

Outcome-Based Curriculum

(Sustaining OBE Compliance)

Part A

1. Title of the Academic Program: M.Sc. in Leather Products Engineering

2. Name of the University: University of Dhaka

3. Vision of the University: To emerge as an institute of eminence in the fields of engineering, technology, business and management in serving the industry and the nation by empowering students with a high degree of technical, managerial and practical competence.

4. Mission of the University

M1: To strengthen the theoretical, practical and ethical dimensions of the learning process by fostering a culture of research and innovation among faculty members and students.

M2: To encourage long term interaction between the academia and industry through the involvement of the industry in the design of the curriculum and its hands-on implementation.

M3: To strengthen and mold students in professional, ethical, social and environmental dimensions by encouraging participation in co-curricular and extra-curricular activities.

5. Name of the Program Offering Entity: Institute of Leather Engineering and Technology

6. Vision of the Program Offering Entity

The vision of Institute of Leather Engineering and Technology (ILET) is to enable innovation through research, advance educational programs in leather, footwear, leather products and allied sector and facilitate enrichment of human resources- the students, faculty and staff, thereby establishing itself as a center of excellence at the national and international level.

7. Mission of the Program Offering Entity

- Provide a contemporary educational approach that integrates high-tech and modern methods, enhancing their learning experience through research conducted locally and internationally.
- Promote industry-academia collaboration for the better understanding and skill development in undergraduate programs in the fields of leather, footwear and leather products.
- To undertake actions to motivate students for life-long learning, students' personal development by fostering ethical and moral values.

8. Objectives of the Program Offering Entity

- To produce competent graduate in the field of leather, footwear and leather products sector;

- To initiate, organize and undertake research in the fields of leather, footwear and leather products engineering;
- To provide industry-oriented training programs in various fields of leather, footwear and leather products engineering;
- To ensure quality control and laboratory facilities for testing raw materials, consumable and finished products;
- To provide facilities for environmental pollution control, chemical management and occupational health and safety compliances;
- To organize seminars, conferences, workshops, exhibitions and other events to disseminate knowledge about state-of-the-art technologies for the relevant fields;
- To establish bridge-programs and research collaborations with various academic, research and industrial organizations both in home and abroad.

9. Name of the Degree: M.Sc. in Leather Products Engineering

10. Description of the Program

The program provides its post-graduate students with the opportunity to participate in advanced professional courses and rigorous research training where students are attached to demand-based knowledge and they relate theories, concepts and techniques learned from the academic courses with real-life experiences. There are three semesters in the M. Sc. Program and a student must complete 40 credits. However, there are two groups in the M. Sc. program:

i. Thesis group: Students of this group are required to complete 24.0 credit course work and a thesis of 16.0 credits. From the beginning of the 1st semester students have to begin their thesis work which must be completed at the end of the 3rd semester.

ii. General: Students of this group are required to complete 33.0 credit coursework, 2.0 credit industrial internship, 1.0 credit viva voce along with a 4.0 credit project work.

Post-graduate education in Leather Products Engineering is balanced and well-rounded. With a rationalized course curriculum and advanced tools and teaching methods, the capacity of graduates fulfils the international level and the students will be able to perform advanced professional activities.

11. Graduate Attributes: The process of achievement of mission and vision of the program is divided into equal contributions, stated from responses given by key stakeholders like Employers and Alumni. Employers happen to motivate our graduates and know the performance of their traits in some key areas of graduate attributes such as knowledge, work skills, communication skills, and interpersonal skills. Each of the key graduate attributes is further subdivided into subcategories (as shown in the list below) to provide an in-depth understanding of our graduate's status in that specific field.

Attribute-1: Knowledge profile
K1: A comprehensive and systematic, theory-based advanced understanding of the modern science and technology
K2: Conceptually based production techniques, formal aspects of emerging technologies, research and business intelligence, creativity and innovation to support analysis and modelling applicable to the discipline
K3: A systematic, theory-based formulation of engineering fundamentals required in the engineering discipline
K4: Engineering specialist knowledge that provides theoretical frameworks and bodies of knowledge for the accepted practice areas in the engineering discipline; much is at the forefront of the discipline
K5: Knowledge of engineering practice (technology) in the practice areas in the engineering discipline
K6: Engagement with selected knowledge in the research literature of the discipline
K7: Comprehension of the role of engineering in society and of the identified issues in engineering practice in the discipline: ethics and the engineer's professional responsibility to public safety; the impacts of engineering activity in economic, social, cultural, environmental and sustainability terms
Attribute-2: Oral communication
C1: Competency in English language for comprehensive communication through academic writing
C2: Skills for proper presentation in any relevant circumstances in the form of conference preceding, project presentation, oral speech etc.
C3: Engineering judgment based on the knowledge and relevance to the discipline and communication of judgment
C4: Discipline and sense of responsibility with strong ethical and moral value aligned with the international scientific norms
Attribute-3: Aptitude in attending professional seminar and training (Work and interpersonal skills)
A1: Aptitude with regards to having professional degrees
A2: Various professional affiliations with internationally recognized organizations
A3: Time management skills
A4: Leadership and team work ability
A5: Independent thinking and self-confidence

12. Program Educational Objectives (PEOs)

PEO 1: Impart advanced technical knowledge to students in the technological topics on leather products engineering and to provide them with opportunities in taking up advanced topics in the field of study.

PEO 2: Create a congenial environment that promotes learning, growth and imparts ability to work with multi-disciplinary groups in professional, industry as well as research organizations.

PEO 3: Broaden and deepen their capabilities in analytical and experimental research methods, analysis of data and drawing relevant conclusions for scholarly writing and presentation.

PEO 4: Achieve professional success through the program's emphasis on experiential learning through ethical reasoning, critical thinking, and problem-solving skills.

PEO 5: Provide guidance to students for their choices in research and professional career outlook and to encourage students to take up research for the sustainable development of leather products and related sectors.

13. Program Learning Outcomes (PLO)

The Master of Science in Leather Products Engineering program is a rigorous and rewarding method of earning a graduate degree. Graduates of the Master of Science in Leather Products Engineering program will be able to accomplish the following aspect.

PLO1: Engineering Knowledge

Able to apply knowledge of leather products engineering, mathematics, and science in a creative and innovative way to design, develop and produce new engineering models and products as specified in K1 to K5 for the solution of complex engineering problems (K6).

PLO2: Environment and Sustainability

Able to create an ability to understand the impact of professional engineering solutions in societal and environmental contexts and demonstrate knowledge of and need for sustainable development by materializing every resource of the relevant field (K7).

PLO3: Ethical Reasoning

Students will be able to reason ethically in evaluating various perspectives, policies, and/or practices relevant to one's field of research and study. Students will be able to recognize ethical responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, and societal contexts. (K7)

PLO4: Communication

Graduates will be able to articulate their thoughts vocally and in writing (oral communication; written communication). Additionally, they will be able to present the

research output in the form of effective writing in international journals, conferences, patents, research proposals, and other scientific venues.

PLO5: Professional autonomy

Graduates would be able to demonstrate all-encompassing professionalism in leather and allied engineering contexts and to make sound decisions that take into account the global, economic, environmental, and social implications of engineering solutions.

PLO6: Research and Execution

Graduates would be able to critically examine and comprehend scientific studies, current events, and new developments in the Leather Products Engineering area to identify, formulate, research, analyze and reach substantiated conclusions along with recommendations for complex leather products and allied engineering problems.

PLO7: The Engineer and Society

Able to apply reason informed by context to assess societal, health, safety, legal, and cultural issues and the resulting professional engineering responsibilities, as well as contribute to society by creating collaborative and inclusive environments and using problem-solving skills to make a more just world (K7).

PLO8: Leadership and Teamwork

Able to function effectively as part of a team, collectively to offer leadership, foster an atmosphere of cooperation and inclusion, set and achieve goals, and organize and execute tasks effectively in a multi-disciplinary environment.

14. Mapping mission of the university with PEOs

	Mission I	Mission II	Mission III
PEO1	✓		✓
PEO2		✓	✓
PEO3	✓		
PEO4			✓
PEO5		✓	✓

15. Mapping of PLOs with PEOs

PLOs	PEO1	PEO2	PEO3	PEO4	PEO5
PLO1	✓				
PLO2		✓		✓	
PLO3		✓	✓	✓	
PLO4	✓		✓		✓
PLO5		✓		✓	✓
PLO6		✓	✓	✓	✓
PLO7			✓	✓	✓
PLO8		✓			✓

16. Mapping courses with the PLOs

Course Code	PLO 1	PLO 2	PLO 3	PLO 4	PLO 5	PLO 6	PLO 7	PLO 8
0723-LPE-6101	✓	✓	✓	✓	✓	✓	✓	✓
0723-LPE-6103	✓		✓	✓	✓	✓	✓	
0723-LPE-6105	✓	✓	✓	✓		✓	✓	✓
0723-LPE-6107	✓	✓	✓	✓	✓	✓	✓	
0723-LPE-6109	✓	✓	✓	✓	✓	✓	✓	✓
0723-LPE-6111	✓	✓	✓	✓	✓	✓	✓	✓
0723-LPE-6213	✓	✓	✓	✓	✓	✓	✓	✓
0723-LPE-6215	✓	✓			✓	✓	✓	
0723-LPE-6217	✓	✓	✓	✓	✓	✓	✓	✓
0723-LPE-6219	✓	✓	✓	✓	✓	✓	✓	✓
0723-LPE-6221	✓	✓	✓	✓	✓	✓	✓	✓
0723-LPE-6000	✓	✓	✓	✓		✓	✓	✓
0723-LPE-6300	✓	✓	✓	✓		✓	✓	✓

0723-LPE-6302	✓	✓		✓	✓	✓	✓	✓
0723-LPE-6304	✓			✓				
	15	13	12	14	11	14	14	11

Part B

17. Structure of the Curriculum

(a) Duration of the Program: Years: 1.5, Semesters: 3

(b) Admission Requirements:

- i. Any applicant who has completed the undergraduate degree in Leather Products Engineering, University of Dhaka and obtained CGPA of 3.0 or above will be eligible for M. Sc. by Research program. The academic committee may set further eligibility conditions.
- ii. Students who have completed their bachelor's degree with a CGPA of 3.25 from Bangladeshi universities, other departments of DU will be able to enroll into the regular master's program. Aspirants will have to sit for a 100-mark written and viva test for empty seats available. The admission requirements and procedure will set by academic committee of the institute and approved by the University authority. Students who have undergraduate degrees from universities overseas will also be allowed to enroll.

(c) Total credit requirement to complete the program: 40.0

(d) Total class weeks in a semester: 14-15 weeks

(e) Minimum CGPA requirements for post-graduation: 2.50

(f) Maximum academic years of completion: 1.5+1 academic years

(g) Category of Courses

i. General Education Courses: N/A

ii. Core Courses: In M.Sc. in Leather Products Engineering program, ILET, DU would like to provide the core courses as following:

Core Courses

Course Code	Course Title	Course Credit	Semester
0723-LPE-6101	Advanced Leather Products Manufacturing	3.0	I
0723-LPE-6103	Optimization Techniques of Leather Products Manufacturing	3.0	I
0723-LPE-6105	Research Methodology	3.0	I
0723-LPE-6107	Industrial Hazards and Waste Management	3.0	I
0723-LPE-6109	Ergonomics and Industrial Safety	3.0	I
0723-LPE-6111	Materials and Quality Management of Leather	3.0	I

	Products		
0723-LPE-6213	Environmental Management and Impact Assessment	3.0	II
0723-LPE-6219	Product Design and Development*	3.0	II
0723-LPE-6221	E-Commerce and International Trade*	3.0	II

***Additionally for general group**

iii. Elective Courses: There are two elective courses from which students (Thesis group) have to choose one.

Course Code	Course Title	Course Credit	Semester
0723-LPE-6215	Nanotechnology for Leather and Leather Products	3.0	II
0723-LPE-6217	Industrial Automation	3.0	II

Note: These two courses are compulsory for students of general group.

iv. Capstone Course/Internship/Thesis

Course	Course Title	Course Credit	Semester
0723-LPE-6000	Thesis	16.0	I-III
0723-LPE-6300	Project	4.0	II, III
0723-LPE-6302	Internship	2.0	III
0723-LPE-6304	Viva voce	1.0	III

18. a) Semester wise distribution of course (Thesis Group)

Semester-I		
Course Code	Course Title	Credits
0723-LPE-6101	Advanced Leather Products Manufacturing	3.0
0723-LPE-6103	Optimization Techniques of Leather Products Manufacturing	3.0
0723-LPE-6105	Research Methodology	3.0
0723-LPE-6107	Industrial Hazards and Waste Management	3.0
0723-LPE-6109	Ergonomics and Industrial Safety	3.0
0723-LPE-6111	Materials and Quality Management of Leather Products	3.0
0723-LPE-6000	Thesis	-

Total	18.0
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Semester-II		
Course Code	Course Title	Credits
0723-LPE-6213	Environmental Management and Impact Assessment	3.0
0723-LPE-6000	Thesis	-
Optional/Elective Course (Anyone from the following List)		
Course Code	Course Title	Credits
0723-LPE-6215	Nanotechnology for Leather and Leather Products	3.0
0723-LPE-6217	Industrial Automation	3.0
Total		6.0

Semester-III		
Course Code	Course Title	Credits
0723-LPE-6000	Thesis	16.0
Grand Total		40.00

N.B. Thesis work will start in Semester-I and be completed in Semester-III

18. (b) Semester-wise distribution of courses (General group)

Semester-I		
Course Code	Course Title	Credits
0723-LPE-6101	Advanced Leather Products Manufacturing	3.0
0723-LPE-6103	Optimization Techniques of Leather Products Manufacturing	3.0
0723-LPE-6105	Research Methodology	3.0
0723-LPE-6107	Industrial Hazards and Waste Management	3.0
0723-LPE-6109	Ergonomics and Industrial Safety	3.0
0723-LPE-6111	Materials and Quality Management of Leather Products	3.0
Total		18.0

Semester-II		
Course Code	Course Title	Credits
0723-LPE-6213	Environmental Management and Impact Assessment	3.0
0723-LPE-6215	Nanotechnology for Leather and Leather Products	3.0
0723-LPE-6217	Industrial Automation	3.0
0723-LPE-6219	Product Design and Development	3.0
0723-LPE-6221	E-Commerce and International Trade	3.0
0723-LPE-6300	Project	-
Total		15.0

Semester-III		
Course Code	Course Title	Credits
0723-LPE-6300	Project	4.0
0723-LPE-6302	Internship	2.0
0723-LPE-6304	Viva Voce	1.0
Total		7.00
Grand Total		40.00

N.B. Project to be taken from Semester-II and will complete in Semester-III

Part C

19. Description of all courses of the program Curriculum

Course Code: 0723-LPE-6101 **Course Title:** Advanced Leather Products Manufacturing
Credits: 3.0

Rationale of the Course: This course is designed to provide advanced knowledge on different techniques and automation to manufacture and develop diversified leather goods and garments. The course furnishes the design and fashion ideas through the knowledge of product development, grading, commercialization, merchandizing, brands etc. One can easily explore the different interests of leather products after equipping once with these contents.

Course Contents

Introduction of modern leather products: Tradition and fashion on continuous evolution from handicrafted leather goods to industry, the value and contribution of materials, materials concept in modern leather products manufacturing with function& purpose, creative aspects leather goods, leather goods manufacturing processes, designing & process development.

Leather in automobile items: Various types of automobile items, specification of different types of automobile items, specification and materials used in automobile items, making procedure of automobile items, creativity in automobile items manufacturing, specialty of automobile items.

Fashion accessories and ornamentation: Principles of fashion design, fashion forecasting, fashion show, length of fashion cycles, sources of inspiration, theory of fashion leadership, areas of fashion design, principles of design, types of design, selecting garments accessories, trims, trimming and decoration, types and selection of fashion accessories, evaluation of quality of trims and accessories, designer's duties, making a garment sellable, developing a line in designing,

Garment Technology: Body, factors affecting garment fit and ease of body movement; different front openings of garments; components of zippers; button and button holes-application, types, styles of attachment; advanced concept of grading, objectives, rules and application of grading methods; block grading, computer aided pattern grading; special types of jackets-blocks, designing, anatomy, grading, garment specification sheet development; garments physiological discomfort sensations, different types and factors affecting comfort.

Proportion in design: Division into eights, geometry of human form, golden section, construction of a golden section, construction of a golden rectangle, use of golden ratio, Phi and its use in consumer products.

Concept of Fusing technology and materials: Lining-Interlining relation with fusing, objectives, interlining-classification, manufacturing, characteristics, selection, and application; advantages and disadvantages of fusing press system, constructions of fusing, requirements of fusing, factors of fusing controls, determination of the optimal fusing parameters, fusing equipment, methods and quality control in fusing.

Automation in Products Manufacturing: Garment manufacturing- from concept to consumer, global scenario of automation, various automation systems and advanced tools and machines in garment manufacturing, areas of automation-inspection, computer-aided design and computer-aided manufacturing, advantages and disadvantages of automation in products manufacturing.

Private labels and brands for leather products: National brands, private labels and brands, private label brand strategy, private labels and brands acquisition, steps, promoting awareness of private labels and brands, developing a label, trends in private labels and brands.

Leather products merchandising: Concepts of leather products merchandising, responsibilities of the store line, responsibilities of the buying line, fashion merchandising direction, buyer's role, target customers, micro-versus macro-merchandising, buying-selling cycle.

Course Objectives

- a) To familiarize students with a comprehensive understanding of modern leather products, fashion accessories, ornamentation.
- b) To impart knowledge about proportion of designing.
- c) To provide students with a comprehensive understanding of automation, private labels and brands, and merchandising procedure for leather products.
- d) To acquaint students with modern knowledge on different techniques to manufacture and develop various leather goods and garments.

Course Learning Outcomes (CLOs) and Mapping of CLOs with Program Learning Outcomes (PLOs)

a) **CLOs:** Upon completion of the course, the students will be able to:

	Course Learning Outcomes (CLOs)	Learning Level
CLO1	Explain and apply different materials to manufacture leather products e.g., handbags, briefcase, luggage, automobile items, garments etc.	C2, C3, A3
CLO2	Analyze and compare various automation systems, private levels and brands alongside merchandising of leather products.	C4, A4
CLO3	Illustrate and integrate fashion accessories and ornamentation, fashion show, fashion cycle, trims, fusing, fusing technology, and proportion in design	C4, A4
CLO4	Interpret grading method and justify factors influencing garments fit and ease of body movement alongside comfort.	C5, A3
CLO5	Design and construct different leather goods and garments.	C6, P5

Mapping of CLO with PLO

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8
CLO1	3			3		2	3	2
CLO2	3	2		2		3	2	
CLO3	3			3		3	3	2
CLO4	3			3		3	2	3
CLO5	3	3	3	2	3	3	3	3

Rank: 3-High match, 2-Medium match, 1-Low match

Mapping of Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture, Multimedia presentation, video presentation and demonstration.	Group Presentation, In-course Exam; Final Exam
CLO2	Lecture, Multimedia presentation, demonstration, video presentation	Assignment, In-course Exam, Final Exam
CLO3	Lecture, multimedia presentation, group discussion, demonstration, and problem-based exercises	Quiz, In-course Exam, and Final Exam
CLO4	Lecture, pictorial, theme board illustration, story board illustration, multimedia presentation, white board illustration,	Group Presentation, In-course Exam, and Final Exam

	demonstration	
CLO5	Multimedia presentation, white board illustration, group discussion and demonstration	Assignment, In-course Exam, and Final Exam

Learning Materials

i. Recommended Readings

- Manual for Leather Accessories and Leather Goods-S. Natesan.
- Inside Fashion Design -S. L Tate.
- Clothing Technology- Roland Kilgus

ii. Supplementary Readings

- Fashion from concept to consumer, seventh edition -Gini Stephens Frings.
- Garments Manufacturing Technology- R. Nayak& R. Padhye

iii. Others: Handout/lecture material provided by the course teacher

Course Code: 0723-LPE 6103

Course Title: Optimization Techniques of Leather Products Manufacturing **Credits:** 3.0

Rationale of the Course: The focus of this course is on theoretical concepts, data-driven models, and numerical techniques for optimization using actual variables. The course provides a thorough understanding in mathematical optimization theory, methods, and algorithms. This course's goal is to give students a systematic understanding of optimization methods. The course will begin with linear optimization and will go into detail about how to formulate problems and find solutions as well as to develop a methodology for leather products engineering design.

Course Contents

Advanced Inventory Management: Demand and control system characteristics, inventory concept, inventory cost, inventory modeling, optimization and inventory control, Dynamic EOQ Models, probabilistic models and safety stock, probabilistic demand, probabilistic example, Single-Period Models, Multiperiod Models.

Aggregate Planning and Master Scheduling: Basic Strategies for Meeting Uneven Demand, Techniques for Aggregate Planning, Disaggregating the Aggregate Plan, Master Scheduling, The Master Scheduling Process, Methods for Aggregate Planning: Graphical Methods, Mathematical Approaches, Comparison of Aggregate Planning Methods.

MRP, MRPII and ERP: Basic ideas of inventory MRP, benefits of MRP, inputs to MRP, bill of material (BOM), BOM examples for leather products manufacture, Master Production

Schedule (MPS), MPS examples for leather products manufacture, time-phased product structure, MRP structure, determining gross requirements, gross requirements plan for leather products manufacture, gross requirements schedule, MRP management, Lot-sizing techniques, Lot-for-Lot examples, EOQ lot size examples, POQ lot size examples, material requirements planning II, distribution resource planning (DRP), enterprise resource planning (ERP), SAP's ERP modules.

Decision Modeling: The Decision Process in Operations; Fundamentals of Decision Making; Types of Decision-Making Environments; Decision Making under Uncertainty, Decision Making under Risk, Decision Making under Certainty, Expected Value of Perfect Information (EVPI); Decision Trees; A More Complex Decision Tree, Using Decision Trees in Ethical Decision Making.

Linear Programming Models: Why Use Linear Programming? Requirements of a Linear Programming Problem, Formulating Linear Programming Problems, Graphical Solution to a Linear Programming Problem, Sensitivity Analysis, Solving Minimization Problems, Linear Programming Applications, The Simplex Method of LP.

Transportations Modeling: Transportation Modeling; Developing an Initial Solution: The Northwest-Corner Rule, The Intuitive Lowest-Cost Method, The Stepping-Stone Method; Special Issues in Modeling: Demand Not Equal to Supply, Degeneracy; Using Software to Solve Transportation Problems; Case Studies.

Integer Programming and Dynamic Programming and Network Techniques: Integer programming - Cutting plane algorithm, Branch and bound technique, Zero-one implicit enumeration – Dynamic Programming – Formulation, Various applications using Dynamic Programming. Network Techniques – Shortest Path Model – Minimum Spanning Tree Problem – Maximal flow problem.

Problem solving tools and improvement strategies: Problem solving process, quality control tools, new management tools, quality function deployment, Deming wheel, zero defect concept, benchmarking, six- sigma.

Learning Objectives

- a) To introduce students with advanced inventory management and aggregate planning
- b) To familiarize students with various production planning techniques
- c) To provide knowledge on different optimization models and their applications in leather products manufacturing

Course Learning Outcomes (CLOs) and Mapping of CLOs with Program Learning Outcomes (PLOs)

CLOs: Upon completion of this course, students will be able to:

	Course Learning Outcomes (CLOs)	Learning Level
CLO1	Explore knowledge on various optimization techniques used in leather products manufacturing.	C1, C2, A1
CLO2	Explain the methods and ways to manage different optimization	C2, A1, A2

	tools.	
CLO3	Implement the advanced tools and techniques of operations research to manage the production in the leather products industry supply chain	C3, A2
CLO4	Manage new project related to new leather products or business	C4
CLO5	Investigate the applicability of a specific tool or technique to a specific case.	C5

Rank: 3-High match, 2-Medium match, 1-Low match

Mapping of CLO with PLO

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8
CLO1	3		-		-	-	-	
CLO2	3			-	-	1		
CLO3	3			-	1	2	2	
CLO4	3		2	1		2	3	
CLO5	3		2		2	2	1	

Rank: 3-High match, 2-Medium match, 1-Low match

Mapping of Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture, multimedia presentation, literature review and problem-based exercises	Group Presentation, Assignment, oral presentation, In-course Exam and Final Exam
CLO2	Lecture, group discussion and problem-based exercises, literature review.	Group Presentation, In-course Exam and Final Exam
CLO3	Lecture, multimedia presentation and problem-based learning: Identifying the problem to be solved	Assignment, Group Presentation, In-course Exam and Final Exam
CLO4	Lecture, multimedia presentation, group discussion, demonstration, and problem-based exercises	Group Presentation, Case study, Assignment, In-course Exam and Final Exam
CLO5	Lecture, multimedia presentation, group discussion, demonstration, and problem-based exercises	Group Presentation, Case study, Assignment, In-course Exam and Final Exam

Learning Materials

I. Recommended Readings

- Jay Heizer, Barry Render, Chuck Munson- Operations Management: Sustainability and Supply Chain Management (13th Edition)
- Jay Heizer, Barry Render- Operations Management (11th Edition)
- Hamdy A. Taha, Operations Research – An Introduction, Prentice Hall of India, 1997
- Gideon Halevi- Handbook of Production Management Methods
- R. Panneerselvam, “Operations Research”, Prentice Hall of India Private Limited, New Delhi 1 – 2005

II. Supplementary Readings

- Larry P. Ritzman, Lee J. Krajewski, and Manoj K. Malhotra- Operations Management: Processes and Supply Chains
- Nicholas J. Aquilano and Richard B. Chase- Production and Operations Management

III. **Others:** Hand notes/Lecture materials will provide by the course teacher.

Course Code: 0723-LPE-6105 **Course Title:** Research Methodology **Credits:** 3.0
Rational of the Course: This course provides an opportunity for students to establish or advance their understanding of research through critical exploration of research language, ethics, and approaches. Students will be able to examine and be practically exposed to the main components of a research framework i.e., problem definition, research design, data collection, ethical issues in research, report writing, and presentation.

Course Content:

Introduction to research: Definitions, characteristics, types, differences and role of research, research and investigation, research methods versus research methodology, criteria of good research, paradigms and ethics in research, proposition, axiom, postulate, theorem and model of research, variables and types, properties of relationships between variables, inductive and deductive method.

Literature review and research problem: Definition, objectives, advantages, principles and procedures of literature review, problem definition, finding a researchable problem, selecting the problem, importance of defining the problem, important qualities of a research problem, techniques involved in defining a problem, evaluating a proposed design.

Research questions and objectives: Research objective and research question, practical examples of research objectives and research question, formulation of research questions, criteria of research objectives, evaluation of research questions, classification and importance of research objectives.

Research hypothesis, design, and proposal: Source, functions, and characteristics of a good research hypothesis, formulation and possible difficulties of research hypothesis, research hypothesis versus research objectives; definition, function, classification of research design, feature of a good research design, qualitative research, observation studies, surveys,

experimentation, steps in a research design; meaning of research proposal, contents of research proposal, steps in the development of a research proposal, criteria for evaluating research proposal.

Qualitative research tools, measurement and scaling technique: Definition, characteristics, uses, and general steps of qualitative research, qualitative research approaches, steps in grounded theory, nature of measurement, measurement scales, types of measurement scales, Likert scale.

Questionnaire design: Questionnaire and questionnaire design, consideration and types of questions, questionnaire designing process, necessary properties of questionnaire, characteristics of a good questionnaire, precaution required in the use of questionnaire, guidelines for constructing questions and questions sequence.

Sampling and sampling design: Concepts and importance of sampling, planning and designing a survey, classification of sampling techniques, probability sampling design, non-probability sampling design, determination of sample size.

Data collection and analysis: Data, data versus information, types and sources of data collection, secondary data collection methods, primary data collection methods, qualitative and quantitative methods of data collection, data validation, editing and coding, data entry and exploring, displaying and examining data, Univariate analysis, Bivariate analysis, Multivariate analysis, SWOT analysis, and Hypothesis testing.

Presenting insights and findings: Importance of the report and presentation, report preparation and presentations process, precautions in interpretation, research report, contents and precautions in writing research report, presentation of statistics, oral presentation, writing thesis/dissertation, writing journal articles and conference papers, bibliography and reference writing styles, copy right, plagiarism.

Course Objectives

- a) To familiarize the students with the key terms, concepts, and practices in the field of research.
- b) To prepare research problems and/or hypotheses in a clear and concise format.
- c) To demonstrate a systematic understanding of the range of advanced research techniques, be able to critically evaluate these techniques and apply them appropriately.
- d) To evaluate and critically analyze the components of scholarly writing and published research.

Course Learning Outcomes (CLOs) and Mapping of CLOs with Program Learning Outcomes (PLOs)

CLOs: Upon completion of the course, the students will be able to:

	Course Learning Outcomes (CLOs)	Learning Level
CLO1	Outline the basic framework of research process, and identify various sources of information for literature review and data collection.	C1, A1
CLO2	Explain the ethical dimensions of conducting basic and applied	C2, A2

	research.	
CLO3	Design questionnaire, explain the procedures and techniques, and analyze data with different statistical tools and techniques using statistical computing for making better decisions.	C2, C3, A3
CLO4	Acquaint with the process of conducting research to identify real-life problems recurrently encounter and to suggest suitable and pragmatic solutions to those problems.	C4, A4
CLO5	Compare the advanced research techniques and critically analyze the components of scholarly writing and published research.	C5, A4

Mapping of CLO with PLO

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8
CLO1	3		3			2		
CLO2	3		3			2		
CLO3	3		3			3		2
CLO4	3	3	3	3		3	2	
CLO5	3	2	3	3		3	3	

Rank: 3-High match, 2-Medium match, 1-Low match

Mapping of Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture, Whiteboard illustration, Multimedia presentation, Interactive Discussion	Assignment, Case study, In-course Exam and Final Exam
CLO2	Lecture, Whiteboard illustration, Multimedia presentation, Interactive Discussion	Assignment, Case study, In-course Exam and Final Exam
CLO3	Lecture, Whiteboard illustration, Multimedia presentation, Interactive Discussion	Assignment, Case study, In-course Exam and Final Exam
CLO4	Lecture Whiteboard illustration, Multimedia presentation, Interactive Discussion	Presentation, Assignment, In-course Exam and Final Exam
CLO5	Lecture, Whiteboard illustration, Multimedia presentation, Interactive Discussion	Presentation, Assignment, In-course Exam and Final Exam

Learning Materials

i) Recommended Readings

- M. A. Salam Akanda (2019). Research Methodology-A Complete Direction for Learners. Latest Ed., Akanda& Sons, Dhaka.
- C. R. Kothari (1996). Research Methodology- Methods & Techniques. Wishaw Prokashan, New Delhi, Wiley Eastern Limited.
- An Introduction to Research Methods; Author: M. Nurul Islam ; Year: 2011 ; Edition: 2nd ; Publisher: Mullick& Brothers

ii) **Supplementary Readings**

- a. Ranjit Kumar (2005). *Research Methodology- A Step-by-Step Guide for Beginners*, 3rd Ed., Singapore, Pearson Education.

iii) **Others:** Handout/lecture material provided by the course teacher.

Course Code: 0723-LPE-6107 **Course Title:** Industrial Hazards and Waste Management

Credits: 3.0

Rationale of the Course: This course is designed to provide in-depth knowledge of the exploitation of valuable products from tannery wastes by utilizing modern technology. This course will facilitate students with deeper understanding of different types and characteristics of industrial hazardous wastes and a comprehensive overview of hazardous waste management's approaches.

Course Contents

Industrial Hazards: Hazard, Types of industrial hazards, Identification of hazardous wastes, Hazardous waste management, Treatment technology, Disposal of radioactive materials, Ground water contamination and remediation. Route of industrial hazard entry into human body-Inhalation, Absorption, Swallowed, Injection, Food chain - Contaminated soil, Vegetables, Crops, Fish and Chicken, Adverse impact of hazard, Occupational cancer.

Solid Waste Generation in the Leather industry and its Utilization:

Generation: Skin collagen waste, Fleshing waste, Wet blue, Trimming, Buffing, Chrome shaving, Chrome split, trimming from crust and finished leather. Utilization: Fleshing-Modified fleshing hydrolysate, Reactive protein (RP), feed ingredients.

Chrome shaving: Treatment with enzyme, MgO, Carbonates and other alkalies, application of hydrolysate.

Waste generation in Footwear and Leather Products Industry: Materials being processed: Leather, Natural rubber/poly-isoprene, Reaction Injection Moulded (RIM) polyurethane (PU), Polyvinyl Chloride (PVC) and blends, Ethylene Vinyl Acetate (EVA) and blends, Styrene Butadiene Rubber (SBR), Thermoplastic Polyurethane (TPU), Thermoplastic Rubber (TR), Leather, textile, cotton, polyesters, nylon, adhesive, solvent, oil.

Solid Waste Management:

Solid waste—sources and engineering classification, characterization, generation and quantification. Transport - collection systems, collection equipment, transfer stations, collection route optimization.

Treatment methods - various methods of refuse, recovery, recycle, composting –aerobic and anaerobic, incineration, pyrolysis and energy recovery.

Disposal methods – Impacts of open dumping, site selection, sanitary land filling – design criteria and design examples, leachate and gas collection systems, and leachate treatment.

Hazardous Waste Management- Introduction, Sources, Classification, Physico-chemical, Chemical and biological Treatment of hazardous waste, regulations.

Thermal treatment - Incineration and pyrolysis.

Soil contamination and site remediation – Bioremediation processes, monitoring of disposal sites.

Removal of Refractory Organic Compounds: Theories on Advanced Oxidation Process viz., Photocatalytic treatment, Membrane separation, Homogenous catalysis system using hydrogen peroxide, ozone, etc. Heterocatalytic systems using metal oxides, activated carbon – Removal of inorganic compounds through electro dialysis, reverse osmosis, multiple effect evaporator, ion-exchange.

Course Objectives

- To provide the advance knowledge about the environmental problems, industrial hazards, and its methods of mitigation.
- To estimate solid waste generation from tanning industry, and leather goods industry and their utilization using modern techniques.
- To improve a comprehensive skill on tannery solid waste, biomedical and other hazardous wastes and integrated solid waste management system.
- To familiarize students with modern biological techniques available for the wastewater treatment.

Course Learning Outcomes (CLOs) and Mapping of CLOs with Program Learning Outcomes (PLOs)

CLOs: Upon completion of this course, students will be able to:

	Course Learning Outcomes (CLOs)	Learning Level
CLO1	Narrate industrial hazards and their adverse impact on the environment and humans.	C1,A1
CLO2	Analyze tannery solid waste utilization into the valuable byproducts as part of circular economy and clean technology.	C3, A3
CLO3	Apply knowledge on the estimation of solid waste generated from leather and allied industries.	C4
CLO4	Justify modern techniques of wastewater treatment with traditional treatment processes.	C5, A4

Mapping of CLO with PLO

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8
CLO1	3	2				2	1	
CLO2	2	3	3			2	3	
CLO3	3	3	3			2	2	
CLO4	3	3		3	3	2	3	

Mapping of Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO-1	Lecture, Multimedia presentation, demonstration and problem-based exercises	In-course Exam; Final Exam
CLO-2	Lecture, audiovisual presentation, group discussion and problem-based exercises, literature review	Presentation, In-course Exam; Final Exam
CLO-3	Lecture, problem-based learning (PBL): Identifying the problem to be solved	Assignment, Group Presentation, In-course Exam, and Final Exam
CLO-4	Lecture, multimedia presentation, group discussion, literature review, demonstration, and problem-based exercises	Assignment, In-course Exam, and Final Exam

Learning Materials

i) Recommended Readings

- Arceivala S. J., “Waste water treatment and disposal” Marcel Dekkar Inc., New York, 1981.
- Besselievie, B. E. and Schwartz, M., “The Treatment of Industrial wastes”, 2nd edn., McGraw Hill.
- Karia G.L., and Christian R.A., (2001), “Wastewater Treatment Concepts and Design Approach”, Prentice Hall of India Pvt. Ltd., New Delhi.

ii) Supplementary Readings

- Assessment of Tannery Solid Waste Management, a case study Sheba Leather Industry, UNIDO, 2018.
- Benefield R.D., and Randal C.W., (1980), “Biological Process Design for Wastewater Treatment”, Prentice Hall, Englewood Chiffs, New Jersey.

iii) Others: Hand notes/Lecture materials will be provided by the course teacher.

