
| | | 28 December | |
| | | 29 December | |
| | | 30 December | |
| | | 31 December | |
| | | 01 January | |
| **14** | 03-01-2022 To 08-01-2022 | 63 | I Internal Examination |
| | | 64 | I Internal Examination |
| | | 65 | I Internal Examination |
| | | 66 | Connected spaces |
| | | 67 | Connected spaces |
| | | 68 | Theorem |
| **15** | 10-01-2022 To 15-01-2022 | 69 | Theorem |
| | | 70 | Pathwise connected |
| | | 71 | Theorem |
| | | 72 | Theorem |
| | | 73 | Local connectedness |
| | | 74 | Local connectedness |
| **16** | 17-01-2022 To 22-01-2022 | 75 | Theorem |
| | | 76 | Totally disconnected spaces |
| | | 77 | Totally disconnected spaces |
| | | 78 | Theorem |
| | | 79 | Class test |
| | | 80 | Theorem |
| **17** | 24-01-2022 To 29-01-2022 | 81 | Theorem |
| | | 82 | Theorem |
| | | 26 January | Republic Day |
| | | 83 | Revision |

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| | | 84 | Revision |
| | | 85 | Revision |
| **18** | 31-01-2022<br>To<br>05-02-2022 | 86 | II Internal Examination |
| | | 87 | II Internal Examination |
| | | 88 | II Internal Examination |
| | | 89 | II Internal Examination |
| | | 90 | II Internal Examination |
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| **Subject Code:** | **MAT1C02** |
| **Subject Name:** | **Linear Algebra** |
| **No. of Credits:** | **4** |
| **No. of Contact Hours:** | **90** |
| **Hours per Week:** | **6** |
| **Name of the Teacher:** | **Remya Raj& Riya Baby** |

**SYLLABUS**

## MAT1C02 Linear Algebra

**Unit 1** : Linear Transformations: Linear Transformations, The Algebra of Linear Transformations, Isomorphism, Representation of Transformation by Matrices, (Chapter-3; Sections 3.1, 3.2,3.3, 3.4,3.5,3.6, 3.7,)
Linear Functionals, The Double Dual, The Transpose of a Linear Transformation.Chapter-6: Section)

**Unit 2:Elementary Canonical Forms**: Introduction, characteristic values, Annihilating Polynomials ,Invariant Subspace, Simultaneous Triangulations& Simultaneous Diagonalisation. , (Chapter-6: Sections 6.1, 6.2,6.3, 6.4, 6.5, 6.6 )

**Unit 3**: **Elementary Canonical Forms:** Invariant Direct Sums The Primary Decomposition Theorem.
**The Rational and Jordan Forms**: Cyclic Subspaces and Annihilators, Cyclic Decomposition and the Rational Forms ,The Jordan forms.
**Inner Product Spaces**: Inner Products, Inner Product Spaces, ( Chapter 6 section 6.7,6.8; Chapter7: Sections: 7.1, 7.2,7.3, Chapter-8: Sections 8.1, 8.2,)

**Text Book:**
Kenneth Hoffman & Ray Kunze; Linear Algebra; Second Edition, Prentice-Hall of India Pvt. Ltd

**Reference:**
1. Stephen H. Friedberg, Arnold J Insel and Lawrence E. Spence:
Linear Algebra: 4th Edition 2002: Prentice Hall.
2. Serge A Land:
Linear Algebra; Springer
3. Paul R Halmos Finite-Dimensional Vector Space; Springer 1974.
4. McLane & Garrell Birkhoff;
Algebra; American Mathematical Society 1999.
5. Thomas W. Hungerford:
Algebra; Springer 1980
6. Neal H.McCoy & Thomas R.Berger:
Algebra-Groups, Rings & Other Topics: Allyn & Bacon.
7. S Kumaresan; Linear Algebra A Geometric Approach; Prentice-Hall of India 2003.

