Tel. No. 2419677/2419361
Fax: 0821-2419363/2419301

e-mail : registrar@uni-mysore.ac.in
www.uni-mysore.ac.in

UNIVERSITY OF MYSORE

Estd. 1916

Vishwavidyanilaya Karyasoudha
Crawford Hall, Mysuru- 570 005

No.AC.2(S)/31/18-19

Dated: 15.06.2018

NOTIFICATION

Sub: Revision of syllabus for Mathematics (UG) as per CBCS pattern from the academic year 2018-19.

Ref: 1. Decision of Board of Studies in Mathematics (UG) meeting held on 26.02.2018.
2. Decision of the Faculty of Science & Technology Meeting held on 21.04.2018.
3. Decision of the Deans Committee meeting held on 22.05.2018.

*****

The Board of Studies in Mathematics (UG) which met on 26th February, 2018 has recommended to revise the syllabus for B.Sc. Mathematics as per CBCS pattern from the academic year 2018-19.

The Faculty of Science and Technology and the Deans committee meetings held on 21-04-2018 and 22-05-2018 respectively have approved the above said proposal with pending ratification of Academic Council and the same is hereby notified.

The CBCS syllabus of B.Sc. Mathematics course is annexed. The contents may be downloaded **from the University Website i.e., www.uni-mysore.ac.in**.

Draft approved by the Registrar

Deputy Registrar(Academic)

To:

1. The Registrar (Evaluation), University of Mysore, Mysore.
2. The Dean, Faculty of Science & Technology, DOS in Physics, Manasagangotri, Mysore.
3. The Chairperson, BOS in Mathematics, DOS in Mathematics, Manasagangotri, Mysore.
4. The Chairperson, Department of Studies in Mathematics, Manasagangotri, Mysore.
5. The Director, College Development Council, Moulya Bhavan, Manasagangotri, Mysore.
6. The Principals of the Affiliated Colleges where UG Program is running in Science stream.
7. The Deputy/Assistant Registrar/Superintendent, AB and EB, UOM, Mysore.
8. The P.A. to the Vice-Chancellor/Registrar/Registrar (Evaluation), UOM, Mysore.
9. Office file.

SYLLABUS FOR

B.Sc. MATHEMATICS
(CBCS SCHEME)

FROM THE ACADEMIC YEAR
2018-19

UNIVERSITY OF MYSORE
MYSURU

UNIVERSITY OF MYSORE

Choice Based Credit System (CBCS) and

Continuous Assessment and Grading Pattern (CAGP)

For Undergraduate Programs From 2018-19.

Preamble

University Grants Commission (UGC) has stressed on speedy and substantive academic and administrative reforms in higher education for promotion of quality and excellence. The Action Plan proposed by UGC outlines the need to consider and adopt Semester System, Choice Based Credit System (CBCS), and Flexibility in Curriculum Development and Examination Reforms in terms of adopting Continuous Evaluation Pattern by reducing the weightage on the semester end examination so that students enjoy learning environment with a lower stress. Further, UGC expects that institutions of higher learning draw a roadmap in a time bound manner to accomplish the above.

As per UGC guidelines, Academic Council of University of Mysore, in its meeting held on 21-09-2017 has decided to implement CBCS scheme in all undergraduate courses from the academic year 2018-2019. In this connection, a committee was formed to frame CBCS regulations and scheme of Examinations. As per CBCS regulations, Syllabus for B.Sc Mathematics and question paper pattern has been formed by the BOS (UG) in Mathematics in its meeting held on 26-02-2018 at Department of Studies in Mathematics, Manasagangotri, Mysuru-570 006.

1. Scheme of Admission: As per the University rules.
2. Eligibility: As prescribed by the University.
3. Scheme of Examination: Continuous assessment.

Evaluation Pattern:

For Discipline Specific Course (DSC) and Discipline Specific Elective (DSE) papers):

(i) Internal assessment

C1 Component: 10 Marks. This will be based on a theory test for 5 marks and a practical test for 5 marks. This should be completed by the 8^{th} week of the semester.

C2 Component: 10 Marks. This will be based on an assignment for 5 marks and 5 marks for writing practical record. This should be completed by the 15^{th} week of the semester.

(ii) C3 Component:

For Theory:
Main Examination of 3 hours duration: Max. Marks : 60

The pattern of the question paper will be as follows:

There will be 5 questions, each question carrying 12 marks. All questions must be answered.