Course Code: 0723-LPE-6109

Course Title: Ergonomics and Industrial Safety

Credits: 3.0

Rationale of the Course: This course intended to instruct knowledge by different approaches to improve better workspace design and efficient work environment designs and management. After completion of this course, the students will be able to design better factory environment and thereby will be able to ensure effective safety management practice in leather industry.

Course Contents

Ergonomics

Introduction: What is Ergonomics; History of Development; Scope & Application of Ergonomics; Importance of Ergonomics; Anthropometry.

Muscle Physiology and Manual Material Handling: Muscle and Work Physiology; Measure of Physiological Strain; Physical Workload; Manual Materials Handling.

Hand Tools and Devices: Introduction to Hand Tools; Structure and Motion of Hand; Principles of Designing Hand Tools and Devices; Vibration & HAVS; Gripping Principles.

Workspace Design: Designing Workspace Envelopes for Seated and Standing Personnel; Designing Horizontal Work Surfaces; Designing Seated and Standing Work Surfaces.

Work Environment Design: Lighting in Work Environment; Vision and Structure of Eye; Visual Defects; Guidelines for Colour Selection; Measurement of Light Photometry; Lighting and Illumination; Reflectance; Lighting Problem; Improving Visibility; Characteristics and Efficiency of Light Sources; Lighting Design Considerations; Glare; Uniformity of Lighting; Complaints, Causes and Control Measures of Visual Discomforts; Sound Propagation; Structure of Human Ear; Process of Hearing; Health Effects of Noise Pollution; Control Measures for Noise Pollution; Thermal Balance; Heat Illness; Heat Acclimatization; Heat Stress Measurement; Cold Injury; Cold Climate Protection.

Safety Management

Introduction to Safety Management: Objectives; Importance of Safety Management; Occupational Health and Safety (OHS); Hazard and Risk.

Introduction to Workplace Safety: Aims; Considerations to Manage Workplace Safety Effectively; Nature, Functions and Benefits of Workplace Safety; Challenges for Practicing Safety; PDCA Cycle in OHS; Idea Generation.

Creating an Effective Workplace Safety Program: Core Regulatory Requirement; Program Review/Audit; Establishing Goals and Objectives; Management Commitment and Responsibility; Work-Site Analysis; Hazard Recognition and Resolution; Job Hazard Analysis (JHA)/Job Safety Analysis (JSA); Hazard Resolution; Incident Investigation; Best Practices.

Workers' Compensation and Record Keeping: Early and Modern Workers' Compensation Laws; Premium Calculation; Background Record Keeping; OSHA 300, 300A and 301 Forms; Recordable Occupational Injuries and Illness; First Aid Cases; Fatalities; Privacy Concern Cases; Posting Annual Summary Requirements.

Introduction to Industrial Hygiene: Definition; Toxicology; Industrial Hygiene Practice.

Fire Prevention and Protection: Means of Egress Regulations; Fire Tetrahedron; Categories of Fire; Categories of Fire Extinguisher.

System Safety: Importance of System Safety; System Life Cycle; Management of System Safety; Elements of A System Safety Program Plan (SPSS); Preliminary Hazard Analysis

(PHA); Subsystem Hazard Analysis (SSHA); System Hazard Analysis (SHA); Technique of Operations Review (TOR); Failure Mode and Effect Analysis (FMEA).

Improving Safety Performance with Behavioural Safety: Introduction; Pilot Error Syndrome; Concepts of Risk; Incidents and Accidents; Loss Exposures; Control Techniques for Loss Exposures; Accident Causation Theories; Single Factor Theory; Heinrich’s Domino Theory; Multiple Factors Theory; Human Factors Theory; Energy Release Theory; Further Incident Investigation.

Course Objectives

- a) To identify the components needed to provide a safe and healthful work environment through case studies and review of injury statistics provided in the course.
- b) To identify potential workplace safety and health hazards and determine how to mitigate the hazards through engineering controls, administrative controls and personal protective equipment.
- c) To conduct basic safety inspections using strategies that they have developed through hazard identification and job hazard analysis.
- d) To identify the requirements of training programs in the workplace under the existing OSHA and State-OSHA requirements.
- e) To understand essential elements of an occupational safety and health program and the components of international standard organizations in safety and health.

Course Learning Outcomes (CLOs) and Mapping of CLOs with Program Learning Outcomes (PLOs)

CLOs: Upon completion of this course, students will be able to:

	Course Learning Outcomes (CLOs)	Learning Level
CLO1	Recall knowledge of fundamentals of ergonomics and safety management related to leather products engineering.	C1, A1
CLO2	Explain various methods and tools to ensure proper ergonomics facilities and safety managements.	C2, C3
CLO3	Apply various modern techniques to design an ergonomic friendly work environment as well as a safer workplace with protection from possible accidents and hazards.	C4
CLO4	Investigate and solve any problem/issue related to ergonomics and safety management in real world leather manufacturing.	C5, A4

Mapping of CLO with PLO

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8
CLO1	3							
CLO2	3	3			2			
CLO3	3	3	3		2	3	2	
CLO4	3	3	2	3	2	2	2	2

Rank: 3-High match, 2-Medium match, 1-Low match

Mapping of Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture, multimedia presentation, literature review and problem-based exercises	Group Presentation, Assignment, oral presentation, In-course Exam and Final Exam
CLO2	Lecture, group discussion and problem-based exercises, literature review.	Group Presentation, In-course Exam and Final Exam
CLO3	Lecture, multimedia presentation and problem-based learning: Identifying the problem to be solved	Assignment, Group Presentation, In-course Exam and Final Exam
CLO4	Lecture, multimedia presentation, group discussion, and problem-based exercises	Group Presentation, Case study, Assignment, In-course Exam and Final Exam

Learning Materials

i) Recommended Readings

- a) Human Factors in Engineering & Design by Mark S. Sanders, Ph. D. and Ernest J. McCormick, Ph. D
- b) Introduction to Ergonomics by R. S. Bridger
- c) Workplace Safety A Guide for Small and Midsized Companies by Dan Hopwood, Steve Thompson
- d) Fundamentals of Occupational Safety and Health (fourth edition) by Mark A. Friend and James P. Kohn

ii) **Supplementary Readings:** The Occupational Ergonomics Hand Book, Edited by Waldemar Karwowski and William S. Marras, CRC Press, New York, USA.

iii) **Others:** Hand notes/Lecture materials will provide by the course teacher.

Course Code: 0723-LPE-6111

Course Title: Materials and Quality Management of Leather Products **Credits:** 3.0

Rationale of the Course: This course's goal is to familiarize students with the concepts and methods of materials management. Proper purchasing policies and practices are necessary for effective material management in order to make commodities available at the accurate quality, amount, timing, cost, and source. Additionally, the course emphasizes inventory management systems while covering crucial issues in purchasing, handling, and warehousing. Moreover, quality management and current best practices in this area will be explored.

Course Contents

Fundamentals of materials management; introduction, history of industrial material management, objectives and function of leather products material management, scope of leather products material management, integrated leather products management concept, Types of leather products material, industrial material management organization.

Bill of Materials, Inventory classification and materials codification: What is BOM; BOM formats for leather products; tabular form, tree structure, single level BOM, Multi-level BOM, Indented BOM, ratio or percentage Bill, Modular bill; low level coding; ABC,HML, VED classification for leather products materials; ABE-VED matrix analysis, SED classification/analysis; FSN classification/analysis; materials codification; coding; material codification; characteristics of a satisfactory coding system; automatic identification , Bar coding.

Store accounting and physical verification of Inventory: meaning, classification and codification; evaluation of assets inventory: FIFO, LIFO, AVCO methods and related problems for leather products industry; stores ledger sheet for FIFO and LIFO of leather products industry; inventory counting: physical verification; cycle counting and periodic review; importance of accurate inventory record; steps of cycle counting; ways of control cut-off.

Surplus materials, waste management, and value engineering for leather products industry: definition of obsolete items; identification and control of surplus materials; materials reduction programme; Value Management, Value Analysis verses Value Engineering, Project selection, Assembling the team; Information gathering Design documents- drawings, specifications, etc. Material / component cost, Cost Models, Annual Purchase Values and Quantities, Commodity data, Sample components, Reject rates, Warranty data, Commercial consideration, Supplier Suggestions/Supplier Walk-through; Idea generation: Creativity, Brainstorming, Process Idea starters, Idea forms; Evaluation of Ideas-Eliminate the Noise.

Lead time management and distribution inventory system for leather products industry: Details of Lead time; distribution inventory system: physical distribution & push and pull distribution system, time-phased order point, distribution requirement planning, fair shares allocations, problems solving related to Lead time management and distribution inventory system.

Leather products warehouse management: Introduction; Types of warehouse; Cost in opening and managing a leather products warehouse; measuring performance of a leather products warehouse; decision making on warehouse design and management for leather products; warehouse components; warehouse design; location in warehouse; dedicated storage, random storage; value added warehousing, Data collection and analysis, Space calculations, assignments model, computerized layout techniques; Warehouse layout examples.

Materials handling and equipment selection for leather products industry: Introduction, Basic Equipment Types, Principle of Material Handling, Storage Equipment, Equipment Selection, Storage Options, Shuttle Technology with A Difference, Very High Bay Warehouses, Other Storage Media, Warehouse Handling Equipment, Vertical and Horizontal Movement, Automated Storage and Retrieval Systems (AS/RS), Specialized Equipment, Recent Technical Advances.

Course Objectives: The learning objectives of this course are:

- a) To make student understand the fundamentals of material quality management related to leather products manufacturing.
- b) To help students obtain the core knowledge of bill of materials, inventory classification and materials codification
- c) To make student able to understand the concept of Store accounting and physical verification of Inventory as well as Surplus materials, waste management, and value engineering for leather products industry.
- d) To help student understand the lead time management, distribution inventory system, warehouse design and material handling for leather products industry

Course Learning Outcomes (CLOs) and Mapping of CLOs with Program Learning Outcomes (PLOs)

CLOs: Upon completion of this course, students will be able to:

	Course Learning Outcomes (CLOs)	Learning Level
CLO1	Comprehend knowledge on fundamentals of material quality management related to leather products manufacturing.	C2
CLO2	Explain various principles, methods and tools to maintain proper quality of materials.	C2, A3
CLO3	Apply and justify various modern warehouse techniques to store different materials to ensure right quality.	C3, A3
CLO4	Interpret, compile and solve any problem/issue related to materials and quality management in real world leather products manufacturing.	C5, C6, A5

Mapping of CLO with PLO

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8
CLO1	3					2	2	
CLO2	3				2			
CLO3	3		2		2	3		
CLO4	3	2	2	2	2	2	3	3

Rank: 3-High match, 2-Medium match, 1-Low match

Mapping of Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture, multimedia presentation, literature review and problem-based exercises	Group Presentation, Assignment, oral presentation, In-course Exam and Final Exam
CLO2	Lecture, group discussion and problem-based exercises, literature review.	Group Presentation, In-course Exam and Final Exam
CLO3	Lecture, multimedia presentation and problem-based learning: Identifying the problem to be solved	Assignment, Group Presentation, In-course Exam and Final Exam
CLO4	Lecture, multimedia presentation, group discussion, and problem-based exercises	Assignment, In-course Exam and Final Exam

Learning Materials

i) Recommended Readings

- a) Steven Nahmias-Production and Operations Analysis, Third edition.
- b) Gwynne Richards- Warehouse Management: A Complete Guide to Improving Efficiency and Minimizing Costs in the Modern Warehouse.
- c) Stan C. McDonald- Materials Management: An Executive's Supply Chain Guide

ii) Supplementary Readings

- a) Steve Chapman, Tony Arnold, Ann Gatewood- Introduction to Materials Management 8th Edition
- b) P. Gopalakrishnan- Handbook of Materials Management, Second Edition.

iii) Others: Hand notes/Lecture materials will provide by the course teacher.

Course Code: 0723-LPE-6213

Course Title: Environmental Management and Impact Assessment **Credits:** 3.0

Rational of the Course: This course is designed to train the graduates in analysis and assessment methods applicable to environmental contamination problems, particularly national and international legislative frameworks. This course is contemplated for LWG and other environmental certification processes for leather industry.

Course Content

Environmental Audit: Principles and philosophies of environmental auditing, basic steps in audit process, Auditing techniques Concept of industrial ecology, cleaner technologies in industrial processes and evaluation of processes, waste minimization

Environmental health hazard and risk assessment: Biological, chemical, physical and psychological health hazard; health risk assessment and management, toxicology, exposure measurement of toxic (carcinogenic and non-carcinogenic) substances

Clean Development Mechanism: Overview on sustainable development. greenhouse gasses reduction mechanism, project cycle for the CDM, CDM for small scale projects, risks and opportunities for industries, financing of CDM projects, case studies.

Environmental Impact Assessment (EIA): Definition, purposes and characteristics of EIA, global evolution of EIA, participants in EIA process, stages of EIA, types of EIA, environmental inventory, baseline data on EIA-environmental data, project data and project alternative data, measurement of impact– physical, social, economic, natural, public participation in environmental decision making, framework of environmental assessment, description of environmental setting, Environmental impact factors and area consideration, environmental impact statement (EIS) and environmental management plan (EMP).

Environmental Impact Analysis: Impact identification and methods of impact identification- adhoc method, checklist, matrix, network, overlay and index methods; impact prediction and predictive methodologies, impact evaluation (assessment) and impact mitigation.

Basic steps for the impact identification, prediction and assessment of air, water, noise, vegetation and wildlife environment with case studies.

Environmental Management System (EMS):Basic definitions and terms, Framework for environmental management system, approach for developing Environmental Management System, International standards, environmental management systems in tanneries and their implementation, environmental reporting, Occupational health and safety management, cross-boundary environmental management, mandatory regulations and ecolabelling criteria governing various substance in leather, life -cycle assessment and carbon footprint in leather industries.

Hazard Mitigation: Classification of hazards, basic concept of disaster (causative factors of disaster, classification of disasters), Hazards due to dams and reservoirs, nuclear power plants, industrial hazards, occupational hazards, mitigation measures, hazard assessment, risk assessment.

EIA in Bangladesh: An overview of history, current procedures, practices and guidelines for Environmental Clearance Certificate, EIA of water resource projects, industries, mining and quarrying, highway construction, and tourism developments.

Course Objectives

- a) To provide knowledge on legal and policy frameworks within which quantitative environmental assessment activities are carried out and
- b) To conduct systematic EIA and auditing methodologies in the leather industry.
- c) To carry out quantitative techniques of analysis for direct determination of contaminant concentrations and distributions within environmental systems.
- d) To investigate statistical and computer modeling techniques for analysis of data.

Course Learning Outcomes (CLOs) and Mapping of CLOs with Program Learning Outcomes (PLOs)

CLOs: The course is intended to achieve the following learning outcomes:

	Course Learning Outcomes (CLOs)	Learning Level
CLO1	Recognize ethical and narrate professional responsibilities in engineering situations and make judgments.	C1, A1
CLO2	Familiarize with the application of a variety of professional tools for predicting environmental impacts.	C2, A2
CLO3	Developing perspectives on impact assessment and relating to practical industrial activities.	C3,C4

Mapping of CLO with PLO

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8
CLO1	3	3	3					
CLO2	2		3	3	2	3	3	
CLO3	3		2			3	2	3

Mapping of Course Learning Outcomes (CLOs) with the Teaching-Learning and Assessment Strategy

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture, Multimedia presentation, white board illustration, problem-based exercises, group discussion by analyzing different case studies	Quiz, In- course exam; Final Exam
CLO2	Lecture, multimedia presentation, Problem based Learning (PBL): Identifying the problems to be solved	Assignment, Group presentation, In-course exam, Final exam
CLO3	Lecture, multimedia presentation, group discussion, analyze and compare through various case-studies	Assignment, In-course Exam, Final Exam

Learning Materials

i) Recommended Readings

- a) Morris, P and Therivel, R. 2001. Methods of environmental impact assessment. London. UCL press.
- b) Introduction to Environmental Impact Assessment: Principles and Procedures, Process, Practice and Prospects - 2nd edition. J. Glasson, R. Therivel, A. Chadwick
- c) Environmental Impact Assessment Methodologies, Y. Anjaneyulu, Valli Manickam, BS Publication
- d) Environmental and Health Risk Assessment and Management: Principles and Practices, ISBN: 9789048169610,9048169615

ii) Supplementary Reading

- a) Bregman, J.I. and Mackenthum, K.M. 1992. Environmental impact statements. Chelsia Michigan: Lewis.
- b) Calow, P. 1997. Handbook of environmental risk assessment and management. Oxford: Blackwell Science.

iii)Others: Handout/lecture material provided by the course teacher

Course Code: 0723-LPE-6215

Course Title: Nanotechnology for Leather and Leather Products **Credits:** 3.0

Rational of the Course: This course is designed to provide in-depth theoretical knowledge of nanotechnology and outlines its applications in leather and allied engineering fields. The course also deals with the design of nanosystems, nanomaterials together with their processing, properties and characterization.

Course Contents

Introduction to Nanoscience and Nanotechnology: Introduction, history and importance of nanotechnology, properties of nanomaterials, difference between bulk and nanomaterials, molecular building blocks for nanostructured systems, influence of nano structure on mechanical, optical, electronic, magnetic and chemical properties, overview of different nanomaterials available, chemistry and physics of nanomaterials, electronic phenomenon in nanostructures, optical absorption in solids, quantum dot, quantum effects, nanocomposites.

Nanomaterials Fabrication:

Chemical Methods: Sol- gel process, self-assembly process, electrodeposition, pyrolysis, metal nanocrystals by reduction, solvothermal synthesis, photochemical synthesis, nanochemical synthesis, reverse micelles and microemulsions, combustion method, template process, chemical vapor deposition, metal organic chemical vapor deposition.

Physical Methods: Ball milling, inert gas condensation technique, thermal evaporation, pulsed laser deposition, DC/RF magnetron sputtering, molecular beam epitaxy, microlithography, etching, wet cleaning, atomic layer deposition.

Biological Synthesis: Protein based nanostructure formation, DNA template nanostructure formation, protein assembly, biologically inspired nanocomposites.

Nanomaterials Characterization:

Structural Characterization: X-ray diffraction (XRD) analysis, FT-IR analysis, Raman spectroscopy

Microscopic and Surface Analysis: Electron microscopes: scanning electron microscopy (SEM), transmission electron microscopy (TEM); scanning probe microscopy: atomic force microscopy (AFM), scanning tunneling microscopy (STM).

Spectroscopy: X-ray photoelectron spectroscopy (XPS), fluorescence spectroscopy, UV-visible spectroscopy, nuclear magnetic resonance (NMR) spectroscopy, electron spin resonance (ESR) spectroscopy.

Electrical, Mechanical and Magnetic Properties: Impedance analysis, electro-analytical techniques: potentiometry, voltammetry, cyclic voltammetry

Thermal and Optical Properties: Differential scanning calorimetry (DSC) analysis, Differential thermal analysis (DTA), Thermogravimetric analysis (TGA), contact angle measurement. Dynamic light scattering (DLS) method.

Applications of nanotechnology in the relevant field and non-leather chemicals: Possible industrial applications of nanomaterials in leather, footwear and leather products industries, application of nano materials on collagen matrix at various stages of processing techniques, synthesis of nano based materials for leather manufacture: syntans, reinforcing materials, finishing chemicals.

Environmental aspects of nanotechnology: Handling, safety and hazard of nanomaterials processing, effects of nanomaterials exposure on human and living stock, long term and

short-term effects, case studies of exposure, effects of nanoparticles on air, water and soil, food and food supplements.

Course Objectives

- a) To introduce and provide a broad view of the nascent field of nanoscience and nanotechnology.
- b) To promote interdisciplinary interactions among engineering, technology, science, and industrial management/technology majors.
- c) To utilize knowledge about developing new products and systems in leather sector.

Course Learning Outcomes (CLOs) and Mapping of CLOs with Program Learning Outcomes (PLOs)

CLOs: At the completion of this course students will be able to:

	Course Learning Outcomes (CLOs)	Learning Level
CLO1	Define and explain the structure, properties and applications of nanomaterials together with associated chemicals	C1,C2
CLO2	Illustrate the importance of dimensional reduction in materials and its relationship with properties.	C3
CLO3	Compare numerous methods of nanomaterials preparation and analyze nanomaterials thoroughly using engineering tools	C5
CLO4	Assess environmental pollutions/concerns by nano based materials during its production and real-life applications.	C5

Mapping of CLO with PLO

(CLOs)	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8
CLO1	3					2		
CLO2	3					3		
CLO3	3	2			3	3	2	
CLO4	2	3			2	2	2	

Mapping of Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture, literature review, multimedia presentation, group discussion	Group Presentation, In-course Exam, Quiz, Assignment, Final Exam
CLO2	Lecture, multimedia presentation, video presentation, demonstration, group discussion	Group Presentation, In-course Exam; quiz, assignment, case study, Final

		Exam
CLO3	Lecture, demonstration, multimedia presentation, literature review, group discussion	Assignment, Quiz, Group Presentation, In-course Exam, and Final Exam
CLO4	Lecture, multimedia presentation, group discussion, literature review, video presentation, demonstration, and problem-based exercises	Quiz, Assessment, Group Presentation, In-course Exam, and Final Exam

Learning Materials

i) Recommended Readings

- a) Hand book of Nano science, Engineering, and Technology, William A. Goddard, CRC press 2003.
- b) Nanolithography and patterning techniques in microelectronics, David G.Bucknall, Wood head publishing 2005.
- c) Nanocomposite science and technology, Pulikel M. Ajayan, Wiley-VCH 2005

ii) Supplementary Readings

- a) Nanotechnology Environmental health and Safety: Risks Regulation and Management, Matthew Hull and Diana Bowman, Elsevier 2010
- b) Hand book of Nano science, Engineering, and Technology, William A. Goddard, CRC press 2003.

iii) Others: Handout/lecture material provided by the course teacher

Course Code: 0723-LPE 6217 **Course Title:** Industrial Automation **Credits:** 3.0

Rationale of the Course: This course provides an overview of the technologies of industrial automation and control as it is commonly encountered in factories of all types including leather and leather products items. Automation of the production process increases the efficiency of labor and the overall rate of growth. By ending this course, students will able to have a fundamental knowledge of current industrial automation technologies and their application.

Course Content

Introduction to Automation and Artificial Intelligence: Introduction, Principles and strategies, Basic elements of an automated system, Advanced automation functions, Levels of automations, Automated flow lines and transfer mechanisms, Introduction of AI, Historical development, Intelligent Systems, Types of Intelligent Agents, Components of AI, Foundations of AI, Scope of AI, Current trends in AI, Relevance to Leather, Products and Footwear Engineering

Boolean Algebra and Logic Circuits and Programmable Logic Controller (PLC): Various logic gates, Truth tables, Logic functions, Boolean Laws, Karnaugh maps, Block

diagram of PLC, Programming languages of PLC, Basic instruction sets, Networking of PLC, Overview of safety of PLC with case studies. Process Safety Automation: Levels of process safety through use of PLCs,

Controllers, Sensors and Actuators:: Control Modes, PID and Digital Controllers, Velocity Control, Adaptive Control, Microprocessor and Microcontrollers, important characteristics, Main industrial sensors, Classification of sensors and their usage, Description of different kinds of sensors, Overview of Actuators, usage of Actuators in Robotics, Classification of Actuators (Pneumatic, Hydraulic, Electric), Basics of Pneumatic and Hydraulic Actuation Systems, Mechanical Actuation Systems, Electrical Actuation Systems.

Robots and their applications: Introduction to robots, Types, Classifications, Selection of robots, Robot Degrees of freedom, Robot configuration, Accuracy and repeatability, Specification of a robot, Robot feedback controls: Point to point control and Continuous path control, Control system for robot joint, Drives and transmission systems, End effectors, Industrial robot applications.

Concept and Algorithms, No programming or numerical: Problem Solving: Tree and Graph Search, Uninformed v/s informed search, uninformed methods: depth first search, breadth first search, Informed search: heuristic search, Best first search, branch and bound; Machine Learning: Introduction, types of machine learning; Learning with Decision Trees, Classification and Regression Trees, K means clustering algorithm, K nearest neighbors algorithm, hierarchical clustering, Concept of ensemble methods.

Artificial Neural Networks and Introduction to AI Technologies: Concept of ANN, Basic Models, Important Terminologies of ANNs McCulloch-Pitts Neuron, NN architecture, perceptron, delta learning rule, backpropagation algorithm, Gradient Descent algorithm, feed forward networks, activation functions, Introduction to AI Technologies in the realm of Automation Concept of Natural Language Processing, Machine Vision, Deep learning, Expert systems, Genetic Algorithms, Industry 4.0

Course Objectives: The learning objectives of this course are:

- a) To provide fundamental knowledge of automated machines and equipment including AI application in leather industry.
- b) To impart the role of Boolean algebra and PLC in industrial automation.
- c) To develop the operating skill of various sensors, actuators and controllers.
- d) To familiarize with the application of robotic systems and artificial neural networks in automated manufacturing processes.

Course Learning Outcomes (CLOs) and Mapping of CLOs with Program Learning Outcomes (PLOs)

CLOs: Upon completion of this course, students will be able to:

	Course Learning Outcomes (CLOs)	Learning Levels
CLO1	Explore their knowledge on fundamentals of industrial automation and its importance in modern manufacturing.	C1, A1
CLO2	Define and explain various automation technologies in leather and leather products manufacturing and process industries.	C1, C2, A2

CLO3	Apply various modern technologies to design an automated production facility including materials handling with robotics application.	C3, A2
CLO4	Investigate and solve any hurdle related to automation with the help of Artificial Intelligence (AI) applications.	C4, C5

Mapping of CLO with PLO

CLO	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8
CLO1	3							
CLO2	3				1			
CLO3	3	2	2		1	3	2	
CLO4	3	3	3	3	2	2	2	1

Rank: 3-High match, 2-Medium match, 1-Low match

Mapping of Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO-1	Lecture, multimedia presentation, literature review and problem-based exercises	Group Presentation, Assignment, oral presentation, In-course Exam and Final Exam
CLO-2	Lecture, group discussion and problem-based exercises, literature review.	Group Presentation, In-course Exam and Final Exam
CLO-3	Lecture, multimedia presentation and problem-based learning: Identifying the problem to be solved	Assignment, Group Presentation, In-course Exam and Final Exam
CLO-4	Lecture, multimedia presentation, group discussion, and problem-based exercises	Group Presentation, Case study, Assignment, In-course Exam and Final Exam

Learning Materials

i) Recommended Readings

- a) Handbook of Industrial Automation-Richard L. Shell, Ernest L. Hall
- b) Introduction to Industrial Automation- Stamatios Manesis, George Nikolakopoulos
- c) Introduction to Artificial Intelligence By Wolfgang Ertel

ii)Supplementary Readings

- a) Introduction to Mechatronics and Measurement Systems by David G. Alciatore.

iii) **Others:** Hand notes/Lecture materials will provide by the course teacher.

Course Code: 0723-LPE-6219 **Course Title:** Products Design and Development
Credits: 3.0

Rationale of the Course: Product design and development is a very important stage for any kind of product. This program is designed to deliver the latest knowledge about the product development stages and its further stages for successful product launching. This program comprises product development processes, product concept development, product planning, product architecture, industrial design, design for manufacturing, prototyping and robust design, patents and intellectual property, product development economies, managing projects, design for environment.

Course contents

Introduction: Characteristics, duration, cost, the challenges of product development.

Development Processes and Organizations: A generic development process, adapting the generic product development process, product development process flows, product development organizations, organizational links with functions, projects.

Product Planning: The product planning process, identify opportunities, evaluate and prioritize projects, allocate resources and plan timing, complete pre-project planning, reflect on the results and the process.

Product Concept Development: Identifying customer needs, product specifications, concept generation, concept selection and concept testing, present the key activities of the concept development phase.

Product Architecture: The implications of product architecture on product change, product variety, component standardization, products performance, manufacturing cost, and project management.

Industrial Design: Assessing the need for industrial design, the impact of industrial design, the industrial design process, management of the industrial design process, assessing the quality of industrial design.

Design for Manufacturing (DFM): Overview the steps of DFM process; estimate the manufacturing costs, reduce the costs of components, reduce the costs of assembly, reduce the costs of supporting production, consider the impact of DFM decisions on other factors.

Prototyping and Robust design: Basics, types, importance, principles of prototyping, prototyping technologies, planning for prototypes. Definition, design of experiments (DOE) , robust design processes.

Patents and Intellectual Property: Definition, overview of patents, utility patents, preparing a disclosure in seven steps.

Product Development Economies: Elements of economic analysis, time of economic analysis, and economic analysis process steps.

Managing Projects: Understanding and representing tasks, Gantt Charts, PERT Charts, the critical path, baseline project planning, project execution, assessing project status, corrective actions, postmortem project evaluation.

Design for Environment (DFE): Basic concept, importance of DFE, four kinds of integration, a sense of timelessness, contemporary footwear and leather products design, functional planning, specific problems, studio projects.

Course Objectives

- a) To provide the basic knowledge of product design, process design, production planning, product concept development, product architecture, product prototyping, product development economics and design for environment etc.
- b) To impart the idea generations of different products design, process planning of a product and will learn how to provide visual representation of a product initially through prototyping.

Course Learning Outcomes (CLOs) and Mapping of CLOs with Program

Course Learning Outcomes (PLOs)

Upon successful completion of this course, students will be able to

CLOs	Course Learning Outcomes (PLOs)	Learning Level
CLO1	Identify different terms and phrases associated with product development.	C1, A1
CLO2	Explain products design through prototype.	C2, P2
CLO3	Analyze different product development processes and planning.	C4
CLO4	Justify different manufacturing problems and solutions.	C5, A3
CLO5	Evaluate product market opportunities and future of the product.	C5

Mapping of Course Learning Outcomes (CLOs) with Programs Learning Outcomes (PLOs)

CLOs	Program Learning Outcomes (PLOs)							
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8
CLO1	3		2	2				
CLO2	3	2	3	2	2			
CLO3	3		3			3	1	2
CLO4	3	2		2		3		2
CLO5	3	2		2	2	3		2

Rank: 3-High match, 2-Medium match, 1-Low match

Mapping of Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture, Multimedia presentation.	Group Presentation, In-course Exam; Final Exam
CLO2	Lecture, group discussion.	Group Presentation, In-course Exam; Final Exam
CLO3	Lecture, Multimedia presentation and group discussion.	In-course Exam, and Final Exam
CLO4	Lecture, multimedia presentation, group discussion.	Group Presentation, In-course Exam, and Final Exam
CLO5	Lecture, group discussion	In-course Exam, and Final Exam

Learning Materials

i) Recommended Readings

- a) Product Design and Development, TATA McGraw-Hill, Third Edition, New Delhi, 2008-Ulrich, Karl T.and Eppinger, Steven D.
- b) The Mechanical Design Process, TATA McGraw-Hill, Second Edition, 1997-Ullman, David G.
- c) Design through discovery -Marjorie Elliott Bevlin.

ii) **Others:** Handout/lecture material provided by the course teacher.

Course Code: 0723-LPE-6221 **Course Title:** E-Commerce and International Trade
Credits: 3.0

Rationale of the Course: This course comprises basic concept of e-commerce, mobile commerce, website evaluation and usability testing, internet marketing, e-security, e-core values, of Commerce, which will help students to establish online business channel. Also, this course includes introduction to international trade, modes of operations, export strategy and marketing, which will deliver ideas to students how the leather, footwear, and leather products export market can be enlarged. Therefore, this course is crucial in this program for professional life of the students.

Course Contents:

Introduction to e-commerce: Conceptual understanding of e-commerce, e-business and e-strategy, E-commerce Drivers, Benefits of the Internet, Role of E-strategy, Value-chain in e-commerce, Analyzing Value Chain Activities, and supply-chain management and how they relate to e-commerce and e-business, Business models of the e-environment, Path to Successful E-commerce, A trend toward integrating e-commerce, E-commerce Business Models.

Mobile Commerce: Concept of Mobile Commerce, benefits of M commerce, M-Commerce Services and Applications available, Attributes of M-Commerce, Services of mobile commerce, Mobile payment, Mobile Commerce Application, Challenges of Mobile commerce, Advantages, and disadvantages of M commerce.

Web Site Evaluation and Usability Testing: Characteristics of Lame Web Sites, Common Mistakes, Questions When Evaluating a Web Site, Basic Web Site Anatomy, Color and Its Psychological Effects, Consumer Association with Key Shapes, Site Evaluation Criteria, Components of Personalization, Steps to Operationalize Personalization, Popular Myths About Cookies, Web Site Usability, Effective Web Site Design, User Testing, Site Performance Issues, Managing Content and Site Traffic.

Internet Marketing: The Pros and Cons of Online Shopping, Justifying an Internet Business, Internet Marketing Techniques, and Applications, Aggressive Internet Marketing, Pop-up Advertising, Permission Marketing, The E-cycle of Internet Marketing, Examples of the “Best” and “Worst” Web Sites, New Format Brand Ads, Personalization - the fifth “P”, Important Personalization Rules, Marketing Implications, Guidelines for Attracting Customers to your Site,

Getting the Money: Real-world and electronic cash and their unique features and uses, the key requirements for Internet-based payments, The many ways people pay to purchase goods and services on the Internet, Business-to-business methods of payment: DigiCash, E-Cash and E-Wallet, Paying for goods and services via the mobile phone, Issues and implications behind electronic money transactions and payments.

E-Security and the USA Patriot Act: Equal Credit Opportunity Act, Maine’s Anti-Hacker laws, Spyware and Adware, Spyware Solutions, Compliance Legislation, Levels of Virus Damage, Steps for Antivirus Strategy, Steps to Prevent E-Commerce Fraud, Security Protection and Recovery, Creating Strong Password, Firewall Design and Implementation Issues, Corporate Networks and Firewalls, Cycle of Recovery from Attack, Biometric Security, Types of Biometrics and Select Application Areas, Terrorism, How Modern Terrorism Uses the Internet, National Strategy to Secure Cyberspace,

E-Core Values: Ethical issues and how to improve the ethical climate in e-commerce, Legal issues in terms of liability, warranties, copyrights, trademarks, and trade names, Taxation issues, legal disputes, and domain name disputes, Encryption laws and what they mean, international issues, especially with regard to intellectual property and developing countries.

Building online store with osCommerce: Introduction to E-Commerce with osCommerce, Setting Up the Development Environment, How osCommerce Works, Basic Configuration, Working with Data, Customization, Taxes, Payments, and Shipping, Securing Your Store, Advanced Features, Tools, Tips, and Tricks, Deployment and Maintenance, Building Your Business, A case study on building online store with osCommerce.

