



MANONMANIAM SUNDARANAR UNIVERSITY,
TIRUNELVELI-12

SYLLABUS

UG - COURSES – AFFILIATED COLLEGES

Course Structure for B. Sc. Mathematics

(Choice Based Credit System)

(with effect from the academic year 2023-2024 onwards)



Semester-VI				
Part	Subject Status	Subject Title	Subject Code	Credit
III	CORE	LINEAR ALGEBRA	EMMA61	4
III	CORE	COMPLEX ANALYSIS	EMMA62	4
III	CORE	MECHANICS	EMMA63	4
III	ELECTIVE	OPERATIONS RESEARCH II	EEMA61	3
III	ELECTIVE	GRAPH THEORY	EEMA62	3
IV	NAAN MUDHALVAN	DATA ANALYTICS USING POWER BI (EDUNET) (SUBSTITUTE COURSE: MATLAB)		2
V	EXTENSION ACTIVITY ***	NSS/NCC/YRC/RRC/ GAMES & SPORTS/ YOUTH WELFARE ACTIVITIES/ OUTREACH PROGRAMMES/ MIGRATION AWARENESS IN THE TAMIL NADU EDUCATION SYSTEM	E5EA61	1



Total Marks: 100 Internal Exam: 25 marks + External Exam: 75 marks

A. Scheme for internal Assessment:

Maximum marks for written test: **20 marks**

3 internal tests, each of **1 hour** duration shall be conducted every semester.

To the average of the **best two** written examinations must be added the marks scored in. The **assignment** for 5 marks.

The break up for internal assessment shall be:

Written test- 20 marks; Assignment -5 marks Total - 25 marks

B. Scheme of External Examination

3 hrs. examination at the end of the semester

A – Part : 1 mark question two - from each unit

B – Part : 5 marks question one - from each unit

C – Part : 8 marks question one - from each unit

➤ **Conversion of Marks into Grade Points and Letter Grades**

S.No	Marks	Letter Grade	Grade point (GP)	Performance
1	90-100	O	10	Outstanding
2	80-89	A+	9	Excellent
3	70-79	A	8	Very Good
4	60-69	B+	7	Good
5	50-59	B	6	Above Average
6	40-49	C	5	Pass
7	0-39	RA	-	Reappear
8	0	AA	-	Absent

➤ **Cumulative Grade Point Average (CGPA)**

$$CGPA = \frac{\Sigma (GP \times C)}{\Sigma C}$$

- **GP** = Grade point, **C** = Credit
- CGPA is calculated only for Part-III courses
- CGPA for a semester is awarded on cumulative basis

➤ **Classification**

- First Class with Distinction : CGPA \geq 7.5*
- First Class : CGPA \geq 6.0
- Second Class : CGPA \geq 5.0 and $<$ 6.0
- Third Class : CGPA $<$ 5.0



LINEAR ALGEBRA

Objectives of the Course

- Vector Spaces, linear dependence and independence of vectors. Dual spaces, Inner product and norm–orthogonalization process.
- Linear transformations. Various operators on vector spaces.

UNIT I

Vector Spaces: Definition and examples– Subspaces– Linear Transformations– Fundamental theorem of homomorphism. (Chapter 5: Sections - 5.1 to 5.3)

UNIT II

Span of a set– Linear Dependence and Independence– Basis and Dimension. (Chapter 5: Sections - 5.4 to 5.6)

UNIT III

Rank and Nullity of a transformation – Matrix of a linear transformation – Inner product space: Definition and examples– Orthogonality – Orthogonal complement. (Chapter 5: Sections - 5.7, 5.8 and Chapter 6: Sections - 6.1 to 6.3)

UNIT IV

Matrices – Elementary transformation – Rank of a matrix – Simultaneous linear equations – Characteristic equation and Cayley-Hamilton Theorem. (Chapter 7: Sections - 7.4 to 7.7)

UNIT V

Eigen values and Eigen vectors – Properties and problems – Bilinear forms – Quadratic forms –Reduction of quadratic form to diagonal form. (Chapter 7: Sections - 7.8 and Chapter 8: Sections - 8.1, 8.2)

Recommended Text

1. S.Arumugam and A. Thangapandi Isaac, Modern Algebra, Scitech, 2014.

Reference Books

1. I.N.Herstein, Topics in Algebra, Wiley Eastern Ltd. Second Edition, 2006.
2. N.S.Gopalakrishnan, University Algebra, New Age International Publications, Wiley Eastern Ltd.
3. John B. Fraleigh, First course in Algebra, Addison Wesley.
4. Stephen H. Friedberg, Arnold J. Insel, Lawrence E. Spence, Linear Algebra, 5th Edition, Prentice Hall of India Pvt. Ltd., 2018.
5. David C. Lay, Linear Algebra and its Applications, 3rd Ed., Pearson Education Asia, Indian Reprint, 2007.
6. S.Lang, Introduction to Linear Algebra, 2nd Ed., Springer, 2005.
7. Gilbert Strang, Linear Algebra and its Applications, Thomson, 2007.

