GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Engineering
Level: Master of Engineering
Branch: Textile Engineering
Course / Subject Code: ME01025081
Course / Subject Name: Optimization and Decision Making Techniques in Textile

w. e. f. Academic Year:	2024-25
Semester:	1st Semester
Category of the Course:	PEC

Prerequisite	Basic knowledge of mathematics at BE level
Rationale:	Optimization and decision-making are an integral part of any manufacturing process and management system. The knowledge optimization and decision-making techniques will help to demonstrate the confluence of theory and applications of various types of multicriteria decision-making and optimization techniques with reference to textile manufacturing and management.

Course Outcome:

After Completion of the Course, Student will able to:

No	Course Outcomes
01	Understand the principles of various optimization and decision making techniques for textiles.
02	Understand the multicriteria decision making and optimization techniques for textile
03	Apply knowledge to various optimization methods and decision making techniques to solve various textile problem..

**Revised Bloom's Taxonomy (RBT)*

Teaching and Examination Scheme:

Teaching Scheme (in Hours)			Total Credits L+T+ (PR/2)	Assessment Pattern and Marks				Total Marks
				Theory		Tutorial / Practical		
L	T	PR	C	ESE (E)	PA / CA (M)	PA/CA (I)	ESE (V)	
3	1	0	4	70	30	0	0	100

Course Content:

Unit No.	Content	No. of Hours	% of Weightage
1.	Introduction, Decision making process and classification, Optimization techniques, analytics hierarchy process methodology, fuzzy analytic hierarchy process	**5**	**5**
2.	Technique for order of preference by similarity to ideal solution (TOPSIS), TOPSIS Methods, Working principles of TOPSIS, Applications of TOPSIS in Textile, Fuzzy TOPSIS Method, Working principles of Fuzzy-TOPSIS.	**6**	**15**
3.	Elimination and choice translating reality methodology, Working principles of ELECTRE method, Application of ELECTRE method, Graph theory and matrix approach of decision making, Principles of Graph theory and matrix approach, Application of graph theory and matrix approach of decision making in textiles.	**7**	**15**
4.	Linear programming problem formulation, Graphical method, Simplex Method, applications of linear programming , Fuzzy linear programming, Crisp set, Fuzzy set, Membership Function, Fuzzy Linear Programming Algorithm, Applications of Fuzzy linear programming.	**7**	**15**
5.	Quadratic Programming Algorithm, Application of Wolfe's method to solve quadratic programming problem, Genetic Algorithm, Working Principles of Genetic Algorithm, Application of Genetic Algorithm in Textiles.	**6**	**15**
6.	Particle swarm optimization, Working principle of particle swarm optimization, Application of Particle Swarm Optimization in textiles, Simulated Annealing, Working principle of Simulated Annealing, Application of Simulated Annealing in textiles.	**6**	**15**

7.	Multiobjective Optimization, Goal Programming, Multiobjective optimization using desirability function, Application of desirability function approach for multiobjective optimization, Multiobjective optimization of Air Permeability, Thermal Conductivity and Ultraviolet protection factor of knitted fabrics using desirability function, Multiobjective optimization using Evolutionary Algorithm, Application of Evolutionary Algorithm for multiobective optimization. Two objective functions: Spinning consistency index and Yarn Strength. Three objective functions: Air permeability, Thermal conductivity and ultraviolet protection factor of knitted fabric.	**8**	**20**
	Total	**45**	**100**

Suggested Specification Table with Marks (Theory):

Distribution of Theory Marks (in %)					
R Level	**U Level**	**A Level**	**N Level**	**E Level**	**C Level**
5	7	8	10	10	10

Where R: Remember; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create (as per Revised Bloom's Taxonomy)

References/Suggested Learning Resources:

(a) Books:

1. Anindya Ghosh, Prithwiraj Mal and Abhijit Majumdar "Advanced Optimization and Decision making Techniques in Textile Manufacturing", CRC Press, New York.
2. Bridgman, P. W. 1922. Dimensional Analysis, Yale University Press, New Haven, CT.
3. Saaty, T. L. 1980. The Analytic Hierarchy Process. McGraw-Hill, New York.
4. Hwang, C. L. and Yoon, K. 1981. Multiple Attribute Decision Making: Methods and Applications, Springer-Verlag, New York.
5. Triantaphyllou, E. 2000. Multi-Criteria Decision Making Methods: A Comparative Study, Kluwer Academic Publishers, Boston.
6. Deo, N. 2000. Graph Theory with Applications to Engineering and Computer Science, Prentice Hall, New Delhi, India.
7. Rao, R. V. 2007. Decision Making in the Manufacturing Environment: Using Graph Theory and Fuzzy Multiple Attribute Decision Making Methods, Springer, London.

8. Dantzig, G. B. 1963. Linear Programming and Extensions, Princeton University Press, Princeton, NJ.
9. Deb, K. 2010. Optimization for Engineering Design, PHI Learning, New Delhi, India.
10. Vohra, N. D. 2010. Quantitative Techniques in Management, Tata McGraw-Hill, New Delhi, India.
11. Davis, L. 1991. Handbook of Genetic Algorithms, Van Nostrand, Reinhold, New York.
12. Deb, K. 2001. Multiobjective Optimization Using Evolutionary Algorithms. Wiley, Chichester, UK.

(b) Open source software and website:

1. http://nptel.iitm.ac.in World Wide Web, Google Search Engine etc.
2. Rahul Dubey, “An Introduction to Internet of Things: Connecting Devices, Edge Gateway, and Cloud with Applications”, Cengage India Publication
3. Raj Kamal, “Internet of Things: Architecture and Design Principles, Mc Graw Hill Education
4. Hanes et al “IoT Fundamentals”, Cisco Press
5. Vijay Madisetti and ArshdeepBahga, “Internet of Things (A Hands-on-Approach)”, , Paperback, 2015.
6. A. McEwen, H. Cassimally, “Designing the Internet of Things”, Wiley, 2013.
7. YashwantKanetkar, “21 Internet of Things Experiments”, Kindle edition
8. AdeelJaved, “Building Arduino projects for Internet of Things”, Apress publication
9. Donald Noris, “The Internet of Things: Do it yourself Projects with Arduino, Raspberry PI and
10. BeagleBone Black” Mc Graw Hill Publication
11. Adrian McEwen & Hakim Cassimally, “Designing the Internet of things”, Willey publication
12. Rahul Dubey, “An Introduction to Internet of Things: Connecting Devices, Edge Gateway, and Cloud with Applications”, Cengage India Publication
13. Raj Kamal, “Internet of Things: Architecture and Design Principles, Mc Graw Hill Education
14. Hanes et al “IoT Fundamentals”, Cisco Press
15. Vijay Madisetti and ArshdeepBahga, “Internet of Things (A Hands-on-Approach)”, , Paperback, 2015.
16. A. McEwen, H. Cassimally, “Designing the Internet of Things”, Wiley, 2013.
17. YashwantKanetkar, “21 Internet of Things Experiments”, Kindle edition
18. AdeelJaved, “Building Arduino projects for Internet of Things”, Apress publication
19. Donald Noris, “The Internet of Things: Do it yourself Projects with Arduino, Raspberry PI and
20. BeagleBone Black” Mc Graw Hill Publication
21. Adrian McEwen & Hakim Cassimally, “Designing the Internet of things”, Willey publication
22. Rahul Dubey, “An Introduction to Internet of Things: Connecting Devices, Edge Gateway, and Cloud with Applications”, Cengage India Publication

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