MANONMANIAM SUNDARANAR UNIVERISTY,
TIRUNELVELI-12

SYLLABUS

UG - COURSES – AFFILIATED COLLEGES

Course Structure for B.Sc. Mathematics
(Choice Based Credit System)
(with effect from the academic year 2020-2021 onwards)

Semester-V				
Part	**Subject Status**	**Subject Title**	**Subject Code**	**Credit**
3	Core	Complex Analysis		4
3	Core	Graph Theory		4
3	Core	Number Theory		4
3	Core	Dynamics		4
3	Core	Numerical Methods		4
3	Major Elective	1. Astronomy 2. Fuzzy 3. Mathematics Modeling		4
3	Major Elective	1. Operations Research II 2. Coding Theory 3. Python		4

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 **I 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)**

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

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

- **Classification**
  a) First Class with Distinction : CGPA $\geq$ 7.5*****
  b) First Class : CGPA $\geq$ 6.0
  c) Second Class : CGPA $\geq$ 5.0 and $<$ 6.0
  d) Third Class : CGPA$<$ 5.0

COMPLEX ANALYSIS

Objectives:

- To understand the concepts of complex variables.
- To learn about elementary transformations in complex variables.

Course Learning Outcomes: It enables the students to

1. know the concept of complex integration, Cauchy integral formula.
2. understand the importance of singularity and residues.

UNIT – 1: (Analytic functions)

Functions of a complex variable – Derivatives – Cauchy – Riemann equations – sufficient conditions– Polar form– Analytic functions– Harmonic functions.

UNIT – 2: (Integrals)

Definite integrals – Contours – Cauchy – Goursat theorem – anti-derivatives and independence of path–Cauchy Integral formula – Morera's theorem.

UNIT – 3: (Series)

Taylor's series – Examples – Laurent's series – Zeros of analytic functions – Residues–Residue theorem–Principal part of functions–Residues at poles.

UNIT – 4: (Evaluation of Integrals)

Evaluation of improper real integrals – improper integrals involving sines and cosines – Definite integrals involving sines and cosines.

UNIT – 5: (Transformations)

Basic properties–Bilinear maps–fixed points.

Text Book:

Arumugam.S and T. Issac–"Complex Analysis" –Scitech Publishing House– Chennai,(2002).

Books for Reference :

1. Churchill.R.V. and J.W.Brown–"Complex variables and Applications"– McGraw Hill International Editions – IX Edition,2013.
2. Ponnuswamy.S "Foundations of Complex Analysis", Narosa Publication House, NewDelhi, II Edition 2005.
3. Duraipandian.P and Lakshmi Duraipandian–"ComplexAnalysis"–Emerald Publications, Chennai (2001).

GRAPH THEORY

Objectives:

- To introduce the notion of graph theory and its applications
- To learn the techniques in graph theory

Course Learning Outcomes: It enables the students to

1. know different types of graphs.
2. understand the concepts of walks, trails and paths.

UNIT – 1:

Definition and examples of graphs – degrees - subgraphs – isomorphism – independent sets and coverings – matrices – operation on graphs.

UNIT – 2:

Degree sequences – graphic sequences – walks – trails and paths – connectedness and components–connectivity.

UNIT – 3:

Eulerian graphs – Hamiltonian graphs – characterization of trees – centre of a tree.

UNIT – 4:

Definition and properties of planar graphs – chromatic number and chromatic index.

UNIT – 5:

Chromatic polynomials – definition and basic properties of digraphs – paths and connectedness in digraphs.

Text Book:

Arumugam.S & S.Ramachandran–Invitation to graph Theory, Scitech publications,Chennai, 2002.

Books for reference:

1. Kumaravelu.S and Susheela Kumaravelu – Graph theory- Nagercoil,2002.
2. Narasingh Deo–Graph theory with application to engineering and computer science, Prentice – Hall of India pvt.Ltd., NewDelhi,1979.

NUMBER THEORY

Objectives:

- To highlight the beauties in the world of numbers
- To prepare the students for coding through congruence

Course Learning Outcomes: It enables the students to

1. learn Fermat's Theorem & Wilson's Theorem.
2. understand the importance of Division algorithm.

UNIT -1:

Peano's Axioms – Mathematical induction – The Binomial Theorem – Early Number Theory.

UNIT – 2:

Division Algorithm – GCD – Euclidean Algorithm –The Diaphantine Equation ax+by=c.

UNIT – 3:

The fundamental Theorem of Arithmetic – The Sieve of Eratosthenes – The Goldbach conjecture.