Website and e-Learning Source

1. <https://nptel.ac.in>



COMPLEX ANALYSIS

Objectives of the Course

- Apply concept and consequences of analyticity and C-Regions.
- Understand the concept of mappings and transformations.
- Compute complex contour integrals and applying Cauchy's integral in various versions.
- Understand zeros and singularities of an analytic function, apply their properties in the evaluation of definite integral.

UNIT I

Functions of a Complex variable –Limits –Theorem on limits –Continuity – Derivatives – Differentiation formulas – Cauchy Riemann equation – conditions for differentiability – Polar coordinates– Analytic functions– Harmonic functions. (Chapter 2: Sections - 2.1 to 2.8)

UNIT II

Conformal Mapping – Elementary Transformation – Bilinear Transformation – Cross Ratio – Fixed Points. (Chapter 2: Section - 2.9 and Chapter 3: Sections –3.1 to 3.4)

UNIT III

Complex Integration: Definite Integral – Cauchy's Theorem– Cauchy integral formula – Higher Derivatives. (Chapter 6: Sections - 6.1 to 6.4)

UNIT IV

Sequence and Series – Power Series – Taylor's series –Laurent series– Zeros of an Analytic function – Singularities. (Chapter 4: Sections - 4.1, 4.3 and Chapter 7: Sections - 7.1 to 7.4)

UNIT V

Residues– Cauchy Residue theorem –Residue at infinity– Evaluation of Definite Integrals. (Chapter 8: Sections -8.1 to 8.3)

Recommended Text

1. S.Arumugam, A. Thangapandi Isaac and A. Somasundaram, Complex Analysis, Scitech, 2014.

Reference Books

1. James Ward Brown and Ruel V.Churchill, Complex Variables and Application, Seventh Edition, Mc-Graw Hill Book Co., International Edition, 2009.
2. Theodore W. Gamelan, Complex Analysis, Springer Verlag, 2008
3. Joseph Bak and Donald J. Newman, Complex analysis, 2nd Ed., Undergraduate Texts in Mathematics, Springer-Verlag New York, Inc., New York, 1997.
4. Richard A. Silverman, Introductory Complex Analysis, Dover Publications, 1972.
5. S.Ponnusamy and H.Silverman, Complex Variables with Applications, Birkhauser, 2006.

Website and e-Learning Source

1. <https://nptel.ac.in>



MECHANICS

Objectives of the Course

- Equilibrium of a particle under the action of given forces
- Simple Harmonic Motion
- Projectiles

UNIT I

Force: Newton's laws of motion – Resultant of two forces on a particle - Equilibrium of a Particle: Equilibrium of a particle – Limiting equilibrium of a particle on an inclined plane. (Chapter 2: Section-2.1, 2.1 and Chapter 3: Section-3.1,3.2)

UNIT II

Forces on a Rigid Body: Moment of a Force – General motion of a body – Equivalent systems of forces- Parallel Forces – Forces acting along a Triangle - A specific reduction of Forces: Reduction of coplanar forces into a force and couple – Problems involving frictional forces. (Chapter 4: Section-4.1 to 4.5 and Chapter 5: Sections-5.1, 5.2)

UNIT III

Work, Energy and Power: Work – Conservative field of force – Power – Rectilinear Motion under Varying Force: Simple Harmonic Motion - along a horizontal line – along a vertical line. (Chapter 11: Sections -11.1 to 11.3; Chapter 12: Sections -12.1 to 12.3)

UNIT IV

Projectiles: Forces on a projectile–Projectile projected on an inclined plane. (Chapter 13: Sections -13.1, 13.2)

UNIT V

Central Orbits: General orbits–Central orbit–Conic centered orbit. (Chapter 16: Sections -16.1 to 16.3)

Recommended Text

1. P.Duraipandian, Laxmi Duraipandian and Muthamizh Jayapragasm, Mechanics, S.Chand & Company Ltd, 2007.

Reference Books

1. A.Ruina and R.Pratap, Introduction to Statics and Dynamics, Oxford University Press, 2014.
2. S.L. Loney, The Elements of Statics and Dynamics, Cambridge University Press, 1904.
3. J.L. Meriam, L. G. Kraige and J.N. Bolton, Engineering Mechanics, Dynamics, 8th edn, Wiley and Sons Pvt Ltd., New York, 2015.
4. A.K. Dhiman, P.Dhinam and D.Kulshreshtha, Engineering Mechanics (Statics and Dynamics), Mc Graw Hill Education (India) Private Limited, New Delhi, 2015.