International trade: Introduction, International trade theory, Barriers to trade, non-tariff barriers to trade, Foreign Exchange Exposure and Foreign Trade, foreign exchange market, Exchange rate, Traditional Foreign exchange Instruments: Currency swaps, Futures contracts. Export and Import: characteristics, types, Export Documentation.

Modes of Operations: Modes of operation in International Business and the Economic Environments facing businesses. Factors influencing the choice of a particular mode of

international business. Various forms of contractual entry mode and challenges in choosing a particular mode. Importance of economic environments, Elements of the economic environment and its impact, Balance of Payments and Balance of Trade.

Export Strategy and Export Marketing: Marketing strategies, Export marketing plan, setting of marketing objectives, market research, product characteristics, export pricing, distribution channels, find export opportunities, deciding on exports marketing objectives, and preparing action plans to achieve the objectives

Course Objectives: The learning objectives of this course are:

- a) To provide the terms and phrases associated with E-Commerce and International Trade.
- b) To introduce the importance of E-Commerce and International Trade.
- c) To impart the role of e-commerce and international trade in leather, leather products and footwear.
- d) To expose to various techniques employed in internet marketing, e-security and e-core values.
- e) To acquire knowledge on how to develop ecommerce online store, international trade and Export Strategy and Export Marketing.

Course Learning Outcomes (CLOs) and Mapping of CLOs with Program Learning Outcomes (PLOs)

CLOs: Upon completion of this course, students will be able to:

	Course Learning Outcomes (CLOs)	Learning Level
CLO1	Explain e-commerce, international trade, mode of operations, export strategy and export marketing and identify the most favorable way for their business.	C2, A2
CLO2	Identify various Business-to-business methods of payment, E-Security and E-Core Values and also recognize the ethical responsibilities in business.	C3, A3
CLO3	Analyze the value chain activities and supply chain management related to e-commerce and integrate teamwork in e-business.	C4, A5
CLO4	Create an e-commerce website to explore their theoretical knowledge on professional life.	C6
CLO5	Summarize and integrate the impact of e-commerce and international trade on global economy and environmental sustainability.	C6, A5

Mapping of CLO with PLO

(CLO	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8

s)								
CLO1	3				2	2		
CLO2	3		3		3		2	
CLO3	3			2		2	2	3
CLO4	3					2	2	2
CLO5	3	3		2	2	2	2	

Rank: 3-High match, 2-Medium match, 1-Low match

Mapping of Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO-1	Lecture, Multimedia presentation, demonstration and problem-based exercises	Group Presentation, In-course Exam; Final Exam
CLO-2	Lecture, group discussion and problem-based exercises	Group Presentation, In-course Exam; Final Exam
CLO-3	Lecture, guided reading and problem-based learning	Assignment, Group Presentation, In-course Exam, and Final Exam
CLO-4	Lecture, multimedia presentation, group discussion, literature review, demonstration, and problem-based exercises	Group Presentation, In-course Exam, and Final Exam
CLO-5	Lecture, group discussion, literature review, and problem-based exercises	Group Presentation, Assignment, In-course Exam, and Final Exam

Learning Materials

i) Recommended Reading

- a) Electronic Commerce: From Vision to Fulfillment by Elias M. Awad, Pearson College Div, 3rd edition.
- b) Building Online Stores with osCommerce: Professional Edition by David Mercer, PACKT Publishing, Mumbai.
- c) Francis Cherunilam, International Business, Text and Cases, Himalaya Publishing Company

ii) Supplementary Readings

- a) T. A. S. Balagopal: Export Management, Himalaya Publishing House
- b) D. C. Kapoor: Export Management, Vikas Publishing House Pvt Ltd

iii) **Others:** Hand notes/Lecture materials will be provided by the course teacher.

Course Code: 0723-LPE-6000 **Course Title:** Thesis **Credit Value:** 16.0

Rationale of the Course: Students for the M.Sc. in Leather Products Engineering have to complete a thesis that demonstrates their ability to conduct in-depth research into a specific area and how it will relate to their own academic backgrounds and professionalism. After completing the thesis, students will be able to think independently about specific problems and develop a research methodology.

Course Content

Preparation of Research Proposal: Background, aim and objectives; review of relevant research; methodology; expected outcomes.

Conformation of Research Proposal: Proposal submission, presentation, and evaluation.

Literature Review: In-depth review of literature, data collection, research gap analysis.

Experimental Work: Materials and methods, method optimization, data generation and analysis, modelling and solution.

Midterm Presentation and Thesis Paper Preparation: Presentation on preliminary findings, drafting, review and editing of thesis paper, final thesis paper.

Submission and Defense: Final thesis paper submission and oral presentation.

Course Objectives: The course has been designed in a manner

- a) To acquaint students with research culture, ethics, and research methodology.
- b) To make the students capable of thinking individually for creative development.
- c) To acquire skills for identifying and analyzing problems as well as devising innovative solutions.
- d) To develop effective communicative skills to present research outcomes.

Course Learning Outcomes (CLOs) and Mapping of CLOs with Program Learning Outcomes (PLOs)

CLOs: At the completion of this course students will be able to:

	Course Learning Outcomes (CLOs)	Learning Level
CLO1	Explain the background of the proposed research project and identify the research gaps.	C2, P2
CLO2	Develop research proposal and present it orally to disseminate the identified problem.	C3, A2, P3
CLO3	Analyze the existing methods and modify them based on the literature review.	C4, C5,A4, P4,
CLO4	Optimize new methods and generate, analyze, and modeling of relevant data based on the research outcomes.	C5, A4, P4
CLO5	Prepare a thesis paper with existing standards and present the results of	C6, A5, P5

	the research through writing and orally.	
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Mapping Course Learning Outcomes (CLOs) with Program Learning Outcomes (PLOs)

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8
CLO1	3	1	3				1	1
CLO2	3	2	3	3		3	2	2
CLO3	3	3	3			3	3	2
CLO4	3	3	3			3		2
CLO5	3	3	3	3		3	3	3

Mapping of Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Discussion and encouragement	Thesis defense and report evaluation by external as well as internal
CLO2	Discussion and encouragement	
CLO3	Self-study	
CLO4	Self-work	
CLO5	Lecture, discussion, demonstration, writing, final proof-reading	

Learning Materials

Recommended Readings:

- a) Writing the Winning Thesis or Dissertation: A Step-by-Step Guide - By Allan A. Glatthorn, Randy L. Joyner.
- b) Relevant books, scientific journals, handbooks, patents and manuals.

Course Code: 0723-LPE-6300 **Course Title:** Project **Credit Value:** 4.0

Rational of the Course: Master's project is the concluding requirement for the M.Sc. in Leather Products Engineering. It is mostly designed to develop research aptitude among the students. Candidates are expected to complete a project that demonstrates their ability to conduct in-depth investigation of a specific problem to find feasible solution.

Course Content

During project work, experimental and theoretical investigation of various problems related to leather and allied industry, environmental science, nanotechnology, industrial engineering etc. will be carried out. The topic should provide an opportunity to the student in developing problem-solving skills, team work capability, argumentative skills, excellent writing ability, creativity and technical knowledge etc. Student is expected to complete the literature

review/survey, selection of suitable methodology for conducting investigation and submission of an individual research proposal. At the end, student is expected to draw conclusion, prepare the dissertation, submit to the committee and appear for the project defense.

Course Objectives:

- a) To develop values and attitudes related to ethical research work among students.
- b) To ensure utilization of gathered knowledge in solving new real-life problems.
- c) Enhance the ability of the students to analyze and summarize information available in the literature
- d) Develop effective communicative skills to present research on leather and allied issues.

Course Learning Outcomes (CLOs) and Mapping of CLOs with Program Learning Outcomes (PLOs)

CLOs: At the completion of this course students will be able to:

	Course Learning Outcomes (CLOs)	Learning Level
CLO1	Identify, analyze and formulate a research problem and use extensive investigation for obtaining its solution.	C1, C5
CLO2	Demonstrate the concept of ethics in research and impact of leather products engineering solutions on society and environment.	C2
CLO3	Deliver designed project findings through oral presentations, demonstrations, and written technical report format.	C2, C3

Mapping Course Learning Outcomes (CLOs) with Program Learning Outcomes

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8
CLO1	3					2	2	1
CLO2	3	3	3			3	3	
CLO3	3			3		2		

(PLOs)

Rank: 3-High match, 2-Medium match, 1-Low match

Mapping of Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Discussion, encouragement, self-study	Project defense and report evaluation by external as well as internal
CLO2	Lecture, discussion, demonstration	
CLO3	Writing and proofreading	

Learning Materials

Recommended Readings:

- a) Writing the Winning thesis or Dissertation: A Step-by-Step Guide - By Allan A. Glatthorn, Randy L. Joyner.
- b) An Introduction to Research Methods- M. Nurul Islam
- c) Relevant books, scientific journals, handbooks, patents and manuals.

Course Code: 0723-LPE-6302 **Course Title:** Internship **Credit Value:** 2.0

Rationale of the Course: The course is designed to expose students to the working environment in the industry. The intensive training will enable students to understand the theories studied with more detailed and hands-on practice within a real job situation. Furthermore, students will learn how to do a work following the specified instructions coupled with their own technical knowledge, creativity and artistry.

Course Content

Factory inside out, product design and development, cutting, skiving, splitting, sewing and finishing, quality control, merchandising and waste management.

Course Objectives: The Course has been designed in a manner

- a) To expose students to the actual working environment and get acquainted with the organization structure, business operations and administrative functions.
- b) To have hands-on experience in unit operation and unit process involved in leather products manufacturing process
- c) To enhance industry- academia collaboration and co-operation.

Course learning outcomes (CLOs) and mapping of CLOs with program learning outcomes (PLOs)

CLOs: At the completion of this course students will be able to:

	Course Learning Outcomes (CLOs)	Learning Level
CLO-1	Demonstrate acquired skills in the actual working environment.	C3, A3
CLO-2	Analyze and evaluate layout, modern technologies, production process and waste management facilities.	C3, C4
CLO-3	Summarize the collected data to generate technical reports.	C4

Mapping course learning outcomes (CLOs) with program learning outcomes (PLOs)

	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8
CLO-1	3				2	2	2	2
CLO-2	3	1				2	2	3
CLO-3	3			2				

Rank: 3-High match, 2-Medium match, 1-Low match

Mapping of Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO-1	Lecture, display, demonstration, interactive discussion, self-study and motivation	Presentation and Viva voce Report Evaluation
CLO-2	Lecture, display, demonstration, interactive discussion, self-study and motivation	
CLO-3	Interactive discussion, lecture, motivation and self-study	

Learning Materials

Recommended Readings

- a) Writing the Winning Thesis or Dissertation: A Step-by-Step Guide - By Allan A. Glatthorn, Randy L. Joyner.
- b) Why (and How) to Take a Plant Tour by David M. Upton and Stephen E. Macadam, published on Harvard Business Review.

Course Code: 0723-LPE-6304 **Course Title:** Viva Voce **Credits:** 1.0

Rational of the Course: This course shall ensure that the students are able to present the knowledge, skills and practical experience they earned throughout the program to the panel of experts'/ Examination committee in the most effective way.

Course Contents

It is based on all the courses the students have studied during the M. Sc. in Leather Products Engineering program.

Course Objectives: The learning objectives of this course are-

- a) To equip the students with analytical and evaluation abilities to respond to impromptu questions by the examination panel members.
- b) To train the students to face the expert panel and present the knowledge, skills and problems in well-organized way.

Course Learning Outcomes (CLOs) and Mapping of CLOs with Program Learning Outcomes (PLOs)

CLOs: At the completion of this course students will be able to:

	Course Learning Outcomes (CLOs)	Learning Level
CLO-1	Demonstrate the acquired knowledge and expertise in the interview panel.	C3, A3

Mapping of CLO with PLO

(CLOs)	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8

CLO-1	3							
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Rank: 3-High match, 2-Medium match, 1-Low match

Course plan specifying content, CLOs, co-curricular activities (if any), teaching learning and assessment strategy mapped with CLOs: Not Applicable

Assessment and Evaluation: Comprehensive Viva: 100%

Learning Materials

All the books of all the semesters and the journals, data bases, real problems of leather and allied sector.

Part D

20. Grading/Evaluation

1. Grading Scale: The letter grade system shall be used to assess the performance of the student and shall be as follows:

Marks Obtained	Grade	Grade point	Grade Description
80% or above	A+	4.00	Grade A: Excellent performance; all course objectives achieved; objectives met in a consistently outstanding manner.
75% to less than 80%	A	3.75	
70% to less than 75%	A	3.50	
65% to less than 70%	B+	3.25	Grade B: Very good performance; significantly more than the majority (at least two-thirds) of the course objectives achieved; objectives met in a consistently thorough manner.
60% to less than 65%	B	3.00	
55% to less than 60%	B-	2.75	
50% to less than 55%	C+	2.50	Grade C: Satisfactory performance; at least majority of the course objectives achieved; objectives met satisfactorily.
45% to less than 50%	C	2.25	
40% to less than 45%	D	2.00	Grade D: Minimally acceptable performance; less than majority but more than the minimum required course objectives achieved.
Less than 40%	F	0.00	Grade F: Failed in the course
Incomplete	I	-	
Withdrawn	W	-	

2. Grades: In the points-based grading system, there is a total number student can earn in a particular course, based on class attendance, in-course exam and final exam scores for a theoretical course. Thus, grade point of a particular course is the summation of possible marks distribution. Provided that, a fraction number in grading calculation shall be considered as the next higher consolidated number.

3. Grade Point Average (GPA) and Cumulative Grade Point Average (CGPA): GPA obtained in all the courses passed/completed by a student in a Semester. 'F' grades will not be counted for GPA calculation. GPA of a Semester will be calculated as follows:

$$\text{GPA} = \frac{\sum(\text{Grade points in a course} \times \text{Credits for the course})}{\text{Total credits of a semester}}$$

The Cumulative Grade Point Average (CGPA) gives the cumulative performance of the student from first semester up to any other semester to which it refers and is computed by dividing the total grade points accumulated up to the date by the total credit hours.

$$\frac{\sum(\text{GPA} \times \text{Credits in a semester})}{\sum(\text{Total credits of all semester})}$$

Both GPA and CGPA will be rounded off to the second place of decimal for reporting.

4.Course Withdrawal: If a student is unable to complete any semester (Semester-I &/or Semester-II) due to illness, accident or any other valid reason etc., he/she may apply to the Registrar through the Director of the institute for total withdrawal from the Semester before the start of semester final examination.

5.Incomplete (I) courses: Incomplete 'I' grade is indicative of a situation where a student, for non-academic reasons beyond his control, is unable to complete the full requirements of the course for not being able to sit for the Semester Final Examination. *Students who fail a course are also said to have an incomplete course.* Meanwhile, the student concerned will be promoted to the next semester. Provided that, for promotion from First Year to Second Year, a student requires to earn a minimum CGPA (calculated for first and second semesters combined) of 2.50. A student can't earn the degree if they have any incomplete or failed courses.

6. Retake: A student will be allowed maximum of one chance to clear F grade/grades with the immediate next. He/she shall repeat the course(s) like a regular student with prior application to the Director of the institute. A student getting F grade in any theory course (courses) has to attend only the final examination for that (those) course (courses). In that case, the maximum grade obtainable in any course by the student shall be B⁺.

7. Grade Improvement: A student may sit for improvement exam for courses where grade obtained is less than or equal to C⁺ (grade point-2.50) and the best grade that a student can be awarded is B⁺. A student will not be allowed for grade improvement if he or she passes and the final semester result is published. However, if the grade is not improved the previous grade will remain valid.

8. Dropout/ Re-admission: A student failing to get promotion may seek re-admission to study with the following batch. In the case of re-admission, all previously earned grades for the two semesters of that year will be cancelled. For re-admission, he or she has at least 30% (thirty percent) attendance in the previous semester or year. A student may take re-admission only one time. Re-admission will be allowed only after the approval of the Academic Committee of ILET. A student failing to get minimum required CGPA even after taking re-admission will be dropped out of the program.

Course Learning Outcomes (CLOs) Attainment Report

Course Learning Outcomes (CLOs)	Assessment										CLO Attainment (%)
	SFE (Summative) 80%				CA (Formative) 20%						
	Incourse/Class Test/Mid-Semester (30%)		Final Examination (60%)		MCQ/MQ / Quiz (10%)		Assignment/ Case Study (5%)		Presentation (5%)		
	AM	AC	AM	AC	AM	AC	AM	AC	AM	AC	
CLO1											
CLO2											
CLO3											
CLO4											
CLO5											
CLO6											
CLO7											

AM: Actual Marks = (Given Marks/Total Given Marks of Component) × (% of the Course)

AC: Assessment Contribution; M=Average Marks in % and W = Weightage=C/T

$$\text{Attainment (A)} = \sum_{i=1}^M (M_i \times W_i)$$

Or Marks of CLO1 = (% marks distributed Assessment Type1×% Overall)+(% marks distributed Assessment Type-2×% Overall)+(% marks distributed Assessment Type-3×% Overall)+....

Part E

21. Course outline

Curriculum
M.Sc. in Leather Products Engineering (Thesis Group)
Institute of Leather Engineering and Technology (ILET)
UNIVERSITY OF DHAKA

Semester-I		
Course Code	Course Title	Credits
0723-LPE-6101	Advanced Leather Products Manufacturing	3.0
0723-LPE-6103	Optimization Techniques of Leather Products Manufacturing	3.0
0723-LPE-6105	Research Methodology	3.0
0723-LPE-6107	Industrial Hazards and Waste Management	3.0
0723-LPE-6109	Ergonomics and Industrial Safety	3.0
0723-LPE-6111	Materials and Quality Management of Leather Products	3.0
Total		18.0

Course Outline of 0723-LPE-6101

Part A

- 1. Course Code:** 0723-LPE-6101
- 2. Course Title:** Advanced Leather Products Manufacturing
- 3. Course Type:** Core Course
- 4. Year/ Semester:** Semester: I
- 5. Academic Session:** 2022-23
- 6. Course Teacher:** Umme Habiba Bodrun Naher, Associate Professor, ILET, DU
Sumaiya Mim, Lecturer, ILET, DU
- 7. Prerequisite(s):** N/A
- 8. Credits:** 3.0
- 9. Contact Hours:** 42
- 10. Total Marks:** 100
- 11. Rationale of the Course:**

This course is designed to provide advanced knowledge on different techniques and automation to manufacture and develop diversified leather goods and garments. The course furnishes the design and fashion ideas through the knowledge of product development, grading, commercialization, merchandizing, brands etc. One can easily explore the different interests of leather products after equipping once with these contents.

Course Contents

Introduction of modern leather products: Tradition and fashion on continuous evolution from handcrafted leather goods to industry, the value and contribution of materials, materials concept in modern leather products manufacturing with function & purpose, creative aspects leather goods, leather goods manufacturing processes, designing & process development.

Leather in automobile items: Various types of automobile items, specification of different types of automobile items, specification and materials used in automobile items, making procedure of automobile items, creativity in automobile items manufacturing, specialty of automobile items.

Fashion accessories and ornamentation: Principles of fashion design, fashion forecasting, fashion show, length of fashion cycles, sources of inspiration, theory of fashion leadership, areas of fashion design, principles of design, types of design, selecting garments accessories, trims, trimming and decoration, types and selection of fashion accessories, evaluation of quality of trims and accessories, designer's duties, making a garment sellable, developing a line in designing,

Garment Technology: Body, factors affecting garment fit and ease of body movement; different front openings of garments; components of zippers; button and button holes-application, types, styles of attachment; advanced concept of grading, objectives, rules and application of grading methods; block grading, computer aided pattern grading; special types of jackets-blocks, designing, anatomy, grading, garment specification sheet development; garments physiological discomfort sensations, different types and factors affecting comfort.

Proportion in design: Division into eights, geometry of human form, golden section, construction of a golden section, construction of a golden rectangle, use of golden ratio, Phi and its use in consumer products.

Concept of Fusing technology and materials: Lining-Interlining relation with fusing, objectives, interlining-classification, manufacturing, characteristics, selection, and application; advantages and disadvantages of fusing press system, constructions of fusing, requirements of fusing, factors of fusing controls, determination of the optimal fusing parameters, fusing equipment, methods and quality control in fusing.

Automation in Products Manufacturing: Garment manufacturing- from concept to consumer, global scenario of automation, various automation systems and advanced tools and machines in garment manufacturing, areas of automation-inspection, computer-aided design and computer-aided manufacturing, advantages and disadvantages of automation in products manufacturing.

Private labels and brands for leather products: National brands, private labels and brands, private label brand strategy, private labels and brands acquisition, steps, promoting awareness of private labels and brands, developing a label, trends in private labels and brands.

Leather products merchandising: Concepts of leather products merchandising, responsibilities of the store line, responsibilities of the buying line, fashion merchandising direction, buyer's role, target customers, micro-versus macro-merchandising, buying-selling cycle.

12. Course Objectives: The objectives of this course are:

- (a) To familiarize students with a comprehensive understanding of modern leather products, fashion accessories, ornamentation.
- (b) To impart knowledge about proportion of designing.
- (c) To provide students with a comprehensive understanding of automation, private labels and brands, and merchandising procedure for leather products.
- (d) To acquaint students with modern knowledge on different techniques to manufacture and develop various leather goods and garments.

13. Course Learning Outcomes (CLOs) and Mapping of CLOs with Program Learning Outcomes (PLOs)

a) **CLOs:** Upon completion of the course, the students will be able to:

	Course Learning Outcomes (CLOs)	Learning Level
CLO1	Explain and apply different materials to manufacture leather products e.g. handbags, briefcase, luggage, automobile items, garments etc.	C2, C3, A3
CLO2	Analyze and compare various automation systems, private levels and brands alongside merchandising of leather products.	C4, A4
CLO3	Illustrate and integrate fashion accessories and ornamentation, fashion show, fashion cycle, trims, fusing, fusing technology, and proportion in design	C4, A4
CLO4	Interpret grading method and justify factors influencing garments fit and ease of body movement alongside comfort.	C5, A3
CLO5	Design and construct different leather goods and garments.	C6, P5

b) **Mapping of CLO with PLO**

(CLOs)	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8
CLO1	3			3		2	3	2
CLO2	3	2		2		3	2	
CLO3	3			3		3	3	2
CLO4	3			3		3	2	3
CLO5	3	3	3	2	3	3	3	3

c) **Mapping of Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy**

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture, Multimedia presentation, video presentation and demonstration.	Group Presentation, In-course Exam; Final Exam
CLO2	Lecture, Multimedia presentation, demonstration, video presentation	Assignment, In-course Exam, Final Exam
CLO3	Lecture, multimedia presentation, group	Quiz, In-course Exam, and Final

	discussion, demonstration, and problem-based exercises	Exam
CLO4	Lecture, pictorial, theme board illustration, story board illustration, multimedia presentation, white board illustration, demonstration	Group Presentation, In-course Exam, and Final Exam
CLO5	Multimedia presentation, white board illustration, group discussion and demonstration	Assignment, In-course Exam, and Final Exam

Part B

14. Course plan specifying content, CLOs, co-curricular activities (if any), teaching learning and assessment strategy mapped with CLOs

Time Period	Topic	Teaching-Learning Methodology	Assessment Method	Corresponding CLOs
Week-01	Introduction of modern leather products: Tradition and fashion on continuous evolution from hand-crafted leather goods to industry, the value and contribution of materials, materials concept in modern leather products manufacturing with function& purpose, creative aspects of leather goods, leather goods manufacturing processes, designing & process development.	Multimedia presentation, Group discussion, White board illustration, Demonstration	Assignment, In-course Exam, Final Exam	CLO1, CLO5
Week -02				
Week -03	Leather in automobile items: Various types of automobile items, specification of different types of automobile items, specification and materials used in automobile items, making procedure of automobile items, creativity in automobile items manufacturing, specialty of automobile items.	Multimedia presentation, White board illustration, Demonstration	Quiz, In-course Exam, Final Exam	CLO1, CLO5
Week -04	Fashion accessories and ornamentation: Principles of	Multimedia presentation,	Assignment, In-course	CLO3

Week - 05	fashion design, fashion forecasting, fashion show, length of fashion cycles, sources of inspiration, theory of fashion leadership, areas of fashion design, principles of design, types of design, selecting garments accessories, trims, trimming and decoration, types and selection of fashion accessories, evaluation of quality of trims and accessories, designer's duties, making a garment sellable, developing a line in designing,	Group discussion, White board illustration, Demonstration	Exam, Final Exam	
Week - 06	Garment Technology: Body, factors affecting garment fit and ease of body movement; different front openings of garments; components of zippers; button and button holes-application, types, styles of attachment; advanced concept of grading, objectives, rules and application of grading methods; block grading, computer aided pattern grading; special types of jackets-blocks, designing, anatomy, grading, garment specification sheet development; garments physiological discomfort sensations, different types and factors affecting comfort.	Multimedia presentation, Video presentation , Group discussion, White board illustration, Demonstration	In-course Exam, Final Exam	CLO1, CLO4, CLO5
Week - 07				
Week - 08	Proportion in design: Division into eights, geometry of human form, golden section, construction of a golden section, construction of a golden rectangle, use of golden ratio, Phi and its use in consumer products.	Multimedia presentation, White board illustration, Demonstration	Assignment, In-course Exam , Final Exam	CLO3

Week -9	Automation in Products Manufacturing: Garment manufacturing- from concept to consumer, global scenario of automation, various automation systems and advanced tools and machines in garment manufacturing, areas of automation-inspection, computer-aided design and computer-aided manufacturing, advantages and disadvantages of automation in products manufacturing.	Multimedia presentation, Group discussion, White board illustration, Demonstration	In-course Exam , Final Exam	CLO2
Week -10				
Week -11	Private labels and brands for leather products: National brands, private labels and brands, private label brand strategy, private labels and brands acquisition, steps, promoting awareness of private labels and brands, developing a label, trends in private labels and brands.	Multimedia presentation, Group discussion, White board illustration, Demonstration	In-course Exam, Final Exam	CLO2
Week -12				
Week-13	Leather products merchandising: Concepts of leather products merchandising, responsibilities of the store line, responsibilities of the buying line, fashion merchandising direction, buyer's role, target customers, micro-versus macro-merchandising, buying-selling cycle.	Multimedia presentation, Group discussion, White board illustration, Problem based exercises	In-course Exam, Final Exam	CLO2
Week-14				

Part C

15. Assessment and Evaluation

i) Assessment Strategy

Strategy	Percentage of Total Marks
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Class participation and attendance	10%
In-course examinations	30%
Final examinations (3 hours duration)	60%
Total	100%

ii) Marks distribution

- a) Continuous Assessment: 40%
- b) Summative: 60%
- c) Make-up Procedures: Two in-course exams will be taken and average marks will be counted. Feedback on in-course assessment is given to the students immediately after the test. If students are very weak in particular topic of this course, additional instruction will be given to help them catch up.

Part D

16. Learning Materials

i. Recommended Readings

- Manual for Leather Accessories and Leather Goods-S. Natesan.
- Inside Fashion Design -S. L Tate.
- Clothing Technology- Roland Kilgus

ii. Supplementary Readings

- Fashion from concept to consumer, seventh edition -Gini Stephens Frings.
- Garments Manufacturing Technology- R. Nayak& R. Padhye

iii. Others: Handout/lecture material provided by the course teacher

Course Outline of 0723-LPE 6103

Part A

1. Course Code: 0723-LPE 6103

2. Course Title: Optimization Techniques of Leather Products Manufacturing

3. Course Type: Core Course

4. Year / Semester: Semester: I

5. Academic Session: 2022-23

6. Course Teachers: Uttam Kumar Roy, Associate Professor, ILET, DU.

Md. Abdus Shabur, Lecturer, ILET, DU.

7. Prerequisite(s): N/A

8. Credits: 3.0

9. Contact Hours: 42

10. Total Marks: 100

11. Rationale of the Course: The focus of this course is on theoretical concepts, data-driven models, and numerical techniques for optimization using actual variables. The course provides a thorough understanding in mathematical optimization theory, methods, and algorithms. This course's goal is to give students a systematic understanding of optimization methods. The course will begin with linear optimization and will go into detail about how to formulate problems and find solutions as well as to develop a methodology for leather products engineering design.

Course Contents

Advanced Inventory Management: Demand and control system characteristics, inventory concept, inventory cost, inventory modeling, optimization and inventory control, Dynamic EOQ Models, probabilistic models and safety stock, probabilistic demand, probabilistic example, Single-Period Models, Multiperiod Models.

Aggregate Planning and Master Scheduling: Basic Strategies for Meeting Uneven Demand, Techniques for Aggregate Planning, Disaggregating the Aggregate Plan, Master Scheduling, The Master Scheduling Process, Methods for Aggregate Planning: Graphical Methods, Mathematical Approaches, Comparison of Aggregate Planning Methods.

MRP, MRPII and ERP: Basic ideas of inventory MRP, benefits of MRP, inputs to MRP, bill of material (BOM), BOM examples for leather products manufacture, Master Production Schedule (MPS), MPS examples for leather products manufacture, time-phased product structure, MRP structure, determining gross requirements, gross requirements plan for leather products manufacture, gross requirements schedule, MRP management, Lot-sizing techniques, Lot-for-Lot examples, EOQ lot size examples, POQ lot size examples, material requirements planning II, distribution resource planning (DRP), enterprise resource planning (ERP), SAP's ERP modules.

Decision Modeling: The Decision Process in Operations; Fundamentals of Decision Making; Types of Decision-Making Environments; Decision Making under Uncertainty, Decision Making under Risk, Decision Making under Certainty, Expected Value of Perfect Information (EVPI); Decision Trees; A More Complex Decision Tree, Using Decision Trees in Ethical Decision Making.

Linear Programming Models: Why Use Linear Programming? Requirements of a Linear Programming Problem, Formulating Linear Programming Problems, Graphical Solution to a Linear Programming Problem, Sensitivity Analysis, Solving Minimization Problems, Linear Programming Applications, The Simplex Method of LP.

Transportations Modeling: Transportation Modeling; Developing an Initial Solution: The Northwest-Corner Rule, The Intuitive Lowest-Cost Method, The Stepping-Stone Method; Special Issues in Modeling: Demand Not Equal to Supply, Degeneracy; Using Software to Solve Transportation Problems; Case Studies.

Integer Programming and Dynamic Programming and Network Techniques: Integer programming - Cutting plane algorithm, Branch and bound technique, Zero-one implicit enumeration – Dynamic Programming – Formulation, Various applications using Dynamic Programming. Network Techniques – Shortest Path Model – Minimum Spanning Tree Problem – Maximal flow problem.

Problem solving tools and improvement strategies: Problem solving process, quality control tools, new management tools, quality function deployment, Deming wheel, zero defect concept, benchmarking, six- sigma.

12. Learning Objectives

- a) To introduce students with advanced inventory management and aggregate planning
- b) To familiarize students with various production planning techniques
- c) To provide knowledge on different optimization models and their applications in leather products manufacturing

13. Course Learning Outcomes (CLOs) and Mapping of CLOs with Program Learning Outcomes (PLOs)

a) **CLOs:** Upon completion of this course, students will be able to:

	Course Learning Outcomes (CLOs)	Learning Level
CLO1	Explore knowledge on various optimization techniques used in leather products manufacturing.	C1, C2, A1
CLO2	Explain the methods and ways to manage different optimization tools.	C2, A1, A2
CLO3	Implement the advanced tools and techniques of operations research to manage the production in the leather products industry supply chain	C3, A2
CLO4	Manage new project related to new leather products or business	C4
CLO5	Investigate the applicability of a specific tool or technique to a specific case.	C5

b) Mapping of CLO with PLO

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8
CLO1	3		-		-	-	-	
CLO2	3			-	-	1		
CLO3	3			-	1	2	2	

CLO4	3		2	1		2	3	
CLO5	3		2		2	2	1	

Rank: 3-High match, 2-Medium match, 1-Low match

c) Mapping of Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO-1	Lecture, multimedia presentation, literature review and problem-based exercises	Group Presentation, Assignment, oral presentation, In-course Exam and Final Exam
CLO-2	Lecture, group discussion and problem-based exercises, literature review.	Group Presentation, In-course Exam and Final Exam
CLO-3	Lecture, multimedia presentation and problem-based learning: Identifying the problem to be solved	Assignment, Group Presentation, In-course Exam and Final Exam
CLO-4	Lecture, multimedia presentation, group discussion, demonstration, and problem-based exercises	Group Presentation, Case study, Assignment, In-course Exam and Final Exam
CLO-5	Lecture, multimedia presentation, group discussion, demonstration, and problem-based exercises	Group Presentation, Case study, Assignment, In-course Exam and Final Exam

Part B

14. Course plan specifying content, CLOs, co-curricular activities (if any), teaching learning and assessment strategy mapped with CLOs

Time	Topic	Teaching-Learning Strategy	Assessment Strategy	Corresponding CLOs
Week-01	Advanced Inventory Management: Demand and control system characteristics, inventory concept, inventory cost, inventory modeling, optimization and inventory control	Lecture, Group Discussion, Multimedia Presentation, literature review	In-course Exam Final Exam	CLO1, CLO2, CLO3
Week -02	Dynamic EOQ Models, probabilistic models and safety stock, probabilistic demand, probabilistic	Lecture, Group Discussion, Multimedia Presentation,	In-course Exam Final Exam	CLO1, CLO2, CLO3

	example, Single-Period Models, Multiperiod Models	literature review		
Week -03	Aggregate Planning and Master Scheduling: Basic Strategies for Meeting Uneven Demand, Techniques for Aggregate Planning, Disaggregating the Aggregate Plan,	Lecture, Group Discussion, Multimedia Presentation	Assignment, In-course Exam, Final Exam	CLO1 CLO2
Week -04	Master Scheduling, The Master Scheduling Process, Methods for Aggregate Planning: Graphical Methods, Mathematical Approaches, Comparison of Aggregate Planning Methods	Lecture, Group Discussion, Multimedia Presentation, Problem solving	In-course Exam Final Exam	CLO1, CLO2
Week -05	MRP, MRPII and ERP: Basic ideas of inventory MRP, benefits of MRP, inputs to MRP, bill of material (BOM), BOM examples for leather products manufacture, Master Production Schedule (MPS)	Lecture, Group Discussion, Multimedia Presentation	Case study In-course Exam Final Exam	CLO1, CLO2, CLO3
Week -06	MPS examples for leather products manufacture, time-phased product structure, MRP structure, determining gross requirements, gross requirements plan for leather products manufacture, gross requirements schedule	Lecture, Group Discussion, Multimedia Presentation	In-course Exam Final Exam	CLO2 CLO3 CLO5
Week -07	MRP management, Lot-sizing techniques, Lot-for-Lot examples, EOQ lot size examples, POQ lot size examples, material requirements planning II,	Lecture, Group Discussion, Multimedia Presentation	Case Study, In-course Exam Final Exam	CLO2

	distribution resource planning (DRP), enterprise resource planning (ERP), SAP's ERP modules			
Week -08	Decision Modeling: The Decision Process in Operations; Fundamentals of Decision Making; Types of Decision-Making Environments; Decision Making under Uncertainty	Lecture, Group Discussion, Multimedia Presentation	In-course Exam Final Exam	CLO3, CLO4, CLO5
Week -09	Decision Making under Risk, Decision Making under Certainty, Expected Value of Perfect Information (EVPI); Decision Trees; A More Complex Decision Tree, Using Decision Trees in Ethical Decision Making.	Lecture, Group Discussion, Multimedia Presentation	Group Presentation , In-course Exam, Final Exam	CLO3, CLO4, CLO5
Week -10	Linear Programming Models: Why Use Linear Programming? Requirements of a Linear Programming Problem, Formulating Linear Programming Problems, Graphical Solution to a Linear Programming Problem, Sensitivity Analysis, Solving Minimization Problems, Linear Programming Applications, The Simplex Method of LP.	Lecture, Group Discussion, Multimedia Presentation	In-course Exam Final Exam	CLO1 CLO3
Week -11	Transportations Modeling: Transportation Modeling; Developing an Initial Solution: The Northwest-Corner Rule, The Intuitive Lowest-Cost Method, The Stepping-Stone Method; Special Issues in Modeling:	Lecture, Group Discussion, Multimedia Presentation, problem solving	In-course Exam Final Exam	CLO1 CLO3 CLO5

	Demand Not Equal to Supply, Degeneracy; Using Software to Solve Transportation Problems; Case Studies.			
Week -12	Integer Programming and Dynamic Programming and Network Techniques: Integer programming - Cutting plane algorithm, Branch and bound technique, Zero-one implicit enumeration – Dynamic Programming – Formulation	Lecture, Group Discussion, Multimedia Presentation	In-course Exam Final Exam	CLO1, CLO3
Week -13	Various applications using Dynamic Programming. Network Techniques – Shortest Path Model – Minimum Spanning Tree Problem – Maximal flow problem.	Lecture, Group Discussion, Multimedia Presentation, problem solving	Oral Presentation , In-course Exam, Final Exam	CLO3
Week -14	Problem solving tools and improvement strategies: Problem solving process, quality control tools, new management tools, quality function deployment, Deming wheel, zero defect concept, benchmarking, six- sigma.	Lecture, Group Discussion, Multimedia Presentation, literature review	In-course Exam Final Exam	CLO1, CLO3, CLO4, CLO5

Part C

15. Assessment and Evaluation

i) Assessment Strategy

Class attendance and participation	10%
In-course Exam/Class Test	30%
Term Final Examination (3 hours duration)	60%
Total	100%

ii) Marks distribution:

- a) Continuous Assessment: 40%

- b) Summative: 60%
- c) Make-up Procedures: Two in-course exams will be taken and average marks will be counted. Feedback on continuous assessment is given to the students immediately after the test. Based on the students' feedback additional class/assignment may be taken by the course teacher

Part D

16. Learning Materials

I. Recommended Readings

- Jay Heizer, Barry Render, Chuck Munson- Operations Management: Sustainability and Supply Chain Management (13th Edition)
- Jay Heizer, Barry Render- Operations Management (11th Edition)
- Hamdy A. Taha, Operations Research – An Introduction, Prentice Hall of India, 1997
- Gideon Halevi- Handbook of Production Management Methods
- R. Panneerselvam, “Operations Research”, Prentice Hall of India Private Limited, New Delhi 1 – 2005

II. Supplementary Readings

- Larry P. Ritzman, Lee J. Krajewski, and Manoj K. Malhotra- Operations Management: Processes and Supply Chains
- Nicholas J. Aquilano and Richard B. Chase- Production and Operations Management

III. Others: Hand notes/Lecture materials will provide by the course teacher.

Course Outline of 0723-LPE-6105

Part A

- 1. Course Code:** 0723-LPE-6105
- 2. Course Title:** Research Methodology
- 3. Course Type:** Core Course
- 4. Year / Semester:** Semester: I
- 5. Academic Session:** 2023-24
- 6. Course Teacher:** Dr. Mohammed Mizanur Rahman, Professor and Director, ILET, DU
- 7. Prerequisite(s):** N/A
- 8. Credits:** 3.0
- 9. Contact Hours:** 42
- 10. Total Marks:** 100

11. Rational of the Course: This course provides an opportunity for students to establish or advance their understanding of research through critical exploration of research language, ethics, and approaches. Students will be able to examine and be practically exposed to the main components of a research framework i.e., problem definition, research design, data collection, ethical issues in research, report writing, and presentation.