Question 1. This question covers all the four units of the syllabus. There are 8 questions (Two questions shall be chosen from each unit) each carrying 2 marks. The candidate has to answer any 6 questions.

Question 2. This question covers Unit 1 of the syllabus. There will be 5 sub-questions each carrying 4 marks. The candidate has to answer any three of the 5 sub-questions.

Question 3. This question covers Unit 2 of the syllabus. There will be 5 sub-questions each carrying 4 marks. The candidate has to answer any three of the 5 sub-questions.

Question 4. This question covers Unit 3 of the syllabus. There will be 5 sub-questions each carrying 4 marks. The candidate has to answer any three of the 5 sub-questions.

Question 5. This question covers Unit 4 of the syllabus. There will be 5 sub-questions each carrying 4 marks. The candidate has to answer any three of the 5 sub-questions.

For Practicals:

Main Examination of 3 hours duration: Max Marks: 20

Two experiments will be given each carrying 10 marks.

For Skill Enhancement Course (SEC) papers:

(i) Internal assessment

C1 Component: 5 Marks. This will be based on test. This should be completed by the 8^{th} week of the semester.

C2 Component: 5 Marks. This will be based on assignment. This should be completed by the 15^{th} week of the semester.

(ii) C3 Component:

Main Examination of 2 hours duration: Max. Marks : 40

The pattern of the question paper will be as follows:

There are 3 questions. All questions must be answered. First question carries 10 marks and remaining questions carry 15 marks.

Question 1. This question covers all the two units of the syllabus. There are 6 questions (Three questions shall be chosen from each unit) each carrying 2 marks. The candidate has to answer any 5 questions.

Question 2. This question covers Unit 1 of the syllabus. There will be 5 sub-questions each carrying 5 marks. The candidate has to answer any three of the 5 sub-questions.

Question 3. This question covers Unit 2 of the syllabus. There will be 5 sub-questions each carrying 5 marks. The candidate has to answer any three of the 5 sub-questions.

4. Minimum marks for Securing Credits: As per CBCS regulations.
5. Minimum credits for getting B.Sc. Degree: As per CBCS regulations.
6. Award of degree: As per CBCS regulations.

Structure of B.Sc Mathematics papers

Sem-ester	Sl. No	Code	Title of the paper	Teaching/instructional class hrs/week	Credit Pattern L:T:P	Credit Value	Marks		
							C1	C2	C3
I	1	DSC – MATH-01	Algebra-I and Calculus-I	4 hrs	4:0:2	6	10	10	60
			Practicals-1	4 hrs					20
II	2	DSC – MATH-02	Calculus-II and Theory of Numbers	4 hrs	4:0:2	6	10	10	60
			Practicals-2	4 hrs					20
III	3	DSC – MATH-03	Algebra-II and Differential Equations	4 hrs	4:0:2	6	10	10	60
			Practicals-3	4 hrs					20
IV	4	DSC – MATH-04	Differential Equations-II and Real Analysis-I	4 hrs	4:0:2	6	10	10	60
			Practicals-4	4 hrs					20
V	5	DSE – MATH-01	Real Analysis-II and Algebra-III	4 hrs	4:0:2	6	10	10	60
			Practicals-5	4 hrs					20
	6	SEC – MATH - 01	Applied Mathematics	2hrs	2:0:0	2	5	5	40
	7	SEC – MATH - 02	Numerical Analysis	2hrs	2:0:0	2	5	5	40
VI	8	DSE – MATH-02	Algebra-IV and Complex Analysis-I	4 hrs	4:0:2	6	10	10	60
			Practicals-6	4 hrs					20
	9	SEC – MATH - 03	Complex Analysis-II and Improper Integrals	2hrs	2:0:0	2	5	5	40
	10	SEC – MATH - 04	Graph Theory	2hrs	2:0:0	2	5	5	40

SYLLABI FOR B.Sc. MATHEMATICS

I SEMESTER

DSC – MATH – 01 : ALGEBRA - I AND CALCULUS - I
(4 lecture hours/ week: 16 x 4 = 64 HOURS)

UNIT – I: Matrices (16 hrs)

Rank of a matrix – Elementary row/column operations – Invariance of rank under elementary operations – Inverse of a non-singular matrix by elementary operations.