Website and e-Learning Source

1. <https://nptel.ac.in>



OPERATIONS RESEARCH II

Objective of the Course

- To teach the techniques for converting the real life and industrial problems as mathematical problems and solving them

UNIT I

Operations Scheduling: Problem of Sequencing – Basic in Sequencing – Gantt Chart – Single Processor Scheduling-SPT, DD and Moore procedure – Flow Shop Scheduling – Two-machine, Three-Machine and k -Machine – Processing of Two jobs through m machines. (Chapter 10: Sections - 10.1 to 10.8)

UNIT II

Scheduling Techniques: Basic components of Network – Logical Sequencing – Rules of Network construction – Network Scheduling– CPM – PERT. (Chapter 13: Sections - 13.1 to 13.10)

UNIT III

Decision Theory: Two-Person Zero-sum Game – Solution of Two-person Zero-sum Game – The Maximin-Minimax Principle – Saddle point – A Games with Pure strategy, mixed strategy – 2×2 Games – Graphical Solution for $2 \times n$ and $m \times 2$ Games – Dominance Property. (Chapter 19: Sections - 19.10, 19.11)

UNIT IV

Queueing Theory: Queueing system – Deterministic, Characteristic and Probability Distributions in Queueing system – Classification Queueing models – Probabilistic Queueing models – Poisson-Exponential Models – $(M/M/1):(N/FCFS)$ and $(M/M/1):\infty/FCFS$. (Chapter 20: Sections - 20.1 to 20.9)

UNIT V

Inventory Management: Types of Inventory – Inventory Decisions – Costs associated with Inventories – EOQ Models – EOQ and Quantity discount – EOQ and price breaks. (Chapter 22: Sections - 22.1, 22.3, 22.5, 22.8 to 22.11)

Recommended Text

1. Kanti Swarup, P. K. Gupta and Man Mohan, Operations Research, [20th Revised Edition], Sultan Chand & Sons, New Delhi, 2022.

Reference Books

1. P.K. Gupta, and D. S. Hira, Operations Research, Sultan Chand & Sons, New Delhi, 2020.
2. P. K. Gupta and Man Mohan. Problems in Operations Research [Ninth Edition], Sultan Chand and Sons, New Delhi, 2014.
3. S.Kalavathy, Operations Research [Fourth Edition], Vikas Publishing House, Chennai, 2012.



GRAPH THEORY

Objectives of the Course

- To introduce the concepts of Graphs.
- To provide a sound knowledge on Trees and Spanning Trees
- To gain knowledge about Matrices of Graphs and Digraphs.

UNIT I

Introduction – Application of Graphs – Finite and Infinite graphs – Incidence and degree – Isolated vertex, Pendent vertex and Null graph – Isomorphism – Sub graphs – Walks, Paths and Circuits – Connected Graphs – Disconnected Graphs and Components. (Chapter 1: Sections - 1.1 to 1.5 and Chapter 2: Sections 2.1, 2.2, 2.4, 2.5)

UNIT II

Euler graphs – Operations on Graphs – More on Euler graphs – Hamiltonian Paths and Circuits – Trees – Some properties on Trees – Pendent vertices in a Tree – Distance and Centers in a Tree – Spanning Trees. (Chapter 2: Sections - 2.6 to 2.9 and Chapter 3: Sections - 3.1 to 3.4, 3.7)

UNIT III

Incidence Matrix – Circuit Matrix – Fundamental Circuit Matrix and Rank of B – Path Matrix – Adjacency Matrix. (Chapter 7: Sections - 7.1, 7.3, 7.4, 7.8, 7.9)

UNIT IV

Planar Graphs – Kuratowski's Two Graphs – Euler's formula – Chromatic Number – Chromatic Partitioning – Chromatic Polynomial. (Chapter 5: Sections - 5.2 to 5.4 and Chapter 8: Sections - 8.1 to 8.3)

UNIT V

Matchings – Coverings – Four Colour Problem – Definition – Some types of Digraphs – Directed Paths and Connectedness – Euler Digraphs. (Chapter 8: Sections - 8.4 to 8.6; Chapter 9: Sections - 9.1, 9.2, 9.4, 9.5)

Recommended Text

1. Narsingh Deo, Graph Theory with Applications to Engineering & Computer Science, Prentice Hall of India, New Delhi, 1974.