Course Content:

Introduction to research: Definitions, characteristics, types, differences and role of research, research and investigation, research methods versus research methodology, criteria of good research, paradigms and ethics in research, proposition, axiom, postulate, theorem and model of research, variables and types, properties of relationships between variables, inductive and deductive method.

Literature review and research problem: Definition, objectives, advantages, principles and procedures of literature review, problem definition, finding a researchable problem, selecting the problem, importance of defining the problem, important qualities of a research problem, techniques involved in defining a problem, evaluating a proposed design.

Research questions and objectives: Research objective and research question, practical examples of research objectives and research question, formulation of research questions, criteria of research objectives, evaluation of research questions, classification and importance of research objectives.

Research hypothesis, design, and proposal: Source, functions, and characteristics of a good research hypothesis, formulation and possible difficulties of research hypothesis, research hypothesis versus research objectives; definition, function, classification of research design, feature of a good research design, qualitative research, observation studies, surveys, experimentation, steps in a research design; meaning of research proposal, contents of research proposal, steps in the development of a research proposal, criteria for evaluating research proposal.

Qualitative research tools, measurement and scaling technique: Definition, characteristics, uses, and general steps of qualitative research, qualitative research approaches, steps in grounded theory, nature of measurement, measurement scales, types of measurement scales, Likert scale.

Questionnaire design: Questionnaire and questionnaire design, consideration and types of questions, questionnaire designing process, necessary properties of questionnaire, characteristics of a good questionnaire, precaution required in the use of questionnaire, guidelines for constructing questions and questions sequence.

Sampling and sampling design: Concepts and importance of sampling, planning and designing a survey, classification of sampling techniques, probability sampling design, non-probability sampling design, determination of sample size.

Data collection and analysis: Data, data versus information, types and sources of data collection, secondary data collection methods, primary data collection methods, qualitative and quantitative methods of data collection, data validation, editing and coding, data entry and exploring, displaying and examining data, Univariate analysis, Bivariate analysis, Multivariate analysis, SWOT analysis, and Hypothesis testing.

Presenting insights and findings: Importance of the report and presentation, report preparation and presentations process, precautions in interpretation, research report, contents

and precautions in writing research report, presentation of statistics, oral presentation, writing thesis/dissertation, writing journal articles and conference papers, bibliography and reference writing styles, copy right, plagiarism.

12. Course Objectives

- a) To familiarize the students with the key terms, concepts, and practices in the field of research.
- b) To prepare research problems and/or hypotheses in a clear and concise format.
- c) To demonstrate a systematic understanding of the range of advanced research techniques, be able to critically evaluate these techniques and apply them appropriately.
- d) To evaluate and critically analyze the components of scholarly writing and published research.

13. Course Learning Outcomes (CLOs) and Mapping of CLOs with Program Learning Outcomes (PLOs)

- a) **CLOs:** Upon completion of the course, the students will be able to:

	Course Learning Outcomes (CLOs)	Learning Level
CLO1	Outline the basic framework of research process, and identify various sources of information for literature review and data collection.	C1, A1
CLO2	Explain the ethical dimensions of conducting basic and applied research.	C2, A2
CLO3	Design questionnaire, explain the procedures and techniques, and analyze data with different statistical tools and techniques using statistical computing for making better decisions.	C2, C3, A3
CLO4	Acquaint with the process of conducting research to identify real-life problems recurrently encounter and to suggest suitable and pragmatic solutions to those problems.	C4, A4
CLO5	Compare the advanced research techniques and critically analyze the components of scholarly writing and published research.	C5, A4

b) Mapping of CLO with PLO

(CLOs)	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8
CLO1	3		3			2		
CLO2	3		3			2		
CLO3	3		3			3		2
CLO4	3	3	3	3		3	2	
CLO5	3	2	3	3		3	3	

Rank: 3-High match, 2-Medium match, 1-Low match

c) Mapping of Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO-1	Lecture, Whiteboard illustration, Multimedia presentation, Interactive Discussion	Assignment, Case study, In-course Exam and Final Exam
CLO-2	Lecture, Whiteboard illustration, Multimedia presentation, Interactive Discussion	Assignment, Case study, In-course Exam and Final Exam
CLO-3	Lecture, Whiteboard illustration, Multimedia presentation, Interactive Discussion	Assignment, Case study, In-course Exam and Final Exam
CLO-4	Lecture Whiteboard illustration, Multimedia presentation, Interactive Discussion	Presentation, Assignment, In-course Exam and Final Exam
CLO-5	Lecture, Whiteboard illustration, Multimedia presentation, Interactive Discussion	Presentation, Assignment, In-course Exam and Final Exam

Part B

14. Course plan specifying content, CLOs, co-curricular activities (if any), teaching learning and assessment strategy mapped with CLOs.

Time Period	Topic	Teaching-Learning Strategy	Assessment Strategy	Corresponding CLOs
Week-01	Introduction to research: Definitions, characteristics, types, differences and role of research, research and investigation, research methods versus research methodology, criteria of good research, paradigms and ethics in research.	Lecture, Whiteboard illustration	In-Course Exam, Final Exam	CLO1, CLO2
Week - 02	Proposition, axiom, postulate, theorem and model of research, variables and types, properties of relationships between variables, inductive and deductive method.	Lecture, Multimedia presentation	In-Course Exam, Final Exam	CLO1, CLO2
Week - 03	Literature review and research problem: Definition, objectives, advantages, principles and procedures of literature review, problem definition, finding a researchable problem, selecting the problem, importance of defining the problem, important qualities of a research problem, techniques involved in defining a	Lecture, Multimedia presentation, Case study	In-Course Exam, Assignment, Final Exam	CLO1, CLO2, CLO4

	problem, evaluating a proposed design.			
Week - 04	Research questions and objectives: Research objective and research question, practical examples of research objectives and research question, formulation of research questions, criteria of research objectives, evaluation of research questions, classification and importance of research objectives.	Lecture, Multimedia presentation, Whiteboard illustration	In-Course Exam, Final Exam	CLO1, CLO2, CLO3
Week - 05	Research hypothesis, design, and proposal: Source, functions, and characteristics of a good research hypothesis, formulation and possible difficulties of research hypothesis, research hypothesis versus research objectives; definition, function, classification of research design, feature of a good research design.	Lecture, Multimedia presentation, Whiteboard illustration	In-Course Exam, Case study, Final Exam	CLO1, CLO2, CLO3
Week - 06	Qualitative research, observation studies, surveys, experimentation, steps in a research design; meaning of research proposal, contents of research proposal, steps in the development of a research proposal, criteria for evaluating research proposal.	Lecture, Multimedia presentation	In-Course Exam, Final Exam	CLO1, CLO2, CLO3
Week - 07	Qualitative research tools, measurement and scaling technique: Definition, characteristics, uses, and general steps of qualitative research, qualitative research approaches, steps in grounded theory, nature of measurement, measurement scales, types of measurement scales, Likert scale.	Lecture, Video presentation, Whiteboard illustration	In-Course Exam, Final Exam	CLO2, CLO3, CLO5

Week - 08	Questionnaire design: Questionnaire and questionnaire design, consideration and types of questions, questionnaire designing process, necessary properties of questionnaire, characteristics of a good questionnaire.	Lecture, Interactive discussion, Whiteboard illustration	In-Course Exam, Final Exam	CLO2, CLO3
Week - 09	Precaution required in the use of questionnaire, guidelines for constructing questions, and questions sequence. Sampling and sampling design: Concepts and importance of sampling, planning and designing a survey, classification of sampling techniques.	Lecture, Multimedia presentation	In-Course Exam, Final Exam	CLO2, CLO3, CLO4
Week - 10	Probability sampling design, non-probability sampling design, and determination of sample size. Data collection and analysis: Data, data versus information, types and sources of data collection, secondary data collection methods, primary data collection methods.	Lecture, Multimedia presentation	In-Course Exam, Final Exam	CLO2, CLO3
Week - 11	Qualitative and quantitative methods of data collection, data validation, editing and coding, data entry and exploring, displaying and examining data, Univariate analysis, Bivariate analysis, Multivariate analysis, SWOT analysis, and Hypothesis testing.	Lecture, Whiteboard illustration, Multimedia presentation	In-Course Exam Presentation, Final Exam	CLO3, CLO4, CLO5
Week - 12	Presenting insights and findings: Importance of the report and presentation, report	Lecture, Multimedia presentation	In-Course Exam, Final Exam	CLO3, CLO4, CLO5

	preparation and presentations process, precautions in interpretation, research report, contents and precautions in writing research report.			
Week - 13	presentation of statistics, oral presentation, writing thesis/dissertation, writing journal articles and conference papers, bibliography and reference writing styles, copyright, plagiarism.	Lecture, Case study	Assignment, Final Exam	CLO3, CLO4, CLO5
Week-14	Review.	Interactive discussion	Final Exam	CLO1—CLO5

Part C

15. Assessment and Evaluation

i) Assessment Strategy

Strategy	Percentage of Total Marks
Class participation and attendance	10
In-Course Examinations	30
Semester final examinations (3 hours duration)	60
Total	100

ii) Marks distribution

- a) Continuous Assessment: 40%
- b) Summative: 60%
- c) Make-up Procedures: Two in-course exam will be taken and average marks will be counted. Feedback on in-course assessment is given to the students immediately after the test. If students is very weak in particular topics of this course, additional instruction will be given to help them catch up.

Part D

16. Learning Materials

i) Recommended Readings

- M. A. Salam Akanda (2019). Research Methodology-A Complete Direction for Learners. Latest Ed., Akanda& Sons, Dhaka.
- C. R. Kothari (1996). Research Methodology- Methods & Techniques. Wishaw Prokashan, New Delhi, Wiley Eastern Limited.

- An Introduction to Research Methods ; Author: M. Nurul Islam ; Year: 2011 ; Edition: 2nd ; Publisher: Mullick& Brothers

ii) Supplementary Readings

- Ranjit Kumar (2005). *Research Methodology- A Step-by-Step Guide for Beginners*, 3rd Ed., Singapore, Pearson Education.

iii) Others: Handout/lecture material provided by the course teacher.

Course Outline of 0723-LPE-6107

Part A

1. Course Code: 0723-LPE-6107

2. Course Title: Industrial Hazards and Waste Management

3. Course Type: Core Course

4. Year / Semester: Semester: I

5. Academic Session: 2022-23

6. Course Teachers: Dr. Md. Abdul Mottalib, Professor, ILET, DU.

Sunzida Haque Rimu, Lecturer, ILET, DU.

7. Prerequisite(s): N/A

8. Credits: 3.0

9. Contact Hours: 42

10. Total Marks: 100

11. Rationale of the Course: This course is designed to provide in-depth knowledge of the exploitation of valuable products from tannery wastes by utilizing modern technology. This course will facilitate students with deeper understanding of different types and characteristics of industrial hazardous wastes and a comprehensive overview of hazardous waste management's approaches.

Course Contents:

Industrial Hazards: Hazard, Types of industrial hazards, Identification of hazardous wastes, Hazardous waste management, Treatment technology, Disposal of radioactive materials, Ground water contamination and remediation. Route of industrial hazard entry into human body-Inhalation, Absorption, Swallowed, Injection, Food chain - Contaminated soil, Vegetables, Crops, Fish and Chicken, Adverse impact of hazard, Occupational cancer.

Solid Waste Generation in the Leather industry and its Utilization:

Generation: Skin collagen waste, Fleshing waste, Wet blue, Trimming, Buffing, Chrome shaving, Chrome split, trimming from crust and finished leather. Utilization: Fleshing-Modified fleshing hydrolysate, Reactive protein (RP), feed ingredients.

Chrome shaving: Treatment with enzyme, MgO, Carbonates and other alkalies, application of hydrolysate.

Waste generation in Footwear and Leather Products Industry: Materials being processed: Leather, Natural rubber/poly-isoprene, Reaction Injection Moulded (RIM) polyurethane (PU), Polyvinyl Chloride (PVC) and blends, Ethylene Vinyl Acetate (EVA) and blends, Styrene Butadiene Rubber (SBR), Thermoplastic Polyurethane (TPU), Thermoplastic Rubber (TR), Leather, textile, cotton, polyesters, nylon, adhesive, solvent, oil.

Solid Waste Management:

Solid waste—sources and engineering classification, characterization, generation and quantification. Transport - collection systems, collection equipment, transfer stations, collection route optimization.

Treatment methods - various methods of refuse, recovery, recycle, composting –aerobic and anaerobic, incineration, pyrolysis and energy recovery.

Disposal methods – Impacts of open dumping, site selection, sanitary land filling – design criteria and design examples, leachate and gas collection systems, and leachate treatment.

Hazardous Waste Management- Introduction, Sources, Classification, Physico-chemical, Chemical and biological Treatment of hazardous waste, regulations.

Thermal treatment - Incineration and pyrolysis.

Soil contamination and site remediation – Bioremediation processes, monitoring of disposal sites.

Removal of Refractory Organic Compounds: Theories on Advanced Oxidation Process viz., Photocatalytic treatment, Membrane separation, Homogenous catalysis system using hydrogen peroxide, ozone, etc. Heterocatalytic systems using metal oxides, activated carbon – Removal of inorganic compounds through electro dialysis, reverse osmosis, multiple effect evaporator, ion-exchange.

12. Course Objectives

- a) To provide the advance knowledge about the environmental problems, industrial hazards and its methods of mitigation.

- b) To estimate solid waste generation from tanning industry, and leather goods industry and their utilization using modern techniques.
- c) To improve a comprehensive skill on tannery solid waste, biomedical and other hazardous wastes and integrated solid waste management system.
- d) To familiarize students with modern biological techniques available for the wastewater treatment.

13. Course Learning Outcomes (CLOs) and Mapping of CLOs with Program Learning Outcomes (PLOs)

a) **CLOs:** Upon completion of this course, students will be able to:

	Course Learning Outcomes (CLOs)	Learning Level
CLO1	Narrate industrial hazards and their adverse impact on the environment and humans.	C1,A1
CLO2	Analyze tannery solid waste utilization into the valuable byproducts as part of circular economy and clean technology.	C3, A3
CLO3	Apply knowledge on the estimation of solid waste generated from leather and allied industries.	C4
CLO4	Justify modern techniques of wastewater treatment with traditional treatment processes.	C5, A4

b) **Mapping of CLO with PLO**

(CLOs)	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8
CLO1	3	2				2	1	
CLO2	2	3	3			2	3	
CLO3	3	3	3			2	2	
CLO4	3	3		3	3	2	3	

c) **Mapping of Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy**

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO-1	Lecture, Multimedia presentation, demonstration and problem-based exercises	In-course Exam; Final Exam
CLO-2	Lecture, audiovisual presentation, group discussion and problem-based exercises, literature review	Presentation, In-course Exam; Final Exam
CLO-3	Lecture, problem-based learning (PBL): Identifying the problem to be solved	Assignment, Group Presentation, In-course Exam, and Final Exam

CLO-4	Lecture, multimedia presentation, group discussion, literature review, demonstration, and problem-based exercises	Assignment, In-course Exam, and Final Exam
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Part B

14. Course plan specifying content, CLOs, co-curricular activities (if any), teaching learning and assessment strategy mapped with CLOs

Time Period	Topic	Teaching-Learning Strategy	Assessment Strategy	Corresponding CLOs
Week-01	Industrial Hazards: Hazard, Types of industrial hazards, Identification of hazardous wastes, Hazardous waste management, Treatment technology, Absorption,	Lecture, Multimedia presentation, Demonstration	In-course Exam, Final Exam	CLO1
Week -02	Disposal of radioactive materials, Ground water contamination and remediation. Route of industrial hazard entry into human body-Inhalation.	Interactive class lecture, Multimedia presentation, Demonstration	In-course Exam, Final Exam	CLO1, CLO2
Week -03	Swallowed, injection, food chain - contaminated soil, vegetables, crops, fish and chicken, adverse impact of hazard, occupational cancer.	Interactive class lecture, Multimedia presentation, Whiteboard illustration	In-course Exam, Final Exam, Assignments	CLO1, CLO2
Week -04	Solid Waste Generation: Skin collagen waste, fleshing waste, wet blue, trimming, buffing, chrome shaving, chrome split, trimming from crust and finished leather.	Audiovisual Lecture, Multimedia presentation, Demonstration	In-course Exam, Final Exam	CLO1, CLO2
Week -05	Utilization: Fleshing- Modified fleshing hydrolysate, reactive protein (RP), feed ingredients.	Audiovisual Lecture, Multimedia presentation, Demonstration	In-course Exam, Final Exam	CLO1, CLO2
Week -06	Chrome shaving: Treatment with enzyme, MgO, Carbonates and other alkalis, applications of protein hydrolysate.	Interactive class lecture, Visual presentation,	Final Exam	CLO2, CLO3

		Whiteboard illustration		
Week - 07	Waste generation in Footwear and Leather Products Industry: Materials being processed: Leather, Natural rubber/poly-isoprene, Reaction Injection Moulded (RIM) polyurethane (PU), Polyvinyl Chloride (PVC) and blends.	Lecture, Multimedia presentation, Group-discussion	In-course Exam, Final Exam	CLO2, CLO3
Week - 08	Ethylene Vinyl Acetate (EVA) and blends, Styrene Butadiene Rubber (SBR), Thermoplastic Polyurethane (TPU), Thermoplastic Rubber (TR), Leather, textile, cotton, polyesters, nylon, adhesive, solvent, oil.	Lecture, Multimedia presentation, Problem-based discussion	In-course Exam, Final Exam	CLO2, CLO3
Week - 09	Solid Waste Management: Solid waste–sources and engineering classification, characterization, generation and quantification. Transport - collection systems, collection equipment, transfer stations, collection route optimization. Treatment methods - various methods of refuse, recovery, recycle.	Audiovisual Lecture, Multimedia presentation, Demonstration	In-course Exam, Final Exam	CLO2, CLO4
Week - 10	Composting –aerobic and anaerobic, incineration, pyrolysis and energy recovery. Disposal methods – Impacts of open dumping, site selection, sanitary land filling – design criteria and design examples.	Interactive class lecture, Visual presentation, Whiteboard illustration	In-course Exam, Final Exam, Assignments	CLO2, CLO3
Week - 11	Leachate and gas collection systems, and leachate treatment, hazardous waste management- introduction, sources, classification, physico-chemical, chemical and biological treatment of hazardous waste, regulations.	Interactive class lecture, Problem solving	In-course Exam, Final Exam	CLO3, CLO4
Week - 12	Thermal treatment - Incineration and pyrolysis, soil contamination and site remediation – bioremediation processes,	Interactive Class lecture, Visual	In-course Exam, Final Exam	CLO2

	monitoring of disposal sites.	presentation, Whiteboard illustration		
Week - 13	Removal of Refractory Organic Compounds: Theories on advanced oxidation process viz., photocatalytic treatment, membrane separation, homogenous catalysis system using hydrogen peroxide, ozone.	Interactive lecture, Visual presentation, Whiteboard illustration	Final Exam	CLO3

Week - 14	Heterocatalytic systems using metal oxides, activated carbon – removal of inorganic compounds through electro dialysis, reverse osmosis, multiple effect evaporator, ion-exchange.	Interactive lecture, Visual presentation, Whiteboard illustration	Final Exam	CLO3, CLO4
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Part C

15. Assessment and Evaluation

i) Assessment Strategy

Class attendance and participation	10%
In-course Examinations	30%
Semester Final Examination (3 hours duration)	60%
Total	100%

ii) Marks distribution:

- Continuous Assessment: 40%
- Summative: 60%
- Make-up Procedures:

Two in-course exams will be taken and average marks will be counted. Feedback on continuous assessment is given to the students immediately after the test. Based on the students' feedback additional class/assignment may be taken by the course teacher

Part D

16. Learning Materials

i) Recommended Readings

- Arceivala S. J., "Waste water treatment and disposal" Marcel Dekkar Inc., New York, 1981.

- Besselievie, B. E. and Schwartz, M., “The Treatment of Industrial wastes”, 2nd edn., McGraw Hill.
- Karia G.L., and Christian R.A., (2001), “Wastewater Treatment Concepts and Design Approach”, Prentice Hall of India Pvt. Ltd., New Delhi.

ii) Supplementary Readings

- Assessment of Tannery Solid Waste Management, a case study Sheba Leather Industry, UNIDO, 2018.
- Benefield R.D., and Randal C.W., (1980), “Biological Process Design for Wastewater Treatment”, Prentice Hall, Englewood Chiffs, New Jersey.

iii) Others: Hand notes/Lecture materials will be provided by the course teacher.

Course Outline for 0723-LPE-6109

Part A

1. Course Code: 0723-LPE-6109

2. Course Title: Ergonomics and Industrial Safety

3. Course Type: Core Course

4. Year / Semester: Semester: I

5. Academic Session: 2022-23

6. Course Teachers: Md. AbdusShabur, Lecturer, ILET, DU.

7. Prerequisite(s): N/A

8. Credits: 3.0

9. Contact Hours: 42

10. Total Marks: 100

11. Rationale of the Course: This course intended to instruct knowledge by different approaches to improve better workspace design and efficient work environment designs and management. After completion of this course, the students will be able to design better factory environment and thereby will be able to ensure effective safety management practice in leather industry.

Course Contents:

Ergonomics

Introduction: What is Ergonomics; History of Development; Scope & Application of Ergonomics; Importance of Ergonomics; Anthropometry.

Muscle Physiology and Manual Material Handling: Muscle and Work Physiology; Measure of Physiological Strain; Physical Workload; Manual Materials Handling.

Hand Tools and Devices: Introduction to Hand Tools; Structure and Motion of Hand; Principles of Designing Hand Tools and Devices; Vibration & HAVS; Gripping Principles.

Workspace Design: Designing Workspace Envelopes for Seated and Standing Personnel; Designing Horizontal Work Surfaces; Designing Seated and Standing Work Surfaces.

Work Environment Design: Lighting in Work Environment; Vision and Structure of Eye; Visual Defects; Guidelines for Colour Selection; Measurement of Light Photometry; Lighting and Illumination; Reflectance; Lighting Problem; Improving Visibility; Characteristics and Efficiency of Light Sources; Lighting Design Considerations; Glare; Uniformity of Lighting; Complaints, Causes and Control Measures of Visual Discomforts; Sound Propagation; Structure of Human Ear; Process of Hearing; Health Effects of Noise Pollution; Control Measures for Noise Pollution; Thermal Balance; Heat Illness; Heat Acclimatization; Heat Stress Measurement; Cold Injury; Cold Climate Protection.

Safety Management

Introduction to Safety Management: Objectives; Importance of Safety Management; Occupational Health and Safety (OHS); Hazard and Risk.

Introduction to Workplace Safety: Aims; Considerations to Manage Workplace Safety Effectively; Nature, Functions and Benefits of Workplace Safety; Challenges for Practicing Safety; PDCA Cycle in OHS; Idea Generation.

Creating an Effective Workplace Safety Program: Core Regulatory Requirement; Program Review/Audit; Establishing Goals and Objectives; Management Commitment and Responsibility; Work-Site Analysis; Hazard Recognition and Resolution; Job Hazard Analysis (JHA)/Job Safety Analysis (JSA); Hazard Resolution; Incident Investigation; Best Practices.

Workers' Compensation and Record Keeping: Early and Modern Workers' Compensation Laws; Premium Calculation; Background Record Keeping; OSHA 300, 300A and 301 Forms; Recordable Occupational Injuries and Illness; First Aid Cases; Fatalities; Privacy Concern Cases; Posting Annual Summary Requirements.

Introduction to Industrial Hygiene: Definition; Toxicology; Industrial Hygiene Practice.

Fire Prevention and Protection: Means of Egress Regulations; Fire Tetrahedron; Categories of Fire; Categories of Fire Extinguisher.

System Safety: Importance of System Safety; System Life Cycle; Management of System Safety; Elements of A System Safety Program Plan (SPSS); Preliminary Hazard Analysis

(PHA); Subsystem Hazard Analysis (SSHA); System Hazard Analysis (SHA); Technique of Operations Review (TOR); Failure Mode and Effect Analysis (FMEA).

Improving Safety Performance with Behavioural Safety: Introduction; Pilot Error Syndrome; Concepts of Risk; Incidents and Accidents; Loss Exposures; Control Techniques for Loss Exposures; Accident Causation Theories; Single Factor Theory; Heinrich’s Domino Theory; Multiple Factors Theory; Human Factors Theory; Energy Release Theory; Further Incident Investigation.

12.Learning Objectives

- a) To identify the components needed to provide a safe and healthful work environment through case studies and review of injury statistics provided in the course.
- b) To identify potential workplace safety and health hazards and determine how to mitigate the hazards through engineering controls, administrative controls and personal protective equipment.
- c) To conduct basic safety inspections using strategies that they have developed through hazard identification and job hazard analysis.
- d) To identify the requirements of training programs in the workplace under the existing OSHA and State-OSHA requirements.
- e) To understand essential elements of an occupational safety and health program and the components of international standard organizations in safety and health.

13. Course Learning Outcomes (CLOs) and Mapping of CLOs with Program Learning Outcomes (PLOs)

a) **CLOs:** Upon completion of this course, students will be able to:

	Course Learning Outcomes (CLOs)	Learning Level
CLO1	Recall knowledge of fundamentals of ergonomics and safety management related to leather products engineering.	C1, A1
CLO2	Explain various methods and tools to ensure proper ergonomics facilities and safety managements.	C2, C3
CLO3	Apply various modern techniques to design an ergonomic friendly work environment as well as a safer workplace with protection from possible accidents and hazards.	C4
CLO4	Investigate and solve any problem/issue related to ergonomics and safety management in real world leather manufacturing.	C5, A4

b) **Mapping of CLO with PLO**

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8

CLO1	3							
CLO2	3	3			2			
CLO3	3	3	3		2	3	2	
CLO4	3	3	2	3	2	2	2	2

Rank: 3-High match, 2-Medium match, 1-Low match

c) Mapping of Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO-1	Lecture, multimedia presentation, literature review and problem-based exercises	Group Presentation, Assignment, oral presentation, In-course Exam and Final Exam
CLO-2	Lecture, group discussion and problem-based exercises, literature review.	Group Presentation, In-course Exam and Final Exam
CLO-3	Lecture, multimedia presentation and problem-based learning: Identifying the problem to be solved	Assignment, Group Presentation, In-course Exam and Final Exam
CLO-4	Lecture, multimedia presentation, group discussion, and problem-based exercises	Group Presentation, Case study, Assignment, In-course Exam and Final Exam

Part B

14. Course plan specifying content, CLOs, co-curricular activities (if any), teaching learning and assessment strategy mapped with CLOs

Time Period	Topic	Teaching-Learning Strategy	Assessment Strategy	Corresponding CLOs

Week-01	Introduction: What is Ergonomics; History of Development; Scope & Application of Ergonomics; Importance of Ergonomics; Anthropometry, Muscle Physiology and Manual Material Handling: Muscle and Work Physiology; Measure of Physiological Strain; Physical Workload; Manual Materials Handling.	Lecture, Group Discussion, Multimedia Presentation, Literature review	In-course Exam, Final Exam	CLO1, CLO2,
Week - 02	Hand Tools and Devices: Introduction to Hand Tools; Structure and Motion of Hand; Principles of Designing Hand Tools and Devices; Vibration & HAVS; Gripping Principles.	Lecture, Group Discussion, Multimedia Presentation, Literature review	In-course Exam, Final Exam	CLO1, CLO2, CLO3
Week - 03	Workspace Design: Designing Workspace Envelopes for Seated and Standing Personnel; Designing Horizontal Work Surfaces; Designing Seated and Standing Work Surfaces.	Lecture, Group Discussion, Multimedia Presentation	Assignment, In-course Exam, Final Exam	CLO2, CLO3, CLO4
Week - 04	Work Environment Design: Lighting in Work Environment; Vision and Structure of Eye; Visual Defects; Guidelines for Color Selection; Measurement of Light Photometry; Lighting and Illumination; Reflectance; Lighting Problem; Improving Visibility; Characteristics and Efficiency of Light Sources; Lighting Design Considerations; Glare	Lecture, Group Discussion, Multimedia Presentation, Problem solving	In-course Exam, Final Exam	CLO2, CLO3, CLO4

Week - 05	Uniformity of Lighting; Complaints, Causes and Control Measures of Visual Discomforts; Sound Propagation; Structure of Human Ear; Process of Hearing; Health Effects of Noise Pollution; Control Measures for Noise Pollution; Thermal Balance; Heat Illness; Heat Acclimatization; Heat Stress Measurement; Cold Injury; Cold Climate Protection.	Lecture, Group Discussion, Multimedia Presentation	Case study, In-course Exam, Final Exam	CLO2, CLO3, CLO4
Week - 06	Introduction to Safety Management: Objectives; Importance of Safety Management; Occupational Health and Safety (OHS); Hazard and Risk.	Group Discussion, Multimedia Presentation, Lecture	In-course Exam, Final Exam	CLO2, CLO3
Week - 07	Introduction to Workplace Safety: Aims; Considerations to Manage Workplace Safety Effectively; Nature, Functions and Benefits of Workplace Safety; Challenges for Practicing Safety; PDCA Cycle in OHS; Idea Generation.	Lecture, Group Discussion, Multimedia Presentation	Case Study, In-course Exam, Final Exam	CLO1, CLO2
Week - 08	Creating an Effective Workplace Safety Program: Core Regulatory Requirement; Program Review/Audit; Establishing Goals and Objectives; Management Commitment and Responsibility;	Lecture, Group Discussion, Multimedia Presentation	In-course Exam, Final Exam	CLO2, CLO3
Week - 09	Work-Site Analysis; Hazard Recognition and Resolution; Job Hazard Analysis (JHA)/Job Safety Analysis (JSA); Hazard Resolution; Incident Investigation; Best Practices.	Lecture, Group Discussion, Multimedia Presentation	Group Presentation, In-course Exam, Final Exam	CLO3, CLO4,

Week - 10	Workers' Compensation and Record Keeping: Early and Modern Workers' Compensation Laws; Premium Calculation; Background Record Keeping; OSHA 300, 300A and 301 Forms; Recordable Occupational Injuries and Illness;	Lecture, Group Discussion, Multimedia Presentation	In-course Exam, Final Exam	CLO2, CLO3
Week - 11	First Aid Cases; Fatalities; Privacy Concern Cases; Posting Annual Summary Requirements. Introduction to Industrial Hygiene: Definition; Toxicology; Industrial Hygiene Practice.	Lecture, Group Discussion, Multimedia Presentation, Problem solving	In-course Exam Final Exam	CLO1, CLO3
Week - 12	Fire Prevention and Protection: Means of Egress Regulations; Fire Tetrahedron; Categories of Fire; Categories of Fire Extinguisher. System Safety: Importance of System Safety; System Life Cycle; Management of System Safety	Lecture, Group Discussion, Multimedia, Presentation	In-course Exam, Final Exam	CLO2, CLO3, CLO4
Week - 13	Elements of A System Safety Program Plan (SPSS); Preliminary Hazard Analysis (PHA); Subsystem Hazard Analysis (SSHA); System Hazard Analysis (SHA); Technique of Operations Review (TOR); Failure Mode and Effect Analysis (FMEA).	Lecture, Group Discussion, Multimedia Presentation,	Oral Presentation, In-course Exam, Final Exam	CLO2, CLO3
Week - 14	Improving Safety Performance with Behavioral Safety: Introduction; Pilot Error Syndrome; Concepts of Risk;	Lecture, Group Discussion,	In-course Exam, Final Exam	CLO1- CLO4

	<p>Incidents and Accidents; Loss Exposures; Control Techniques for Loss Exposures; Accident Causation Theories; Single Factor Theory; Heinrich's Domino Theory; Multiple Factors Theory; Human Factors Theory; Energy Release Theory; Further Incident Investigation.</p> <p>Review class</p>	<p>Multimedia Presentation, Literature review</p>		
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Part C

15. Assessment and Evaluation

i) Assessment Strategy

Class attendance and participation	10%
In-course exam/Class Test	30%
Semester Final Examination (3 hours duration)	60%
Total	100%

ii) Marks distribution:

- a. Continuous Assessment: 40%
- b. Summative: 60%
- c. Make-up Procedures: Two in-course exams will be taken and average marks will be counted. Feedback on continuous assessment is given to the students immediately after the test. Based on the students' feedback additional class/assignment may be taken by the course teacher

Part D

16. Learning Materials

i) Recommended Readings

- a) Human Factors in Engineering & Design by Mark S. Sanders, Ph. D. and Ernest J. McCormick, Ph. D
- b) Introduction to Ergonomics by R. S. Bridger
- c) Workplace Safety A Guide for Small and Midsized Companies by Dan Hopwood, Steve Thompson
- d) Fundamentals of Occupational Safety and Health (fourth edition) by Mark A. Friend and James P. Kohn

ii) **Supplementary Readings:** The Occupational Ergonomics Hand Book, Edited by Waldemar Karwowski and William S. Marras, CRC Press, New York, USA.

iii) **Others:** Hand notes/Lecture materials will provide by the course teacher.

