

Gujarat University
Choice Based Credit System
Revised Syllabus for Under Graduate (B. Sc.) Mathematics
Effective from June-2017

All Courses and the structure of Under Graduate Mathematics Syllabi remain unchanged except for the minor changes in MAT102, MAT104, MAT302, MAT308, MAT309 and MAT312 Practical-2.

Since there are only minor changes in only a couple of courses, there will not be any old course examinations for any of the under graduate course. However, paper-setters and evaluators are requested to take note of the changes and act in such a way that old repeater students are not at any disadvantage.

Gujarat University
Choice Based Credit System
Revised Syllabus for first semester (Mathematics)
Revised MAT102: Practical (Calculus and Matrix Algebra)

Hours: 4 /week
No. of practical: 16

Credits: 3
Duration: 2hrs/practical

List of Practicals:

- 1) Graphs of Trigonometric and Inverse trigonometric functions.
- 2) Find the limit of sums using the definite integral. (5+5=10 problems)
- 3) Find the definite integrals using substitution. (5+5=10 problems)
- 4) Find the definite integrals using integration by parts. (5+5=10 problems)
- 5) Find the definite integral by method of partial fractions. (5+5=10 problems)
- 6) Find the n^{th} derivative of the functions at the given points.
- 7) Applications of Leibnitz theorem.
- 8) Discuss Convergence of the infinite series.
- 9) Geometrical Interpretation of M.V.T. Problems on M.V.T.
- 10) Expansions of functions in infinite power series using Taylor and Macalurin's formulae
- 11) Evaluate limit using L'Hospital's rule.
- 12) Find RRE form and rank of a matrix.
- 13) Find inverse using Gauss Jordan method (using row operations).
- 14) Verify the Cayley-Hamilton (CH) theorem –inverse of matrix using it- problems on Cayley-Hamilton (CH) theorem.
- 15) Find Eigen values and Eigen vectors of square matrices of order 2 and 3.
- 16) Solution of system of linear equations using row operations and Cramer's rule.

Gujarat University
Choice Based Credit System
Revised Syllabus for first semester (Mathematics)
Revised MAT104: Practical (Differential equation and Co-ordinate Geometry)

Hours: 4 /week
No. of practical: 16

Credits: 3
Duration: 2hrs/practical

List of Practicals:

- 1) Graphs of Cartesian curves (circle, parabola, ellipse, hyperbola, asteroid).
- 2) Graphs of Cartesian curves (logarithm function, exponential function, $\sinh x$, $\cosh x$, $\tanh x$).
- 3) Evaluate the following using reduction formulae only: $\sin^n x$, $\cos^n x$, $\tan^n x$ for different odd/even $n \in \mathbb{N}$. (10 problems)
- 4) Evaluate the $\sin^m x \cos^n x$ using reduction formulae for different odd/even $m, n \in \mathbb{N}$. (10 problems)
- 5) Find the length of arc and curves in Cartesian & parametric forms using definite integral. (5+5 problems)
- 6) Find the surface area of a surface generated by rotating the arc of a continuous curve $y = f(x)$ cut off by straight lines $x=a, x=b$ about x -axis or by similar situation about y -axis, using definite integral. (5+5 problems)
- 7) Find the volume of a solid generated by the continuous curve $y = f(x)$ defined on interval $[a, b]$ and straight lines $x=a, x=b$ about x -axis or by similar situation about y -axis, using definite integral. (5+5 problems)
- 8) Solve the differential equations of order 1 & degree 1.
- 9) Solve the differential equations of order 1 & higher degree.
- 10) Solve the linear differential equations of higher order with constant coefficient.
- 11) Solve the linear differential equations of higher order with variable coefficient.
- 12) The mutual relation between polar and Cartesian co-ordinate system in \mathbb{R}^2 . Transformation of equations from one system to another system.
- 13) The mutual relation among Cartesian, cylindrical and spherical co-ordinate system in \mathbb{R}^3 . Transformation of equations from one system to another system.
- 14) Problems on Sphere.
- 15) Problems on Cone.
- 16) Problems on Cylinder.

Gujarat University
Choice Based Credit System (CBCS)
Revised Syllabus for B. Sc. Semester V (Mathematics)
Revised MAT302: Analysis – I (Theory)

Hours: 4 /week

Credits: 4

Unit I: The Real Numbers

- 1.1 Sets and Functions
- 1.2 Finite and Infinite Sets
- 1.3 Algebraic and Order properties of \mathbb{R}
- 1.4 Absolute Value and Real Line
- 1.5 The completeness Property of \mathbb{R}
- 1.6 The Applications of Supremum Property

1.7 Intervals

Articles 1.1, 1.3, 2.1 to 2.4 of Text Book (2)

Unit II: Sequences

- 2.1 Sequences and limits
- 2.2 Limit Theorems
- 2.3 Monotonic sequences
- 2.4 Sequences defined inductively
- 2.5 Subsequences
- 2.6 Cauchy Sequences
- 2.7 Infinite limits

Articles 4.2 to 4.7 of Text Book (3); 2.4 of Text book (1).

