RAJIV GANDHI UNIVERSITY

(A Central University)

RONO HILLS :: DOIMUKH

DEPARTMENT OF MATHEMATICS

Semester wise Course Structure

M. Phil. (Two Years)

Mathematics & Computing

w.e.f. 2019-20

STRUCTURE OF THE SYLLABUS FOR
M. Phil. (TWO YEARS) PROGRAMME

M. Phil. Programme			
Semester	*Paper Code*	*Title*	*Marks Distribution*
I-Semester (Two Papers)	*MATH –601*	*Research Methodology*	*Th–60, Int– 20, Proj–20*
	MATH –602	*Computer Applications*	*Th–50, Int– 20, Pr–30*
II-Semester	*Optional Papers (MATH –603 to MATH –608) (Only one paper is to be selected)*		
	MATH –603	*Advanced Analysis*	*Th–80, In– 20*
	MATH –604	*Functional Analysis*	*Th–80, Int– 20*
	MATH –605	*Approximation Theory*	*Th–80, Int– 20*
	MATH –606	*Advanced Fluid Dynamics*	*Th–80, Int– 20*
	MATH –607	*Algebra*	*Th–80, Int– 20*
	MATH –608	*Number theory and special functions*	*Th–80, Int– 20*
II-Semester	*MATH –609*	*Review of Research paper (Concerned Research field)*	*Review Report–50, Int – 20, Presentation– 30*
III & IV – Semester	*Preparation of Dissertation on the concerned Research Topic and Viva-Voce*		

Th – Theory, Int – Internal, Proj – Project

DEPARTMENT OF MATHEMATICS
Date:
RAJIV GANDHI UNIVERSITY

Department of Mathematics

HEAD
Department of Mathematics
Rajiv Gandhi University
Rono Hills, Doimukh (A.P.)

(Approved by the BPGS in Mathematics held on 16 May 2019)

FIRST SEMESTER

MATH: 601: RESEARCH METHODOLOGY

Maximum marks **:** 100 (Terminal–60, Sessional–20, Project–20)
Term end **:** 60
Terminal Examination duration **:** 2 and ½ hours

Course Outcome: *The paper equips students with the basics of the research. It equips students with concept of Formulating research aim and objectives in an appropriate manner are one of the most important aspects and give the overall direction of the research.*

Unit	Contains	Marks
I	***An overview of Research Methodology:*** *Research concept, characteristics of Research, the choice and statement of research problem, justification and hypothesis. Literature collection-textual and digital.* ***Elementary Scientific Method:*** *Authority in science, observation and descriptions, analysis and synthesis, Hypothesis, Deduction, Models and Mathematics, Testing of Hypothesis, Preparation of research synopsis, Significance of Research Work.*	**20**
II	***Scientific writing skills and Technical writing skills:*** *Form of scientific and technical writing: Planning and Producing documents, Documents types, elements of technical documents, Graph and figure, Paragraphs, Mechanism of, citing sources and listing Reference, Reference Writings, Different types of Article and Theses writing styles.*	**20**
III	***Numerical Analysis:*** *Interpolations, Differentiations and Integrations. Solving differential equations by Euler and Euler modified methods, Finite Difference Methods.*	**20**

UNIT-IV : PROJECT WORK

Contact Hours Per Week : 2 hours
Examination Duration : 1 hour
Maximum Marks **: 20** (Record-10,Presentation-5, Viva-5)

Research Project Proposal and Resource Generation:

1. *Write a Research Project Proposal;*
2. *Getting funds from different funding agencies.*

Internal Assessment: Seminar Presentation. ***Marks – 20***

Text and Reference Books

1. *Nicholas J. Higham: Handbook of Writing for the Mathematical Sciences, Second Edition, SIAM Publisher (1998).*
2. *Robert K, Yin: Case Study Research: Design and Methods, Sage Publications Ltd., London (2008).*
3. *Leslie C. Prerelman: The Mayfield Technical Scientific Writing, Tata James parade & McGraw Hills (2001).*

4. *H. C. Saxena: Finite Difference and Numerical Analysis, S. Chand & Co. (2005).*

FIRST SEMESTER

MATH: 602: COMPUTER APPLICATIONS

Maximum marks **:** 100 (Terminal–50, Sessional–20, Practical–30)
Term end **:** 50
Terminal Examination duration **:** 2 hours