Course Outline for 0723-LPE-6111

Part A

1. **Course Code:** 0723-LPE-6111

2. **Course Title:** Materials and Quality Management of Leather Products

3. **Course Type:** Core Course

4. **Year / Semester:** Semester: I

5. **Academic Session:** 2022-23

6. **Course Teachers:** Md. Abdus Shabur, Lecturer, ILET, DU.

7. **Prerequisite(s):** N/A

8. **Credits:** 3.0

9. **Contact Hours:** 42

10. **Total Marks:** 100

11. **Rationale of the Course:** This course's goal is to familiarize students with the concepts and methods of materials management. Proper purchasing policies and practices are necessary for effective material management in order to make commodities available at the accurate quality, amount, timing, cost, and source. Additionally, the course emphasizes inventory management systems while covering crucial issues in purchasing, handling, and warehousing. Moreover, quality management and current best practices in this area will be explored.

Course Contents

Fundamentals of materials management; introduction, history of industrial material management, objectives and function of leather products material management, scope of leather products material management, integrated leather products management concept, Types of leather products material, industrial material management organization.

Bill of Materials, Inventory classification and materials codification: What is BOM; BOM formats for leather products; tabular form, tree structure, single level BOM, Multi-level BOM, Indented BOM, ratio or percentage Bill, Modular bill; low level coding; ABC,HML, VED classification for leather products materials; ABE-VED matrix analysis, SED classification/analysis; FSN classification/analysis; materials codification; coding; material codification; characteristics of a satisfactory coding system; automatic identification , Bar coding.

Store accounting and physical verification of Inventory: meaning, classification and codification; evaluation of assets inventory: FIFO, LIFO, AVCO methods and related problems for leather products industry; stores ledger sheet for FIFO and LIFO of leather products industry; inventory counting: physical verification; cycle counting and periodic review; importance of accurate inventory record; steps of cycle counting; ways of control cut-off.

Surplus materials, waste management, and value engineering for leather products industry: definition of obsolete items; identification and control of surplus materials; materials reduction programme; Value Management, Value Analysis verses Value Engineering, Project selection, Assembling the team; Information gathering Design documents- drawings, specifications, etc. Material / component cost, Cost Models, Annual Purchase Values and Quantities, Commodity data, Sample components, Reject rates, Warranty data, Commercial consideration, Supplier Suggestions/Supplier Walk-through; Idea generation: Creativity, Brainstorming, Process Idea starters, Idea forms; Evaluation of Ideas-Eliminate the Noise.

Lead time management and distribution inventory system for leather products industry: Details of Lead time; distribution inventory system: physical distribution & push and pull distribution system, time-phased order point, distribution requirement planning, fair shares allocations, problems solving related to Lead time management and distribution inventory system.

Leather products warehouse management: Introduction; Types of warehouse; Cost in opening and managing a leather products warehouse; measuring performance of a leather products warehouse; decision making on warehouse design and management for leather products; warehouse components; warehouse design; location in warehouse; dedicated storage, random storage; value added warehousing, Data collection and analysis, Space calculations, assignments model, computerized layout techniques; Warehouse layout examples.

Materials handling and equipment selection for leather products industry: Introduction, Basic Equipment Types, Principle of Material Handling, Storage Equipment, Equipment Selection, Storage Options, Shuttle Technology with A Difference, Very High Bay Warehouses, Other Storage Media, Warehouse Handling Equipment, Vertical and Horizontal

Movement, Automated Storage and Retrieval Systems (AS/RS), Specialized Equipment, Recent Technical Advances.

12. Course Objectives: The learning objectives of this course are:

- a) To make student understand the fundamentals of material quality management related to leather products manufacturing.
- b) To help students obtain the core knowledge of bill of materials, inventory classification and materials codification
- c) To make student able to understand the concept of Store accounting and physical verification of Inventory as well as Surplus materials, waste management, and value engineering for leather products industry.
- d) To help student understand the lead time management, distribution inventory system, warehouse design and material handling for leather products industry

13. Course Learning Outcomes (CLOs) and Mapping of CLOs with Program Learning Outcomes (PLOs)

a) **CLOs:** Upon completion of this course, students will be able to:

	Course Learning Outcomes (CLOs)	Learning Level
CLO1	Comprehend knowledge on fundamentals of material quality management related to leather products manufacturing.	C2
CLO2	Explain various principles, methods and tools to maintain proper quality of materials.	C2, A3
CLO3	Apply and justify various modern warehouse techniques to store different materials to ensure right quality.	C3, A3
CLO4	Interpret, compile and solve any problem/issue related to materials and quality management in real world leather products manufacturing.	C5, C6, A5

b) **Mapping of CLO with PLO**

CLO	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8
CLO1	3					2	2	
CLO2	3				2			
CLO3	3		2		2	3		
CLO4	3	2	2	2	2	2	3	3

Rank: 3-High match, 2-Medium match, 1-Low match

c. Mapping of Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO-1	Lecture, multimedia presentation, literature review and problem-based exercises	Group Presentation, Assignment, oral presentation, In-course Exam and Final Exam
CLO-2	Lecture, group discussion and problem-based exercises, literature review.	Group Presentation, In-course Exam and Final Exam
CLO-3	Lecture, multimedia presentation and problem-based learning: Identifying the problem to be solved	Assignment, Group Presentation, In-course Exam and Final Exam
CLO-4	Lecture, multimedia presentation, group discussion, and problem-based exercises	Assignment, In-course Exam and Final Exam

Part B

14. Course plan specifying content, CLOs, co-curricular activities (if any), teaching learning and assessment strategy mapped with CLOs

Time	Topic	Teaching-Learning Strategy	Assessment Strategy	Corresponding CLOs
Week-01	Fundamentals of materials management; introduction, history of industrial material management, objectives and function of leather products material management, scope of leather products material management, integrated leather products management concept, Types of leather products material, industrial material management organization.	Lecture, Group Discussion, Multimedia Presentation, literature review	In-course Exam, Final Exam	CLO1, CLO2,
Week - 02	Bill of Materials, Inventory classification and materials codification: What is BOM; BOM formats for leather products; tabular form, tree structure, single level BOM, Multi-level BOM, Indented BOM, ratio or percentage Bill, Modular bill; low level	Lecture, Group Discussion, Multimedia Presentation, literature review	In-course Exam, Final Exam	CLO1, CLO2, CLO3

	coding;			
Week - 03	ABC, HML, VED classification for leather products materials; ABE-VED matrix analysis, SED classification/analysis; FSN classification/analysis; materials codification; coding; material codification; characteristics of a satisfactory coding system; automatic identification, Bar coding.	Lecture, Group Discussion, Multimedia Presentation	Assignment, In-course Exam, Final Exam	CLO2 CLO3 CLO4
Week - 04	Store accounting and physical verification of Inventory: meaning, classification and codification; evaluation of assets inventory: FIFO, LIFO, AVCO methods and related problems for leather products industry	Lecture, Group Discussion, Multimedia Presentation, Problem solving	In-course Exam, Final Exam	CLO2 CLO3 CLO4
Week - 05	Store accounting and physical verification of Inventory: meaning, classification and codification; evaluation of assets inventory: FIFO, LIFO, AVCO methods and related problems for leather products industry; advantages and disadvantages of FIFO method; stores ledger sheet for FIFO of leather products industry	Lecture, Group Discussion, Multimedia Presentation	Case study, In-course Exam, Final Exam	CLO2 CLO3 CLO4
Week - 06	stores ledger sheet for FIFO and LIFO of leather products industry; inventory counting: physical verification; cycle counting and periodic review; importance of accurate inventory record; steps of cycle counting; ways of control cut-off.	Lecture, Group Discussion, Multimedia Presentation	In-course Exam, Final Exam	CLO2 CLO3

Week - 07	Surplus materials, waste management, and value engineering for leather products industry: definition of obsolete items; identification and control of surplus materials; materials reduction programme; Value Management, Value Analysis verses Value Engineering,	Lecture, Group Discussion, Multimedia Presentation	Case Study, In-course Exam, Final Exam	CLO1 CLO2
Week - 08	Project selection, Assembling the team; Information gathering Design documents- drawings, specifications, etc. Material / component cost, Cost Models, Annual Purchase Values and Quantities, Commodity data, Sample components, Reject rates, Warranty data	Lecture, Group Discussion, Multimedia Presentation	In-course Exam, Final Exam	CLO2, CLO3
Week - 09	Commercial consideration, Supplier Suggestions/Supplier Walk-through; Idea generation: Creativity, Brainstorming, Process Idea starters, Idea forms; Evaluation of Ideas- Eliminate the Noise.	Lecture, Group Discussion, Multimedia Presentation	Group Presentation, In-course Exam, Final Exam	CLO3, CLO4,
Week - 10	Lead time management and distribution inventory system for leather products industry: Details of Lead time; distribution inventory system: physical distribution & push and pull distribution system, time-phased order point, distribution requirement planning, fair shares allocations, problems solving related to Lead time management and distribution inventory system.	Lecture, Group Discussion, Multimedia Presentation	In-course Exam, Final Exam	CLO2 CLO3
Week - 11	Leather products warehouse management: Introduction; Types of warehouse; Cost in opening and managing a leather products	Lecture, Group Discussion, Multimedia	In-course Exam, Final Exam	CLO1 CLO3

	warehouse; measuring performance of a leather products warehouse; decision making on warehouse design and management for leather products; warehouse components	Presentation, problem solving		
Week - 12	warehouse design; location in warehouse; dedicated storage, random storage; value added warehousing, Data collection and analysis, Space calculations, assignments model, computerized layout techniques; Warehouse layout examples.	Lecture, Group Discussion, Multimedia Presentation	In-course Exam, Final Exam	CLO2, CLO3 CLO4
Week - 13	Materials handling and equipment selection for leather products industry: Introduction, Basic Equipment Types, Principle of Material Handling, Storage Equipment, Equipment Selection, Storage Options, Shuttle Technology with A Difference	Lecture, Group Discussion, Multimedia Presentation	Oral Presentation, In-course Exam, Final Exam	CLO2, CLO3
Week - 14	Very High Bay Warehouses, Other Storage Media, Warehouse Handling Equipment, Vertical and Horizontal Movement, Automated Storage and Retrieval Systems (AS/RS), Specialized Equipment, Recent Technical Advances	Lecture, Group Discussion, Multimedia Presentation,	In-course Exam, Final Exam	CLO1, CLO3, CLO4,

Part C

15. Assessment and Evaluation

i) Assessment Strategy

Class attendance and participation	10%
In-course Exam/Class Test	30%
Semester Final Examination (3 hours duration)	60%
Total	100%

ii) Marks distribution:

- a) Continuous Assessment: 40%

- b) Summative: 60%
- c) Make-up Procedures: Two in-course exams will be taken and average marks will be counted. Feedback on continuous assessment is given to the students immediately after the test. Based on the students' feedback additional class/assignment may be taken by the course teacher

Part D

16. Learning Materials

i) Recommended Readings

- a) Steven Nahmias-Production and Operations Analysis, Third edition.
- b) Gwynne Richards- Warehouse Management: A Complete Guide to Improving Efficiency and Minimizing Costs in the Modern Warehouse.
- c) Stan C. McDonald- Materials Management: An Executive's Supply Chain Guide

ii) Supplementary Readings

- a) Steve Chapman, Tony Arnold, Ann Gatewood- Introduction to Materials Management 8th Edition
- b) P. Gopalakrishnan- Handbook of Materials Management, Second Edition.

iii) Others: Hand notes/Lecture materials will provide by the course teacher.

Semester-II		
Course Code	Course Title	Credits
0723-LPE-6213	Environmental Management and Impact Assessment	3.0
Optional/Elective Course (Anyone from the following List)		
Course Code	Course Title	Credits
0723-LPE-6215	Nanotechnology for Leather and Leather Products	3.0
0723-LPE-6217	Industrial Automation	3.0
Total		6.0

Course Outline for 0723-LPE-6213

Part A

1. Course Code: 0723-LPE-6213

2. Course Title: Environmental Management and Impact Assessment

3. Course Type: Core Course

4. Year/Semester: Year: Semester: II

5. Academic Session: 2022-2023

6. Course Teacher: Sunzida Haque Rimu, Lecturer

Institute of Leather Engineering and Technology, University of Dhaka

7. Prerequisite(s): N/A

8. Credits: 3

9. Contact Hours: 42

10. Total Marks: 100

11. Rational of the Course:

This course is designed to train the graduates in analysis and assessment methods applicable to environmental contamination problems, particularly national and international legislative frameworks. This course is contemplated for LWG and other environmental certification processes for leather industry.

Course Content:

Environmental Audit: Principles and philosophies of environmental auditing, basic steps in audit process, Auditing techniques Concept of industrial ecology, cleaner technologies in industrial processes and evaluation of processes, waste minimization

Environmental health hazard and risk assessment: Biological, chemical, physical and psychological health hazard; health risk assessment and management, toxicology, exposure measurement of toxic (carcinogenic and non-carcinogenic) substances

Clean Development Mechanism: Overview on sustainable development. greenhouse gasses reduction mechanism, project cycle for the CDM, CDM for small scale projects, risks and opportunities for industries, financing of CDM projects, case studies.

Environmental Impact Assessment (EIA): Definition, purposes and characteristics of EIA, global evolution of EIA, participants in EIA process, stages of EIA, types of EIA, environmental inventory, baseline data on EIA-environmental data, project data and project alternative data, measurement of impact– physical, social, economic, natural, public participation in environmental decision making, framework of environmental assessment, description of environmental setting, Environmental impact factors and area consideration, environmental impact statement (EIS) and environmental management plan (EMP).

Environmental Impact Analysis: Impact identification and methods of impact identification- adhoc method, checklist, matrix, network, overlay and index methods; impact prediction and predictive methodologies, impact evaluation (assessment) and impact mitigation.

Basic steps for the impact identification, prediction and assessment of air, water, noise, vegetation and wildlife environment with case studies.

Environmental Management System (EMS):Basic definitions and terms, Framework for environmental management system, approach for developing Environmental Management System, International standards, environmental management systems in tanneries and their implementation, environmental reporting, Occupational health and safety management, cross-boundary environmental management, mandatory regulations and ecolabelling criteria governing various substance in leather, life -cycle assessment and carbon footprint in leather industries.

Hazard Mitigation: Classification of hazards, basic concept of disaster (causative factors of disaster, classification of disasters), Hazards due to dams and reservoirs, nuclear power plants, industrial hazards, occupational hazards, mitigation measures, hazard assessment, risk assessment.

EIA in Bangladesh: An overview of history, current procedures, practices and guidelines for Environmental Clearance Certificate, EIA of water resource projects, industries, mining and quarrying, highway construction, and tourism developments.

12. Course Objectives:

- a) To provide knowledge on legal and policy frameworks within which quantitative environmental assessment activities are carried out and
- b) To conduct systematic EIA and auditing methodologies in the leather industry.
- c) To carry out quantitative techniques of analysis for direct determination of contaminant concentrations and distributions within environmental systems.
- d) To investigate statistical and computer modeling techniques for analysis of data.

13. Course Learning Outcomes (CLOs) and Mapping of CLOs with Program Learning Outcomes (PLOs)

- a) **CLOs:**The course is intended to achieve the following learning outcomes:

	Course Learning Outcomes (CLOs)	Learning Level
CLO1	Recognize ethical and narrate professional responsibilities in engineering situations and make judgments.	C1,A1

CLO2	Familiarize with the application of a variety of professional tools for predicting environmental impacts.	C2, A2
CLO3	Developing perspectives on impact assessment and relating to practical industrial activities.	C3,C4

b) Mapping of CLO with PLO

(CLOs)	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8
CLO1	3	3	3					
CLO2	2		3	3	2	3	3	
CLO3	3		2			3	2	3

c) Mapping of Course Learning Outcomes (CLOs) with the Teaching-Learning and Assessment Strategy

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO-1	Lecture, Multimedia presentation, white board illustration, problem-based exercises, group discussion by analyzing different case studies	Quiz, In- course exam; Final Exam
CLO-2	Lecture, multimedia presentation, Problem based Learning (PBL): Identifying the problems to be solved	Assignment, Group presentation, In-course exam, Final exam
CLO-3	Lecture, multimedia presentation, group discussion, analyze and compare through various case-studies	Assignment, In-course Exam, Final Exam

Part B

14. Course plan specifying content, CLOs, teaching learning and assessment strategy mapped with CLOs

Time Period	Topic	Teaching-Learning Methodology	Assessment Method	Corresponding CLOs
Week-01	Environmental Audit: -Principles and philosophies of environmental auditing, - basic steps in audit process, - Auditing techniques -Concept of industrial ecology	Lecture, Group discussion, Literature	In-course, Final exam, Quiz	CLO1
Week -	Environmental Audit:	Lecture,	In-course,	CLO1

02	-cleaner technologies in industrial processes and evaluation of processes -waste minimization incorporated with industrial ecology	Literature	Final exam	
Week - 03	Environmental health hazard and risk assessment: -Biological, chemical, physical and psychological health hazard -health risk assessment and management, -toxicology, exposure measurement of toxic (carcinogenic and non-carcinogenic) substances	Lecture, Group Discussion, Literature	In-course, Final exam	CLO1
Week - 04	Clean Development Mechanism: -Overview on sustainable development -greenhouse gasses reduction mechanism -project cycle for the CDM, CDM for small scale projects -risks and opportunities for industries -financing of CDM projects, case studies.	Lecture, Literature, Group Assignment,	In-course, Final exam, Assignment	CLO1
Week - 05	Environmental Impact Assessment (EIA): -Definition, purposes and characteristics of EIA -global evolution of EIA, -participants in EIA process -stages of EIA, types of EIA, environmental inventory, -baseline data on EIA-environmental data -project data and project alternative data - measurement of impact– physical, social, economic, natural, public participation in environmental decision making,	Lecture, Literature, Case studies	Assignment, In-course exam, Final exam	CLO1, CLO2

Week - 06	Environmental Impact Assessment (EIA): -framework of environmental assessment -description of environmental setting -Environmental impact factors and area consideration - Environmental impact statement (EIS) and environmental management plan (EMP)	Lecture, Literature, Case studies,	Assignment, Quiz, Final Exam	CLO1, CLO2
Week - 07	Environmental Impact Analysis: -Impact identification and methods of impact identification- adhoc method, checklist, matrix, network, overlay and index methods; -impact prediction and predictive methodologies, -impact evaluation (assessment) and impact mitigation.	Lecture, Literature, Assignment	In-course, Final Exam, Assignments	CLO3
Week - 08	Environmental Impact Analysis (cont.) -Basic steps for the impact identification, prediction and assessment of air, water, noise, vegetation and wildlife environment with case studies.	Lecture, Literature	In-course , Final Exam, Assignment	CLO3
Week - 09	Environmental Management System (EMS): -Basic definitions and terms -Framework for environmental management system -approach for developing Environmental Management System	Lecture, Literature	In-course, Final Exam	CLO1, CLO3
Week - 10	Environmental Management System (EMS) -International standards -environmental management systems in tanneries and their implementation -environmental reporting	Lecture, Literature, Case studies	In-course, Final Exam	CLO1, CLO3
Week - 11	Environmental Management System (EMS) (Cont.)	Lecture, Literature,	In-course, Final Exam	CLO1, CLO2

	<ul style="list-style-type: none"> -Occupational health and safety management -cross-boundary environmental management -mandatory regulations and ecolabelling criteria governing various substance in leather -life-cycle assessment and carbon footprint in leather industries. 			
Week - 12	<p>Hazard Mitigation:</p> <ul style="list-style-type: none"> -Classification of hazards -basic concept of disaster (causative factors of disaster, classification of disasters) -Hazards due to dams and reservoirs, nuclear power plants -industrial hazards, occupational hazards, mitigation measures, hazard assessment, risk assessment. 	Lecture, Literature, Case studies	In-course, Final exam	CLO1, CLO2
Week - 13	<p>EIA in Bangladesh:</p> <ul style="list-style-type: none"> -An overview of history, current procedures, practices and guidelines for Environmental Clearance Certificate, -EIA of water resource projects, industries, mining and quarrying, highway construction, tourism developments. 	Lecture, Literature, Case studies	In-course, Final exam	CLO1, CLO2, CLO3
Week- 14	Review of the whole content	Problem oriented exercises		CLO1, CLO2, CLO3

Part C

15. Assessment and Evaluation

a. Assessment Strategy

Strategy	Percentage of Total Marks
Class participation and attendance	10%
Class tests/ Class assessments	30%
Term final examinations (3 hours duration)	60%
Total	100%

ii) Marks distribution:

- a. Continuous Assessment: 40%
- b. Summative: 60%
- c. Make-up Procedures:
 - Two in-course exams will be taken and average marks will be counted.
 - Feedback on continuous assessment is given to the students immediately after the test. Based on the students' feedback additional class/assignment may be taken by the course teacher.

Part D

16. Learning Materials

i) Recommended Readings

- a) Morris, P and Therivel, R. 2001. Methods of environmental impact assessment. London. UCL press.
- b) Introduction to Environmental Impact Assessment : Principles and Procedures, Process, Practice and Prospects - 2nd edition. J. Glasson, R. Therivel, A. Chadwick
- c) Environmental Impact Assessment Methodologies, Y. Anjaneyulu, Valli Manickam, BS Publication
- d) Environmental and Health Risk Assessment and Management: Principles and Practices ,ISBN: 9789048169610,9048169615

ii) Supplementary Reading

- a) Bregman, J.I. and Mackenthum, K.M. 1992. Environmental impact statements. Chelsia Michigan: Lewis.
- b) Calow, P. 1997. Handbook of environmental risk assessment and management. Oxford: Blackwell Science.

iii)Others: Handout/lecture material provided by the course teacher

Course Outline of 0723-LPE-6215

Part A

1. Course Code: 0723-LPE-6215

2. Course Title: Nanotechnology for Leather and Leather Products

3. Course Type: Core Course

4.Year/ Semester: Semester: II

5. Academic Session: 2022-23

6. Course Teachers: 1. Dr. Mohammed Mizanur Rahman, Professor, ACCE, DU.
2. Md. Adib Hossain Chisty, Lecturer, ILET, DU.

7. Prerequisite(s): N/A

8. Credits: 3.0

9. Contact Hours: 42 hours

10. Total Marks: 100

11. Rational of the Course: This course is designed to provide in-depth theoretical knowledge of nanotechnology and outlines its applications in leather and allied engineering fields. The course also deals with the design of nano systems, nanomaterials together with their processing, properties and characterization.

Course Contents

Introduction to Nanoscience and Nanotechnology: Introduction, history and importance of nanotechnology, properties of nanomaterials, difference between bulk and nanomaterials, molecular building blocks for nanostructured systems, influence of nano structure on mechanical, optical, electronic, magnetic and chemical properties, overview of different nanomaterials available, chemistry and physics of nanomaterials, electronic phenomenon in nanostructures, optical absorption in solids, quantum dot, quantum effects, nanocomposites.

Nanomaterials Fabrication:

Chemical Methods: Sol- gel process, self-assembly process, electrodeposition, pyrolysis, metal nanocrystals by reduction, solvothermal synthesis, photochemical synthesis, nano chemical synthesis, reverse micelles and microemulsions, combustion method, template process, chemical vapor deposition, metal organic chemical vapor deposition.

Physical Methods: Ball milling, inert gas condensation technique, thermal evaporation, pulsed laser deposition, DC/RF magnetron sputtering, molecular beam epitaxy, microlithography, etching, wet cleaning, atomic layer deposition.

Biological Synthesis: Protein based nanostructure formation, DNA template nanostructure formation, protein assembly, biologically inspired nanocomposites.

Nanomaterials Characterization:

Structural Characterization: X-ray diffraction (XRD) analysis, FT-IR analysis, Raman spectroscopy

Microscopic and Surface Analysis: Electron microscopes: scanning electron microscopy (SEM), transmission electron microscopy (TEM); scanning probe microscopy: atomic force microscopy (AFM), scanning tunneling microscopy (STM).

Spectroscopy: X-ray photoelectron spectroscopy (XPS), fluorescence spectroscopy, UV-visible spectroscopy, nuclear magnetic resonance (NMR) spectroscopy, electron spin resonance (ESR) spectroscopy.

Electrical, Mechanical and Magnetic Properties: Impedance analysis, electro-analytical techniques: potentiometry, voltammetry, cyclic voltammetry

Thermal and Optical Properties: Differential scanning calorimetry (DSC) analysis, Differential thermal analysis (DTA), Thermogravimetric analysis (TGA), contact angle measurement. Dynamic light scattering (DLS) method.

Applications of nanotechnology in the relevant field and non-leather chemicals: Possible industrial applications of nanomaterials in leather, footwear and leather products industries, application of nano materials on collagen matrix at various stages of processing techniques, synthesis of nano based materials for leather manufacture: syntans, reinforcing materials, finishing chemicals.

Environmental aspects of nanotechnology: Handling, safety and hazard of nanomaterials processing, effects of nanomaterials exposure on human and living stock, long term and short-term effects, case studies of exposure, effects of nanoparticles on air, water and soil, food and food supplements.

12. Course Objectives

- a) To introduce and provide a broad view of the nascent field of nanoscience and nanotechnology.
- b) To promote interdisciplinary interactions among engineering, technology, science, and industrial management/technology majors.
- c) To utilize knowledge about developing new products and systems in leather sector.

13. Course Learning Outcomes (CLOs) and Mapping of CLOs with Program Learning Outcomes (PLOs)

- a) **CLOs:** At the completion of this course students will be able to:

	Course Learning Outcomes (CLOs)	Learning Level
CLO1	Define and explain the structure, properties and applications of nanomaterials together with associated chemicals	C1, C2
CLO2	Illustrate the importance of dimensional reduction in materials and its relationship with properties.	C3
CLO3	Compare numerous methods of nanomaterials preparation and analyze nanomaterials thoroughly using engineering tools	C5
CLO4	Assess environmental pollutions/concerns by nano based materials during its production and real-life applications.	C5

b) Mapping of CLO with PLO

(CLOs)	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8
CLO1	3					2		
CLO2	3					3		
CLO3	3	2			3	3	2	
CLO4	2	3			2	2	2	

c) Mapping of Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO-1	Lecture, literature review, multimedia presentation, group discussion	Group Presentation, In-course Exam, Quiz, Assignment, Final Exam
CLO-2	Lecture, multimedia presentation, video presentation, demonstration, group discussion	Group Presentation, In-course Exam; quiz, assignment, case study, Final Exam
CLO-3	Lecture, demonstration, multimedia presentation, literature review, group discussion	Assignment, Quiz, Group Presentation, In-course Exam, and Final Exam
CLO-4	Lecture, multimedia presentation, group discussion, literature review, video presentation, demonstration, and problem-based exercises	Quiz, Assessment, Group Presentation, In-course Exam, and Final Exam

Part B

14. Course plan specifying content, CLOs, co-curricular activities (if any), teaching learning and assessment strategy mapped with CLOs

Time Period	Topic	Teaching-Learning strategy	Assessment Method	Corresponding CLOs
Week-01	Introduction to Nanoscience and Nanotechnology: Introduction, history and importance of nanotechnology, properties of nanomaterials, difference between bulk and nanomaterials, molecular building blocks for nanostructured systems, influence of nano structure on mechanical, optical, electronic, magnetic and chemical properties, overview of different nanomaterials available, chemistry and physics of	Class Lecture	In-course Exam, Final Exam	CLO1, CLO2
Week -02		Class Lecture, Slide Presentation	In-course Exam, Final Exam	CLO1, CLO2

	nanomaterials, electronic phenomenon in nanostructures, optical absorption in solids, quantum dot, quantum effects, nanocomposites			
Week -03	Nanomaterials Fabrication: Chemical Methods: Sol- gel process, self-assembly process, electrodeposition, pyrolysis, metal nanocrystals by reduction,	Class Lecture, Slide Presentation	In-course Exam, Final Exam	CLO1, CLO3
Week -04	solvothermal synthesis, photochemical synthesis, sonochemical synthesis, reverse micelles and microemulsions, combustion method, template process, chemical vapor deposition, metal organic chemical vapor deposition.	Class Lecture	In-course Exam, Final Exam	CLO3
Week -05	Physical Methods: Ball milling, inert gas condensation technique, thermal evaporation, pulsed laser deposition, DC/RF magnetron sputtering, molecular beam epitaxy, microlithography, etching, wet cleaning, atomic layer deposition.	Class Lecture, Assignments	In-course Exam, Final Exam	CLO3
Week -06	Biological Synthesis: Protein based nanostructure formation, DNA template nanostructure formation, protein assembly, biologically inspired nanocomposites. Nanomaterials Characterization: Structural Characterization: X-ray diffraction (XRD) analysis, FT-IR analysis	Class Lecture, Assignment	In-course Exam, Final Exam	CLO3
Week -07	Raman spectroscopy Microscopic and Surface Analysis: Electron microscopes: scanning electron microscopy (SEM), transmission electron microscopy (TEM); scanning probe	Class Lecture, Slide Presentation	In-course Exam, Final Exam	CLO3

	microscopy: atomic force microscopy (AFM), scanning tunneling microscopy (STM).			
Week -08	Spectroscopy: X-ray photoelectron spectroscopy (XPS), fluorescence spectroscopy, UV-visible spectroscopy	Class Lecture,	In-course Exam, Final Exam	CLO3
Week -09	nuclear magnetic resonance (NMR) spectroscopy, electron spin resonance (ESR) spectroscopy. Electrical, Mechanical and Magnetic Properties: Impedance analysis	Class Lecture, Assignment	In-course Exam	CLO3
Week -10	electro-analytical techniques: potentiometry, voltammetry, cyclic voltammetry. Thermal and Optical Properties: Differential scanning calorimetry (DSC) analysis	Class Lecture	In-course Exam, Final Exam	CLO3
Week -11	Differential thermal analysis (DTA), Thermogravimetric analysis (TGA), contact angle measurement. Dynamic light scattering (DLS) method.	Class Lecture, Assignment	In-course Exam, Final Exam	CLO1, CLO2, CLO3
Week -12	Applications of nanotechnology in the relevant field and non-leather chemicals: Possible industrial applications of nanomaterials in leather, footwear and leather products industries,application of nano materials on collagen matrix at various stages of processing, synthesis of nano based materials for leather manufacture: syntans, reinforcing materials, finishing chemicals.	Class Lecture	In-course Exam, Final Exam	CLO1, CLO3
Week -13	Environmental aspects of nanotechnology: Handling, safety and hazard of nanomaterials	Class Lecture	Final Exam, Assignment	CLO1, CLO3, CLO4

	processing, effects of nanomaterials exposure on human and living stock, long term and short term effects, case studies of exposure, effects of nanoparticles on air, water and soil, food and food supplements.			
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Week-14	Review Class	Class Lecture, Presentation, Assignment	Final Exam, Assignment	CLO1, CLO2, CLO3, CLO4
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Part C

15. Assessment and Evaluation

i) Assessment Strategy

Class participation	10%
In-course Examination	30%
Semester Final Examination (3 hours duration)	60%
Total	100%

ii) Marks distribution:

- a) Continuous Assessment: 40%
- b) Summative: 60%
- c) Make-up Procedures: Two in-course exams will be taken and average marks will be counted. Feedback on continuous assessment is given to the students immediately after the test. The Based on the students' feedback additional class-test/assignment may be taken by the course teacher

Part D

16. Learning Materials

i) Recommended Readings

- a) Hand book of Nano science, Engineering, and Technology, William A. Goddard, CRC press 2003.
- b) Nanolithography and patterning techniques in microelectronics, David G.Bucknall, Wood head publishing 2005.
- c) Nanocomposite science and technology, Pulikel M. Ajayan, Wiley-VCH 2005

iii) Supplementary Readings:

- a) Nanotechnology Environmental health and Safety: Risks Regulation and Management, Matthew Hull and Diana Bowman, Elsevier 2010
 - b) Hand book of Nano science, Engineering, and Technology, William A. Goddard, CRC press 2003.
- iii) Others:** Handout/lecture material provided by the course teacher

Course Outline of 0723-LPE-6217

Part A

1. Course Code: 0723-LPE 6217

2. Course Title: Industrial Automation

3. Course Type: Core Course

4. Year / Semester: Semester: II

5. Academic Session: 2022-23

6. Course Teachers: Md. Abdus Shabur, Lecturer, ILET, DU.

7. Prerequisite(s): N/A

8. Credits: 3.0

9. Contact Hours: 42

10. Total Marks: 100

11. Rationale of the Course: This course provides an overview of the technologies of industrial automation and control as it is commonly encountered in factories of all types including leather and leather products items. Automation of the production process increases the efficiency of labor and the overall rate of growth. By ending this course, students will be able to have a fundamental knowledge of current industrial automation technologies and their application.

Course Contents

Introduction to Automation and Artificial Intelligence: Introduction, Principles and strategies, Basic elements of an automated system, Advanced automation functions, Levels of automations, Automated flow lines and transfer mechanisms, Introduction of AI, Historical development, Intelligent Systems, Types of Intelligent Agents, Components of AI, Foundations of AI, Scope of AI, Current trends in AI, Relevance to Leather, Products and Footwear Engineering

Boolean Algebra and Logic Circuits and Programmable Logic Controller (PLC): Various logic gates, Truth tables, Logic functions, Boolean Laws, Karnaugh maps, Block

diagram of PLC, Programming languages of PLC, Basic instruction sets, Networking of PLC, Overview of safety of PLC with case studies. Process Safety Automation: Levels of process safety through use of PLCs,

Controllers, Sensors and Actuators:: Control Modes, PID and Digital Controllers, Velocity Control, Adaptive Control, Microprocessor and Microcontrollers, important characteristics, Main industrial sensors, Classification of sensors and their usage, Description of different kinds of sensors, Overview of Actuators, usage of Actuators in Robotics, Classification of Actuators (Pneumatic, Hydraulic, Electric), Basics of Pneumatic and Hydraulic Actuation Systems, Mechanical Actuation Systems, Electrical Actuation Systems.

