- Virtual Reality Systems, John Vince, Pearson Education India, 2002. https://all3dp.com/2/blender-3d-printing-tutorial/
- Understanding Virtual Reality: Interface, Application and Design, William R Sherman and Alan B Craig, Morgan Kaufmann, 2018
- Virtual Reality, Samuel Greengard, MIT Press, 2019.
- Virtual and Augmented Reality, Paul Mealy, Wiley, 2018.

DISCIPLINE SPECIFIC ELECTIVE COURSE -4 (DSE-4)
VI.5.7. Complex Systems

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		
Complex Systems, DSE 4, VI. 5.7	4	0	0	4	12th Pass with Maths	Programming languages, data Structure, Algorithm design and analysis, Computer Neworks, Discrete Mathematics

Learning Objectives

The objective of this course is to provide a practical and detailed understanding of the complex systems which can be found in various fields and disciplines, like sociology, political systems, biology, and economics etc.

Learning outcomes

At the end of the course, the students will be able to:

- to understand the basics of complex systems and their importance.
- to recognise complex systems related to societal, environmental, engineering and scientific problems and to learn their basic features;
- to introduce a problem-solving approaches for complex systems.
- to get hands-on experience in studying and solving complex systems problems.

Syllabus

Practicals- (120 Hours)

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	12th 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