UNIT – 4:

Basic properties of congruences – Linear congruence and the Chinese Remainder Theorem.

UNIT – 5:

Fermat's Theorem – Wilson's Theorem – The Fermat – Kraitchik Factorization Method.

Text Book:

David.M.Burton-ElementaryNumberTheory-Tata McGraw Hill Education Pvt. Ltd-(SixthEdition)-2007.

Books for Reference :

1. Ivan Nivenand. H, Zuckerman-An Introduction to Theory of Numbers,Cambridge University Press -2019.
2. Kumaravelu.S, and Susheela Kumaravelu -Elements of Number Theory-Nagercoil,2002.

DYNAMICS

Objectives:

- To provide a basic knowledge of the behavior of objects in motion
- To develop a working knowledge to handle practical problems

Course Learning Outcomes: It enables the students to

1. develop the Knowledge in Projectiles.
2. learn about the differential equation of central orbit.

UNIT – 1:

Projectiles – Equation of path – range–maximum height – time of flight – range on an inclined plane - problems.

UNIT – 2:

Collision of elastic bodies – Laws of impact – direct and oblique impact-Problems.

UINT – 3:

Simple Harmonic Motion (SHM) in a straight line- Geometrical representation – composition of SHM of the same period in the same line and along two perpendicular directions–problems.

UNIT – 4:

Motion under the action of central forces – velocity and acceleration in polar co-ordinates–problems.

UNIT – 5:

Differential Equation of central orbit - pedal equation of central orbit – problems to find the law of force towards the pole when the orbit is given.

Text Book:

Venkatraman, M.K.- A Text Book on Dynamics, Agasthiar Publication, Trichy,2020.

Books for Reference:

1. Narayanan, S-Dynamics, S.Chand & company, 16th Edition,1986, NewDelhi.
2. Duraipandian.P, LaxmiDuraipandian and Muthamizh Jayaprgasam-Mechanics S.Chand & Company (2003).
3. I.Rajeswari –Mechanics- Saras Publication,Nagercoil,(2016).

NUMERICAL METHODS

Objectives:

- To introduce the finite differences
- To solve numerical problems by different methods

Course Learning Outcomes: It enables the students to

1. recognize numerical differentiation and integration.
2. understand the concepts of solving various numerical problems by using different methods.

UNIT – 1:

Solution of Numerical algebraic and Transcendental Equations : Bisection method– Newton's method. Criterion of order of convergence of Newton's method. Regula False method – Gauss elimination – Gauss Jacobi – Gauss Seidal method.

UNIT – 2:

Finite Difference: First and higher order differences – Forward and backward differences – Properties of Operator – Differences of a polynomial –Factorial Polynomial.

UNIT – 3:

Interpolation: Newton's Forward–backward, Gauss forward–backward interpolation formula–Bessel's formula. Divided differences – Newton's divided difference formula – Lagrange's interpolation formula.

UNIT -4:

Numerical Differentiation and Integration: Newton's forward and backward differences for differentiation – Derivatives using Bessel's formula – Trapezoidal rule, Simpson's 1/3rule & 3/8rule.

UNIT – 5:

Difference Equations: Definition – order and degree of difference equation – Linear difference equation – Finding complementary function – particular Integral – simple applications.

Text Book:

Venkatraman.M.K - Numerical methods in Science and Engineering National Publishing Company - V Edition 1998.

Books for Reference:

1. Kandasamy.P.K.Thilagavathy and K.Gunavathy, Numerical Methods, S.Chand & Company Ltd. Edn. 2006.
2. Autar Kaw and Egwwn Enc Kalu – Numerical methods with Application Abidet. Autokaw.com 2nd Edtion , 2011.
3. Dr.A.Singaravelu Statistics & Numerical Methods, Meenakshi Agency (2012).

ASTRONOMY

Objectives:

- To introduce the exciting world of Astronomy to students
- To understand the movements of the celestial sphere

Course Learning Outcomes: It enables the students to

1. know the Kepler's laws of the Planetary motion.
2. study the concept of the fundamental formula of Spherical trigonometry.

UNIT – 1:

Spherical Trigonometry : Spherical triangle – The fundamental formula of Spherical trigonometry, the sine, cosine, four parts and Napier formula (without proof) and simple problems.

UNIT – 2:

The Celestial Sphere: Celestial co-ordinates – Diurnal motion – Rising and setting of a star – sidereal time – circumpolar stars – Morning and evening stars - Twilight.

UNIT – 3:

Earth – length of a day – Refraction – Tangent formula – Cassini's formula – Effects of refraction.