Course Outcome: *The students are expected to be well equipped with fundamentals knowledge of computer programming and mathematical software's for their computational aspects of their research.*

Unit	Contains	Marks
	Plane Geometry	
I	*Fundamental of Computing, Windows and UNIX (Linux) operating systems, MS- Office, Problem Solving Techniques, Networking.*	**20**
II	*Programming in C, MATLAB and MATHEMATICA, Complete idea on LaTeX and LyX.*	**30**

UNIT-III : PRACTICAL
Contact Hours Per Week : 2 hours
Examination Duration : 2 hours
Maximum Marks **: 30** (Expt-20, Viva-5, Record-5)

Experiments

1. *Summation of series through MATHEMATICA / MATLAB / C – Programming.*
2. *Plotting the graphs of the polynomial of degree 2 to 5 through MATHEMATICA / MATLAB / C – Programming.*
3. *Solution of quadratic equations MATHEMATICA / MATLAB / C – Programming.*
4. *Obtaining adjoint and inverse of a matrix through MATHEMATICA / MATLAB / C – Programming.*
5. *Find the sum of Gregory's series by MATLAB.*
6. *Matrix operation (addition, multiplication, inverse, transpose) by MATHEMATICA / MATLAB.*
7. *Display Mathematical statements/Mathematical equations etc. by LaTeX.*
8. *Solution of ODE & PDE by MATHEMATICA / MATLAB.*
9. *Evaluation of Standard Deviation, Correlation, Regression etc by MATHEMATICA / MATLAB.*
10. *Solution of system of linear equations by Gauss Elimination method through MATHEMATICA / MATLAB / C – Programming.*

Internal Assessment: Seminar Presentation Marks– 20

Text and Reference Books

1. *V. Rajarman: Fundamentals of Computing, PHI.*
2. *Jon Sticklen & M. Taner Eskil : An Introduction to Technical Problem Solving with MATAB v.7, 2e, 2 2006, Great lakes press.*
3. *Michel Trott: The Mathematical Guide Book for Programming, 2004, Spinger-Verlag.*
4. *P. Dey and M. Ghosh: Computer Fundamentals and Programming in C, 2007, Oxford University Press*
5. *Shubhi Lall: Computer Fundamentals and Introduction to IBM. PC, 2005, University Book House*
6. *E.Balagurusamy: Programming in ANSIC, Tata McGraw Hill, 2001.*
7. *Laslie Lamport : LaTeX: a document preparation system, User's guide and reference Manual, 2nd Edition, Addison Wesley, 1994.*
8. *F. Mittelbach: The LaTeX Companion, 2nd Edition, Addison Wesley, 2004.*

SECOND SEMESTER

MATH – 603: AVANCED ANALYSES

Optional Paper

Maximum marks **:** 100 (Terminal – 80, Sessional – 20)
Term end **:** 80
Terminal Examination duration **:** 3 hours

Course Outcome: *The students are expected to apply these concepts to study the topological properties of different spaces in their research work.*

Unit	Contains	Marks
I	*Nets and filters, their convergence, and interrelation. Hausdorffness and compactness in terms of net/filter convergence.*	**20**
II	*Tychonoffs theorem on the topological product of compact spaces. Local finiteness. Paracompactness- Normality of a paracompact space.*	**30**
III	*The L^p – space. Convex functions. Jensen's inequality. Holder and Murkowski inequalities. Completeness of L^p. Convergence in measure, almost uniform convergence.*	**30**

Internal Assessment: ***Seminar Presentation*** ***Marks– 20***

Text Books:

1. *James Munkers: Topology.*
2. *H. L. Rodyn: Real Analysis.*
3. *T. M. Apostol: Mathematical Analysis.*

SECOND SEMESTER

MATH – 604: FUNCTIONAL ANALYSIS

Optional Paper

Maximum marks : 100 (Terminal – 80, Sessional – 20)
Term end : 80
Terminal Examination duration : 3 hours

Course Outcome: *Knowing this module, if someone wants to do research works on functional analysis, especially in- sequence space, operator theory, fixed point theory etc., then this module will certainly guides the students.*