System of m linear equations in n unknowns – Matrices associated with linear equations – trivial and non trivial solutions – Criterion for existence of non-trivial solution of homogeneous and non-homogeneous systems – Criterion for uniqueness of solutions.

Eigen values and eigenvectors of a square matrix – Properties – Diagonalization of a real symmetric matrix – Cayley - Hamilton theorem – Applications to determine the powers of square matrices and inverses of non-singular matrices.

UNIT – II: Theory of Equations (16 hrs)

Theory of equations – Euclid's algorithm – Polynomials with integral coefficients – Remainder theorem – Factor theorem – Fundamental theorem of algebra(statement only) – Irrational and complex roots occurring in conjugate pairs – Relation between roots and coefficients of a polynomial equation – Symmetric functions – Transformation – Reciprocal equations – Descartes' rule of signs – Multiple roots – Solving cubic equations by Cardon's method – Solving quartic equations by Descarte's Method.

UNIT III: Differential Calculus -I and Integral Calculus - I (16 hrs)

Derivative of a function - Derivatives of higher order – n^{th} derivatives of the functions: e^{ax}, $(ax + b)^n$, log(ax + b), sin(ax + b) , cos(ax + b), e^{ax} sin(bx+ c), e^{ax} cos(bx + c) – Problems, Leibnitz theorem – Monotonic functions – Maxima and Minima – Concavity Convexity and points of inflection.

Definite Integrals, properties and Reduction formulae.

UNIT IV: Differential Calculus -II (16 hrs)

Polar coordinates – angle between the radius vector and the tangent at a point on a curve – angle of intersection between two curves – Pedal equations – Derivative of arc length in Cartesian, Parametric and Polar form, Coordinates of center of curvature – Radius of curvature – Circle of curvature – Evolutes.

.

Books for References:

1. Natarajan, Manicavasagam Pillay and Ganapathy – Algebra
2. Serge Lang – First Course in Calculus
3. Lipman Bers – Calculus, Volumes 1 and 2
4. N. Piskunov – Differential and Integral Calculus
5. B S Vatssa, Theory of Matrices, New Delhi: New Age International Publishers, 2005.
6. A R Vashista, Matrices, Krishna Prakashana Mandir, 2003.
7. G B Thomas and R L Finney, Calculus and analytical geometry, Addison Wesley, 1995.
8. J Edwards, An elementary treatise on the differential calculus: with Applications and numerous example, Reprint. Charleston, USA BiblioBazaar, 2010.
9. N P Bali, Differential Calculus, India: Laxmi Publications (P) Ltd.., 2010.
10. S Narayanan & T. K. Manicavachogam Pillay, Calculus.:S. Viswanathan Pvt. Ltd., vol. I & II 1996.
11. Frank Ayres and Elliott Mendelson, Schaum's Outline of Calculus, 5th ed.USA: Mc. Graw Hill., 2008.
12. Shanti Narayan and P K Mittal, Text book of Matrices, 5th edition, New Delhi, S Chand and Co. Pvt. Ltd.,2013.
13. Shanthi Narayan and P K Mittal, Differential Calculus, Reprint. New Delhi: S Chand and Co. Pvt. Ltd., 2014.

PRACTICALS - 1
(4 hours/ week per batch of not more than 15 students)
Mathematics practical with Free and open Source Software (FOSS) tools for computer programs

Programs using Scilab/Maxima/Python:

1. Getting Started – Introduction.
2. Solving problems in Sets and Functions.
3. Solving problems in Algebra of Polynomials and Rational Functions.
4. Solving problems in Matrices – 1.
5. Solving problems in Matrices – 2.
6. Plotting 2D graphs.
7. Plotting 3D graphs.

II SEMESTER

DSC– MATH – 02 : CALCULUS - II AND THEORY OF NUMBERS
(4 lecture hours / week: 16 x 4 = 64 HOURS)

UNIT I: Limits and Continuity (16 hrs)

Limit of a function – Properties and problems, Continuity of functions – Properties and problems – Infimum and supremum of a function – Theorems on continuity – Intermediate value theorem.

UNIT II: Differential Calculus - III (16 hrs)

Rolle's theorem – Lagrange's Mean Value theorem – Cauchy's mean value theorem – Taylor's theorem – Maclaurin's theorem – Taylor's infinite series and power series expansion – Maclaurin's infinite series – Indeterminate forms.

