

The course will be conducted completely on a hands-on mode and project based learning. The basic concepts will be explained and associated real world challenging problems will be identified.

- Practical exposure to complex systems in domains like global climate, organisms, the human brain, infrastructure such as power grid, transportation or communication systems, complex software and electronic systems, social and economic organizations (like cities).
- Experiment to model dependencies, competitions, relationships, or other types of interactions between their parts or between a given system and its environment.
- Practicals on problem solving on nonlinearity, emergence, spontaneous order, adaptation, and feedback loops, among others.
- Practical on network approach a solution to complex problems where the nodes represent the components and links to their interactions.
- Students will be exposed to the practical application of complex systems concepts and problem-solving approaches on such real world problems.

Essential/recommended/ suggested readings

- Bar-Yam, Y. (2019). Dynamics of complex systems. CRC Press.
- Cilliers, P. (2002). Complexity and postmodernism: Understanding complex systems. Routledge.
- Dekker, S. (2016). Drift into failure: From hunting broken components to understanding complex systems. CRC Press.

DISCIPLINE SPECIFIC ELECTIVE COURSE -4 (DSE-4) VI.5.8. Research Methodology

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical/ Practice		
Research Methodology, DSE 4, VI. 5.8	4	0	0	4	12 th Pass	NIL

Learning Objectives:

The course is designed to make students understand about what, why and how to conduct research includes nature and purpose of research, identifying research problems, building research design, appropriate selection of research tools and methods for data analysis and also developing the base of future researches

Learning Outcomes

After completing the course, student should be able to

- Identify a research problem
- Formulate hypotheses
- In depth literature review
- Plan research design
- Use research tools and techniques, methods of analysis
- Ethics in research
- Communication skills

Practicals – Hours)

(120

- Art of reviewing research articles, identification of research gap and finding research problems, framing research objectives, Outline for research proposal.
- How to conduct an exploratory study, Experiments, Quantitative and qualitative study based on research questions and objectives, Data coding and entry to the software, Analysis of data through various tools, applications and research techniques such as regression and correlation, Hypothesis testing and inferences
- Familiarity with data collection software, E-resource library system with journals, books and publications, Usage of the data analysis and software.
- Directing students to follow report writing conventions, citations, acknowledgements, checking originality of the work vis plagiarism software and abiding research ethics, Presentation of work, how to get the research work published in a reputed journal.

Suggested Readings:

- Kitsakorn Locharoenrat, Research Methodologies for Beginners, Pan Stanford Publishing Pte. Ltd., Singapore, 2017.
- C. R. Kothari, Research Methodology: Methods and Techniques, New Age International, 2004, ISBN 8122415229, 978812241522.
- Kumar R. Research Methodology: A step by step Guide for Beginners (2010) 3rd ed., Pearson Education. (ISBN-13: 978-1849203012)
- Relevant study material from ACM, IEEE, Elsevier, Springer
- Levin, R. I and D.S. Rubin, Statistics for Management, Prentice Hall of India.
- Aczel, Amir D., and Sounderpandian, J., Complete Business Statistics, Tata McGraw Hill Publishing