UNIT – 4:

Geocentric parallax – Effects – Heliocentric parallax – Effects.

UNIT – 5:

Kepler's laws – verification of Kepler's laws – True anomaly, mean anomaly, Eccentric anomaly - Relation between them.

Text Book:

- Kumaravelu.S and Susheela Kumaravelu –Astronomy for degree classes, Rainbow Printers, Nagercoil (2005).

Book for Reference :

- Ramachandran.G.V –Astronomy, Mission Press, Palayamkottai,1965.

FUZZY MATHEMATICS

Objectives:

- To introduce fuzzy concepts to students.
- To facilitate the students to study fuzzy operations and fuzzy numbers.

Course Learning Outcomes: It enables the students to

1. form a clear idea about Fuzzy sets.
2. learn the concepts of Fuzzy operations & Fuzzy numbers.

UNIT – 1:

Crisp Sets – Fuzzy Sets – Basic Types – Basic Concepts – Characteristics and Significance of Paradigm Shift.

UNIT – 2:

Additional properties of α-cuts – representations of fuzzy sets – Extension principle for fuzzy sets.

UNIT – 3:

Fuzzy set operations – Fuzzy complements – Fuzzy intersections: t-norms – Fuzzy Unions: t- conforms –Combinations of operations.

UNIT -4:

Fuzzy Numbers – Linguistic variables – Arithmetic operations on intervals – Arithmetic operations of fuzzy numbers – Lattice of fuzzy numbers – Fuzzy Equations.

UNIT – 5:

Fuzzy Decision Making – Individual Decision Making – Multi – person decision making –Fuzzy linear Programming.

Text Book:

GeorgeJ.Klir and BoBo Yuan–Fuzzy sets and Fuzzy Logic Theory Applications, Prentice Hall of India, 2002, New Delhi.

Book for Reference:

GeorgeJ.KlirandTina. A.Folger–Fuzzy sets, uncertainty and Informations – Prentice Hall of India, 2003, New Delhi.

MATHEMATICAL MODELLING

Objectives:

- To study the mathematical models through ODE and difference equations.
- To train the students to develop mathematical models in real life problems.

Course Learning Outcomes: It enables the students to

1. get training to develop mathematical models in real life problems.
2. make mathematical models through O.D.E. understand the concepts of solving various numerical problem by using different methods.

UNIT – 1:

(Mathematical modeling through O.D.E(First order)): Linear growth and Decay models – Non –linear growth and Decay models – Compartment Models – Dynamics Problems – Geometrical Problems.

UNIT – 2:

Population dynamics – Epidemics – Compartment Models – Economics, Medicine, Arms race, Battles and International Trade.

UNIT – 3:

(Mathematical Modelling through O.D.E.(Second order)): Planetary motion – circular motion – Motion of satellites – Modelling through linear difference equations of second order.

UNIT – 4:

(Mathematical Modelling through difference equations): Basic theory of difference equation with constant coefficients – Economics and Finance – Population dynamics and genetics – Probability theory.

UNIT – 5:

(Modelling through graphs): Solutions that can be modelled through graphs - models in terms of directed graphs, signed graphs – weighted digraphs and unoriented graphs.

Text Book:

• Kapur.J.N – Treatment as in "Mathematical Modelling" New Age International Publishers, 2004.

Books for Reference :

1. Kapur.J.N–Mathematical Modelling in Biology and Medicine – East West Press – 1985.

2. Singh – Mathematical Modelling, International Book house –2003.
3. Frank R.Giordano, MauriceD.Weir and WilliamP.Fox,- A first course in mathematical modelling, Thomson Learning, London and New York, 2003.

OPERATIONS RESEARCH – II

Objectives:

- To introduce Games and strategies.
- To understand networking problems.

Course Learning Outcomes: It enables the students to

1. acquire knowledge about queuing model.
2. solve life oriented problems.

UNIT – 1:

Games and Strategies: Two Person Zero sum Games – The Maximin – Minimax Principle – Games without Saddle Points – Mixed Strategies – Graphical Solution of 2xn and mx2 games–Dominance Property.

UNIT – 2:

Replacement of items that deteriorate with time – replace mentage of a machine taking money value into consideration – replacement of items that completely fail suddenly and Staffing Problems.

UNIT – 3:

Queing models: General concept and definitions – characteristics – properties of Poisson process Models(M/M/1:/FCFS),(M/M/1:N/FCFS),(M/M/S:/FCFS).

UNIT – 4:

Network scheduling by PERT/CPM: Network and basic components – Rules of Network Construction – Time Calculation in network – Critical Path Method –PERT Calculation.