Unit	Contains	Marks
I	*Convergence of Cauchy nets in a Banach spaces, computation of conjugate spaces of continuous linear functional on certain Banach spaces, Weak and Weak* topologies on Banach spaces, the conjugate space of C([0,1]).*	**20**
II	*The Lebesgue space: L^1 and L^∞ ; The Dardy spaces: H^1 and H^∞ .*	**20**
III	*The Banach algebra of continuous functions, Abstract Banach algebras, Abstract index in a Banach algebra, Gelfand- Mazur Theorem, Sectral radius formula, Stone Weierstrass theorem, The Disk algebra, Algebra of functions with absolutely convergent Fourier series.*	**20**
IV	*Weak and strong operator topology, W* algebras, Isomorphism of L^∞ spaces, Maximal abelian W* algebras, Homomorphism of C* algebras, Extended functional calculus, Fuglede Theorem.*	**20**

Internal Assessment: Seminar Presentation Marks– 20

Text Books:

1. *R. G. Dougals: Banach Algebra Techniques in Operator Theory, Academic Press, 1971.*
2. *R. Larsen: Banach Algebras, Marcel Dekker Inc., New York, 1973.*
3. *B. V. Limaye: Functional Analysis, Wiley Eastern Limited, New Delhi, 1996.*
4. *Ervin Kreyszig: Introductory Functional Analysis with Applications John Wiley and Sons.*

SECOND SEMESTER

MATH – 605: APPROXIMATION THEORY

Optional Paper

Maximum marks **:** 100 (Terminal – 80, Sessional – 20)
Term end **:** 80
Terminal Examination duration **:** 3 hours

Course Outcome: *The students are expected to understand and master theoretical issues that arise in approximation of functions by polynomials which will encourage research in the areas of approximation theory.*

Unit	Contains	Marks
I	*Linear operators, Examples – Bernstein Polynomials, Fourier series, Approximation theorem-Bohman and Korvokin's theorems, and its applications***.**	**20**
II	*Exostejce pf polynomials of best approximation, characteristics of polynomial of best Approxination, Applications of convexity, Chebyshev system.*	**20**
III	*Apolication of some complex functions, Uniqueness of polynomials of Best Approximation, Chebyshev theorem, Chebyshev polynomial Interpolation, Algebraic polynomials, Trigonometric Polynomials.*	**20**
IV	*Least square approximation, Approxmation on an interval, Jacobi polymomials, Approcimation on a finite set of uniform approximation on a finite set of points.*	**20**

Internal Examination: Seminar Presentation ***Marks – 20***

Tex Books:

1. *G. G. Lorentz: Approximation of Functions; Holt, Tinehart and Wiston, Inc. 1966.*
2. *T. J. Rivlin: An introduction to the Approximation of Functions, Dover publications, 1981.*

Reference Books:

1. *N. Hrushikesh, M. haskar and D. V. Pai: Fundamental of Approximation theory, Narosa Publishing House, 2000.*
2. *A. F. Timan: Theory of Functions Real Variable, New York, Macmillan, 1963.*
3. *G. Meinnardus: Approximation of Functions Theory and Nunerical Methods, Springer Verlag, Vol- 13, 1967.*

SECOND SEMESTER

MATH -606: ADVANCED FLUID DYNAMICS

Optional Paper

Maximum marks **:** 100 (Terminal – 80, Sessional – 20)
Term end **:** 80
Terminal Examination duration **:** 3 hours

Course Outcome: *It is intended to provide a treatment of advanced topics in fluid mechanics where the students will be able to apply the techniques used in deriving arrange of important results and in research problems.*

Unit	Contains	Marks
I	***Dimensional Analysis*:** *Similitude; Geometrical, Kinematic and Dynamic Similarity; Dimensionless numbers, Techniques of dimensional analysis: Rayleigh technique and Buckingham pi- theorem.*	**20**
II	***Heat Transfer:*** *Heat Transfer, Fouriers Law, the energy equation-conservation of energy, temperature distribution in (i) Couette flow, (ii) Poiseuille flow, (iii) Hagen-Poiseuille flow, thermal boundary layer, thermal boundary layer equation in two dimensional flow, free convection and forced convection.*	**30**
III	***Mass Transfer:*** *Mass transfer, Diffusion and Convection. Fick's law, Concentration boundary layer equations.* ***Perturbation Method*:** *Series Solution Methods or Perturbation Techniques for solving differential equations.*	**30**