Unit III: Functions and continuity

- 3.1 Limit of a function
- 3.2 Limit theorems
- 3.3 Other limits
- 3.4 Continuity. Intermediate values, extreme values
- 3.5 Uniform continuity
- 3.6 Monotone and Inverse functions

Articles 3.1-3.6 of Text Book (1), Article 5.6 of Text Book (2)

Unit IV: The derivative

- 4.1 Definition
- 4.2 Rules for differentiation
- 4.3 Mean value theorems
- 4.4 Inverse functions
- 4.5 Intermediate value Property of Derivatives
- 4.6 L'Hospital's Rules

Articles 4.1 to 4.4 of Text Book (1), Sections 6.2.11 and 6.2.12, Article 6.3 of Text Book (2)

Text Books:

1. An Introduction to Analysis - Gerald G. Bilodeau, Paul R. Thie and G. E. Keough. Second Edition
2. Introduction to Real Analysis - Robert G. Bartle and Donald R. Sherbert, Wiley Student Edition, 2010.
3. Fundamentals of mathematical analysis- G. Das & S Pattanayak, Tata Mcgraw Hill Pub. Co. Ltd

Reference Books:

1. A First course in Mathematical Analysis, D. Somasundaram & B. Choudhary ,(Corrected Edition) Narosa Publication.
2. Elementary Analysis: the theory of calculus - K. Ross, Springer, India.
3. Numbers to Analysis - I. K. Rana, world scientific.
4. Calculus - Michael Spivak.
5. Principles of Mathematical Analysis- W. Rudin, McGraw-Hill
6. A Course in Calculus & Real Analysis – S. R. Ghorpade & B. V. Limaye
7. A First course in Analysis- D. Somasundaram & B. Choudha

Gujarat University
Choice Based Credit System (CBCS)
Revised Syllabus for B. Sc. Semester VI (Mathematics)
Revised MAT308: Analysis-II (Theory)

Hours: 4 /week

Credits: 4

Unit I: Riemann Integration

- 1.1. Definition of the integral
- 1.2. Properties of the integral
- 1.3. Existence theory (monotone, continuous functions etc. (includes Riemann sums)
- 1.4. Fundamental theorem
- ~~1.5. Integration by parts and change of variable~~
- 1.6. Mean value theorems (~~Weierstrass's Form and Bonnet's Form~~) (First and Second)

Articles 8.1, 8.3, 8.4 of Text book (1).

Unit II: Infinite series

- 2.1 Basic Theory (covers upto comparison test)
- 2.2 Series with positive terms (Condensation Test, Pringsheim's Test)
- 2.3 Absolute convergence (includes alternating series), ratio and root tests with \limsup and \liminf

Articles 3.1 to 3.4 of Text Book (1).

Unit III: Infinite Series –II

- 3.1 Rearrangement of series, Cauchy Product of Series, Merten's theorem
- 3.2 Power Series
- 3.3 Improper integrals of the first and second kind.

Articles 4.12, 4.14, 4.15 of Text book (2); 3.3 to be supplemented from reference book (1) (Article 5.5).

Unit IV: Taylor Series

- 4.1 Taylor's Theorem with Lagrange and Cauchy form of remainders
- 4.2 Expansions of exponential, logarithmic and trigonometric functions
- 4.3 Binomial series theorem
- 4.4 Power series solutions of differential equations

Articles 9.2 of (1); 9.7 of Text book (2); 4.4 to be supplemented from reference book (1) (Article 8.3).

Text Book:

1. A First course in Mathematical Analysis, D. Somasundaram & B. Choudhary (Corrected Edition) Narosa Publication.
2. Fundamentals of Mathematical Analysis, Das and Pattanayak, TMH.

Reference Books:

1. An Introduction to Analysis, Gerald G. Bileau, Paul R. Thie and G.E. Keough. Jones and Bartlett Student edition
2. Introduction to Real Analysis - Robert G. Bartle and Donald R. Sherbert, Wiley Student Edition, 2010.
3. Principles of Mathematical Analysis, W. Rudin, McGraw-Hill
4. Mathematical Analysis by Tom M. Apostol, Narosa Publ. House India.
5. Elementary Analysis: the theory of calculus - K. Ross, Springer, India
6. A Course in Calculus & Real Analysis - S. R. Ghorpade & B. V. Limaye.
7. Mathematical Analysis- Andrew Browder, Springer

Gujarat University
Choice Based Credit System (CBCS)
Revised B. Sc. Semester VI (Mathematics)
Revised MAT309: Analysis-III (Theory)

Hours: 4 /week

Credits: 4

Unit I: Metric Spaces

- 1.1. Definition and Examples
- 1.2. Open Sets.
- 1.3. Closed Sets
- 1.4. Convergence, Completeness and Baire's Theorem.