# TEACHING SCHEDULE

| No of Weeks | Dates | Session | Topic |
|---|---|---|---|
| 1 | 06-10-2021 To 09-10-2021 | 1 | Linear Transformation-Definition, examples |
| | | 2 | Theorem 1 |
| | | 3 | Examples |
| | | 09 October | Second Saturday |
| 2 | 11-10-2021 To 16-10-2021 | 4 | Null space, Range space- examples |
| | | 5 | Rank Nullity theorem |
| | | 6 | Examples |
| | | 14 October | Mahanavami |
| | | 15 October | Vijayadashami |
| | | 7 | Theorem 4,6 |
| 3 | 18-10-2021 To 23-10-2021 | 8 | Linear operator- Definition, examples |
| | | 19 October | Nabidinam |
| | | 9 | Theorem 5 |
| | | 10 | Inverible linear transformation- definition, theorem 7 |
| | | 11 | Non singular LT., theorem 8 |
| | | 12 | Examples, Problems |
| 4 | 25-10-2021 To 30-10-2021 | 13 | Problems |
| | | 14 | Theorem 9 |
| | | 15 | Isomorphism- definition, theorem 10 |
| | | 16 | Problems |
| | | 17 | Representation of transformations by matrix- theorem 11 |
| | | 18 | The matrix of T relating to B- definition, theorem 12 |
| 5 | 01-11-2021 To 06-11-2021 | 19 | Problems |
| | | 20 | Problems |
| | | 21 | Theorem 13 |
| | | 04 November | Diwali |
| | | 22 | Theorem 14 |
| | | 23 | Problems |
| 6 | 08-11-2021 To 13-11-2021 | 24 | Linear functionals- definition, examples |
| | | 25 | Problem |
| | | 26 | Dual space - definition, theorem 15 |
| | | 27 | Example |
| | | 28 | Annihilator of a set- definition, Remarks |
| | | 13 November | Second Saturday |
| 7 | 15-11-2021 To | 29 | Theorem 16 |
| | | 30 | Corollary |
| | | 31 | Problems |

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| | 20-11-2021 | 32 | Problems |
| | | 33 | Problems |
| | | 34 | Class test |
| **8** | 22-11-2021 To 27-11-2021 | 35 | Double dual - definition, theorem 17 |
| | | 36 | Corollary, theorem 18 |
| | | 37 | Maximal proper subspace of V- definition, hyper space - definition, theorem 19 |
| | | 38 | Lemma |
| | | 39 | Theorem 20 |
| | | 40 | The transpose of a LT - definition, example |
| **9** | 29-11-2021 To 04-12-2021 | 41 | Theorem 22 |
| | | 42 | Problems |
| | | 43 | Revision |
| | | 44 | Class test |
| | | 45 | Unit 2: Elementary canonical forms- characteristic values - definition, remarks |
| | | 46 | Theorem 1,characteristic polynomial - definition, similar marices - definition |
| **10** | 06-12-2021 To 11-12-2021 | 47 | Lemma, remarks |
| | | 48 | Problems |
| | | 49 | Diagonalizable LO - definition, remarks, examples |
| | | 50 | Lemma, remark |
| | | 51 | Lemma |
| | | 11 December | Second Saturday |
| **11** | 13-12-2021 To 18-12-2021 | 52 | Theorem 2 |
| | | 53 | Problems |
| | | 54 | Problems |
| | | 55 | Problems |
| | | 56 | Annihilating polynomial: ideal , principal ideal - definition, remarks |
| | | 57 | Remarks |
| **12** | 20-12-2021 To 25-12-2021 | 58 | Minimal polynomial- definition, theorem 3 |
| | | 59 | Problems |
| | | 60 | Problems |
| | | 61 | Problems |
| | | 62 | Theorem 4: Cayley Hamilton theorem,problems |
| | | 24 December | |
| | | 25 December | |
| **13** | 27-12-2021 To 01-01-2022 | 27 December | |
| | | 28 December | |
| | | 29 December | |
| | | 30 December | |
| | | 31 December | |
| | | 01 January | |