UNIT III: Partial Derivatives (16 hrs)

Functions of two or more variables – Explicit and implicit functions – The neighbourhood of a point – The limit of a function – Continuity – Partial derivatives — Homogeneous functions – Euler's theorem – Chain rule – Change of variables – Directional derivative – Partial derivatives of higher order – Taylor's theorem for two variables – Derivatives of implicit functions – Jacobians – Some illustrative examples.

UNIT IV: Theory of Numbers (16 hrs)

Division Algorithm - Divisibility – Prime and composite numbers - Euclidean algorithm – fundamental theorem of Arithmetic – The greatest common divisor and least common multiple – congruences – Linear congruences –Simultaneous congruences – Wilson's, Euler's and Fermat's Theorems and their applications.

Books for References:

1. Serge Lang – First Course in Calculus
2. Lipman Bers – Calculus Volumes 1 and 2
3. N P Bali, Differential Calculus, India: Laxmi Publications (P) Ltd.., 2010.
4. S. Narayanan & T. K. Manicavachogam Pillay, Calculus, S. Viswanathan Pvt. Ltd., vol. I & II 1996.
5. G B Thomas and R L Finney, Calculus and analytical geometry, Addison Wesley, 1995.
6. David M Burton, Elementary Number Theory, 6th edition, McCraw Hill, 2007.
7. Emil Grosswald, Topics from the Theory of Numbers, Modern Birhauser, 1984.
8. Ivan Niven, Herbert S. Zuckerman and Hugh L. Montgomery, An Introduction to the Theory of Numbers, John Willey (New York), 1991.

PRACTICALS - 2
(4 hours/ week per batch of not more than 15 students)
Mathematics practical with Free and open Source Software (FOSS) tools for computer programs

Programs using Scilab/Maxima/Python:

1. Programming with Scilab/Maxima/Python – 1.
2. Programming with Scilab/Maxima/Python – 2.
3. Solving problems in Differentiation.
4. Solving problems in Integration.
5. Solving problems in Partial derivatives.
6. Solving problems in Limits & Continuity.
7. Solving problems in Number Theory.

III SEMESTER

DSC – MATH – 03 : ALGEBRA – II AND DIFFERENTIAL EQUATIONS
(4 lecture hours/week: 16 x 4 = 64 HOURS)

UNIT I: Group Theory I (16 hrs)

Definition and examples of groups – Some general properties of Groups, Group of permutations – Cyclic permutations – Even and odd permutations. Powers of an element of a group – Subgroups – Cyclic groups problems and theorems. Cosets, Index of a group, Lagrange's theorem, consequences.

UNIT II: Normal Subgroups and Homomorphism (16 hrs)

Normal Subgroups, Quotient groups – Homomorphism. – Kernel of homomorphism – Isomorphism - Automorphism – Fundamental theorem of homomorphism,

UNIT III: Differential Equations (16 hrs)

Recapitulation of Definition, examples of differential equations, formation of differential equations by elimination of arbitrary constants, Differential equations of first order- separation of variables, homogeneous differential equations. Exact differential equations, reducible to exact, Linear differential equations. The general solution of a linear equation – Integrating factors found by inspection. The determination of integrating factors, Bernoulli's equation.

UNIT IV: Ordinary Differential Equations (16 hrs)

Ordinary Linear differential equations with constant coefficients – Complementary function – particular integral – Inverse differential operators. Cauchy – Euler differential equations – Simultaneous differential equations (two variables with constant coefficients)

Books for References:

1. Daniel A Murray – Introductory Course to Differential equations
2. Earl David Rainville and Philip Edward Bedient – A short course in Differential equations, Prentice Hall College Div; 6th edition.
3. I N Herstien – Topics in Algebra.
4. Joseph Gallian – Contemporary Abstract Algebra, Narosa Publishing House, New Delhi, Fourth Edition.
5. G. D. Birkhoff and S Maclane – A brief Survey of Modern Algebra.
6. J B Fraleigh – A first course in Abstract Algebra.
7. Michael Artin – Algebra, 2nd ed. New Delhi, India: PHI Learning Pvt. Ltd., 2011.
8. Vashista, A First Course in Modern Algebra, 11th ed.: Krishna Prakasan Mandir, 1980.
9. R Balakrishan and N.Ramabadran, A Textbook of Modern Algebra, 1st ed. New Delhi, India: Vikas publishing house pvt. Ltd., 1991.
10. M D Raisinghania, Advanced Differential Equations, S Chand and Co. Pvt. Ltd., 2013.
11. F Ayres, Schaum's outline of theory and problems of Differential Equations, 1st ed. USA McGraw-Hill, 2010.
12. S Narayanan and T K Manicavachogam Pillay, Differential Equations .: S V Publishers Private Ltd., 1981.
13. G F Simmons, Differential equation with Applications and historical notes, 2nd ed.: McGraw-Hill Publishing Company, Oct 1991.
13. E Kreyszig- Advanced Engineering Mathematics, Wiley India Pvt. Ltd.