Articles 9, 10, 11 and 12 (Baire's Theorem without Proof) of Text Book (1)

Unit II: Continuity, Compactness and Connectedness

- 2.1 [Compact sets](#)
- 2.2 [Connected sets](#)
- 2.3 [Continuous functions](#)
- 2.4 [Continuity and compactness](#)
- 2.5 [Continuity and connectedness](#)

[Articles 2.1 \(2.31 to 2.38\), 2.2 \(2.45 to 2.47\), 2.3 \(4.5 to 4.8\), 2.4 \(4.13 to 4.18\), 2.5 \(4.22, 4.23\) covered from Text Book \(2\)](#)

Unit III: Uniform Convergence

- 3.1 Pointwise Convergence
- 3.2 Uniform Convergence
- 3.3 Uniform Convergence and Continuity
- 3.4 Uniform Convergence and Differentiation
- 3.5 Term by Term Integration of Series
- 3.6 Term by Term Differentiation of Series

Articles 9.1-9.5 of Text Book (3)

Unit IV: Applications of Uniform Convergence

- 4.1 Power Series (advanced)
- 4.2 Abel's Limit Theorem, Multiplication of Power Series (Except Stirling's Formula)
- 4.3 Taylor's Series
- 4.4 Weierstrass Approximation Theorem
- 4.5 Exponential, Logarithmic and Trigonometric Functions

Articles 9.6-9.8 and only topics of Article 4.5 from 9.9 of Text Book (3)

Text Books:

1. Topology and Modern Analysis - G. F. Simmons.
2. [Principles of Mathematical Analysis, Third edition- Walter Rudin, McGraw-Hill International Editions, McGraw-Hill Book Company.](#)
3. Fundamentals of Mathematical Analysis - Das and Pattanayak, TMH.

Reference Books:

1. [Mathematical Analysis -Tom Apostol, Addison Wesley](#)
2. Introduction to Real Analysis - Robert G. Bartle and Donald R. Sherbert, Wiley Student Edition, 2010.
3. A First Course in Mathematical Analysis – D. Somasundaram & B. Choudhary, Narosa Publishing House, New Delhi.
4. A Course in Calculus & Real Analysis - S. R. Ghorpade & B. V. Limaye
5. Elementary Analysis: the theory of calculus - K. Ross, Springer. India.
6. Topology of Metric Spaces - S. Kumaresan, Narosa
7. Metric Spaces - Shirali, Springer, India.

Gujarat University
Choice Based Credit System (CBCS)
Revised Syllabus for B. Sc. Semester VI (Mathematics)
Revised MAT312: Practical-2 (Based mainly on MAT309, MAT310)

Hours: 6 /week

Credits: 2.5

List of Practicals:

Unit I:

1. Metric spaces, examples
2. Uniform convergence of sequences
3. Uniform convergence of series, term by term differentiation and integration
4. Multiplication of power series

Unit II:

5. Properties of exponential, logarithmic and trigonometric functions
6. Compact and connected spaces

The following two practicals are not from Unit II

7. Well-known examples of parametric surfaces such as Sphere, Cylinder, Cone, Torus and special case of parametrized surface that is given as a graph of function of two variables $f(u,v)$ along with their special cases. Understand these surfaces and calculate their first fundamental forms.
8. Find surface area of some regions of well-known parametrized surfaces studied in Practical 7.

Unit III:

9. Using the adjacency matrix, determine whether the given graph is connected or not.
10. Determine whether the given graph is connected or not using fusion algorithm.
11. Find a minimal spanning tree of a given connected weighted graph using Kruskal's algorithm.
12. Find a minimal spanning tree of a given connected weighted graph using Prim's algorithm.

Unit IV:

13. Find a shortest path between two vertices of a given connected graph using the Breadth First Search algorithm.
14. Find a shortest path between two vertices of a given connected graph using the Back-tracking algorithm.
15. Find a shortest path between two vertices of a given connected weighted graph using the Dijkstra's algorithm.
16. Construct an Euler tour in a Euler graph using Fleury's algorithm.

References:

1. www.mathworld.com.
2. Elements of Differential Geometry - Richard S. Millman & George D. Parke, Printice-Hall Inc.
3. Elementary Differential Geometry - Andrew Pressley, Springer.
4. Handwritten notes by Mr. H. D. Kamat especially for practical 7 & 8.