

M.PHIL. / PH.D. COURSEWORK SYLLABUS 2020-21

The courses MATH20-R01 Research Methodology and MATH20-R02 Research and Publication Ethics are compulsory. Apart from this a research scholar is required to study any of the three courses from the nine courses MATH20-R03 to MATH20-R11. Total credits of the course work is 16.

MATH20-R01: RESEARCH METHODOLOGY

Total Marks: **50 (Theory: 35, Internal Assessment: 15)**

Duration of Examination: **2 Hrs.**

Workload: **2 Lectures per week.** Credits: **2**

Scientific Research and Literature Survey: History of mathematics, Overview of scientific research, Selection of a research topic and a research problem, Literature survey of the topic and a problem, Role of a supervisor, Studying, reviewing and publishing a paper, Funding agencies, Writing a research proposal.

Scientific Writing and Presentation: Writing a research paper and thesis by using LaTeX; Presentation tools and skills: Beamer as a tool for paper and thesis presentations, Oral and poster presentation.

Software for Mathematics: Mathematica / Matlab.

References

1. **Katz Victor J.**, *A History of Mathematics: An Introduction*, 3rd edition, Addison-Wesley, 2009.
2. **Kitsakorn Locharoenrat**, *Research Methodologies for Beginners*, Pan Stanford Publishing Pte. Ltd., Singapore, 2017.
3. **Nicholas J. Higham**, *Handbook of Writing for the Mathematical Sciences*, SIAM, 1998.
4. **Donald E. Knuth, Tracy Larrabee & Paul M. Roberts**, *Mathematical Writing*, Mathematical Association of America, 1989.
5. **Norman E. Steenrod, Paul R. Halmos, Menahem M. Schiffer & Jean A. Dieudonné**, *How to Write Mathematics*, American Mathematical Society, 1973.
6. **Leslie Lamport**, *LaTeX, a Document Preparation System*, Pearson, 2008.
7. **Michel Goossens, Frank Mittelbach, Sebastian Rahtz, Denis Roegel & Herbert Voss**, *The LaTeX Graphics Companion*, Addison-Wesley, 2008.
8. **Paul Wellin, Sam Kemin and Richard Gaylord**, *An Introduction to Programming with Mathematica*, Cambridge University Press, 3rd edition, UK, 2005.

MATH20-R02: RESEARCH AND PUBLICATION ETHICS

Total Marks: **50 (Theory: 35, Internal Assessment: 15)**

Duration of Examination: **2 Hrs.**

Workload: **2 Lectures per week.** Credits: **2**

Philosophy and Ethics: Introduction to philosophy: Definition, nature and scope, concept, branches; Ethics: Definition, moral philosophy, nature of moral judgements and reactions.

Scientific Conduct: Ethics with respect to science and research, Intellectual honesty and research integrity; Scientific misconducts: Falsification, Fabrication and Plagiarism(FFP); Redundant publications: Duplicate and overlapping publications, salami slicing; Selective reporting and misrepresentation of data.

Publication Ethics: Definition, introduction and importance of publication ethics; Best practices / standards setting initiatives and guidelines: COPE, WAME, etc.; Conflicts of interest; Publication misconduct: Definition, concept, problems that led to unethical behaviour and vice versa, types; Violation of publication ethics, authorship and contributorship; Identification of publication misconduct, complaints and appeals; Predatory publishers and journals.

Open Access Publishing: Open access publications and initiatives; SHEPRA/RoMEO online resource to check publisher copyright & self-archiving policies; Software tool to identify predatory publishers developed by SPPU; Journal finder/journal suggestion tools viz. JANE, Elsevier Journal Finder, Springer Journal Suggester, etc.

Publication Misconduct: Subject specific ethical issues, FFP, authorship; Conflict of interest; Complaints and appeals: examples and fraud from India and abroad.

Software tools: Use of plagiarism software like Turnitin, Urkund and other open source software tools.

Database and Research Metrics: Databases: Indexing databases; Citation databases: Web of science, Scopus, etc.; Research Metrics: Impact factor of journal as per Journal Citation Report, SNIP, SJR, IPP, CiteScore; Metrics: h -index, g index, $i10$ index, altmetrics.

References

1. University Grants Commission (Promotion of Academic Integrity and Prevention of Plagiarism in Higher Educational Institutions) Regulations 2018 (The Gazette of India: Extraordinary, Part-iii-Sec.4)
2. **Kitsakorn Locharoenrat**, *Research Methodologies for Beginners*, Pan Stanford Publishing Pte. Ltd., Singapore, 2017.
3. **Anthony, M., Graziano, A.M. and Raulin, M.L.**, *Research Methods: A Process of Inquiry*, Allyn and Bacon, 2009.
4. Committee on Publication Ethics- COPE (<https://publicationethics.org/>)

MATH20-R03: ADVANCED COMMUTATIVE ALGEBRA

Total Marks: **100 (Theory: 70, Internal Assessment: 30)**

Duration of Examination: **3 Hrs.** Workload: **4 Lectures per week**

Credits: **4**

Localization of rings and its properties, Integral extensions, Discrete valuation rings, Dedekind domains, Graded rings and modules, Associated graded rings, I -adic completion, Krull's intersection theorem, Hensel's lemma, Hilbert function, Hilbert polynomial, Dimension theory of Noetherian local rings, Regular local rings, Hom functor, Tensor functor, I -torsion functor, Flat modules, Projective and injective modules, Complexes, Projective and injective resolution, Derived functor, Tor and ext functor.

References

1. **M.F. Atiyah & I.G. MacDonald**, *Introduction to Commutative Algebra*, CRC Press, 2018.
2. **David Eisenbud**, *Commutative Algebra with a View Toward Algebraic Geometry*, Springer-Verlag, 1995.
3. **Hideyuki Matsumura**, *Commutative Ring Theory*, Cambridge, 1989.
4. **Balwant Singh**, *Basic Commutative Algebra*, World Scientific, 2011.