PRACTICALS - 3
(4 hours/ week per batch of not more than 15 students)
Mathematics practical with Free and open Source Software (FOSS) tools for computer programs

Programs using Scilab/maxima/Python

IV SEMESTER

DSC – MATH – 04 : DIFFERENTIAL EQUATIONS – II AND REAL ANALYSIS - I
(4 lecture hours/week: 16 x 4 = 64 HOURS)

UNIT I: Linear differential equations (16 hrs)

Solution of ordinary second order linear differential equations with variable coefficient by various methods such as :

(i) Changing the independent variable.
(ii) Changing the dependent variable.
(iii) By method of variation of parameters.
(iv) Exact equations.

Total differential equations - Necessary and sufficient condition for the equation Pdx + Qdy + Rdz = 0 to be exact (proof only for the necessary part) – Simultaneous equations of the form $\frac{dx}{P} = \frac{dy}{Q} = \frac{dz}{R}$.

UNIT II: Partial differential equations (16 hrs)

Basic concepts – Formation of a partial differential equations by elimination of arbitrary constants and functions – Solution of partial differential equations – Solution by Direct integration, Lagrange's linear equations of the form Pp + Qq = R , Standard types of first order non-linear partial differential equations – Charpit's method – Homogenous linear equations with constant coefficient – Rules for finding the complementary function – Rules for finding the particular integral, Method of separation of variables (product method).

UNIT III: Line and Multiple Integrals (16 hrs)

Definition of a line integral and basic properties – Examples on evaluation of line integrals – Definition of a double integral – Conversion to iterated integrals – Evaluation of double integrals under given limits - Evaluation of double integrals in regions bounded by given curves. Changing the order of integration, Change of variables from Cartesian to polar - Surface areas. Definition of a triple integral – Evaluation – Change of variables (Cylindrical and Spherical) – Volume as a triple integral.

Unit IV: Riemann integration (16 hrs)

The Riemann integral – Upper and lower sums – Criterion for integrability – Integrability of continuous functions and monotonic functions. Fundamental theorem of Calculus – Change of variables – Integration by parts – First and second mean value theorems of integral calculus.

Books for References:

1. G. Stephonson – An introduction to Partial Differential Equations.
2. B. S. Grewal – Higher Engineering Mathematics

3. E Kreyszig- Advanced Engineering Mathematics, Wiley India Pvt. Ltd.
4. E D Reinville and P E Bedient – A Short Course in Differential Equations
5. D A Murray – Introductory Course in Differential Equations.
6. G P Simmons – Differential Equations
7. F. Ayres – Differential Equations (Schaum Series)
8. Martin Brown – Application of Differential Equations.
9. M D Raisinghania, Advanced Differential Equations, S Chand and Co. Pvt. Ltd., 2013.
10. S C Malik –Real Analysis
11. Leadership project – Bombay university- Text book of mathematical analysis
12. S S Bali – Real analysis.

PRACTICALS - 4
(4 hours/ week per batch of not more than 15 students)
Mathematics practical with Free and open Source Software (FOSS) tools for computer programs

Programs using Scilab/maxima/Python

V SEMESTER

DSE – MATH – 01 : REAL ANALYSIS-II AND ALGEBRA - III
(4 lecture hours/week: 16 x 4 = 64 HOURS)

UNIT I: Sequences (16 hrs)

Sequence of real numbers – Bounded and unbounded sequences – Infimum and supremum of a sequence – Limit of a sequence – Sum, product and quotient of limits – Standard theorems on limits – Convergent , divergent and oscillatory sequences – Standard properties – Monotonic sequences and their properties – Cauchy's general principle of convergence.