Internal Assessment: Seminar Presentation ***Marks – 20***

Text Books:

1. *H. Schlichting: Boundary Layer theory, Mc. Graw- Hill pub Co.*
2. *H. D. Baehr and K. Stephan: Heat and Mass Transfer.*
3. *J. L. Bansal: Viscous Fluid Dynamics.*
4. *A. Bejan: Convection Heat Transfer.*
5. *J. A. Shercliff: A Text Book of Magnetohydrodynamics, Pergamen Press.*
6. *Milton- Von Dyke: Perturbation techniques in fluid mechanics.*

Reference Books*:*

1. *L. Rosenhead: Laminar boundary layers.*
2. *F. Chorlton: A Text Book of Fluid Dynamics by, CBS.*
3. *Schaum's Series : Fluid Dynamics, 3rd Edition.*
4. *V. C. A. Ferraro & C. Plumpton: Magnetohydrodynamics, Oxford University Press.*
5. *Von Dyake: Fluid Dynamics.*

SECOND SEMESTER

MATH – 607: ALGEBRA

Optional Paper

Maximum marks **:** 100 (Terminal – 80, Sessional – 20)
Term end **:** 80
Terminal Examination duration **:** 3 hours

Course Outcome: *Knowing this module, if someone wants to do research works on algebra, especially in-commutative and non-commutative algebra, category theory, Goldie dimension, algebraic geometry, lie groups, algebraic graphs theory, theoretical computer science etc., then this module will certainly guides the students.*

Unit	Contains	Marks
I	*Rings and Ideals; Maximal ideals: Algebra of Ideals; Quotient Ring; Local Ring; Modules; Basic properties of Modules; Simple Modules.*	**20**
II	*Chain conditions; ascending chain conditions on modules; maximal condition; Noetherian modules; descending chain conditions; minimal condition, Artinian modules; their properties; Noetherian rings; Hilbert basis theorem; Artinian rings; structure theorem for Artinian rings, Uniform Modules; Goldie Rings.*	**30**
III	*Tensor Product of modules; Existence and uniqueness of tensor product of two modules; Tensor product of scakars; exactness properties of the tensor products; Algebras; Tensor product of algebras, Essential Extensions; Injective Hulls: Semi simple Modules; The Singular Submodules.*	**30**

Internal Assessment: Seminar Presentation ***Marks – 20***

Text Books:

1. *M. F. Atiyah and I.G. Macdonald: Introduction to Commulative Algebra, AdditionWesley, 2000.*
2. *S. Lang: Algebra, Addition –Wesley Publication Company, London, 2000.*
3. *C. Musili: Introduction to Rings and Modules, Narosa Publishing House, New Delhi,1999.*

Reference Books*:*

1. *K. R. Gooderal: Rings Theory Nonsingular Rings and Modules, Marcel Dekker Inc, New York, 1976*
2. *M. Reid: Undergraduate Commutative Algebra; London, Math. Soc. 1995*
3. *H. Matsumara: Commutative Algebra; Benjamin/ Cummings Pub. Company, 1980.*
4. *A.W. Chatters and C. R. Hajarnavis: An Introduction Course in Commutative Algebra; Oxford University Press, 1960.*
5. *David Eisenbud: Commutative Algebra; Springer 1960.*

SECOND SEMESTER

MATH – 608: Number Theory and Special Functions

Optional Paper

Maximum marks **:** 100 (Terminal – 80, Sessional – 20)
Term end **:** 60
Terminal Examination duration **:** 3 hours

Course Outcome: *The course provides a foundation to number theory, q-series and their applications in the field of partition theory, continued fractions and other related areas. The paper encourages research in the areas of mathematics inspired by Ramanujan.*

Unit	Contains	Marks
I	*Liner and Polynomial congruence, Diophantine equation, representations of number as of two squares and three squares, Fermat's last theorem.*	**25**
II	*Partition of a number, graphical representation of portion, conjugates partition.*	**25**
III	*Q-Series and infinite products, Ramanujan's general theta-function and its special cases. Simple relations of theta-functions. Jacobi's triple product identity, Rogers-Ramanujan functions, their identities and partition theoretic interpretations.*	**30**

Internal – Seminar Presentation ***Marks – 20***