Reference Books

1. Frank Harary, Graph Theory, Narosa Publishing House Pvt Ltd, New Delhi, 2001.
2. S.Arumugam and S. Ramachandran, Invitation to Graph Theory, Scitech Publications, Chennai, 2001.
3. S.P. Rajagopalan and R. Sattanathan, Graph Theory, Margham Publications, Chennai.
4. Neeraj Pant and Shahab Faruqi, Graph Theory, CBS Publisher, 2017.

Website and e-Learning Source

1. <https://nptel.ac.in>



FINANCIAL MATHEMATICS

Objectives of the Course

- Basic knowledge on stock, bond and mutual funds
- To know the importance of life insurance.

UNIT I

Mathematics of Investment: Stocks – Bonds – Mutual funds. (Chapter 5: Sections - 1 to 3)

UNIT II

Mathematics of Investment: Options – Cost of Capital and Ratio. (Chapter 5: Sections - 4 and 5)

Unit III

Mathematics of Return and Risk: Measuring Return and Risk – The Capital Asset Pricing Model. (Chapter 6: Sections -1 and 2)

Unit IV

Mathematics of Insurance: Life Annuities – Life Insurance. (Chapter 7: Sections - 1, 2.1 to 2.8)

Unit V

Mathematics of Insurance: Life Insurance – Property and Casualty Insurance. (Chapter 7: Sections - 2.9 to 2.14, 3)

Recommended Text

1. M.J. Alhabeeb, Mathematical Finance, A John Wiley & Sons, Inc., Publication, 2012.

Reference Books

1. S.P. Gupta and S. K. Jain, Financial Mathematics, Sahitya Bhawan Publications, 2022.
2. Bimal Jaiswal and Leena S. Shimpi, Financial Mathematics, New Royal Book Company, 2020.
3. Marek Capinski and Tomasz Zastawniak, Mathematics for Finance: An Introduction to Financial Engineering, Springer, 2010.

Website and e-Learning Source

1. <https://nptel.ac.in>



NAAN MUDHALVAN 5

MAT LAB

Objectives of the Course

- Gain knowledge the software MATLAB
- Gain knowledge of array addressing by using MATLAB built
- Understand the knowledge of script files

UNIT I

Starting MATLAB, MATLAB – Windows working in the command window – Arithmetic operations with scalars – Display formats – Elementary Math Built-in functions – Defining scalar variables – Useful commands for managing variables – Related problems. (Chapter1:Sections - 1.1to 1.7)

UNIT II

Creating Arrays: Creating a one-dimensional array (Vector) - Creating a two-dimensional array (Matrix) – The transpose operator – Array addressing – Using a colon in addressing arrays – Adding elements to existing variables – Deleing elements – Built-in functions for handling arrays – Related problems. (Chapter2: Sections -2.1 to 2.9)

UNIT III

Mathematical Operations with Arrays: Addition and subtraction – Array multiplication – Array division – Element-by-Element Operations – Using arrays in MATLAB Built-in Math functions – Built-in functions for analyzing arrays – Related problems. (Chapter 3: Sections - 3.1 to 3.6)

UNIT IV

Creating and Saving a Script File – Running a Script File – Inputto Script File – Output commands – The save and load commands – Related problems.
(Chapter 1: Section- 1.8 and Chapter 4: Sections - 4.1to4.4)

UNIT V

The Plot command – Thef plot command-Plotting multiple graphs in the same plot – Plots with Logarithmic Axes - Plots with Special Graphics – Histograms – Polar plots – Related problems. (Chapter 5: Sections- 5.1 to 5.3, 5.5, 5.7 to 5.9)

Recommended Text

1. Amos Gilat, MATLAB-An Introduction with Applications, The Ohio State University, Wiley, 2012.

Reference Books

1. N.S. Alam and S. S. Alam, Understanding MATLAB: A text book for beginners, TechSar Pvt. Ltd., 2013.
2. R.Pratap, Getting started with MATLAB: A quick introduction for Scientists & Engineers, Oxford, 2010.

Website and e-Learning Source

1. <https://nptel.ac.in>



EXTENSION ACTIVITY

- * NSS/NCC/YRC/RRC/Sports and Games/ Youth Welfare Activities/ Outreach Programmes/ Migration Awareness in the Tamil Nadu Education System
- * Internal: 50 marks and External: 50 marks (total: 100 marks)
- * External examination will be conducted at the end of 6th semester instead of 4th semester as per the existing pattern for extension activity.