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|---|---|---|---|
| **14** | 03-01-2022 To 08-01-2022 | 63 | I Internal Examination |
| | | 64 | I Internal Examination |
| | | 65 | I Internal Examination |
| | | 66 | Invariant subspace - definition, examples, T- conductor- definition, lemma |
| | | 67 | Remark, triangulable- definition, Lemma - definition |
| | | 68 | Lemma – definition, Theorem 5 |
| **15** | 10-01-2022 To 15-01-2022 | 69 | Theorem 6 |
| | | 70 | Simultaneous triangulation, diagonalization, definition, lemma |
| | | 71 | Theorem 7,8 |
| | | 72 | Direct sum decomposition- definition remarks, lemma |
| | | 73 | Theorem 9,examples |
| | | 74 | Unit 3: inner product space - definition, examples, normed space- definition |
| **16** | 17-01-2022 To 22-01-2022 | 75 | Polarization identities |
| | | 76 | Theorem 1 , examples |
| | | 77 | Orthogonal victors definition, examples, Theorem 2 |
| | | 78 | Theorem 3,examples |
| | | 79 | Best approximation- definition, theorem 4 |
| | | 80 | Orthogonal Projection- definition, theorem 5,examples, Bessels inequality |
| **17** | 24-01-2022 To 29-01-2022 | 81 | Invariant direct sums- definition, theorem 10,11 |
| | | 82 | Theorem 12: primary decomposition theorem, rational and Jordan form of a matrix, examples |
| | | 26 January | Republic Day |
| | | 83 | Cyclic subspaces- definition, remarks, results, theorem |
| | | 84 | Revision, university Question paper discussion |
| | | 85 | Class test |
| **18** | 31-01-2022 To 05-02-2022 | 86 | II Internal Examination |
| | | 87 | II Internal Examination |
| | | 88 | II Internal Examination |
| | | 89 | II Internal Examination |
| | | 90 | II Internal Examination |
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| **Subject Code:** | **MAT 1C05** |
| **Subject Name:** | **Differential Equations** |
| **No. of Credits:** | **4** |
| **No. of Contact Hours:** | **90** |
| **Hours per Week:** | **6** |
| **Name of the Teacher:** | **Anil M V & Noble Philip** |

**SYLLABUS**

# MAT1C05 Differential Equations

Text Book: G.F Simmons - Differential Equations with Historical Notes; Third Edition-CRC Press, Taylor and Francis Group.

## Unit I

Introduction. A Review of Power Series, Series Solutions of First Order Equations, Second Order Linear Equations. Ordinary Points, Regular Singular Points, Regular Singular Points (Continued), Gauss's Hyper Geometric Equation, The Point at Infinity.
(Chapter-5; Sections 26 to 32)

## Unit II

Legendre Polynomials, Properties of Legendre Polynomials, Bessel Functions. The Gamma Function, Properties of Bessel functions, General Remarks on Systems, Linear Systems Homogeneous Linear Systems with Constant Coefficients.
(Chapter-8; Sections 44 to 47; Chapter-10; Sections 54 to 56)

## Unit III

Oscillations and the Sturm Separation Theorem, The Sturm Comparison Theorem, The Method of Successive Approximations, Picard's Theorem, Systems. The Second Order Linear Equation
(Chapter-4; Sections 24 and 25; Chapter-13; Sections 68 to 70)

**Reference:**


1. G.Birkoff and G.C Rota: Ordinary Differential Equations; Wiley and Sons; (1978)
2. E.A Coddington; An Introduction to Ordinary Differential Equations; Prentice Hall of India, New Delhi (1974)
3. P.Hartmon; Ordinary Differential Equations; John Wiley and Sons
4. Chakraborti; Elements of Ordinary Differential Equations and Special Functions; Wiley Eastern Ltd New Delhi (1990)
5. L.S Poutrigardian: A Course in Ordinary Differential Equations; Hindustan Publishing Corporation Delhi (1967)
6. S.G Deo & V.Raghavendra; Ordinary Differential Equations and Stability Theory; Tata McGraw Hill New Delhi (1967)
7. V.I Arnold; Ordinary Differential Equations; MIT Press, Cambridge 1981

