Gautam Buddha University
School of Vocational Studies and Applied Sciences
Mathematics Courses

Department of Applied Mathematics
Ph.D. (Applied Mathematics)

Session 2014-2015

Contents

Compulsory Subject

AS 601 (Research Methodology)

Credit (L-T-P) : 3 (3- 0- 0)

Objectives and types of research: Motivation and objectives Research methods vs Methodology. Types of research Descriptive vs. Analytical, Applied vs. Fundamental, Quantitative vs. Qualitative, Conceptual vs. Empirical.
Research Formulation Defining and formulating the research problem - Selecting the problem - Necessity of defining the problem - Importance of literature review in defining a problem Literature review Primary and secondary sources reviews, treatise, monographs-patents web as a source searching the web - Critical literature review Identifying gap areas from literature review - Development of working hypothesis.
Research design and methods Research design Basic Principles- Need of research design Features of good design Important concepts relating to research design Observation and Facts, Laws and Theories, Prediction and explanation, Induction, Deduction, Development of Models. Developing a research plan - Exploration, Description, Diagnosis, Experimentation. Determining experimental and sample designs.
MATLAB and LaTex
Reporting and thesis writing Structure and components of scientific reports - types of report Technical reports and thesis Significance Different steps in the preparation Layout, structure and Language of typical reports Illustrations and tables - Bibliography, referencing and footnotes - Oral presentation Planning Preparation Practice Making presentation Use of visual aids - Importance of effective communication.
Application of results and ethics - Environmental impacts - Ethical issues - ethical committees - Commercialisation Copy right royalty - Intellectual property rights and patent law Trade Related aspects of Intellectual Property Rights Reproduction of published material Plagiarism - Citation and acknowledgement - Reproducibility and accountability.

References

[1] Garg, B.L., Karadia, R., Agarwal, F. and Agarwal, U.K., 2002. An introduction to Research Methodology, RBSA Publishers.

[2] Kothari, C.R., 1990. Research Methodology: Methods and Techniques. New Age International. 418p.

[3] Sinha, S.C. and Dhiman, A.K., 2002. Research Methodology, Ess Ess Publications. 2 volumes.

[4] Trochim, W.M.K., 2005. Research Methods: the concise knowledge base, Atomic Dog Publishing. 270p.

[5] Wadehra, B.L. 2000. Law relating to patents, trade-marks, copyright designs and geographical indications. Universal Law Publishing.

[6] Research Methodology: Methods and Techniques by C. R. Kothari, New Age International Publishers, ISBN:81-224-1522-9

[7] Statistical Methods for Research Workers by Fisher R. A., Cosmo Publications, New Delhi ISBN:81-307-0128-6

[8] Design and Analysis of Experiments by Montogomery D.C. (2001), John Wiley, ISBN: 0471260088

[9] Anthony, M., Graziano, A.M. and Raulin, M.L., 2009. Research Methods: A Process of Inquiry, Allyn and Bacon.

[10] Carlos, C.M., 2000. Intellectual property rights, the WTO and developing countries: The TRIPS agreement and policy options. Zed Books, New York.

[11] Coley, S.M. and Scheinberg, C. A., 1990, "Proposal Writing", Sage Publications.

[12] Day, R.A., 1992.How to Write and Publish a Scientific Paper, Cambridge University Press.

[13] Fink, A., 2009. Conducting Research Literature Reviews: From the Internet to Paper. Sage Publications

[14] Leedy, P.D. and Ormrod, J.E., 2004 Practical Research: Planning and Design, Prentice Hall.

[15] Satarkar, S.V., 2000. Intellectual property rights and Copy right. Ess Ess Publications.

MA 604 (Linear Algebra and ODE)

Credit (L-T-P) : 2 (2- 0- 0)

Linear Algebra: Finite dimensional Vector spaces; basis and dimension; Inner product space; Orthonormal basis, Gram-Schmidt process and $A = QR$, The geometry of linear equations, least squares approximation, eigen values and eigenvectors of e^{At}, Gershgorin circle theorem and its applications. Courant-Fischer minimax and related Theorems. Markov matrices, defective matrices, Jordan form, Generalized eigenvectors, Singular value decomposition, sparse matrices and Iterative methods.
ODE: Existence and uniqueness of solutions of differential equations and system of differential equations, Fundamental matrix, Solution of system of linear differential equations, Qualitative theory of ODE, stability. Green function, Lypanov stability and its applications and introduction to delay differential equations and Iterative methods.

References

[1] G. Strang, *Linear Algebra and Its Applications*, 4th edition, Brooks/Cole (Cengage Learning), 2006

[2] G. Strang, *Introduction to Linear Algebra*, 4th edition, Cambridge University Press India Pvt Ltd, 2009

[3] G. F. Roach, *Greens Functions*, Cambridge University.

[4] G. F. Simmons, *Differential equations with applications and Historical Notes*, Second Edition, Mc-Graw Hill, 1991

[5] M. Braun, *Differential Equations and Their Applications : An Introduction to Applied Mathematics* (Texts in Applied Mathematics, Vol. 11), Springer

[6] W. E. Boyce and R. C. DiPrima, *Elementary Differential Equations and Boundary Value Problems*, Wiley, 2000. Press, 1995.

MA 605 (Analysis)

Credit (L-T-P) : 2 (2- 0- 0)

Sequences and Series of Functions, Point-wise and Uniform Convergence, Weierstrass Approximation Theorem, Banach Space: Hahn-Banach Theorems, Uniform Boundedness Principle, Closed Graph and Open Mapping Theorems, Hilbert Space: Bounded, Adjoint, Normal, Unitary, Self-Adjoint, Compact Self-Adjoint Operators, Spectrum and Numerical Range.
Analytic functions, Cauchy Integral formula, Residue theorem. Application to evaluating improper integral. Fourier series, Integral and Transform.

References

[1] W. Rudin, *Principles of Mathematical Analysis*, 3rd ed., McGraw-Hill, 1994.

[2] T. Apostol, *Mathematical Analysis*, 2nd edition, Narosa, 2002

[3] B. V. Limaye, *Functional Analysis*, Revised 2nd edition, New Age International Limited, 1996