

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

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

Th – Theory, Int – Internal, Proj – Project




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(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

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).



Text and Reference Books

1. V. Rajarman: *Fundamentals of Computing*, PHI.
2. Jon Sticklen & M. Taner Eskin : *An Introduction to Technical Problem Solving with MATLAB v.7, 2e, 2 2006*, Great lakes press.
3. Michel Trott: *The Mathematical Guide Book for Programming*, 2004, Springer-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

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

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, Spectral 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. Douglas: 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

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

Internal Examination: Seminar Presentation

Marks – 20

Text Books:

1. G. G. Lorentz: *Approximation of Functions*; Holt, Rinehart and Winston, 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. Meinardus: *Approximation of Functions Theory and Numerical 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

Unit	Contains	Marks
I	Dimensional Analysis: <i>Similitude; Geometrical, Kinematic and Dynamic Similarity; Dimensionless numbers, Techniques of dimensional analysis: Rayleigh technique and Buckingham pi- theorem.</i>	20
II	Heat Transfer: <i>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.</i>	30
III	Mass Transfer: <i>Mass transfer, Diffusion and Convection. Fick's law, Concentration boundary layer equations.</i> Perturbation Method: <i>Series Solution Methods or Perturbation Techniques for solving differential equations.</i>	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

Unit	Contains	Marks
I	<i>Rings and Ideals; Maximal ideals: Algebra of Ideals; Quotient Ring; Local Ring; Modules; Basic properties of Modules; Simple Modules.</i>	20
II	<i>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.</i>	30
III	<i>Tensor Product of modules; Existence and uniqueness of tensor product of two modules; Tensor product of scalars; exactness properties of the tensor products; Algebras; Tensor product of algebras, Essential Extensions; Injective Hulls: Semi simple Modules; The Singular Submodules.</i>	30

Internal Assessment: Seminar Presentation

Marks – 20

Text Books:

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

Reference Books:

1. *K. R. Goodearl: 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

Unit	Contains	Marks
I	<i>Linear and Polynomial congruence, Diophantine equation, representations of number as of two squares and three squares, Fermat's last theorem.</i>	25
II	<i>Partition of a number, graphical representation of partition, conjugates partition.</i>	25
III	<i>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.</i>	30

Internal – Seminar Presentation

Marks – 20