UNIT II: Infinite Series (16 hrs)

Infinite series of real numbers – Convergence and Divergence - Oscillation of series – Properties of convergence – Series of positive terms – Geometric series – p – series – Comparison tests – D'Alembert's ratio test – Raabe's test – Cauchy's root test – Leibnitz's test for alternating series. Summation of Binomial, Exponential and Logarithmic series.

UNIT III: Rings and Fields (16 hrs)

Rings – Examples – Integral Domains – Division rings – Fields – Subrings. Subfields – Characteristic of a ring – Ordered integral domain – Imbedding of a ring into another ring – The field of quotients – Ideals – Algebra of Ideals – Principal ideal ring – Divisibility in an integral domain – Units and Associates – Prime elements

UNIT IV: Polynomial rings and Homomorphisms (16 hrs)

Polynomial rings – Divisibility – Irreducible polynomials – Division Algorithm – Greatest Common Divisors – Euclidean Algorithm – Unique factorization theorem – Prime fields – Quotient rings – Homomorphism of rings – Kernel of a ring homomorphism – Fundamental theorem of homomorphism – Maximal ideals – Prime ideals – Properties – Eisenstein's Criterion of irreducibility.

Books for References:

1. S.C Malik –Real Analysis
2. S.C.Malik and Savita Arora, Mathematical Analysis, 2nd ed. New Delhi, India: New Age international (P) Ltd., 1992
3. Richard R Goldberg, Methods of Real Analysis, Indian ed.
4. Asha Rani Singhal and M .K Singhal, A first course in Real Analysis
5. I. N. Herstien – Topics in Algebra.
6. G. D. Birkhoff and S Maclane – A brief Survey of Modern Algebra.
7. T. K. Manicavasagam Pillai and K S Narayanan – Modern Algebra Volume 2
8. J B Fraleigh – A first course in Abstract Algebra.
9. Robert G Bartle and Donald R Sherbert, Introduction to Real Analysis, John Wiley and Sons Inc., Fourth Ed.

PRACTICALS - 5
(4 hours/ week per batch of not more than 15 students)
Mathematics practical with Free and open Source Software (FOSS) tools for computer programs

Programs using Scilab/maxima/Python

V SEMESTER

SEC – MATH – 01 : APPLIED MATHEMATICS
(2 lecture hours/week: 16 x 2 = 32 HOURS)

UNIT I: **Laplace Transforms (16 hrs)**

Definition and basic properties – Laplace transforms of e^{kt}, cos kt, sin kt, a^t, t^n, cosh kt and sinh kt – Laplace transform of e^{at} F(t), t^n F(t), F(t)/t – problems – Laplace transform of derivatives of functions – Laplace transforms of integrals of functions – Laplace transforms of α-functions – Inverse Laplace transforms – problems.

Convolution theorem – Simple initial value problems – Solution of first and second order differential equations with constant coefficients by Laplace transform method.

UNIT II: Fourier series (16 hrs)

Introduction – Periodic functions – Fourier series and Euler formulae (statement only) – Even and odd functions – Half range series – Change of interval.

References

1. Murray R Speigel – Laplace Transforms
2. E Kreyszig- Advanced Engineering Mathematics, Wiley India Pvt. Ltd.
3. M D Raisinghania, Laplace and Fourier Transforms S. Chand publications.

V SEMESTER

SEC – MATH – 02 : NUMERICAL ANALYSIS
(2 lecture hours/week: 16 x 2 = 32 HOURS)

UNIT I: Numerical Analysis (16 hrs)

Numerical solutions of Algebraic and transcendental equations – Bisection method – The method of false position – Newton – Raphson method .

Numerical solutions of first order linear differential equations – Euler – Cauchy method – Euler's modified method – Runge -Kutta fourth order method – Picard's method.

UNIT II: Finite differences and Numerical integration (16 hrs)

Forward and backward differences – shift operator – Interpolation – Newton – Gregory forward and backward interpolation formulae – Lagrange's interpolation formula.

General quadrature formula – Trapezoidal Rule – Simpson's 1/3 rule – Simpson's 3/8 th rule, Weddle's rule.