Robots and their applications: Introduction to robots, Types, Classifications, Selection of robots, Robot Degrees of freedom, Robot configuration, Accuracy and repeatability, Specification of a robot, Robot feedback controls: Point to point control and Continuous path control, Control system for robot joint, Drives and transmission systems, End effectors, Industrial robot applications.

Concept and Algorithms, No programming or numerical: Problem Solving: Tree and Graph Search, Uninformed v/s informed search, uninformed methods: depth first search, breadth first search, Informed search: heuristic search, Best first search, branch and bound; Machine Learning: Introduction, types of machine learning; Learning with Decision Trees, Classification and Regression Trees, K means clustering algorithm, K nearest neighbors algorithm, hierarchical clustering, Concept of ensemble methods.

Artificial Neural Networks and Introduction to AI Technologies: Concept of ANN, Basic Models, Important Terminologies of ANNs McCulloch-Pitts Neuron, NN architecture, perceptron, delta learning rule, backpropagation algorithm, Gradient Descent algorithm, feed forward networks, activation functions, Introduction to AI Technologies in the realm of Automation Concept of Natural Language Processing, Machine Vision, Deep learning, Expert systems, Genetic Algorithms, Industry 4.0

12. Course Objectives: The learning objectives of this course are:

- a) To provide fundamental knowledge of automated machines and equipment including AI application in leather industry.
- b) To impart the role of Boolean algebra and PLC in industrial automation.
- c) To develop the operating skill of various sensors, actuators and controllers.
- d) To familiarize with the application of robotic systems and artificial neural networks in automated manufacturing processes.

13. Course Learning Outcomes (CLOs) and Mapping of CLOs with Program Learning Outcomes (PLOs)

a) **CLOs:** Upon completion of this course, students will be able to:

	Course Learning Outcomes (CLOs)	Learning Levels
CLO1	Explore their knowledge on fundamentals of industrial automation and its importance in modern manufacturing.	C1, A1
CLO2	Define and explain various automation technologies in leather and	C1, C2, A2

	leather products manufacturing and process industries.	
CLO3	Apply various modern technologies to design an automated production facility including materials handling with robotics application.	C3, A2
CLO4	Investigate and solve any hurdle related to automation with the help of Artificial Intelligence (AI) applications.	C4, C5

b) Mapping of CLO with PLO

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8
CLO1	3							
CLO2	3				1			
CLO3	3	2	2		1	3	2	
CLO4	3	3	3	3	2	2	2	1

Rank: 3-High match, 2-Medium match, 1-Low match

c) Mapping of Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO-1	Lecture, multimedia presentation, literature review and problem-based exercises	Group Presentation, Assignment, oral presentation, In-course Exam and Final Exam
CLO-2	Lecture, group discussion and problem-based exercises, literature review.	Group Presentation, In-course Exam and Final Exam
CLO-3	Lecture, multimedia presentation and problem-based learning: Identifying the problem to be solved	Assignment, Group Presentation, In-course Exam and Final Exam
CLO-4	Lecture, multimedia presentation, group discussion, and problem-based exercises	Group Presentation, Case study, Assignment, In-course Exam and Final Exam

Part B

14. Course plan specifying content, CLOs, co-curricular activities (if any), teaching learning and assessment strategy mapped with CLOs

Time	Topic	Teaching-Learning Strategy	Assessment Strategy	Corresponding CLOs
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Week-01	Introduction to Automation and Artificial Intelligence: Introduction, Principles and strategies, Basic elements of an automated system, Advanced automation functions, Levels of automations, Automated flow lines and transfer mechanisms	Lecture, Group Discussion, Multimedia Presentation, literature review	In-course Exam, Final Exam	CLO1, CLO2
Week -02	Introduction of AI, Historical development, Intelligent Systems, Types of Intelligent Agents, Components of AI, Foundations of AI, Scope of AI, Current trends in AI, Relevance to Leather, Products and Footwear Engineering	Lecture, Group Discussion, Multimedia Presentation, literature review	In-course Exam, Final Exam	CLO1, CLO2
Week -03	Boolean Algebra and Logic Circuits: Various logic gates, Truth tables, Logic functions, Boolean Laws, Karnaugh maps.	Lecture, Multimedia Presentation, Problem solving	Assignment, In-course Exam, Final Exam	CLO1, CLO2 CLO3, CLO4
Week -04	Block diagram of PLC, Programming languages of PLC, Basic instruction sets, Networking of PLC, Overview of safety of PLC with case studies. Process Safety Automation: Levels of process safety through use of PLCs.	Lecture, Group Discussion, Multimedia Presentation,	In-course Exam, Final Exam	CLO1, CLO2 CLO3, CLO4
Week -05	Controllers: Control Modes, PID and Digital Controllers, Velocity Control, Adaptive Control, Microprocessor and Microcontrollers	Lecture, Group Discussion, Multimedia Presentation	Case study, In-course Exam, Final Exam	CLO1, CLO2 CLO3
Week -06	Important characteristics of sensors, Main industrial sensors, Classification of sensors and their usage, Description of different kinds of sensors	Lecture, Group Discussion, Multimedia Presentation	In-course Exam, Final Exam	CLO2, CLO3

Week - 07	Overview of Actuators, usage of Actuators in Robotics, Classification of Actuators (Pneumatic, Hydraulic, Electric), Basics of Pneumatic and Hydraulic Actuation Systems, Mechanical Actuation Systems, Electrical Actuation Systems	Lecture, Group Discussion, Multimedia Presentation	Case Study, In-course Exam, Final Exam	CLO2, CLO3, CLO4
Week - 08	Robots and their applications: Introduction to robots, Types, Classifications, Selection of robots, Robot Degrees of freedom, Robot configuration, Accuracy and repeatability, Specification of a robot, Robot feedback controls	Lecture, Group Discussion, Multimedia Presentation	Group Presentation, In-course Exam, Final Exam	CLO1, CLO2
Week - 09	Point to point control and Continuous path control, Control system for robot joint, Adaptive control, Drives and transmission systems, End effectors, Industrial robot applications of robots	Lecture, Group Discussion, Multimedia Presentation	In-course Exam, Final Exam, Assignment	CLO3, CLO4,
Week - 10	Concept and Algorithms, No programming or numerical: Problem Solving: Tree and Graph Search, Uninformed v/s informed search, uninformed methods: depth first search, breadth first search, Informed search: heuristic search	Lecture, Group Discussion, Multimedia Presentation	In-course Exam, Final Exam	CLO1, CLO3, CLO4
Week - 11	Best first search, branch and bound; Machine Learning: Introduction, types of machine learning: supervised, unsupervised, reinforcement learning; Learning with Decision Trees: Introduction to Decision Trees	Lecture, Group Discussion, Multimedia Presentation, problem solving	In-course Exam, Final Exam	CLO1, CLO3, CLO4
Week - 12	Classification and Regression Trees, K means clustering algorithm, K nearest neighbors algorithm, hierarchical clustering, Concept of ensemble methods	Lecture, Group Discussion, Multimedia Presentation	In-course Exam, Final Exam	CLO2, CLO3 CLO4

Week - 13	Concept of ANN, Basic Models, Important Terminologies of ANNs McCulloch-Pitts Neuron, NN architecture, perceptron, delta learning rule, backpropagation algorithm, Gradient Descent algorithm, feed forward networks, activation functions	Lecture, Group Discussion, Multimedia Presentation	Oral Presentation, In-course Exam, Final Exam	CLO1, CLO2
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Week - 14	Introduction to AI Technologies in the realm of Automation Concept of Natural Language Processing, Machine Vision, Deep learning, Expert systems, Genetic Algorithms, Industry 4.0	Lecture, Group Discussion, Multimedia Presentation,	In-course Exam, Final Exam	CLO1, CLO3, CLO4,
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Part C

15. Assessment and Evaluation

i) Assessment Strategy

Class attendance and participation	10%
In-course Exam/Class Test	30%
Semester Final Examination (3 hours duration)	60%
Total	100%

ii) Marks distribution:

- Continuous Assessment: 40%
- Summative: 60%
- Make-up Procedures: Two in-course exams will be taken and average marks will be counted. Feedback on continuous assessment is given to the students immediately after the test. Based on the students' feedback additional class/assignment may be taken by the course teacher

Part D

16. Learning Materials

i) Recommended Readings

- Handbook of Industrial Automation-Richard L. Shell, Ernest L. Hall
- Introduction to Industrial Automation- Stamatios Manesis, George Nikolakopoulos
- Introduction to Artificial Intelligence By Wolfgang Ertel

ii)Supplementary Readings

a) Introduction to Mechatronics and Measurement Systems by David G. Alciatore.

iii) **Others:** Hand notes/Lecture materials will provide by the course teacher.

Semester-III		
Course Code	Course Title	Credits
0723-LPE-6000	Thesis	16.0
Grand Total		40.00

Course Outline of 0723-LPE-6000

Part A

1. **Course Code:** 0723-LPE-6000

2. **Course Title:** Thesis

3. **Course Type:** Core course

4. **Year/Semester:** Semester: I, II and III

5. **Academic Session:** 2022-2023

6. **Course Teacher:** Respective Supervisor/Co-supervisor, ILET, DU.

7. **Pre-requisite:** N/A

8. **Credit Value:** 16.0

9. **Contact Hour:** No specific contact hour per week.

10. **Total Marks:** 300

11. **Rationale of the Course:** Students for the M.Sc. in Leather Products Engineering have to complete a thesis that demonstrates their ability to conduct in-depth research into a specific area and how it will relate to their own academic backgrounds and professionalism. After completing the thesis, students will be able to think independently about specific problems and develop a research methodology.

Course Content

Preparation of Research Proposal: Background, aim and objectives; review of relevant research; methodology; expected outcomes.

Conformation of Research Proposal: Proposal submission, presentation, and evaluation.

Literature Review: In-depth review of literature, data collection, research gap analysis.

Experimental Work: Materials and methods, method optimization, data generation and analysis, modelling and solution.

Midterm Presentation and Thesis Paper Preparation: Presentation on preliminary findings, drafting, review and editing of thesis paper, final thesis paper.

Submission and Defense: Final thesis paper submission and oral presentation.

12. Course Objectives: The course has been designed in a manner

- a) To acquaint students with research culture, ethics, and research methodology.
- b) To make the students capable of thinking individually for creative development.
- c) To acquire skills for identifying and analyzing problems as well as devising innovative solutions.
- d) To develop effective communicative skills to present research outcomes.

13. Course Learning Outcomes (CLOs) and Mapping of CLOs with Program Learning Outcomes (PLOs)

a) **CLOs:** At the completion of this course students will be able to:

	Course Learning Outcomes (CLOs)	Learning Level
CLO1	Explain the background of the proposed research project and identify the research gaps.	C2, P2
CLO2	Develop research proposal and present it orally to disseminate the identified problem.	C3, A2, P3
CLO3	Analyze the existing methods and modify them based on the literature review.	C4, C5, A4, P4,
CLO4	Optimize new methods and generate, analyze, and modeling of relevant data based on the research outcomes.	C5, A4, P4
CLO5	Prepare a thesis paper with existing standards and present the results of the research through writing and orally.	C6, A5, P5

b) **Mapping Course Learning Outcomes (CLOs) with Program Learning Outcomes (PLOs)**

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8
CLO1	3	1	3				1	1
CLO2	3	2	3	3		3	2	2
CLO3	3	3	3			3	3	2
CLO4	3	3	3			3		2
CLO5	3	3	3	3		3	3	3

c) Mapping of Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Discussion and encouragement	Thesis defense and report evaluation by external as well as internal
CLO2	Discussion and encouragement	
CLO3	Self-study	
CLO4	Self-work	
CLO5	Lecture, discussion, demonstration, writing, final proof-reading	

PART B

14. Course plan specifying content, CLOs, co-curricular activities (if any), teaching learning and assessment strategy mapped with CLOs

Month	Topic	Teaching-Learning Strategy	Assessment Strategy	Corresponding CLOs
1—3	Preparation of Research Proposal: Background, aim and objectives; review of relevant research; methodology; expected outcomes.	Discussion and encouragement	Thesis defense and report evaluation by external as well as internal	CLO1
4	Conformation of Research Proposal: Proposal submission, presentation, and evaluation.	Discussion and encouragement		CLO2
5—7	Literature Review: In-depth review of literature, data collection, research gap analysis. Start the experimental work.	Self-study		CLO3
8—15	Experimental Work: Materials and methods, method optimization, data generation, and analysis, modeling and solution.	Self-work		CLO4
16	Midterm Presentation and Thesis Paper Preparation: Presentation on preliminary findings, drafting.	Lecture, Discussion and demonstration		CLO5

17	Review and editing of thesis paper, final thesis paper.	Writing, Final proofreading.		
18	Submission and Defense: Final thesis paper submission and oral presentation.	Demonstration		

Part C

15. Assessment and Evaluation

i) Assessment Strategy

Strategy	Percentage of total marks
Thesis defense	40%
Dissertation Submission	60%
Total	100%

ii) Marks distribution:

- a) Continuous Assessment/defense: 40%
- b) Summative: 60%
- c) Make-up Procedures: N/A.

Part D

16. Learning Materials

Recommended Readings

- a) Writing the Winning Thesis or Dissertation: A Step-by-Step Guide - By Allan A. Glatthorn, Randy L. Joyner.
- b) Relevant books, scientific journals, handbooks, patents and manuals.

Curriculum
M.Sc. in Leather Products Engineering (General Group)
Institute of Leather Engineering and Technology (ILET)
UNIVERSITY OF DHAKA

Semester-I		
Course Code	Course Title	Credits
0723-LPE-6101	Advanced Leather Products Manufacturing	3.0
0723-LPE-6103	Optimization Techniques of Leather Products Manufacturing	3.0
0723-LPE-6105	Research Methodology	3.0
0723-LPE-6107	Industrial Hazards and Waste Management	3.0
0723-LPE-6109	Ergonomics and Industrial Safety	3.0
0723-LPE-6111	Materials and Quality Management of Leather Products	3.0
Total		18.0

Course Outline for 0723-LPE-6101

Part A

- 1. Course Code:** 0723-LPE-6101
- 2. Course Title:** Advanced Leather Products Manufacturing
- 3. Course Type:** Core Course
- 4. Year/ Semester:** Semester: I
- 5. Academic Session:** 2022-23
- 6. Course Teacher:** Umme Habiba Bodrun Naher, Associate Professor, ILET, DU
Sumaiya Mim, Lecturer, ILET, DU
- 7. Prerequisite(s):** N/A
- 8. Credits:** 3.0
- 9. Contact Hours:** 42
- 10. Total Marks:** 100
- 11. Rational of the Course:**

This course is designed to provide advanced knowledge on different techniques and automation to manufacture and develop diversified leather goods and garments. The course furnishes the design and fashion ideas through the knowledge of product development, grading, commercialization, merchandizing, brands etc. One can easily explore the different interests of leather products after equipping once with these contents.

Course Contents:

Introduction of modern leather products: Tradition and fashion on continuous evolution from handcrafted leather goods to industry, the value and contribution of materials, materials concept in modern leather products manufacturing with function & purpose, creative aspects leather goods, leather goods manufacturing processes, designing & process development.

Leather in automobile items: Various types of automobile items, specification of different types of automobile items, specification and materials used in automobile items, making procedure of automobile items, creativity in automobile items manufacturing, specialty of automobile items.

Fashion accessories and ornamentation: Principles of fashion design, fashion forecasting, fashion show, length of fashion cycles, sources of inspiration, theory of fashion leadership, areas of fashion design, principles of design, types of design, selecting garments accessories, trims, trimming and decoration, types and selection of fashion accessories, evaluation of quality of trims and accessories, designer's duties, making a garment sellable, developing a line in designing,

Garment Technology: Body, factors affecting garment fit and ease of body movement; different front openings of garments; components of zippers; button and button holes-application, types, styles of attachment; advanced concept of grading, objectives, rules and application of grading methods; block grading, computer aided pattern grading; special types of jackets-blocks, designing, anatomy, grading, garment specification sheet development; garments physiological discomfort sensations, different types and factors affecting comfort.

Proportion in design: Division into eights, geometry of human form, golden section, construction of a golden section, construction of a golden rectangle, use of golden ratio, Phi and its use in consumer products.

Concept of Fusing technology and materials: Lining-Interlining relation with fusing, objectives, interlining-classification, manufacturing, characteristics, selection, and application; advantages and disadvantages of fusing press system, constructions of fusing, requirements of fusing, factors of fusing controls, determination of the optimal fusing parameters, fusing equipment, methods and quality control in fusing.

Automation in Products Manufacturing: Garment manufacturing- from concept to consumer, global scenario of automation, various automation systems and advanced tools and machines in garment manufacturing, areas of automation-inspection, computer-aided design and computer-aided manufacturing, advantages and disadvantages of automation in products manufacturing.

Private labels and brands for leather products: National brands, private labels and brands, private label brand strategy, private labels and brands acquisition, steps, promoting awareness of private labels and brands, developing a label, trends in private labels and brands.

Leather products merchandising: Concepts of leather products merchandising, responsibilities of the store line, responsibilities of the buying line, fashion merchandising direction, buyer's role, target customers, micro-versus macro-merchandising, buying-selling cycle.

12. Course Objectives: The objectives of this course are:

- (a) To familiarize students with a comprehensive understanding of modern leather products, fashion accessories, ornamentation.
- (b) To impart knowledge about proportion of designing.
- (c) To provide students with a comprehensive understanding of automation, private labels and brands, and merchandising procedure for leather products.
- (d) To acquaint students with modern knowledge on different techniques to manufacture and develop various leather goods and garments.

13. Course Learning Outcomes (CLOs) and Mapping of CLOs with Program Learning Outcomes (PLOs)

a) **CLOs:** Upon completion of the course, the students will be able to:

	Course Learning Outcomes (CLOs)	Learning Level
CLO1	Explain and apply different materials to manufacture leather products e.g. handbags, briefcase, luggage, automobile items, garments etc.	C2, C3, A3
CLO2	Analyze and compare various automation systems, private levels and brands alongside merchandising of leather products.	C4, A4
CLO3	Illustrate and integrate fashion accessories and ornamentation, fashion show, fashion cycle, trims, fusing, fusing technology, and proportion in design	C4, A4
CLO4	Interpret grading method and justify factors influencing garments fit and ease of body movement alongside comfort.	C5, A3
CLO5	Design and construct different leather goods and garments.	C6, P5

b) **Mapping of CLO with PLO**

(CLOs)	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8
CLO1	3			3		2	3	2
CLO2	3	2		2		3	2	
CLO3	3			3		3	3	2
CLO4	3			3		3	2	3
CLO5	3	3	3	2	3	3	3	3

c) **Mapping of Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy**

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO-1	Lecture, Multimedia presentation, video presentation and demonstration.	Group Presentation, In-course Exam; Final Exam
CLO-2	Lecture, Multimedia presentation,	Assignment, In-course Exam, Final

	demonstration, video presentation	Exam
CLO-3	Lecture, multimedia presentation, group discussion, demonstration, and problem-based exercises	Quiz, In-course Exam, and Final Exam
CLO-4	Lecture, pictorial, theme board illustration, story board illustration, multimedia presentation, white board illustration, demonstration	Group Presentation, In-course Exam, and Final Exam
CLO-5	Multimedia presentation, white board illustration, group discussion and demonstration	Assignment, In-course Exam, and Final Exam

Part B

14. Course plan specifying content, CLOs, co-curricular activities (if any), teaching learning and assessment strategy mapped with CLOs

Time Period	Topic	Teaching-Learning Methodology	Assessment Method	Corresponding CLOs
Week-01	Introduction of modern leather products: Tradition and fashion on continuous evolution from hand-crafted leather goods to industry, the value and contribution of materials, materials concept in modern leather products manufacturing with function& purpose, creative aspects of leather goods, leather goods manufacturing processes, designing & process development.	Multimedia presentation, Group discussion, White board illustration, Demonstration	Assignment, In-course Exam, Final Exam	CLO1, CLO5
Week -02				
Week -03	Leather in automobile items: Various types of automobile items, specification of different types of automobile items, specification and materials used in automobile items, making procedure of automobile items, creativity in automobile items manufacturing, specialty of automobile items.	Multimedia presentation, White board illustration, Demonstration	Quiz, In-course Exam, Final Exam	CLO1, CLO5

Week - 04	Fashion accessories and ornamentation: Principles of fashion design, fashion forecasting, fashion show, length of fashion cycles, sources of inspiration, theory of fashion leadership, areas of fashion design, principles of design, types of design, selecting garments accessories, trims, trimming and decoration, types and selection of fashion accessories, evaluation of quality of trims and accessories, designer's duties, making a garment sellable, developing a line in designing,	Multimedia presentation, Group discussion, White board illustration, Demonstration	Assignment, In-course Exam, Final Exam	CLO3
Week - 05				
Week - 06	Garment Technology: Body, factors affecting garment fit and ease of body movement; different front openings of garments; components of zippers; button and button holes-application, types, styles of attachment; advanced concept of grading, objectives, rules and application of grading methods; block grading, computer aided pattern grading; special types of jackets-blocks, designing, anatomy, grading, garment specification sheet development; garments physiological discomfort sensations, different types and factors affecting comfort.	Multimedia presentation, Video presentation, Group discussion, White board illustration, Demonstration	In-course Exam, Final Exam	CLO1, CLO4, CLO5
Week - 07				
Week - 08	Proportion in design: Division into eights, geometry of human form, golden section, construction of a golden section, construction of a golden rectangle, use of golden ratio, Phi and its use in consumer	Multimedia presentation, White board illustration, Demonstration	Assignment, In-course Exam, Final Exam	CLO3

	products.			
Week -9	Automation in Products Manufacturing: Garment manufacturing- from concept to consumer, global scenario of automation, various automation systems and advanced tools and machines in garment manufacturing, areas of automation-inspection, computer-aided design and computer-aided manufacturing, advantages and disadvantages of automation in products manufacturing.	Multimedia presentation, Group discussion, White board illustration, Demonstration	In-course Exam , Final Exam	CLO2
Week -10				
Week -11	Private labels and brands for leather products: National brands, private labels and brands, private label brand strategy, private labels and brands acquisition, steps, promoting awareness of private labels and brands, developing a label, trends in private labels and brands.	Multimedia presentation, Group discussion, White board illustration, Demonstration	In-course Exam, Final Exam	CLO2
Week -12				
Week-13	Leather products merchandising: Concepts of leather products merchandising, responsibilities of the store line, responsibilities of the buying line, fashion merchandising direction, buyer's role, target customers, micro-versus macro-merchandising, buying-selling cycle.	Multimedia presentation, Group discussion, White board illustration, Problem based exercises	In-course Exam, Final Exam	CLO2
Week-14				

Part C

15. Assessment and Evaluation

i) Assessment Strategy

Strategy	Percentage of Total Marks
Class participation and attendance	10%
In-course examinations	30%
Final examinations (3 hours duration)	60%
Total	100%

ii) Marks distribution

- a) Continuous Assessment: 40%
- b) Summative: 60%
- c) Make-up Procedures: Two in-course exams will be taken and average marks will be counted. Feedback on in-course assessment is given to the students immediately after the test. If students are very weak in particular topic of this course, additional instruction will be given to help them catch up.

Part D

16. Learning Materials

i. Recommended Readings

- Manual for Leather Accessories and Leather Goods-S. Natesan.
- Inside Fashion Design -S. L Tate.
- Clothing Technology- Roland Kilgus

ii. Supplementary Readings

- Fashion from concept to consumer, seventh edition -Gini Stephens Frings.
- Garments Manufacturing Technology- R. Nayak& R. Padhye

iii. Others: Handout/lecture material provided by the course teacher

Course Outline of 0723-LPE 6103

Part A

1. Course Code: 0723-LPE 6103

2. Course Title: Optimization Techniques of Leather Products Manufacturing

3. Course Type: Core Course

4. Year / Semester: Semester: I

5. Academic Session: 2022-23

6. Course Teachers: Uttam Kumar Roy, Associate Professor, ILET, DU.

7. Prerequisite(s): N/A

8. Credits: 3.0

9. Contact Hours: 42

10. Total Marks: 100

11. Rationale of the Course: The focus of this course is on theoretical concepts, data-driven models, and numerical techniques for optimization using actual variables. The course provides a thorough understanding in mathematical optimization theory, methods, and algorithms. This course's goal is to give students a systematic understanding of optimization methods. The course will begin with linear optimization and will go into detail about how to formulate problems and find solutions as well as to develop a methodology for leather products engineering design.

Course Contents

Advanced Inventory Management: Demand and control system characteristics, inventory concept, inventory cost, inventory modeling, optimization and inventory control, Dynamic EOQ Models, probabilistic models and safety stock, probabilistic demand, probabilistic example, Single-Period Models, Multiperiod Models.

Aggregate Planning and Master Scheduling: Basic Strategies for Meeting Uneven Demand, Techniques for Aggregate Planning, Disaggregating the Aggregate Plan, Master Scheduling, The Master Scheduling Process, Methods for Aggregate Planning: Graphical Methods, Mathematical Approaches, Comparison of Aggregate Planning Methods.

MRP, MRPII and ERP: Basic ideas of inventory MRP, benefits of MRP, inputs to MRP, bill of material (BOM), BOM examples for leather products manufacture, Master Production Schedule (MPS), MPS examples for leather products manufacture, time-phased product structure, MRP structure, determining gross requirements, gross requirements plan for leather products manufacture, gross requirements schedule, MRP management, Lot-sizing techniques, Lot-for-Lot examples, EOQ lot size examples, POQ lot size examples, material requirements planning II, distribution resource planning (DRP), enterprise resource planning (ERP), SAP's ERP modules.

Decision Modeling: The Decision Process in Operations; Fundamentals of Decision Making; Types of Decision-Making Environments; Decision Making under Uncertainty, Decision Making under Risk, Decision Making under Certainty, Expected Value of Perfect Information (EVPI); Decision Trees; A More Complex Decision Tree, Using Decision Trees in Ethical Decision Making.

Linear Programming Models: Why Use Linear Programming? Requirements of a Linear Programming Problem, Formulating Linear Programming Problems, Graphical Solution to a Linear Programming Problem, Sensitivity Analysis, Solving Minimization Problems, Linear Programming Applications, The Simplex Method of LP.

Transportations Modeling: Transportation Modeling; Developing an Initial Solution: The Northwest-Corner Rule, The Intuitive Lowest-Cost Method, The Stepping-Stone Method;

Special Issues in Modeling: Demand Not Equal to Supply, Degeneracy; Using Software to Solve Transportation Problems; Case Studies.

Integer Programming and Dynamic Programming and Network Techniques: Integer programming - Cutting plane algorithm, Branch and bound technique, Zero-one implicit enumeration – Dynamic Programming – Formulation, Various applications using Dynamic Programming. Network Techniques – Shortest Path Model – Minimum Spanning Tree Problem – Maximal flow problem.

Problem solving tools and improvement strategies: Problem solving process, quality control tools, new management tools, quality function deployment, Deming wheel, zero defect concept, benchmarking, six- sigma.

12. Learning Objectives

- a) To introduce students with advanced inventory management and aggregate planning
- b) To familiarize students with various production planning techniques
- c) To provide knowledge on different optimization models and their applications in leather products manufacturing

13. Course Learning Outcomes (CLOs) and Mapping of CLOs with Program Learning Outcomes (PLOs)

- a) **CLOs:** Upon completion of this course, students will be able to:

	Course Learning Outcomes (CLOs)	Learning Level
CLO1	Explore knowledge on various optimization techniques used in leather products manufacturing.	C1, C2, A1
CLO2	Explain the methods and ways to manage different optimization tools.	C2, A1, A2
CLO3	Implement the advanced tools and techniques of operations research to manage the production in the leather products industry supply chain	C3, A2
CLO4	Manage new project related to new leather products or business	C4
CLO5	Investigate the applicability of a specific tool or technique to a specific case.	C5

b) Mapping of CLO with PLO

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8
CLO1	3		-		-	-	-	
CLO2	3			-	-	1		
CLO3	3			-	1	2	2	
CLO4	3		2	1		2	3	

CLO5	3		2		2	2	1	
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Rank: 3-High match, 2-Medium match, 1-Low match

c) Mapping of Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO-1	Lecture, multimedia presentation, literature review and problem-based exercises	Group Presentation, Assignment, oral presentation, In-course Exam and Final Exam
CLO-2	Lecture, group discussion and problem-based exercises, literature review.	Group Presentation, In-course Exam and Final Exam
CLO-3	Lecture, multimedia presentation and problem-based learning: Identifying the problem to be solved	Assignment, Group Presentation, In-course Exam and Final Exam
CLO-4	Lecture, multimedia presentation, group discussion, demonstration, and problem-based exercises	Group Presentation, Case study, Assignment, In-course Exam and Final Exam
CLO-5	Lecture, multimedia presentation, group discussion, demonstration, and problem-based exercises	Group Presentation, Case study, Assignment, In-course Exam and Final Exam

Part B

14. Course plan specifying content, CLOs, co-curricular activities (if any), teaching learning and assessment strategy mapped with CLOs

Time	Topic	Teaching-Learning Strategy	Assessment Strategy	Corresponding CLOs
Week-01	Advanced Inventory Management: Demand and control system characteristics, inventory concept, inventory cost, inventory modeling, optimization and inventory control	Lecture, Group Discussion, Multimedia Presentation, literature review	In-course Exam Final Exam	CLO1, CLO2, CLO3
Week -02	Dynamic EOQ Models, probabilistic models and safety stock, probabilistic demand, probabilistic example, Single-Period	Lecture, Group Discussion, Multimedia Presentation, literature review	In-course Exam Final Exam	CLO1, CLO2, CLO3

	Models, Multiperiod Models			
Week -03	Aggregate Planning and Master Scheduling: Basic Strategies for Meeting Uneven Demand, Techniques for Aggregate Planning, Disaggregating the Aggregate Plan,	Lecture, Group Discussion, Multimedia Presentation	Assignment, In-course Exam, Final Exam	CLO1 CLO2
Week -04	Master Scheduling, The Master Scheduling Process, Methods for Aggregate Planning: Graphical Methods, Mathematical Approaches, Comparison of Aggregate Planning Methods	Lecture, Group Discussion, Multimedia Presentation, Problem solving	In-course Exam Final Exam	CLO1, CLO2
Week -05	MRP, MRPII and ERP: Basic ideas of inventory MRP, benefits of MRP, inputs to MRP, bill of material (BOM), BOM examples for leather products manufacture, Master Production Schedule (MPS)	Lecture, Group Discussion, Multimedia Presentation	Case study In-course Exam Final Exam	CLO1, CLO2, CLO3
Week -06	MPS examples for leather products manufacture, time-phased product structure, MRP structure, determining gross requirements, gross requirements plan for leather products manufacture, gross requirements schedule	Lecture, Group Discussion, Multimedia Presentation	In-course Exam Final Exam	CLO2 CLO3 CLO5
Week -07	MRP management, Lot-sizing techniques, Lot-for-Lot examples, EOQ lot size examples, POQ lot size examples, material requirements planning II, distribution resource planning (DRP), enterprise resource	Lecture, Group Discussion, Multimedia Presentation	Case Study, In-course Exam Final Exam	CLO2

	planning (ERP), SAP's ERP modules			
Week -08	Decision Modeling: The Decision Process in Operations; Fundamentals of Decision Making; Types of Decision-Making Environments; Decision Making under Uncertainty	Lecture, Group Discussion, Multimedia Presentation	In-course Exam Final Exam	CLO3, CLO4, CLO5
Week -09	Decision Making under Risk, Decision Making under Certainty, Expected Value of Perfect Information (EVPI); Decision Trees; A More Complex Decision Tree, Using Decision Trees in Ethical Decision Making.	Lecture, Group Discussion, Multimedia Presentation	Group Presentation, In-course Exam, Final Exam	CLO3, CLO4, CLO5
Week -10	Linear Programming Models: Why Use Linear Programming? Requirements of a Linear Programming Problem, Formulating Linear Programming Problems, Graphical Solution to a Linear Programming Problem, Sensitivity Analysis, Solving Minimization Problems, Linear Programming Applications, The Simplex Method of LP.	Lecture, Group Discussion, Multimedia Presentation	In-course Exam Final Exam	CLO1 CLO3
Week -11	Transportations Modeling: Transportation Modeling; Developing an Initial Solution: The Northwest-Corner Rule, The Intuitive Lowest-Cost Method, The Stepping-Stone Method; Special Issues in Modeling: Demand Not Equal to Supply, Degeneracy; Using Software to Solve Transportation	Lecture, Group Discussion, Multimedia Presentation, problem solving	In-course Exam Final Exam	CLO1 CLO3 CLO5

	Problems; Case Studies.			
Week -12	Integer Programming and Dynamic Programming and Network Techniques: Integer programming - Cutting plane algorithm, Branch and bound technique, Zero-one implicit enumeration – Dynamic Programming – Formulation	Lecture, Group Discussion, Multimedia Presentation	In-course Exam Final Exam	CLO1, CLO3
Week -13	Various applications using Dynamic Programming. Network Techniques – Shortest Path Model – Minimum Spanning Tree Problem – Maximal flow problem.	Lecture, Group Discussion, Multimedia Presentation, problem solving	Oral Presentation, In-course Exam, Final Exam	CLO3
Week -14	Problem solving tools and improvement strategies: Problem solving process, quality control tools, new management tools, quality function deployment, Deming wheel, zero defect concept, benchmarking, six- sigma.	Lecture, Group Discussion, Multimedia Presentation, literature review	In-course Exam Final Exam	CLO1, CLO3, CLO4, CLO5

Part C

15. Assessment and Evaluation

i) Assessment Strategy

Class attendance and participation	10%
In-course Exam/Class Test	30%
Term Final Examination (3 hours duration)	60%
Total	100%

ii) Marks distribution

- a) Continuous Assessment: 40%

- b) Summative: 60%
- c) Make-up Procedures: Two in-course exams will be taken and average marks will be counted. Feedback on continuous assessment is given to the students immediately after the test. Based on the students' feedback additional class/assignment may be taken by the course teacher

Part D

16. Learning Materials

I. Recommended Readings

- Jay Heizer, Barry Render, Chuck Munson- Operations Management: Sustainability and Supply Chain Management (13th Edition)
- Jay Heizer, Barry Render- Operations Management (11th Edition)
- Hamdy A. Taha, Operations Research – An Introduction, Prentice Hall of India, 1997
- Gideon Halevi- Handbook of Production Management Methods
- R. Panneerselvam, “Operations Research”, Prentice Hall of India Private Limited, New Delhi 1 – 2005

II. Supplementary Readings

- Larry P. Ritzman, Lee J. Krajewski, and Manoj K. Malhotra- Operations Management: Processes and Supply Chains
- Nicholas J. Aquilano and Richard B. Chase- Production and Operations Management

III. Others: Hand notes/Lecture materials will provide by the course teacher.

Course Outline of 0723-LPE-6105

Part A

- 1. Course Code:** 0723-LPE-6105
- 2. Course Title:** Research Methodology
- 3. Course Type:** Core Course
- 4. Year / Semester:** Semester: I
- 5. Academic Session:** 2023-24
- 6. Course Teacher:** Dr. Mohammed Mizanur Rahman, Professor and Director, ILET, DU
- 7. Prerequisite(s):** N/A
- 8. Credits:** 3.0
- 9. Contact Hours:** 42
- 10. Total Marks:** 100
- 11. Rational of the Course:**

This course provides an opportunity for students to establish or advance their understanding of research through critical exploration of research language, ethics, and approaches. Students will be able to examine and be practically exposed to the main components of a research framework i.e., problem definition, research design, data collection, ethical issues in research, report writing, and presentation.

