



**Birla Institute of Technology & Science, Pilani**  
Hyderabad Campus

## FIRST SEMESTER 2021-2022

### Course Handout Part II

20.08.2021

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.* : BITS F313  
*Course Title* : **Multicriterion Decision Making in Engineering and Management**  
*Instructor-in-Charge* : K. SRINIVASA RAJU  
*Chamber No.* : D – 107

### **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 Level Outcomes:** After successful completion of this course, the student 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).**

### **Text Book:**

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

### **Reference Books:**

- R1. S.N. Sivanandam and S.N. Deepa, Principles of Soft Computing, Wiley, 2013.  
R2. Ross TJ, Fuzzy Logic with Engineering Applications, John Wiley and Sons, 2013.

### Lecture wise 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 Analytic 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 sets obtained from multiobjective optimization;  Able to solve the same manually and using software	K-Means Cluster Analysis Fuzzy Cluster Analysis Artificial Neural Networks Kohonen Neural Networks Cluster Validation Techniques Case Study SPSS perspective MATLAB perspective	CH-5	a,c,e
19- 25	Able to understand necessity of ranking non-dominated data sets	Introduction to Discrete MCDM methods Compromise Programming Co-Operative Game Theory	CH-6 & Supplementary	a,c,e,h

	obtained from multiobjective optimization/cluster analysis;  Able to solve the same manually and using software	TOPSIS PROMETHEE Weighted average Multi Attribute Utility Theory Analytic Hierarchy Process Case Studies MATLAB perspective	material	
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 Envelopment Analysis and Expert Systems	Data Envelopment Analysis Fuzzy Optimization Taguchi methodology Differential Evolution Particle Swarm Optimization Expert Systems Cognitive mapping MATLAB perspective Case Studies	CH-9 CH-2, CH-4 & Supplementary material	a,c,e

\*Supplementary material will be provided wherever required.

**\* 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.

**Evaluation Scheme:**

Component number	Evaluation Component	Duration (min)	Weightage (%)	Date & Time	Nature of Component
1	Mid-Semester Test	90	30	23/10/2021 9.00 - 10.30AM	Open
2	Assignments (5 Nos)	--	10	Continuous Evaluation	Open
3	Project (2 Reviews)		10	Continuous Evaluation	Open
4	Surprise Quiz in Lecture (Atleast 5)*	-	10	Continuous Evaluation	Open
5	Comprehensive Examination	120	40	27/12 AN	Open

\*Best (n-2) would be considered, n is the total number of surprise quizzes conducted

**Chamber Consultation Hour: MONDAY 5-6 P.M**

**Notices:** Notices concerning this course will be uploaded on Google Classroom Page for this course.

**Make-up Policy:** Make-ups will not be granted under any circumstances.

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

**INSTRUCTOR-IN-CHARGE**  
**BITS F313**