Birla Institute of Technology & Science, Pilani
Hyderabad Campus

FIRST SEMESTER 2020-2021

Course Handout Part II

14.08.2020

In addition to part-I (General Handout for all courses appended to the time table) this portion gives further specific details regarding the course.

Course No. : CE G516
Course Title : MULTICRITERIA ANALYSIS IN ENGINEERING
Instructor-in-Charge : KOMARAGIRI SRINIVASA RAJU
Chamber No :D - 107

Description : Introduction, Conventional optimization, Multi-objective Optimization, Fuzzy logic and its extensions, in multi-objective optimization, Multicriterion Decision Making, Deterministic analysis, Stochastic analysis, Fuzzy analysis, Classification problems, Hybrid approaches in Decision Making, Genetic Algorithms, Artificial Intelligence, Artifical Neural networks, Practical applications in Engineering

1. Scope and Objective of the Course:
This course is an introduction to the field of Multicriterion Decision Making (MCDM) and allied fields. The aim of this course is twofold: **1**. Provide a thorough understanding of the basics; **2.** Bring the students face-to-face with an application in Multicriterion Decision Making and allied fields. In addition, every student is required to work on a project, as part of the course, involving an application of Multicriterion Decision Making and allied fields. Further, the project work provides an opportunity to learn about the latest developments in this upcoming field. The unified approach will enable students to tackle the real life problems in more comprehensive manner and provide a broader view on the subject..

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

1. Formulate engineering problems in optimization framework
2. Choose the best suited Decision Making Technique and Data Mining Technique
3. Acquainting with Matlab/R/Suitable Programming Language
4. Develop a power point based presentation that describes the formulated model and the solving technique, analyse the results and propose recommendations in language understandable to the decision-making process.

Student Learning Outcomes (SLOs) assessed in this course **– (a), (b), (c), (e), (h), and (k).**

2(a) Textbook:

T1. K. Srinivasa Raju, D. Nagesh Kumar, Multicriterion Analysis in Engineering and Management, PHI Learning Private Limited, New Delhi, 2014

(b) **Reference books**

R1. Ross TJ, Fuzzy Logic with Engineering Applications, John Wiley and Sons, 2013.

R2. S.N. Sivanandam and S.N. Deepa, Principles of Soft Computing, Wiley, 2013.

3.Course Plan:

Lecture No.	Learning objectives	Topics to be covered	Chapter in the Text Book	SLO*
1	To identify the intricacies involved in Decision Making	Introduction to the course and role of optimization, data mining, MCDM methods in sustainable and effective decision making	CH-1	a
2-3	Able to formulate Single Objective Optimization problem including identifying appropriate objective functions, constraints; Able to solve the same using software	Linear Programming Nonlinear Programming and other methods	CH-2	a,c,e
4-6	Able to understand necessity of multiobjective optimization in real world problems	Introduction to Fuzzy Logic, Membership development, Various types of membership functions	CH-4	a
7 -10	Able to understand necessity of assigning weights to different objectives/criteria in multiobjective context; Able to estimate weights for the given situation and data	Normalization approaches Rating method Entropy method Analytic Hierarchy Process Fuzzy Analyitc Hierarchy Process MATLAB perspective	CH-3	a,c,e,k
11 -13	Able to understand various approaches to solve multiobjective optimization problems; Able to solve the same using software	Weighting method Constraint method Case study MATLAB perspective	CH-4	a,c,e,h
14-18	Able to understand necessity of grouping/clustering non-dominated data	K-Means Cluster Analysis Fuzzy Cluster Analysis Artificial Neural Networks Kohonen Neural Networks	CH-5	a,c,e

	sets obtained from multiobjective optimization; Able to solve the same manually and using software	Cluster Validation Techniques Case Study SPSS perspective MATLAB perspective		
19- 25	Able to understand necessity of ranking non-dominated data sets obtained from multiobjective optimization/cluster analysis; Able to solve the same manually and using software	Introduction to Discrete MCDM methods Compromise Programming Co-Operative Game Theory TOPSIS PROMETHEE Weighted average Multi Attribute Utility Theory Analytic Hierarchy Process Case Studies MATLAB perspective	CH-6 &Supplementary material	a,c,e,h
26-27	Able to understand necessity of ranking non-dominated data sets obtained from multiobjective optimization/cluster analysis in uncertain environment Able to solve the same manually and using software	Role of uncertainty in decision making Normalization techniques Fuzzy TOPSIS MATLAB perspective	CH-7 & Supplementary material	a,c.e
28-29	Able to understand necessity of knowing correlation between ranking methods and group decision making Able to solve the same manually and using software	Spearman rank correlation coefficient Kendall rank correlation coefficient Group decision making algorithms SPSS perspective MATLAB perspective	CH-8& Supplementary material	a,b,c,e
30-42	Able to understand necessity of advanced topics related to Evolutionary algorithms, Data	Data Envelopment Analysis Fuzzy Optimization Taguchi methodology Differential Evolution Particle Swarm Optimization	CH-9 CH-2, CH-4& Supplementary	a,c,e

	Envelopment Analysis and Expert Systems	Expert Systems Cognitive mapping MATLAB perspective Case Studies	material	

***Student Learning Outcomes (SLOs):**

SLOs are outcomes (a) through (k) plus any additional outcomes that may be articulated by the program.

(a) an ability to apply knowledge of mathematics, science and engineering
(b) an ability to design and conduct experiments, as well as to analyze and interpret data
(c) an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
(d) an ability to function on multidisciplinary teams
(e) an ability to identify, formulate, and solve engineering problems
(f) an understanding of professional and ethical responsibility
(g) an ability to communicate effectively
(h) the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context
(i) a recognition of the need for, and an ability to engage in life-long learning
(j) a knowledge of contemporary issues
(k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

4.Evaluation Scheme:

Component number	Evaluation Component	Duration (min)	Weightage (%)	Date & Time	Remarks
1	Test-1	30	15	Will be announced	OB
2	Test-2	30	15	Will be announced	OB
3	Test-3	30	15	Will be announced	OB
4	Assignments (4)	-	5	Continuous Evaluation	OB
5	Project		15	Continuous Evaluation	OB
6	Lab component	-	10	Continuous Evaluation	OB
7	Comprehensive Examination	120	25	11/12 AN	OB

5. **Chamber Consultation Hour:** Monday 5-6 P.M
6. **Notices:**All notices concerning the course will be displayed on CMS/ Civil Engineering Department Notice Board
7. **Make-up Policy:** Make-up will not be entertained under any circumstances.

8. **Academic honesty and academic integrity Policy:** Academic honesty and academic integrity are to be maintained by all of the students throughout the Semester and no type of academic dishonesty is acceptable.

INSTRUCTOR-IN-CHARGE
CE G516