Books for References:

1. B. D Gupta – Numerical Analysis
2. H. C Saxena – Finite Difference and Numerical Analysis
3. S. S. Shastry- Introductory Methods of Numerical Analysis
4. B. S. Grewal – Numerical Methods for Scientists and Engineers
5. M K Jain, S R K Iyengar, and R K Jain, Numerical Methods for Scientific and Engineering Computation, 4th ed. New Delhi, India: New Age International, 2012.
6. S S Sastry, Introductory methods of Numerical Analysis, Prentice Hall of India, 2012.
7. E Kreyszig- Advanced Engineering Mathematics, Wiley India Pvt. Ltd.

VI SEMESTER

DSE – MATH – 02 : ALGEBRA - IV AND COMPLEX ANALYSIS I
(4 lecture hours/week: 16 x 4 = 64 HOURS)

UNIT I: Vector Spaces (16 hrs)

Vector Spaces – Definition – Examples – Vector subspaces – Criterion for a subset to be a subspace – Algebra of Subspaces – Linear Combination – Linear Span – Linear dependence and linear Independence of vectors – Theorems on linear dependence and linear independence – Basis of a vector space – Dimension of a vector space — Some properties – Quotient spaces – Homomorphism of vector spaces– Isomorphism of vector spaces – Direct Sums.

UNIT II: Linear Transformations (16 hrs)

Linear transformation – Linear maps as matrices – Change of basis and effect of associated matrices – Kernel and image of a linear transformation – Rank and nullity theorem – Eigen values and Eigen vectors of a linear transformation.

UNIT III: Functions of a Complex Variable (16 hrs)

Equation to a circle and a straight line in complex form, Limit of a function – Continuity and differentiability – Analytic functions – Singular points – Cauchy-Riemann equations in Cartesian and polar forms – Necessary and sufficient condition for function to be analytic – Harmonic functions – Real and Imaginary parts of an analytic function are harmonic – Construction of analytic function i) Milne Thomson Method – ii) using the concept of Harmonic function.

UNIT IV: Transformations (16 hrs)

Definition – Jacobean of a transformation – Identity transformation – Reflection – Translation – Rotation – Stretching – Inversion – Linear transformation – Definitions – The Bilinear transformations – Cross Ratio of four points – cross ratio preserving property – Preservation of the family of straight lines and circles – conformal mappings – Discussion of the transformations $w = z^2$, $w = \sin z$. $w = e^z$, $w = \frac{1}{2}(z + 1/z)$.

Books for References:

1. I. N. Herstien – Topics in Algebra.
2. Stewart – Introduction to Linear Algebra
3. T. K. Manicavasagam Pillai and K S Narayanan – Modern Algebra Volume 2
4. S. Kumaresan – Linear Algebra
5. G. D. Birkhoff and S Maclane – A brief Survey of Modern Algebra.
6. Gopalakrishna – University Algebra
7. Saymour Lipschitz – Theory and Problems of Linear Algebra.

8. L. V. Ahlfors – Complex Analysis
9. Bruce P. Palka – Introduction to the Theory of Function of a Complex Variable
10. Serge Lang – Complex Analysis
11. Shanthinarayan – Theory of Functions of a Complex Variable
12. S. Ponnuswamy – Foundations of Complex Analysis
13. R. P. Boas – Invitation to Complex Analysis.
14. R V Churchil & J W Brown, Complex Variables and Applications, 5th ed.:McGraw Hill Companies., 1989.
15. A R Vashista, Complex Analysis, Krishna Prakashana Mandir, 2012.
16. Tristan Needham, Visual Complex Analysis, Clarendon Press Oxford.

PRACTICALS - 6
(4 hours/ week per batch of not more than 15 students)
Mathematics practical with Free and open Source Software (FOSS) tools for computer programs

Programs using Scilab/maxima/Python

VI SEMESTER

SEC – MATH – 03 : COMPLEX ANALYSIS II AND IMPROPER INTEGRALS
(2 lecture hours/week: 16 x 2 = 32 HOURS)

UNIT I: Complex Integration (16 hrs)

The complex Line integral – Examples and Properties – Proof of Cauchy's Integral theorem using Green's Theorem – Direct consequences of Cauchy's theorem – The Cauchy's integral formula for the function and the derivatives – Applications to the evaluations of simple line integrals – Cauchy's Inequality – Liouville's theorem – Fundamental theorem of Algebra.

UNIT II: Improper Integrals (16 hrs)

Improper Integrals (definition only) – Gamma and Beta functions and results following the definitions – Connection between Beta and gamma functions – Applications to evaluation of integrals – Duplication formula.

