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**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 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 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 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 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.

1. an ability to apply knowledge of mathematics, science and engineering
2. an ability to design and conduct experiments, as well as to analyze and interpret data
3. 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
4. an ability to function on multidisciplinary teams
5. an ability to identify, formulate, and solve engineering problems
6. an understanding of professional and ethical responsibility
7. an ability to communicate effectively
8. the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context
9. a recognition of the need for, and an ability to engage in life-long learning
10. a knowledge of contemporary issues
11. an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

**Evaluation Scheme:**

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| --- | --- | --- | --- | --- | --- |
| **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 | Surprize 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**