Course Content:

Introduction to research: Definitions, characteristics, types, differences and role of research, research and investigation, research methods versus research methodology, criteria of good research, paradigms and ethics in research, proposition, axiom, postulate, theorem and model of research, variables and types, properties of relationships between variables, inductive and deductive method.

Literature review and research problem: Definition, objectives, advantages, principles and procedures of literature review, problem definition, finding a researchable problem, selecting the problem, importance of defining the problem, important qualities of a research problem, techniques involved in defining a problem, evaluating a proposed design.

Research questions and objectives: Research objective and research question, practical examples of research objectives and research question, formulation of research questions, criteria of research objectives, evaluation of research questions, classification and importance of research objectives.

Research hypothesis, design, and proposal: Source, functions, and characteristics of a good research hypothesis, formulation and possible difficulties of research hypothesis, research hypothesis versus research objectives; definition, function, classification of research design, feature of a good research design, qualitative research, observation studies, surveys, experimentation, steps in a research design; meaning of research proposal, contents of research proposal, steps in the development of a research proposal, criteria for evaluating research proposal.

Qualitative research tools, measurement and scaling technique: Definition, characteristics, uses, and general steps of qualitative research, qualitative research approaches, steps in grounded theory, nature of measurement, measurement scales, types of measurement scales, Likert scale.

Questionnaire design: Questionnaire and questionnaire design, consideration and types of questions, questionnaire designing process, necessary properties of questionnaire, characteristics of a good questionnaire, precaution required in the use of questionnaire, guidelines for constructing questions and questions sequence.

Sampling and sampling design: Concepts and importance of sampling, planning and designing a survey, classification of sampling techniques, probability sampling design, non-probability sampling design, determination of sample size.

Data collection and analysis: Data, data versus information, types and sources of data collection, secondary data collection methods, primary data collection methods, qualitative and quantitative methods of data collection, data validation, editing and coding, data entry and exploring, displaying and examining data, Univariate analysis, Bivariate analysis, Multivariate analysis, SWOT analysis, and Hypothesis testing.

Presenting insights and findings: Importance of the report and presentation, report preparation and presentations process, precautions in interpretation, research report, contents

and precautions in writing research report, presentation of statistics, oral presentation, writing thesis/dissertation, writing journal articles and conference papers, bibliography and reference writing styles, copy right, plagiarism.

12. Course Objectives:

- a) To familiarize the students with the key terms, concepts, and practices in the field of research.
- b) To prepare research problems and/or hypotheses in a clear and concise format.
- c) To demonstrate a systematic understanding of the range of advanced research techniques, be able to critically evaluate these techniques and apply them appropriately.
- d) To evaluate and critically analyze the components of scholarly writing and published research.

13. Course Learning Outcomes (CLOs) and Mapping of CLOs with Program Learning Outcomes (PLOs)

- a) **CLOs:** Upon completion of the course, the students will be able to:

	Course Learning Outcomes (CLOs)	Learning Level
CLO1	Outline the basic framework of research process, and identify various sources of information for literature review and data collection.	C1, A1
CLO2	Explain the ethical dimensions of conducting basic and applied research.	C2, A2
CLO3	Design questionnaire, explain the procedures and techniques, and analyze data with different statistical tools and techniques using statistical computing for making better decisions.	C2, C3, A3
CLO4	Acquaint with the process of conducting research to identify real-life problems recurrently encounter and to suggest suitable and pragmatic solutions to those problems.	C4, A4
CLO5	Compare the advanced research techniques and critically analyze the components of scholarly writing and published research.	C5, A4

b) Mapping of CLO with PLO

(CLOs)	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8
CLO1	3		3			2		
CLO2	3		3			2		
CLO3	3		3			3		2
CLO4	3	3	3	3		3	2	
CLO5	3	2	3	3		3	3	

Rank: 3-High match, 2-Medium match, 1-Low match

c) Mapping of Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy

CLOs	Teaching-Learning Strategy	Assessment Strategy
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CLO-1	Lecture, Whiteboard illustration, presentation, Interactive Discussion	Multimedia	Assignment, Case study, In-course Exam and Final Exam
CLO-2	Lecture, Whiteboard illustration, presentation, Interactive Discussion	Multimedia	Assignment, Case study, In-course Exam and Final Exam
CLO-3	Lecture, Whiteboard illustration, presentation, Interactive Discussion	Multimedia	Assignment, Case study, In-course Exam and Final Exam
CLO-4	Lecture Whiteboard illustration, presentation, Interactive Discussion	Multimedia	Presentation, Assignment, In-course Exam and Final Exam
CLO-5	Lecture, Whiteboard illustration, presentation, Interactive Discussion	Multimedia	Presentation, Assignment, In-course Exam and Final Exam

Part B

14. Course plan specifying content, CLOs, co-curricular activities (if any), teaching learning and assessment strategy mapped with CLOs.

Time Period	Topic	Teaching-Learning Strategy	Assessment Strategy	Corresponding CLOs
Week-01	Introduction to research: Definitions, characteristics, types, differences and role of research, research and investigation, research methods versus research methodology, criteria of good research, paradigms and ethics in research.	Lecture, Whiteboard illustration	In-Course Exam, Final Exam	CLO1, CLO2
Week - 02	Proposition, axiom, postulate, theorem and model of research, variables and types, properties of relationships between variables, inductive and deductive method.	Lecture, Multimedia presentation	In-Course Exam, Final Exam	CLO1, CLO2
Week - 03	Literature review and research problem: Definition, objectives, advantages, principles and procedures of literature review, problem definition, finding a researchable problem, selecting the problem, importance of defining the problem, important qualities of a research problem, techniques involved in defining a	Lecture, Multimedia presentation, Case study	In-Course Exam, Assignment, Final Exam	CLO1, CLO2, CLO4

	problem, evaluating a proposed design.			
Week - 04	Research questions and objectives: Research objective and research question, practical examples of research objectives and research question, formulation of research questions, criteria of research objectives, evaluation of research questions, classification and importance of research objectives.	Lecture, Multimedia presentation, Whiteboard illustration	In-Course Exam, Final Exam	CLO1, CLO2, CLO3
Week - 05	Research hypothesis, design, and proposal: Source, functions, and characteristics of a good research hypothesis, formulation and possible difficulties of research hypothesis, research hypothesis versus research objectives; definition, function, classification of research design, feature of a good research design.	Lecture, Multimedia presentation, Whiteboard illustration	In-Course Exam, Case study, Final Exam	CLO1, CLO2, CLO3
Week - 06	Qualitative research, observation studies, surveys, experimentation, steps in a research design; meaning of research proposal, contents of research proposal, steps in the development of a research proposal, criteria for evaluating research proposal.	Lecture, Multimedia presentation	In-Course Exam, Final Exam	CLO1, CLO2, CLO3
Week - 07	Qualitative research tools, measurement and scaling technique: Definition, characteristics, uses, and general steps of qualitative research, qualitative research approaches, steps in grounded theory, nature of measurement, measurement scales, types of measurement scales, Likert scale.	Lecture, Video presentation, Whiteboard illustration	In-Course Exam, Final Exam	CLO2, CLO3, CLO5

Week - 08	Questionnaire design: Questionnaire and questionnaire design, consideration and types of questions, questionnaire designing process, necessary properties of questionnaire, characteristics of a good questionnaire.	Lecture, Interactive discussion, Whiteboard illustration	In-Course Exam, Final Exam	CLO2, CLO3
Week - 09	Precaution required in the use of questionnaire, guidelines for constructing questions, and questions sequence. Sampling and sampling design: Concepts and importance of sampling, planning and designing a survey, classification of sampling techniques.	Lecture, Multimedia presentation	In-Course Exam, Final Exam	CLO2, CLO3, CLO4
Week - 10	Probability sampling design, non-probability sampling design, and determination of sample size. Data collection and analysis: Data, data versus information, types and sources of data collection, secondary data collection methods, primary data collection methods.	Lecture, Multimedia presentation	In-Course Exam, Final Exam	CLO2, CLO3
Week - 11	Qualitative and quantitative methods of data collection, data validation, editing and coding, data entry and exploring, displaying and examining data, Univariate analysis, Bivariate analysis, Multivariate analysis, SWOT analysis, and Hypothesis testing.	Lecture, Whiteboard illustration, Multimedia presentation	In-Course Exam Presentation, Final Exam	CLO3, CLO4, CLO5
Week - 12	Presenting insights and findings: Importance of the report and presentation, report preparation and presentations process, precautions in interpretation, research report,	Lecture, Multimedia presentation	In-Course Exam, Final Exam	CLO3, CLO4, CLO5

	contents and precautions in writing research report.			
Week - 13	presentation of statistics, oral presentation, writing thesis/dissertation, writing journal articles and conference papers, bibliography and reference writing styles, copyright, plagiarism.	Lecture, Case study	Assignment, Final Exam	CLO3, CLO4, CLO5
Week-14	Review.	Interactive discussion	Final Exam	CLO1—CLO5

Part C

15. Assessment and Evaluation

i) Assessment Strategy

Strategy	Percentage of Total Marks
Class participation and attendance	10
In-Course Examinations	30
Semester final examinations (3 hours duration)	60
Total	100

ii) Marks distribution:

- a) Continuous Assessment: 40%
- b) Summative: 60%
- c) Make-up Procedures: Two in-course exam will be taken and average marks will be counted. Feedback on in-course assessment is given to the students immediately after the test. If students is very weak in particular topics of this course, additional instruction will be given to help them catch up.

Part D

16. Learning Materials

i) Recommended Readings

- M. A. Salam Akanda (2019). Research Methodology-A Complete Direction for Learners. Latest Ed., Akanda& Sons, Dhaka.
- C. R. Kothari (1996). Research Methodology- Methods & Techniques. Wishaw Prokashan, New Delhi, Wiley Eastern Limited.
- An Introduction to Research Methods ; Author: M. Nurul Islam ; Year: 2011 ; Edition: 2nd ; Publisher: Mullick& Brothers

ii) Supplementary Readings

- Ranjit Kumar (2005). *Research Methodology- A Step-by-Step Guide for Beginners*, 3rd Ed., Singapore, Pearson Education.
- iii) **Others:** Handout/lecture material provided by the course teacher.

Course Outline of 0723-LPE-6107

Part A

1. Course Code: 0723-LPE-6107

2. Course Title: Industrial Hazards and Waste Management

3. Course Type: Core Course

4. Year / Semester: Semester: I

5. Academic Session: 2022-23

6. Course Teachers: Dr. Md. Abdul Mottalib, Professor, ILET, DU.

Sunzida Haque Rimu, Lecturer, ILET, DU.

7. Prerequisite(s): N/A

8. Credits: 3.0

9. Contact Hours: 42

10. Total Marks: 100

11. Rationale of the Course: This course is designed to provide in-depth knowledge of the exploitation of valuable products from tannery wastes by utilizing modern technology. This course will facilitate students with deeper understanding of different types and characteristics of industrial hazardous wastes and a comprehensive overview of hazardous waste management's approaches.

Course Contents

Industrial Hazards: Hazard, Types of industrial hazards, Identification of hazardous wastes, Hazardous waste management, Treatment technology, Disposal of radioactive materials, Ground water contamination and remediation. Route of industrial hazard entry into human body-Inhalation, Absorption, Swallowed, Injection, Food chain - Contaminated soil, Vegetables, Crops, Fish and Chicken, Adverse impact of hazard, Occupational cancer.

Solid Waste Generation in the Leather industry and its Utilization:

Generation: Skin collagen waste, Fleshing waste, Wet blue, Trimming, Buffing, Chrome shaving, Chrome split, trimming from crust and finished leather. Utilization: Fleshing-Modified fleshing hydrolysate, Reactive protein (RP), feed ingredients.

Chrome shaving: Treatment with enzyme, MgO, Carbonates and other alkalies, application of hydrolysate.

Waste generation in Footwear and Leather Products Industry: Materials being processed: Leather, Natural rubber/poly-isoprene, Reaction Injection Moulded (RIM) polyurethane (PU), Polyvinyl Chloride (PVC) and blends, Ethylene Vinyl Acetate (EVA) and blends, Styrene Butadiene Rubber (SBR), Thermoplastic Polyurethane (TPU), Thermoplastic Rubber (TR), Leather, textile, cotton, polyesters, nylon, adhesive, solvent, oil.

Solid Waste Management:

Solid waste—sources and engineering classification, characterization, generation and quantification. Transport - collection systems, collection equipment, transfer stations, collection route optimization.

Treatment methods - various methods of refuse, recovery, recycle, composting –aerobic and anaerobic, incineration, pyrolysis and energy recovery.

Disposal methods – Impacts of open dumping, site selection, sanitary land filling – design criteria and design examples, leachate and gas collection systems, and leachate treatment.

Hazardous Waste Management- Introduction, Sources, Classification, Physico-chemical, Chemical and biological Treatment of hazardous waste, regulations.

Thermal treatment - Incineration and pyrolysis.

Soil contamination and site remediation – Bioremediation processes, monitoring of disposal sites.

Removal of Refractory Organic Compounds: Theories on Advanced Oxidation Process viz., Photocatalytic treatment, Membrane separation, Homogenous catalysis system using hydrogen peroxide, ozone, etc. Heterocatalytic systems using metal oxides, activated carbon – Removal of inorganic compounds through electro dialysis, reverse osmosis, multiple effect evaporator, ion-exchange.

12. Course Objectives

- a) To provide the advance knowledge about the environmental problems, industrial hazards, and its methods of mitigation.
- b) To estimate solid waste generation from tanning industry, and leather goods industry and their utilization using modern techniques.
- c) To improve a comprehensive skill on tannery solid waste, biomedical and other hazardous wastes and integrated solid waste management system.

- d) To familiarize students with modern biological techniques available for the wastewater treatment.

13. Course Learning Outcomes (CLOs) and Mapping of CLOs with Program Learning Outcomes (PLOs)

a) **CLOs:** Upon completion of this course, students will be able to:

	Course Learning Outcomes (CLOs)	Learning Level
CLO1	Narrate industrial hazards and their adverse impact on the environment and humans.	C1, A1
CLO2	Analyze tannery solid waste utilization into the valuable byproducts as part of circular economy and clean technology.	C3, A3
CLO3	Apply knowledge on the estimation of solid waste generated from leather and allied industries.	C4
CLO4	Justify modern techniques of wastewater treatment with traditional treatment processes.	C5, A4

b) **Mapping of CLO with PLO**

(CLOs)	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8
CLO1	3	2				2	1	
CLO2	2	3	3			2	3	
CLO3	3	3	3			2	2	
CLO4	3	3		3	3	2	3	

c) **Mapping of Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy**

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO-1	Lecture, Multimedia presentation, demonstration and problem-based exercises	In-course Exam; Final Exam
CLO-2	Lecture, audiovisual presentation, group discussion and problem-based exercises, literature review	Presentation, In-course Exam; Final Exam
CLO-3	Lecture, problem-based learning (PBL): Identifying the problem to be solved	Assignment, Group Presentation, In-course Exam, and Final Exam
CLO-4	Lecture, multimedia presentation, group discussion, literature review, demonstration, and problem-based exercises	Assignment, In-course Exam, and Final Exam

Part B

14. Course plan specifying content, CLOs, co-curricular activities (if any), teaching learning and assessment strategy mapped with CLOs

Time Period	Topic	Teaching-Learning Strategy	Assessment Strategy	Corresponding CLOs
Week-01	Industrial Hazards: Hazard, Types of industrial hazards, Identification of hazardous wastes, Hazardous waste management, Treatment technology, Absorption,	Lecture, Multimedia presentation, Demonstration	In-course Exam, Final Exam	CLO1
Week -02	Disposal of radioactive materials, Ground water contamination and remediation. Route of industrial hazard entry into human body-Inhalation.	Interactive class lecture, Multimedia presentation, Demonstration	In-course Exam, Final Exam	CLO1, CLO2
Week -03	Swallowed, injection, food chain - contaminated soil, vegetables, crops, fish and chicken, adverse impact of hazard, occupational cancer.	Interactive class lecture, Multimedia presentation, Whiteboard illustration	In-course Exam, Final Exam, Assignments	CLO1, CLO2
Week -04	Solid Waste Generation: Skin collagen waste, fleshing waste, wet blue, trimming, buffing, chrome shaving, chrome split, trimming from crust and finished leather.	Audiovisual Lecture, Multimedia presentation, Demonstration	In-course Exam, Final Exam	CLO1, CLO2
Week -05	Utilization: Fleshing- Modified fleshing hydrolysate, reactive protein (RP), feed ingredients.	Audiovisual Lecture, Multimedia presentation, Demonstration	In-course Exam, Final Exam	CLO1, CLO2
Week -06	Chrome shaving: Treatment with enzyme, MgO, Carbonates and other alkalis, applications of protein hydrolysate.	Interactive class lecture, Visual presentation, Whiteboard illustration	Final Exam	CLO2, CLO3

Week - 07	Waste generation in Footwear and Leather Products Industry: Materials being processed: Leather, Natural rubber/poly-isoprene, Reaction Injection Moulded (RIM) polyurethane (PU), Polyvinyl Chloride (PVC) and blends.	Lecture, Multimedia presentation, Group-discussion	In-course Exam, Final Exam	CLO2, CLO3
Week - 08	Ethylene Vinyl Acetate (EVA) and blends, Styrene Butadiene Rubber (SBR), Thermoplastic Polyurethane (TPU), Thermoplastic Rubber (TR), Leather, textile, cotton, polyesters, nylon, adhesive, solvent, oil.	Lecture, Multimedia presentation, Problem-based discussion	In-course Exam, Final Exam	CLO2, CLO3
Week - 09	Solid Waste Management: Solid waste–sources and engineering classification, characterization, generation and quantification. Transport - collection systems, collection equipment, transfer stations, collection route optimization. Treatment methods - various methods of refuse, recovery, recycle.	Audiovisual Lecture, Multimedia presentation, Demonstration	In-course Exam, Final Exam	CLO2, CLO4
Week - 10	Composting –aerobic and anaerobic, incineration, pyrolysis and energy recovery. Disposal methods – Impacts of open dumping, site selection, sanitary land filling – design criteria and design examples.	Interactive class lecture, Visual presentation, Whiteboard illustration	In-course Exam, Final Exam, Assignments	CLO2, CLO3
Week - 11	Leachate and gas collection systems, and leachate treatment, hazardous waste management- introduction, sources, classification, physico-chemical, chemical and biological treatment of hazardous waste, regulations.	Interactive class lecture, Problem solving	In-course Exam, Final Exam	CLO3, CLO4
Week - 12	Thermal treatment - Incineration and pyrolysis, soil contamination and site remediation – bioremediation processes, monitoring of disposal sites.	Interactive Class lecture, Visual presentation, Whiteboard illustration	In-course Exam, Final Exam	CLO2

Week - 13	Removal of Refractory Organic Compounds: Theories on advanced oxidation process viz., photocatalytic treatment, membrane separation, homogenous catalysis system using hydrogen peroxide, ozone.	Interactive lecture, Visual presentation, Whiteboard illustration	Final Exam	CLO3
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Week - 14	Heterocatalytic systems using metal oxides, activated carbon – removal of inorganic compounds through electro dialysis, reverse osmosis, multiple effect evaporator, ion-exchange.	Interactive lecture, Visual presentation, Whiteboard illustration	Final Exam	CLO3, CLO4
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Part C

15. Assessment and Evaluation

i) Assessment Strategy

Class attendance and participation	10%
In-course Examinations	30%
Semester Final Examination (3 hours duration)	60%
Total	100%

ii) Marks distribution:

- Continuous Assessment: 40%
- Summative: 60%
- Make-up Procedures:

Two in-course exams will be taken and average marks will be counted. Feedback on continuous assessment is given to the students immediately after the test. Based on the students' feedback additional class/assignment may be taken by the course teacher

Part D

16. Learning Materials

i) Recommended Readings

- Arceivala S. J., "Waste water treatment and disposal" Marcel Dekkar Inc., New York, 1981.
- Bessellievie, B. E. and Schwartz, M., "The Treatment of Industrial wastes", 2nd edn., McGraw Hill.

- Karia G.L., and Christian R.A., (2001), “Wastewater Treatment Concepts and Design Approach”, Prentice Hall of India Pvt. Ltd., New Delhi.

ii) Supplementary Readings

- Assessment of Tannery Solid Waste Management, a case study Sheba Leather Industry, UNIDO, 2018.
- Benefield R.D., and Randal C.W., (1980), “Biological Process Design for Wastewater Treatment”, Prentice Hall, Englewood Cliffs, New Jersey.

iii) Others: Hand notes/Lecture materials will be provided by the course teacher.

Course Outline for 0723-LPE-6109

Part A

1. Course Code: 0723-LPE-6109

2. Course Title: Ergonomics and Industrial Safety

3. Course Type: Core Course

4. Year / Semester: Semester: I

5. Academic Session: 2022-23

6. Course Teachers: Md. AbdusShabur, Lecturer, ILET, DU.

7. Prerequisite(s): N/A

8. Credits: 3.0

9. Contact Hours: 42

10. Total Marks: 100

11. Rationale of the Course: This course intended to instruct knowledge by different approaches to improve better workspace design and efficient work environment designs and management. After completion of this course, the students will be able to design better factory environment and thereby will be able to ensure effective safety management practice in leather industry.

Course Contents:

Ergonomics

Introduction: What is Ergonomics; History of Development; Scope & Application of Ergonomics; Importance of Ergonomics; Anthropometry.

Muscle Physiology and Manual Material Handling: Muscle and Work Physiology; Measure of Physiological Strain; Physical Workload; Manual Materials Handling.

Hand Tools and Devices: Introduction to Hand Tools; Structure and Motion of Hand; Principles of Designing Hand Tools and Devices; Vibration & HAVS; Gripping Principles.

Workspace Design: Designing Workspace Envelopes for Seated and Standing Personnel; Designing Horizontal Work Surfaces; Designing Seated and Standing Work Surfaces.

Work Environment Design: Lighting in Work Environment; Vision and Structure of Eye; Visual Defects; Guidelines for Colour Selection; Measurement of Light Photometry; Lighting and Illumination; Reflectance; Lighting Problem; Improving Visibility; Characteristics and Efficiency of Light Sources; Lighting Design Considerations; Glare; Uniformity of Lighting; Complaints, Causes and Control Measures of Visual Discomforts; Sound Propagation; Structure of Human Ear; Process of Hearing; Health Effects of Noise Pollution; Control Measures for Noise Pollution; Thermal Balance; Heat Illness; Heat Acclimatization; Heat Stress Measurement; Cold Injury; Cold Climate Protection.

Safety Management

Introduction to Safety Management: Objectives; Importance of Safety Management; Occupational Health and Safety (OHS); Hazard and Risk.

Introduction to Workplace Safety: Aims; Considerations to Manage Workplace Safety Effectively; Nature, Functions and Benefits of Workplace Safety; Challenges for Practicing Safety; PDCA Cycle in OHS; Idea Generation.

Creating an Effective Workplace Safety Program: Core Regulatory Requirement; Program Review/Audit; Establishing Goals and Objectives; Management Commitment and Responsibility; Work-Site Analysis; Hazard Recognition and Resolution; Job Hazard Analysis (JHA)/Job Safety Analysis (JSA); Hazard Resolution; Incident Investigation; Best Practices.

Workers' Compensation and Record Keeping: Early and Modern Workers' Compensation Laws; Premium Calculation; Background Record Keeping; OSHA 300, 300A and 301 Forms; Recordable Occupational Injuries and Illness; First Aid Cases; Fatalities; Privacy Concern Cases; Posting Annual Summary Requirements.

Introduction to Industrial Hygiene: Definition; Toxicology; Industrial Hygiene Practice.

Fire Prevention and Protection: Means of Egress Regulations; Fire Tetrahedron; Categories of Fire; Categories of Fire Extinguisher.

System Safety: Importance of System Safety; System Life Cycle; Management of System Safety; Elements of A System Safety Program Plan (SPSS); Preliminary Hazard Analysis (PHA); Subsystem Hazard Analysis (SSHA); System Hazard Analysis (SHA); Technique of Operations Review (TOR); Failure Mode and Effect Analysis (FMEA).

Improving Safety Performance with Behavioural Safety: Introduction; Pilot Error Syndrome; Concepts of Risk; Incidents and Accidents; Loss Exposures; Control Techniques

for Loss Exposures; Accident Causation Theories; Single Factor Theory; Heinrich’s Domino Theory; Multiple Factors Theory; Human Factors Theory; Energy Release Theory; Further Incident Investigation.

12.Learning Objectives:

- a) To identify the components needed to provide a safe and healthful work environment through case studies and review of injury statistics provided in the course.
- b) To identify potential workplace safety and health hazards and determine how to mitigate the hazards through engineering controls, administrative controls and personal protective equipment.
- c) To conduct basic safety inspections using strategies that they have developed through hazard identification and job hazard analysis.
- d) To identify the requirements of training programs in the workplace under the existing OSHA and State-OSHA requirements.
- e) To understand essential elements of an occupational safety and health program and the components of international standard organizations in safety and health.

13. Course Learning Outcomes (CLOs) and Mapping of CLOs with Program Learning Outcomes (PLOs)

c) **CLOs:** Upon completion of this course, students will be able to:

	Course Learning Outcomes (CLOs)	Learning Level
CLO1	Recall knowledge of fundamentals of ergonomics and safety management related to leather products engineering.	C1, A1
CLO2	Explain various methods and tools to ensure proper ergonomics facilities and safety managements.	C2, C3
CLO3	Apply various modern techniques to design an ergonomic friendly work environment as well as a safer workplace with protection from possible accidents and hazards.	C4
CLO4	Investigate and solve any problem/issue related to ergonomics and safety management in real world leather manufacturing.	C5, A4

d) Mapping of CLO with PLO

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8
CLO1	3							
CLO2	3	3			2			
CLO3	3	3	3		2	3	2	

CLO4	3	3	2	3	2	2	2	2
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Rank: 3-High match, 2-Medium match, 1-Low match

c) Mapping of Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO-1	Lecture, multimedia presentation, literature review and problem-based exercises	Group Presentation, Assignment, oral presentation, In-course Exam and Final Exam
CLO-2	Lecture, group discussion and problem-based exercises, literature review.	Group Presentation, In-course Exam and Final Exam
CLO-3	Lecture, multimedia presentation and problem-based learning: Identifying the problem to be solved	Assignment, Group Presentation, In-course Exam and Final Exam
CLO-4	Lecture, multimedia presentation, group discussion, and problem-based exercises	Group Presentation, Case study, Assignment, In-course Exam and Final Exam

Part B

14. Course plan specifying content, CLOs, co-curricular activities (if any), teaching learning and assessment strategy mapped with CLOs

Time Period	Topic	Teaching-Learning Strategy	Assessment Strategy	Corresponding CLOs
Week-01	Introduction: What is Ergonomics; History of Development; Scope & Application of Ergonomics; Importance of Ergonomics; Anthropometry, Muscle Physiology and Manual Material Handling; Muscle and Work Physiology; Measure of Physiological Strain; Physical Workload; Manual Materials Handling.	Lecture, Group Discussion, Multimedia Presentation, Literature review	In-course Exam, Final Exam	CLO1, CLO2,

Week - 02	Hand Tools and Devices: Introduction to Hand Tools; Structure and Motion of Hand; Principles of Designing Hand Tools and Devices; Vibration & HAVS; Gripping Principles.	Lecture, Group Discussion, Multimedia Presentation, Literature review	In-course Exam, Final Exam	CLO1, CLO2, CLO3
Week - 03	Workspace Design: Designing Workspace Envelopes for Seated and Standing Personnel; Designing Horizontal Work Surfaces; Designing Seated and Standing Work Surfaces.	Lecture, Group Discussion, Multimedia Presentation	Assignment, In-course Exam, Final Exam	CLO2, CLO3, CLO4
Week - 04	Work Environment Design: Lighting in Work Environment; Vision and Structure of Eye; Visual Defects; Guidelines for Color Selection; Measurement of Light Photometry; Lighting and Illumination; Reflectance; Lighting Problem; Improving Visibility; Characteristics and Efficiency of Light Sources; Lighting Design Considerations; Glare	Lecture, Group Discussion, Multimedia Presentation, Problem solving	In-course Exam, Final Exam	CLO2, CLO3, CLO4
Week - 05	Uniformity of Lighting; Complaints, Causes and Control Measures of Visual Discomforts; Sound Propagation; Structure of Human Ear; Process of Hearing; Health Effects of Noise Pollution; Control Measures for Noise Pollution; Thermal Balance; Heat Illness; Heat Acclimatization; Heat Stress Measurement; Cold Injury; Cold Climate Protection.	Lecture, Group Discussion, Multimedia Presentation	Case study, In-course Exam, Final Exam	CLO2, CLO3, CLO4

Week - 06	Introduction to Safety Management: Objectives; Importance of Safety Management; Occupational Health and Safety (OHS); Hazard and Risk.	Group Discussion, Multimedia Presentation, Lecture	In-course Exam, Final Exam	CLO2, CLO3
Week - 07	Introduction to Workplace Safety: Aims; Considerations to Manage Workplace Safety Effectively; Nature, Functions and Benefits of Workplace Safety; Challenges for Practicing Safety; PDCA Cycle in OHS; Idea Generation.	Lecture, Group Discussion, Multimedia Presentation	Case Study, In-course Exam, Final Exam	CLO1, CLO2
Week - 08	Creating an Effective Workplace Safety Program: Core Regulatory Requirement; Program Review/Audit; Establishing Goals and Objectives; Management Commitment and Responsibility;	Lecture, Group Discussion, Multimedia Presentation	In-course Exam, Final Exam	CLO2, CLO3
Week - 09	Work-Site Analysis; Hazard Recognition and Resolution; Job Hazard Analysis (JHA)/Job Safety Analysis (JSA); Hazard Resolution; Incident Investigation; Best Practices.	Lecture, Group Discussion, Multimedia Presentation	Group Presentation, In-course Exam, Final Exam	CLO3, CLO4,
Week - 10	Workers' Compensation and Record Keeping: Early and Modern Workers' Compensation Laws; Premium Calculation; Background Record Keeping; OSHA 300, 300A and 301 Forms; Recordable Occupational Injuries and Illness;	Lecture, Group Discussion, Multimedia Presentation	In-course Exam, Final Exam	CLO2, CLO3
Week - 11	First Aid Cases; Fatalities; Privacy Concern Cases; Posting	Lecture, Group	In-course Exam	CLO1, CLO3

	Annual Summary Requirements. Introduction to Industrial Hygiene: Definition; Toxicology; Industrial Hygiene Practice.	Discussion, Multimedia Presentation, Problem solving	Final Exam	
Week - 12	Fire Prevention and Protection: Means of Egress Regulations; Fire Tetrahedron; Categories of Fire; Categories of Fire Extinguisher. System Safety: Importance of System Safety; System Life Cycle; Management of System Safety	Lecture, Group Discussion, Multimedia, Presentation	In-course Exam, Final Exam	CLO2, CLO3, CLO4
Week - 13	Elements of A System Safety Program Plan (SPSS); Preliminary Hazard Analysis (PHA); Subsystem Hazard Analysis (SSHA); System Hazard Analysis (SHA); Technique of Operations Review (TOR); Failure Mode and Effect Analysis (FMEA).	Lecture, Group Discussion, Multimedia Presentation,	Oral Presentation, In-course Exam, Final Exam	CLO2, CLO3
Week - 14	Improving Safety Performance with Behavioral Safety: Introduction; Pilot Error Syndrome; Concepts of Risk; Incidents and Accidents; Loss Exposures; Control Techniques for Loss Exposures; Accident Causation Theories; Single Factor Theory; Heinrich's Domino Theory; Multiple Factors Theory; Human Factors Theory; Energy Release Theory; Further Incident Investigation. Review class	Lecture, Group Discussion, Multimedia Presentation, Literature review	In-course Exam, Final Exam	CLO1- CLO4

Part C

15. Assessment and Evaluation

i) Assessment Strategy

Class attendance and participation	10%
In-course exam/Class Test	30%
Semester Final Examination (3 hours duration)	60%
Total	100%

ii) Marks distribution

- a. Continuous Assessment: 40%
- b. Summative: 60%
- c. Make-up Procedures: Two in-course exams will be taken and average marks will be counted. Feedback on continuous assessment is given to the students immediately after the test. Based on the students' feedback additional class/assignment may be taken by the course teacher

Part D

16. Learning Materials

i) Recommended Readings

- a) Human Factors in Engineering & Design by Mark S. Sanders, Ph. D. and Ernest J. McCormick, Ph. D
- b) Introduction to Ergonomics by R. S. Bridger
- c) Workplace Safety A Guide for Small and Midsized Companies by Dan Hopwood, Steve Thompson
- d) Fundamentals of Occupational Safety and Health (fourth edition) by Mark A. Friend and James P. Kohn

ii) **Supplementary Readings:** The Occupational Ergonomics Hand Book, Edited by Waldemar Karwowski and William S. Marras, CRC Press, New York, USA.

iii) **Others:** Hand notes/Lecture materials will provide by the course teacher.

Course Outline for 0723-LPE-6111

Part A

1. **Course Code:** 0723-LPE-6111

2. **Course Title:** Materials and Quality Management of Leather Products

3. Course Type: Core Course

4. Year / Semester: Semester: I

5. Academic Session: 2022-23

6. Course Teachers: Md. Abdus Shabur, Lecturer, ILET, DU.

7. Prerequisite(s): N/A

8. Credits: 3.0

9. Contact Hours: 42

10. Total Marks: 100

11. Rationale of the Course: This course's goal is to familiarize students with the concepts and methods of materials management. Proper purchasing policies and practices are necessary for effective material management in order to make commodities available at the accurate quality, amount, timing, cost, and source. Additionally, the course emphasizes inventory management systems while covering crucial issues in purchasing, handling, and warehousing. Moreover, quality management and current best practices in this area will be explored.

Course Contents:

Fundamentals of materials management; introduction, history of industrial material management, objectives and function of leather products material management, scope of leather products material management, integrated leather products management concept, Types of leather products material, industrial material management organization.

Bill of Materials, Inventory classification and materials codification: What is BOM; BOM formats for leather products; tabular form, tree structure, single level BOM, Multi-level BOM, Indented BOM, ratio or percentage Bill, Modular bill; low level coding; ABC,HML, VED classification for leather products materials; ABE-VED matrix analysis, SED classification/analysis; FSN classification/analysis; materials codification; coding; material codification; characteristics of a satisfactory coding system; automatic identification , Bar coding.

Store accounting and physical verification of Inventory: meaning, classification and codification; evaluation of assets inventory: FIFO, LIFO, AVCO methods and related problems for leather products industry; stores ledger sheet for FIFO and LIFO of leather products industry; inventory counting: physical verification; cycle counting and periodic review; importance of accurate inventory record; steps of cycle counting; ways of control cut-off.

Surplus materials, waste management, and value engineering for leather products industry: definition of obsolete items; identification and control of surplus materials; materials reduction programme; Value Management, Value Analysis verses Value Engineering, Project selection, Assembling the team; Information gathering Design documents- drawings, specifications, etc. Material / component cost, Cost Models, Annual Purchase Values and Quantities, Commodity data, Sample components, Reject rates,

Warranty data, Commercial consideration, Supplier Suggestions/Supplier Walk-through; Idea generation: Creativity, Brainstorming, Process Idea starters, Idea forms; Evaluation of Ideas-Eliminate the Noise.