UNIT – V:

Inventory Control : Introductions– Types of Inventories – Inventory decisions– Deterministic inventory Problem – EOQ problems without shortages.

Text Book:

KantiSwarup,P.K.GuptaandManmohan–OperationsResearch–SultanChand&Sons– 2006, 12th Edition.

Books for Reference :

1. Gupta.P.KandD.S.Hira –OperationsResearch– S.Chand & sons – VII Edition..
2. B.J.RanganathandA.S.Srikantappa–Operations Research, Yes Dee Publishing House, Chennai (2017).
3. Hillier,F.S.andG.J.Lieberman –Introduction to Operations Research, 9th Ed., Tata McGraw Hill, Singapore,2009.
4. HamdyA.Taha,-Operations Research, An Introduction,8th Ed.,Prentice–HallIndia,2006.
5. Hadley.G.- Linear Programming, Narosa Publishing House, NewDelhi,2002.

CODING THEORY

Objectives:

- To introduce coding and decoding concepts.
- To develop the students in the field of coding theory.

Course Learning Outcomes: It enables the students to

1. acquire knowledge about different codes.
2. understand the concepts of coding and decoding.

UNIT – 1:

Basic assumptions–Correcting and detecting error patterns–information rate–effects of error correction and detection – finding the most likely code word transmitted.

UNIT – 2:

Linear codes – two important–subspaces independence – basis, dimension–matrices – Bases for C and C+ generating matrices on coding.

UNIT – 3:

Parity check matrices– equivalent codes–distance of a linear code–Linear codes – cosets – MLD for linear codes– Reliability of IMLD for linear codes.

UNIT – 4:

Someboundsforcodes–perfectcodes–hammingcodes–extendedcodes–TheextendedGolaycode–decodingtheextendedGolaycode–Golaycode.

UNIT – 5:

Polynomialsandwords–introductiontocycliccodes–introductiontocycliccodes – Polynomial encoding and decoding – finding cyclic codes – Dual cyclic codes.

Text Books:

• Coding theory, the essentials–Marcel Dekker, Inc. Madtrison Avenue, New York.

Books for Reference:

1. Elwyn Berlekamp – Algebraic Coding Theory – Springer -1970.

PYTHON

Objectives:

- To Know the basic concept and structure of Python program.
- To Develop Student's Programming skills.

Course Learning Outcomes: It enables the students to

1. use string function in python.
2. understand the fundamental concepts to write a Python program

UNIT – 1:

Basics of Python Programming: Features – History – Future – Python Interpreter and Interactive mode – Writing and Executing First Python Program – Value and Types – Data Types – Operators and Expressions – Operations on Strings – Type Conversion – Comments – Functions and Modules. Chapter 2: Section 2.1 – 2.22

UNIT – 2:

Control Flow Statements: Introduction to Decision control Statements – Conditional Branching – Loops Structures – Nested Loops – Break – Continue – Pass – Else Statement Used with Loops. Chapter 3: Section 3.1 – 3.8

UNIT – 3:

Functions: Introduction – Defining a function – Function Call – Variable Scope and Life time – Fruitful Function – Lambda – Function Composition – Documentation Strings – Recursive Functions. Chapter 4: Section 4.1 – 4.8, 4.10 (Omit 4.9)

UNIT – 4:

Strings: Concatenating, Appending and Multiplying Strings – Immutable – Formatting Operator – Built – in String Methods and Functions – Slice Operation – Comparing Strings – Iterating String. Lists, Tuples and Dictionaries: Sequence – Lists. Chapter 5: Section 5.1 – 5.5, 5.8, 5.9 (Omit 5.6, 5.7)

UNIT – 5:

Lists, Tuples and Dictionaries: Tuple – Dictionaries – File Handling: Opening and Closing Files – Reading and Writing Files – Error and Exception Handling: Introduction – Handling Exceptions. Chapter 6: Section 6.4 – 6.5 (Omit 6.3) ,Chapter 7: Section 7.4, 7.5, Chapter 8: Section 8.1, 8.2

Text Book:

"Problem solving and Programming with Python", by Reema Thareja (Second Edition, 2019, OXFORD University Press)

Books for Reference:

1. "Problem Solving and Python Programming", by Mr. Ashok NamdevKamthane and Mr. Amit Ashok kamthane (McGraw Hill Education (India) Private Limited).
2. "Python Programming", by Ch. Sathyanarayana, M. Radhika Mani, B. N. Jagadesh, Universities Press (INDIA) Private Ltd.