Special Centre for Disaster Research
(In collaboration with NIDM, MHA Govt of India)
Jawaharlal Nehru University
New Delhi, INDIA

Course Title: EWS and Computational Intelligence

Course **Objective:**

The objective of the course to understand operational mechanisms and procedures for the prediction, forecasting, monitoring and response to warning. It aims to discuss the human factors in early warnings like Risk Perception, Assessment and Appropriate Communications, Standard Operating Procedures and the preventive measures. Further, the course focuses on the role of computational intelligence in EWS. How techniques like neural network, fuzzy logic, evolutionary computation and swarm computation can be used for effective and efficient early warning systems.

Course **Content:**

Introduction to Early Warning System, Bringing Early Warning to the People — Public and Partnership Responsibilities for Early Warning; Hazard Detection, Monitoring, Forecasting and Information for Warning, The Human Factor in Early Warnings: Risk Perception, Assessment and Appropriate Communications, Standard Operating Procedures; Preventive measures in EWS; role of computational intelligence in EWS. Introduction to computational Intelligence; Supervised and Unsupervised learning; Knowledge discovery from data, Data mining methodologies – classification, prediction, regression, association, clustering, outlier analysis, Introduction to neural networks, General Attributes of Biological Neural Networks and Artificial Neural Networks; Fuzzy Logic: Introduction and Motivation, Fuzzy Set, Membership Functions, Fuzzy Relation, Operations on Fuzzy Sets and Relations, Approximate Reasoning, Fuzzy Rule based Systems; Introduction to metaheuristics, Discrete and Continuous Optimization Problems; fundamentals of Evolutionary Computation, Components of Evolutionary Computation: Framework, Populations, Selection Operators, Genetic Operators; Genetic Algorithms, Introduction to swarm intelligence, Social Behaviour as Optimization:, Swarm Intelligence algorithms; Hybridized algorithms, Multi-objective optimization; Use of computational intelligence for EWS. **Suggested Readings**

1. Zschau, Jochen, Küppers, Andreas N., Early Warning Systems for Natural Disaster Reduction; Springer-Verlag Berlin Heidelberg, 2003
2. Davies, J. L., Gurr, T.R., Preventive Measures: Building Risk Assessment and Crisis Early Warning Systems;
3. Eberhart, R., Shi, Y., Computational Intelligence: Concepts to Implementation, Morgan Kaufman, 2007
4. Engelbrecht, A.P. Computational Intelligence: An Introduction, Second Edition, John Wiley and Sons, 2007.
5. Han, J. and Kamber, M., Data Mining: Concepts and Techniques, Morgan Kaufmann, 2e, 2007.
6. C. M Bishop, "Neural Network for Pattern Recognition", Oxford University Press, 2014

7. George J. Klir, "Fuzzy Sets and Fuzzy Logic: Theory and Applications", Ist Edition, PHI, 2015
8. Eiben, A.E., Smith, J.E., Introduction to Evolutionary Computing, Springer-Verlag, 2003
9. Kennedy, J. and Eberhart, R.C., Swarm Intelligence, Morgan Kaufmann Publishers, 2001
10. Coello-Coello, C., Lamont, G.B., van Veldhuizen, D. A., Evolutionary Algorithms for Solving Multi-Objective Problems, Springer Verlag, 2007