Books for References:

1. L. V. Ahlfors – Complex Analysis
2. Bruce P. Palka – Introduction to the Theory of Function of a Complex Variable
3. Serge Lang – Complex Analysis
4. Shanthinarayan – Theory of Functions of a Complex Variable
5. S. Ponnuswamy – Foundations of Complex Analysis
6. R P Boas – Invitation to Complex Analysis.
7. R V Churchil & J W Brown, Complex Variables and Applications, 5th ed.:McGraw Hill Companies., 1989.
8. A R Vashista, Complex Analysis, Krishna Prakashana Mandir, 2012.
9. Tristan Needham, Visual Complex Analysis, Clarendon Press Oxford.

VI SEMESTER

SEC – MATH – 04 : GRAPH THEORY
(2 lecture hours/week: 16 x 2 = 32 HOURS)

UNIT - I: Basics of Graph theory (16 hrs)

Basic Definitions, Isomorphism, Subgraphs, Operations on graphs, Walks, Paths, Circuits, Connected and disconnected graphs, Euler graphs, Hamiltonian graphs, Some Applications, Trees and Basic properties, Distance, Eccentricity, centre, Spanning trees, Minimal spanning tree.

UNIT - II: Cut- sets, Cut- vertices and Planar Graphs (16 hrs)

Cut- sets, Fundamental circuits; fundamental cut-sets, Connectivity, Separability, cut-vertex, Network flows, 1- and 2- Isomorphisms. Planar and non planar graphs, Euler's formula, Detection of planarity. Matrix representation of Graphs – Adjacency matrix of a graph, Incidence matrix of a graph.

Books for References:

1. Edgar G. Goodaire and Michael M. Parameter, Discrete Mathematics with Graph theory, 2nd Ed., Pearson Education(Singapore) P. Ltd., Indian Reprint, 2003.
2. Rudolf Lidl And Gunter Pilz, Applied Abstract Algebra, 2nd Ed., Undergraduate Texts in Mathematics, Springer (SIE), Indian reprint, 2004.
3. C.L. Liu – Elements of discrete mathematics, McGraw-Hill, 1986.
4. Kenneth H. Rosen – Discrete Mathematics and its applications, McGraw-Hill, 2002.
5. F Harary – Graph theory, Addison Wesley, Reading Mass, 1969.
6. N Deo – Graph theory with applications to Engineering and Computer Science, Prentice Hall of India, 1987.
7. K R Parthasarathy – Basic Graph theory, Tata McGraw-Hill, New Delhi, 1994.

8. D B West – Introduction to Graph theory, Pearson Education inc., 2001, 2nd Ed.
9. J A Bondy and U S R Murthy – Graph theory with applications, Elsevier, 1976.

Useful web links:

1. http://www.cs.columbia.edu/~zeph/3203s04/lectures.html
2. http://home.scarlet.be/math/matr.htm
3. http://www.themathpage.com/
4. http://www.abstractmath.org/
5. http://ocw.mit.edu/courses/mathematics/
6. http://planetmath.org/encyclopedia/TopicsOnCalculus.html
7. http://mathworld.wolfram.com/
8. http://www.univie.ac.at/future.media/moe/galerie.html
9. http://www.mathcs.org/
10. http://www.amtp.cam.ac.uk/lab/people/sd/lectures/nummeth98/index.htm
11. http://math.fullerton.edu/mathews/numerical.html
12. http://www.onesmartclick.com/engineering/numerical-methods.html
13. http://www.math.gatech.edu/~harrell/calc/
14. http://tutorial.math.lamar.edu/classes/de/de.aspx
15. http://www.sosmath.com/diffeq/diffeq.html
16. http://www.analyzemath.com/calculus/Differential_Equations/applications.html
17. http://www.math.gatech.edu/~harrell/calc/
18. http://www.amtp.cam.ac.uk/lab/people/sd/lectures/nummeth98/index.htm
19. http://www.fourier-series.com/
20. http://www.princeton.edu/~rvdb
21. http://www.zweigmedia.com/RealWorld/Summary4.html
22. http://www.math.unl.edu/~webnotes/contents/chapters.htm
23. http://www-groups.mcs.st-andrews.ac.uk/~john/analysis/index.html
24. http://web01.shu.edu/projects/reals/index.html

* * * * * * * * * * *