# TEACHING SCHEDULE

| No of Weeks | Dates | Session | Topic |
|---|---|---|---|
| 1 | 06-10-2021 To 09-10-2021 | 1 | Introduction to power series |
| | | 2 | Convergence of power series |
| | | 3 | Radius of curvature of power series |
| | | 09 October | Second Saturday |
| 2 | 11-10-2021 To 16-10-2021 | 4 | Examples |
| | | 5 | Examples |
| | | 6 | Series solution of first order equations |
| | | 14 October | Mahanavami |
| | | 15 October | Vijayadashami |
| | | 7 | Problems |
| 3 | 18-10-2021 To 23-10-2021 | 8 | Problems |
| | | 19 October | Nabidinam |
| | | 9 | Second order linear equations |
| | | 10 | Ordinary points, singular points |
| | | 11 | Regular singular points, examples |
| | | 12 | Theorem |
| 4 | 25-10-2021 To 30-10-2021 | 13 | Problems |
| | | 14 | Power series solution of Legendre's equation |
| | | 15 | Power series solution of Bessel's equation |
| | | 16 | Theorem |
| | | 17 | Problems |
| | | 18 | Problems |
| 5 | 01-11-2021 To 06-11-2021 | 19 | Class test |
| | | 20 | Assignment |
| | | 21 | Gauss's Hypergeometric equation |
| | | 04 November | Diwali |
| | | 22 | Hypergeometric series |
| | | 23 | General solution of Gauss's Hypergeometric equation |
| 6 | 08-11-2021 To 13-11-2021 | 24 | Examples |
| | | 25 | Examples |
| | | 26 | The point at infinity |
| | | 27 | Confluent Hypergeometric equation |
| | | 28 | Problems |
| | | 13 November | Second Saturday |
| 7 | 15-11-2021 To 20-11-2021 | 29 | Problems |
| | | 30 | Assignment |
| | | 31 | Legendre Polynomials |
| | | 32 | Rodrigues' formula |

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| | | 33 | Problems |
| | | 34 | Generating function of the Legendre Polynomials |
| **8** | 22-11-2021 To 27-11-2021 | 35 | Problems |
| | | 36 | Orthogonality Property of Legendre Polynomials |
| | | 37 | Legendre series, Bessel Function |
| | | 38 | General solution of the Bessel equation |
| | | 39 | Bessel function of the first kind |
| | | 40 | Class test |
| **9** | 29-11-2021 To 04-12-2021 | 41 | The Gamma function |
| | | 42 | Properties of Gamma function |
| | | 43 | Problems |
| | | 44 | Problems |
| | | 45 | Orthogonality Property of Bessel functions |
| | | 46 | Zeros and the Bessel series |
| **10** | 06-12-2021 To 11-12-2021 | 47 | Bessel expansion Theorem |
| | | 48 | Problems |
| | | 49 | Assignment |
| | | 50 | Discussions |
| | | 51 | Linear systems |
| | | 11 December | Second Saturday |
| **11** | 13-12-2021 To 18-12-2021 | 52 | Homogeneous Linear systems |
| | | 53 | Theorem |
| | | 54 | Theorem |
| | | 55 | Theorem |
| | | 56 | Theorem |
| | | 57 | Problems |
| **12** | 20-12-2021 To 25-12-2021 | 58 | Homogeneous systems with constant coefficients |
| | | 59 | Classifications |
| | | 60 | Examples |
| | | 61 | Examples |
| | | 62 | Examples |
| | | 24 December | |
| | | 25 December | |
| **13** | 27-12-2021 To 01-01-2022 | 27 December | |
| | | 28 December | |
| | | 29 December | |
| | | 30 December | |
| | | 31 December | |
| | | 01 January | |
| **14** | 03-01-2022 To 08-01-2022 | 63 | I Internal Examination |
| | | 64 | I Internal Examination |
| | | 65 | I Internal Examination |
| | | 66 | Oscillations |

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| | | 67 | Sturm separation Theorem |
| | | 68 | Normal and standard form |
| **15** | 10-01-2022 To 15-01-2022 | 69 | Theorem |
| | | 70 | Problems |
| | | 71 | Theorem |
| | | 72 | Discussions |
| | | 73 | The Sturm comparison theorem |
| | | 74 | Theorem |
| **16** | 17-01-2022 To 22-01-2022 | 75 | Successive approximations |
| | | 76 | Problems |
| | | 77 | Picard's iteration method |
| | | 78 | Problems |
| | | 79 | Class test |
| | | 80 | The Picard's theorem |
| **17** | 24-01-2022 To 29-01-2022 | 81 | The Picard's theorem(contd.) |
| | | 82 | Lipschitz condition |
| | | 26 January | Republic Day |
| | | 83 | Examples |
| | | 84 | Systems of initial value problems |
| | | 85 | Revision |
| **18** | 31-01-2022 To 05-02-2022 | 86 | II Internal Examination |
| | | 87 | II Internal Examination |
| | | 88 | II Internal Examination |
| | | 89 | II Internal Examination |
| | | 90 | II Internal Examination |
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