Lead time management and distribution inventory system for leather products industry: Details of Lead time; distribution inventory system: physical distribution & push and pull distribution system, time-phased order point, distribution requirement planning, fair shares allocations, problems solving related to Lead time management and distribution inventory system.

Leather products warehouse management: Introduction; Types of warehouse; Cost in opening and managing a leather products warehouse; measuring performance of a leather products warehouse; decision making on warehouse design and management for leather products; warehouse components; warehouse design; location in warehouse; dedicated storage, random storage; value added warehousing, Data collection and analysis, Space calculations, assignments model, computerized layout techniques; Warehouse layout examples.

Materials handling and equipment selection for leather products industry: Introduction, Basic Equipment Types, Principle of Material Handling, Storage Equipment, Equipment Selection, Storage Options, Shuttle Technology with A Difference, Very High Bay Warehouses, Other Storage Media, Warehouse Handling Equipment, Vertical and Horizontal Movement, Automated Storage and Retrieval Systems (AS/RS), Specialized Equipment, Recent Technical Advances.

12. Course Objectives: The learning objectives of this course are:

- a) To make student understand the fundamentals of material quality management related to leather products manufacturing.
- b) To help students obtain the core knowledge of bill of materials, inventory classification and materials codification
- c) To make student able to understand the concept of Store accounting and physical verification of Inventory as well as Surplus materials, waste management, and value engineering for leather products industry.
- d) To help student understand the lead time management, distribution inventory system, warehouse design and material handling for leather products industry

13. Course Learning Outcomes (CLOs) and Mapping of CLOs with Program Learning Outcomes (PLOs)

- a) **CLOs:** Upon completion of this course, students will be able to:

	Course Learning Outcomes (CLOs)	Learning Level
CLO1	Comprehend knowledge on fundamentals of material quality management related to leather products manufacturing.	C2

CLO2	Explain various principles, methods and tools to maintain proper quality of materials.	C2, A3
CLO3	Apply and justify various modern warehouse techniques to store different materials to ensure right quality.	C3, A3
CLO4	Interpret, compile and solve any problem/issue related to materials and quality management in real world leather products manufacturing.	C5, C6, A5

b) Mapping of CLO with PLO

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8
CLO1	3					2	2	
CLO2	3				2			
CLO3	3		2		2	3		
CLO4	3	2	2	2	2	2	3	3

Rank: 3-High match, 2-Medium match, 1-Low match

c. Mapping of Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO-1	Lecture, multimedia presentation, literature review and problem-based exercises	Group Presentation, Assignment, oral presentation, In-course Exam and Final Exam
CLO-2	Lecture, group discussion and problem-based exercises, literature review.	Group Presentation, In-course Exam and Final Exam
CLO-3	Lecture, multimedia presentation and problem-based learning: Identifying the problem to be solved	Assignment, Group Presentation, In-course Exam and Final Exam
CLO-4	Lecture, multimedia presentation, group discussion, and problem-based exercises	Assignment, In-course Exam and Final Exam

Part B

14. Course plan specifying content, CLOs, co-curricular activities (if any), teaching learning and assessment strategy mapped with CLOs

Time	Topic	Teaching-Learning Strategy	Assessment Strategy	Corresponding CLOs
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Week-01	Fundamentals of materials management; introduction, history of industrial material management, objectives and function of leather products material management, scope of leather products material management, integrated leather products management concept, Types of leather products material, industrial material management organization.	Lecture, Group Discussion, Multimedia Presentation, literature review	In-course Exam, Final Exam	CLO1, CLO2,
Week -02	Bill of Materials, Inventory classification and materials codification: What is BOM; BOM formats for leather products; tabular form, tree structure, single level BOM, Multi-level BOM, Indented BOM, ratio or percentage Bill, Modular bill; low level coding;	Lecture, Group Discussion, Multimedia Presentation, literature review	In-course Exam, Final Exam	CLO1, CLO2, CLO3
Week -03	ABC, HML, VED classification for leather products materials; ABE-VED matrix analysis, SED classification/analysis; FSN classification/analysis; materials codification; coding; material codification; characteristics of a satisfactory coding system; automatic identification , Bar coding.	Lecture, Group Discussion, Multimedia Presentation	Assignment, In-course Exam, Final Exam	CLO2 CLO3 CLO4
Week -04	Store accounting and physical verification of Inventory: meaning, classification and codification; evaluation of assets inventory: FIFO, LIFO, AVCO methods and related problems for leather products industry	Lecture, Group Discussion, Multimedia Presentation, Problem solving	In-course Exam, Final Exam	CLO2 CLO3 CLO4

Week - 05	Store accounting and physical verification of Inventory: meaning, classification and codification; evaluation of assets inventory: FIFO, LIFO, AVCO methods and related problems for leather products industry; advantages and disadvantages of FIFO method; stores ledger sheet for FIFO of leather products industry	Lecture, Group Discussion, Multimedia Presentation	Case study, In-course Exam, Final Exam	CLO2 CLO3 CLO4
Week - 06	stores ledger sheet for FIFO and LIFO of leather products industry; inventory counting: physical verification; cycle counting and periodic review; importance of accurate inventory record; steps of cycle counting; ways of control cut-off.	Lecture, Group Discussion, Multimedia Presentation	In-course Exam, Final Exam	CLO2 CLO3
Week - 07	Surplus materials, waste management, and value engineering for leather products industry: definition of obsolete items; identification and control of surplus materials; materials reduction programme; Value Management, Value Analysis verses Value Engineering,	Lecture, Group Discussion, Multimedia Presentation	Case Study, In-course Exam, Final Exam	CLO1 CLO2
Week - 08	Project selection, Assembling the team; Information gathering Design documents- drawings, specifications, etc. Material / component cost, Cost Models, Annual Purchase Values and Quantities, Commodity data, Sample components, Reject rates, Warranty data	Lecture, Group Discussion, Multimedia Presentation	In-course Exam, Final Exam	CLO2, CLO3
Week - 09	Commercial consideration, Supplier Suggestions/Supplier Walk-through; Idea generation:	Lecture, Group Discussion,	Group Presentation, In-course	CLO3, CLO4,

	Creativity, Brainstorming, Process Idea starters, Idea forms; Evaluation of Ideas- Eliminate the Noise.	Multimedia Presentation	Exam, Final Exam	
Week - 10	Lead time management and distribution inventory system for leather products industry: Details of Lead time; distribution inventory system: physical distribution & push and pull distribution system, time-phased order point, distribution requirement planning, fair shares allocations, problems solving related to Lead time management and distribution inventory system.	Lecture, Group Discussion, Multimedia Presentation	In-course Exam, Final Exam	CLO2 CLO3
Week - 11	Leather products warehouse management: Introduction; Types of warehouse; Cost in opening and managing a leather products warehouse; measuring performance of a leather products warehouse; decision making on warehouse design and management for leather products; warehouse components	Lecture, Group Discussion, Multimedia Presentation, problem solving	In-course Exam, Final Exam	CLO1 CLO3
Week - 12	warehouse design; location in warehouse; dedicated storage, random storage; value added warehousing, Data collection and analysis, Space calculations, assignments model, computerized layout techniques; Warehouse layout examples.	Lecture, Group Discussion, Multimedia Presentation	In-course Exam, Final Exam	CLO2, CLO3 CLO4
Week - 13	Materials handling and equipment selection for leather products industry: Introduction, Basic Equipment Types, Principle of Material Handling, Storage Equipment, Equipment Selection, Storage Options, Shuttle	Lecture, Group Discussion, Multimedia Presentation	Oral Presentation, In-course Exam, Final Exam	CLO2, CLO3

	Technology with A Difference			
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Week - 14	Very High Bay Warehouses, Other Storage Media, Warehouse Handling Equipment, Vertical and Horizontal Movement, Automated Storage and Retrieval Systems (AS/RS), Specialized Equipment, Recent Technical Advances	Lecture, Group Discussion, Multimedia Presentation,	In-course Exam, Final Exam	CLO1, CLO3, CLO4,
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Part C

15. Assessment and Evaluation

i) Assessment Strategy

Class attendance and participation	10%
In-course Exam/Class Test	30%
Semester Final Examination (3 hours duration)	60%
Total	100%

ii) Marks distribution

- a) Continuous Assessment: 40%
- b) Summative: 60%
- c) Make-up Procedures: Two in-course exams will be taken and average marks will be counted. Feedback on continuous assessment is given to the students immediately after the test. Based on the students' feedback additional class/assignment may be taken by the course teacher

Part D

16. Learning Materials

i) Recommended Readings

- a) Steven Nahmias-Production and Operations Analysis, Third edition.
- b) Gwynne Richards- Warehouse Management: A Complete Guide to Improving Efficiency and Minimizing Costs in the Modern Warehouse.

- c) Stan C. McDonald- Materials Management: An Executive's Supply Chain Guide
- ii) **Supplementary Readings**
- a) Steve Chapman, Tony Arnold, Ann Gatewood- Introduction to Materials Management 8th Edition
- b) P. Gopalakrishnan- Handbook of Materials Management, Second Edition.
- iii) **Others:** Hand notes/Lecture materials will provide by the course teacher.

Semester-II		
Course Code	Course Title	Credits
0723-LPE-6213	Environmental Management and Impact Assessment	3.0
0723-LPE-6215	Nanotechnology for Leather and Leather Products	3.0
0723-LPE-6217	Industrial Automation	3.0
0723-LPE-6219	Product Design and Development	3.0
0723-LPE-6221	E-Commerce and International Trade	3.0
0723-LPE-6300	Project	-
Total		15.0

Course Outline for 0723-LPE-6213

Part A

- 1. Course Code:** 0723-LPE-6213
- 2. Course Title:** Environmental Management and Impact Assessment
- 3. Course Type:** Core Course
- 4. Year/Semester:** Year: Semester: II
- 5. Academic Session:** 2022-2023
- 6. Course Teacher:** Sunzida Haque Rimu, Lecturer
Institute of Leather Engineering and Technology, University of Dhaka
- 7. Prerequisite(s):** N/A
- 8. Credits:** 3

9. Contact Hours: 42

10. Total Marks: 100

11. Rational of the Course: This course is designed to train the graduates in analysis and assessment methods applicable to environmental contamination problems, particularly national and international legislative frameworks. This course is contemplated for LWG and other environmental certification processes for leather industry.

Course Content

Environmental Audit: Principles and philosophies of environmental auditing, basic steps in audit process, Auditing techniques Concept of industrial ecology, cleaner technologies in industrial processes and evaluation of processes, waste minimization

Environmental health hazard and risk assessment: Biological, chemical, physical and psychological health hazard; health risk assessment and management, toxicology, exposure measurement of toxic (carcinogenic and non-carcinogenic) substances

Clean Development Mechanism: Overview on sustainable development. greenhouse gasses reduction mechanism, project cycle for the CDM, CDM for small scale projects, risks and opportunities for industries, financing of CDM projects, case studies.

Environmental Impact Assessment (EIA): Definition, purposes and characteristics of EIA, global evolution of EIA, participants in EIA process, stages of EIA, types of EIA, environmental inventory, baseline data on EIA-environmental data, project data and project alternative data, measurement of impact– physical, social, economic, natural, public participation in environmental decision making, framework of environmental assessment, description of environmental setting, Environmental impact factors and area consideration, environmental impact statement (EIS) and environmental management plan (EMP).

Environmental Impact Analysis: Impact identification and methods of impact identification- adhoc method, checklist, matrix, network, overlay and index methods; impact prediction and predictive methodologies, impact evaluation (assessment) and impact mitigation.

Basic steps for the impact identification, prediction and assessment of air, water, noise, vegetation and wildlife environment with case studies.

Environmental Management System (EMS):Basic definitions and terms, Framework for environmental management system, approach for developing Environmental Management System, International standards, environmental management systems in tanneries and their implementation, environmental reporting, Occupational health and safety management, cross-boundary environmental management, mandatory regulations and ecolabelling criteria governing various substance in leather, life -cycle assessment and carbon footprint in leather industries.

Hazard Mitigation: Classification of hazards, basic concept of disaster (causative factors of disaster, classification of disasters), Hazards due to dams and reservoirs, nuclear power plants, industrial hazards, occupational hazards, mitigation measures, hazard assessment, risk assessment.

EIA in Bangladesh: An overview of history, current procedures, practices and guidelines for Environmental Clearance Certificate, EIA of water resource projects, industries, mining and quarrying, highway construction, and tourism developments.

12. Course Objectives

- a) To provide knowledge on legal and policy frameworks within which quantitative environmental assessment activities are carried out and
- b) To conduct systematic EIA and auditing methodologies in the leather industry.
- c) To carry out quantitative techniques of analysis for direct determination of contaminant concentrations and distributions within environmental systems.
- d) To investigate statistical and computer modeling techniques for analysis of data.

13. Course Learning Outcomes (CLOs) and Mapping of CLOs with Program Learning Outcomes (PLOs)

- a) **CLOs:** The course is intended to achieve the following learning outcomes:

	Course Learning Outcomes (CLOs)	Learning Level
CLO1	Recognize ethical and narrate professional responsibilities in engineering situations and make judgments.	C1,A1
CLO2	Familiarize with the application of a variety of professional tools for predicting environmental impacts.	C2, A2
CLO3	Developing perspectives on impact assessment and relating to practical industrial activities.	C3,C4

b) Mapping of CLO with PLO

(CLOs)	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8
CLO1	3	3	3					
CLO2	2		3	3	2	3	3	
CLO3	3		2			3	2	3

c) Mapping of Course Learning Outcomes (CLOs) with the Teaching-Learning and Assessment Strategy

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO-1	Lecture, Multimedia presentation, white board illustration, problem-based exercises, group discussion by analyzing different case studies	Quiz, In- course exam; Final Exam
CLO-2	Lecture, multimedia presentation, Problem based Learning (PBL): Identifying the problems to be solved	Assignment, Group presentation, In-course exam, Final exam
CLO-3	Lecture, multimedia presentation, group discussion, analyze and compare through various case-studies	Assignment, In-course Exam, Final Exam

Part B

14. Course plan specifying content, CLOs, teaching learning and assessment strategy mapped with CLOs

Time Period	Topic	Teaching-Learning Methodology	Assessment Method	Corresponding CLOs
Week-01	Environmental Audit: -Principles and philosophies of environmental auditing, - basic steps in audit process, - Auditing techniques -Concept of industrial ecology	Lecture, Group discussion, Literature	In-course, Final exam, Quiz	CLO1
Week -02	Environmental Audit: -cleaner technologies in industrial processes and evaluation of processes -waste minimization incorporated with industrial ecology	Lecture, Literature	In-course, Final exam	CLO1
Week -03	Environmental health hazard and risk assessment: -Biological, chemical, physical and psychological health hazard -health risk assessment and management, -toxicology, exposure measurement of toxic (carcinogenic and non-carcinogenic) substances	Lecture, Group Discussion, Literature	In-course, Final exam	CLO1
Week -	Clean Development Mechanism:	Lecture,	In-course,	CLO1

04	<ul style="list-style-type: none"> -Overview on sustainable development -greenhouse gasses reduction mechanism -project cycle for the CDM, CDM for small scale projects -risks and opportunities for industries -financing of CDM projects, case studies. 	Literature, Group Assignment,	Final exam, Assignment	
Week - 05	<p>Environmental Impact Assessment (EIA):</p> <ul style="list-style-type: none"> -Definition, purposes and characteristics of EIA -global evolution of EIA, -participants in EIA process -stages of EIA, types of EIA, environmental inventory, -baseline data on EIA-environmental data -project data and project alternative data - measurement of impact– physical, social, economic, natural, public participation in environmental decision making, 	Lecture, Literature, Case studies	Assignment, In-course exam, Final exam	CLO1, CLO2
Week - 06	<p>Environmental Impact Assessment (EIA):</p> <ul style="list-style-type: none"> -framework of environmental assessment -description of environmental setting -Environmental impact factors and area consideration - Environmental impact statement (EIS) and environmental management plan (EMP) 	Lecture, Literature, Case studies,	Assignment, Quiz, Final Exam	CLO1, CLO2
Week - 07	<p>Environmental Impact Analysis:</p> <ul style="list-style-type: none"> -Impact identification and methods of impact identification- adhoc method, checklist, matrix, network, overlay and index methods; 	Lecture, Literature, Assignment	In-course, Final Exam, Assignments	CLO3

	-impact prediction and predictive methodologies, -impact evaluation (assessment) and impact mitigation.			
Week - 08	Environmental Impact Analysis (cont.) -Basic steps for the impact identification, prediction and assessment of air, water, noise, vegetation and wildlife environment with case studies.	Lecture, Literature	In-course , Final Exam, Assignment	CLO3
Week - 09	Environmental Management System (EMS): -Basic definitions and terms -Framework for environmental management system -approach for developing Environmental Management System	Lecture, Literature	In-course, Final Exam	CLO1, CLO3
Week - 10	Environmental Management System (EMS) -International standards -environmental management systems in tanneries and their implementation -environmental reporting	Lecture, Literature, Case studies	In-course, Final Exam	CLO1, CLO3
Week - 11	Environmental Management System (EMS) (Cont.) -Occupational health and safety management -cross-boundary environmental management -mandatory regulations and ecolabelling criteria governing various substance in leather -life-cycle assessment and carbon footprint in leather industries.	Lecture, Literature,	In-course, Final Exam	CLO1, CLO2
Week - 12	Hazard Mitigation: -Classification of hazards -basic concept of disaster (causative factors of disaster, classification of disasters) -Hazards due to dams and reservoirs, nuclear power plants	Lecture, Literature, Case studies	In-course, Final exam	CLO1, CLO2

	-industrial hazards, occupational hazards, mitigation measures, hazard assessment, risk assessment.			
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Week - 13	EIA in Bangladesh: -An overview of history, current procedures, practices and guidelines for Environmental Clearance Certificate, -EIA of water resource projects, industries, mining and quarrying, highway construction, tourism developments.	Lecture, Literature, Case studies	In-course, Final exam	CLO1, CLO2, CLO3
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Strategy		Percentage of Total Marks		
Class participation and attendance		10%		
Class tests/ Class assessments		30%		
Term final examinations (3 hours duration)		60%		
Total		100%		
Week- 14	Review of the whole content	Problem oriented exercises		CLO1, CLO2, CLO3

Part C

15. Assessment and Evaluation

i) Assessment Strategy

ii) Marks distribution

- a. Continuous Assessment: 40%
- b. Summative: 60%
- c. Make-up Procedures:
 - Two in-course exams will be taken and average marks will be counted.

- Feedback on continuous assessment is given to the students immediately after the test. Based on the students' feedback additional class/assignment may be taken by the course teacher.

Part D

16. Learning Materials

ii) Recommended Readings

- a) Morris, P and Therivel, R. 2001. Methods of environmental impact assessment. London. UCL press.
- b) Introduction to Environmental Impact Assessment: Principles and Procedures, Process, Practice and Prospects - 2nd edition. J. Glasson, R. Therivel, A. Chadwick
- c) Environmental Impact Assessment Methodologies, Y. Anjaneyulu, Valli Manickam, BS Publication
- d) Environmental and Health Risk Assessment and Management: Principles and Practices, ISBN: 9789048169610,9048169615

ii) Supplementary Reading

- a) Bregman, J.I. and Mackenthum, K.M. 1992. Environmental impact statements. Chelsia Michigan: Lewis.
- b) Calow, P. 1997. Handbook of environmental risk assessment and management. Oxford: Blackwell Science.

iii)Others: Handout/lecture material provided by the course teacher

Course Outline of 0723-LPE-6215

Part A

1. Course Code: 0723-LPE-6215

2. Course Title: Nanotechnology for Leather and Leather Products

3. Course Type: Core Course

4.Year/ Semester: Semester: II

5. Academic Session: 2022-23

6. Course Teachers: 1. Dr. Mohammed Mizanur Rahman, Professor, ACCE, DU.
2. Md. Adib Hossain Chisty, Lecturer, ILET, DU.

7. Prerequisite(s): N/A

8. Credits: 3.0

9. Contact Hours: 42 hours

10. Total Marks: 100

11. Rational of the Course:

This course is designed to provide in-depth theoretical knowledge of nanotechnology and outlines its applications in leather and allied engineering fields. The course also deals with the design of nano systems, nanomaterials together with their processing, properties and characterization.

Course Contents

Introduction to Nanoscience and Nanotechnology: Introduction, history and importance of nanotechnology, properties of nanomaterials, difference between bulk and nanomaterials, molecular building blocks for nanostructured systems, influence of nano structure on mechanical, optical, electronic, magnetic and chemical properties, overview of different nanomaterials available, chemistry and physics of nanomaterials, electronic phenomenon in nanostructures, optical absorption in solids, quantum dot, quantum effects, nanocomposites.

Nanomaterials Fabrication:

Chemical Methods: Sol- gel process, self-assembly process, electrodeposition, pyrolysis, metal nanocrystals by reduction, solvothermal synthesis, photochemical synthesis, nano chemical synthesis, reverse micelles and microemulsions, combustion method, template process, chemical vapor deposition, metal organic chemical vapor deposition.

Physical Methods: Ball milling, inert gas condensation technique, thermal evaporation, pulsed laser deposition, DC/RF magnetron sputtering, molecular beam epitaxy, microlithography, etching, wet cleaning, atomic layer deposition.

Biological Synthesis: Protein based nanostructure formation, DNA template nanostructure formation, protein assembly, biologically inspired nanocomposites.

Nanomaterials Characterization:

Structural Characterization: X-ray diffraction (XRD) analysis, FT-IR analysis, Raman spectroscopy

Microscopic and Surface Analysis: Electron microscopes: scanning electron microscopy (SEM), transmission electron microscopy (TEM); scanning probe microscopy: atomic force microscopy (AFM), scanning tunneling microscopy (STM).

Spectroscopy: X-ray photoelectron spectroscopy (XPS), fluorescence spectroscopy, UV-visible spectroscopy, nuclear magnetic resonance (NMR) spectroscopy, electron spin resonance (ESR) spectroscopy.

Electrical, Mechanical and Magnetic Properties: Impedance analysis, electro-analytical techniques: potentiometry, voltammetry, cyclic voltammetry

Thermal and Optical Properties: Differential scanning calorimetry (DSC) analysis, Differential thermal analysis (DTA), Thermogravimetric analysis (TGA), contact angle measurement. Dynamic light scattering (DLS) method.

Applications of nanotechnology in the relevant field and non-leather chemicals: Possible industrial applications of nanomaterials in leather, footwear and leather products industries, application of nano materials on collagen matrix at various stages of processing techniques, synthesis of nano based materials for leather manufacture: syntans, reinforcing materials, finishing chemicals.

Environmental aspects of nanotechnology: Handling, safety and hazard of nanomaterials processing, effects of nanomaterials exposure on human and living stock, long term and short-term effects, case studies of exposure, effects of nanoparticles on air, water and soil, food and food supplements.

12. Course Objectives:

- To introduce and provide a broad view of the nascent field of nanoscience and nanotechnology.
- To promote interdisciplinary interactions among engineering, technology, science, and industrial management/technology majors.
- To utilize knowledge about developing new products and systems in leather sector.

13. Course Learning Outcomes (CLOs) and Mapping of CLOs with Program Learning Outcomes (PLOs)

- CLOs:** At the completion of this course students will be able to:

	Course Learning Outcomes (CLOs)	Learning Level
CLO1	Define and explain the structure, properties and applications of nanomaterials together with associated chemicals	C1, C2
CLO2	Illustrate the importance of dimensional reduction in materials and its relationship with properties.	C3
CLO3	Compare numerous methods of nanomaterials preparation and analyze nanomaterials thoroughly using engineering tools	C5
CLO4	Assess environmental pollutions/concerns by nano based materials during its production and real-life applications.	C5

b) Mapping of CLO with PLO

(CLOs)	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8
CLO1	3					2		
CLO2	3					3		

CLO3	3	2			3	3	2	
CLO4	2	3			2	2	2	

c) Mapping of Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO-1	Lecture, literature review, multimedia presentation, group discussion	Group Presentation, In-course Exam, Quiz, Assignment, Final Exam
CLO-2	Lecture, multimedia presentation, video presentation, demonstration, group discussion	Group Presentation, In-course Exam; quiz, assignment, case study, Final Exam
CLO-3	Lecture, demonstration, multimedia presentation, literature review, group discussion	Assignment, Quiz, Group Presentation, In-course Exam, and Final Exam
CLO-4	Lecture, multimedia presentation, group discussion, literature review, video presentation, demonstration, and problem-based exercises	Quiz, Assessment, Group Presentation, In-course Exam, and Final Exam

Part B

14. Course plan specifying content, CLOs, co-curricular activities (if any), teaching learning and assessment strategy mapped with CLOs

Time Period	Topic	Teaching-Learning strategy	Assessment Method	Corresponding CLOs
Week-01	Introduction to Nanoscience and Nanotechnology: Introduction, history and importance of nanotechnology, properties of nanomaterials, difference between bulk and nanomaterials, molecular building blocks for nanostructured systems, influence of nano structure on mechanical, optical, electronic, magnetic and chemical properties, overview of different nanomaterials available, chemistry and physics of nanomaterials, electronic phenomenon in nanostructures, optical absorption in solids, quantum dot, quantum effects, nanocomposites	Class Lecture	In-course Exam, Final Exam	CLO1, CLO2
Week-02		Class Lecture, Slide Presentation	In-course Exam, Final Exam	CLO1, CLO2

Week -03	Nanomaterials Fabrication: Chemical Methods: Sol- gel process, self-assembly process, electrodeposition, pyrolysis, metal nanocrystals by reduction, solvothermal synthesis,	Class Lecture, Slide Presentation	In-course Exam, Final Exam	CLO1, CLO3
Week -04	photochemical synthesis, nano chemical synthesis, reverse micelles and microemulsions, combustion method, template process, chemical vapor deposition, metal organic chemical vapor deposition.	Class Lecture	In-course Exam, Final Exam	CLO3
Week -05	Physical Methods: Ball milling, inert gas condensation technique, thermal evaporation, pulsed laser deposition, DC/RF magnetron sputtering, molecular beam epitaxy, microlithography, etching, wet cleaning, atomic layer deposition.	Class Lecture, Assignments	In-course Exam, Final Exam	CLO3
Week -06	Biological Synthesis: Protein based nanostructure formation, DNA template nanostructure formation, protein assembly, biologically inspired nanocomposites. Nanomaterials Characterization: Structural Characterization: X-ray diffraction (XRD) analysis, FT-IR analysis	Class Lecture, Assignment	In-course Exam, Final Exam	CLO3
Week -07	Raman spectroscopy Microscopic and Surface Analysis: Electron microscopes: scanning electron microscopy (SEM), transmission electron microscopy (TEM); scanning probe microscopy: atomic force microscopy (AFM), scanning tunneling microscopy (STM).	Class Lecture, Slide Presentation	In-course Exam, Final Exam	CLO3
Week -08	Spectroscopy: X-ray photoelectron spectroscopy (XPS), fluorescence spectroscopy, UV-visible	Class Lecture,	In-course Exam, Final Exam	CLO3

	spectroscopy			
Week -09	nuclear magnetic resonance (NMR) spectroscopy, electron spin resonance (ESR) spectroscopy. Electrical, Mechanical and Magnetic Properties: Impedance analysis	Class Lecture, Assignment	In-course Exam	CLO3
Week -10	electro-analytical techniques: potentiometry, voltammetry, cyclic voltammetry. Thermal and Optical Properties: Differential scanning calorimetry (DSC) analysis	Class Lecture	In-course Exam, Final Exam	CLO3
Week -11	Differential thermal analysis (DTA), Thermogravimetric analysis (TGA), contact angle measurement. Dynamic light scattering (DLS) method.	Class Lecture, Assignment	In-course Exam, Final Exam	CLO1, CLO2, CLO3
Week -12	Applications of nanotechnology in the relevant field and non-leather chemicals: Possible industrial applications of nanomaterials in leather, footwear and leather products industries, application of nano materials on collagen matrix at various stages of processing, synthesis of nano based materials for leather manufacture: syntans, reinforcing materials, finishing chemicals.	Class Lecture	In-course Exam, Final Exam	CLO1, CLO3
Week -13	Environmental aspects of nanotechnology: Handling, safety and hazard of nanomaterials processing, effects of nanomaterials exposure on human and living stock, long term and short-term effects, case studies of exposure, effects of nanoparticles on air, water and soil, food and food supplements.	Class Lecture	Final Exam, Assignment	CLO1, CLO3, CLO4

Week-14	Review Class	Class Lecture, Presentation, Assignment	Final Exam, Assignment	CLO1, CLO2, CLO3, CLO4
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Part C

15. Assessment and Evaluation

i) Assessment Strategy

Class participation	10%
In-course Examination	30%
Semester Final Examination (3 hours duration)	60%
Total	100%

ii) Marks distribution:

- a) Continuous Assessment: 40%
- b) Summative: 60%
- c) Make-up Procedures: Two in-course exams will be taken and average marks will be counted. Feedback on continuous assessment is given to the students immediately after the test. The Based on the students' feedback additional class-test/assignment may be taken by the course teacher

Part D

16. Learning Materials

i) Recommended Readings

- a) Hand book of Nano science, Engineering, and Technology, William A. Goddard, CRC press 2003.
- b) Nanolithography and patterning techniques in microelectronics, David G.Bucknall, Wood head publishing 2005.
- c) Nanocomposite science and technology, Pulikel M. Ajayan, Wiley-VCH 2005

ii) Supplementary Readings:

- a) Nanotechnology Environmental health and Safety: Risks Regulation and Management, Matthew Hull and Diana Bowman, Elsevier 2010
- b) Hand book of Nano science, Engineering, and Technology, William A. Goddard, CRC press 2003.

iii) Others: Handout/lecture material provided by the course teacher

Course Outline of 0723-LPE-6217

Part A

1. **Course Code:** 0723-LPE 6217
2. **Course Title:** Industrial Automation
3. **Course Type:** Core Course
4. **Year / Semester:** Semester: II
5. **Academic Session:** 2022-23
6. **Course Teachers:** Md. Abdus Shabur, Lecturer, ILET, DU.
7. **Prerequisite(s):** N/A
8. **Credits:** 3.0
9. **Contact Hours:** 42
10. **Total Marks:** 100

11. Rationale of the Course: This course provides an overview of the technologies of industrial automation and control as it is commonly encountered in factories of all types including leather and leather products items. Automation of the production process increases the efficiency of labor and the overall rate of growth. By ending this course, students will be able to have a fundamental knowledge of current industrial automation technologies and their application.

Course Contents

Introduction to Automation and Artificial Intelligence: Introduction, Principles and strategies, Basic elements of an automated system, Advanced automation functions, Levels of automations, Automated flow lines and transfer mechanisms, Introduction of AI, Historical development, Intelligent Systems, Types of Intelligent Agents, Components of AI, Foundations of AI, Scope of AI, Current trends in AI, Relevance to Leather, Products and Footwear Engineering

Boolean Algebra and Logic Circuits and Programmable Logic Controller (PLC): Various logic gates, Truth tables, Logic functions, Boolean Laws, Karnaugh maps, Block diagram of PLC, Programming languages of PLC, Basic instruction sets, Networking of PLC, Overview of safety of PLC with case studies. Process Safety Automation: Levels of process safety through use of PLCs,

Controllers, Sensors and Actuators:: Control Modes, PID and Digital Controllers, Velocity Control, Adaptive Control, Microprocessor and Microcontrollers, important characteristics, Main industrial sensors, Classification of sensors and their usage, Description of different kinds of sensors, Overview of Actuators, usage of Actuators in Robotics, Classification of Actuators (Pneumatic, Hydraulic, Electric), Basics of Pneumatic and Hydraulic Actuation Systems, Mechanical Actuation Systems, Electrical Actuation Systems.

Robots and their applications: Introduction to robots, Types, Classifications, Selection of robots, Robot Degrees of freedom, Robot configuration, Accuracy and repeatability, Specification of a robot, Robot feedback controls: Point to point control and Continuous path control, Control system for robot joint, Drives and transmission systems, End effectors, Industrial robot applications.

Concept and Algorithms, No programming or numerical: Problem Solving: Tree and Graph Search, Uninformed v/s informed search, uninformed methods: depth first search, breadth first search, Informed search: heuristic search, Best first search, branch and bound; Machine Learning: Introduction, types of machine learning; Learning with Decision Trees, Classification and Regression Trees, K means clustering algorithm, K nearest neighbors algorithm, hierarchical clustering, Concept of ensemble methods.

Artificial Neural Networks and Introduction to AI Technologies: Concept of ANN, Basic Models, Important Terminologies of ANNs McCulloch-Pitts Neuron, NN architecture, perceptron, delta learning rule, backpropagation algorithm, Gradient Descent algorithm, feed forward networks, activation functions, Introduction to AI Technologies in the realm of Automation Concept of Natural Language Processing, Machine Vision, Deep learning, Expert systems, Genetic Algorithms, Industry 4.0

12. Course Objectives: The learning objectives of this course are:

- a) To provide fundamental knowledge of automated machines and equipment including AI application in leather industry.
- b) To impart the role of Boolean algebra and PLC in industrial automation.
- c) To develop the operating skill of various sensors, actuators and controllers.
- d) To familiarize with the application of robotic systems and artificial neural networks in automated manufacturing processes.

13. Course Learning Outcomes (CLOs) and Mapping of CLOs with Program Learning Outcomes (PLOs)

a) **CLOs:** Upon completion of this course, students will be able to:

	Course Learning Outcomes (CLOs)	Learning Levels
CLO1	Explore their knowledge on fundamentals of industrial automation and its importance in modern manufacturing.	C1, A1
CLO2	Define and explain various automation technologies in leather and leather products manufacturing and process industries.	C1, C2, A2
CLO3	Apply various modern technologies to design an automated production facility including materials handling with robotics application.	C3, A2
CLO4	Investigate and solve any hurdle related to automation with the help of Artificial Intelligence (AI) applications.	C4, C5

b) **Mapping of CLO with PLO**

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8

CLO1	3							
CLO2	3				1			
CLO3	3	2	2		1	3	2	
CLO4	3	3	3	3	2	2	2	1

Rank: 3-High match, 2-Medium match, 1-Low match

c) Mapping of Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO-1	Lecture, multimedia presentation, literature review and problem-based exercises	Group Presentation, Assignment, oral presentation, In-course Exam and Final Exam
CLO-2	Lecture, group discussion and problem-based exercises, literature review.	Group Presentation, In-course Exam and Final Exam
CLO-3	Lecture, multimedia presentation and problem-based learning: Identifying the problem to be solved	Assignment, Group Presentation, In-course Exam and Final Exam
CLO-4	Lecture, multimedia presentation, group discussion, and problem-based exercises	Group Presentation, Case study, Assignment, In-course Exam and Final Exam

Part B

14. Course plan specifying content, CLOs, co-curricular activities (if any), teaching learning and assessment strategy mapped with CLOs

Time	Topic	Teaching-Learning Strategy	Assessment Strategy	Corresponding CLOs
Week-01	Introduction to Automation and Artificial Intelligence: Introduction, Principles and strategies, Basic elements of an automated system, Advanced automation functions, Levels of automations, Automated flow lines and transfer mechanisms	Lecture, Group Discussion, Multimedia Presentation, literature review	In-course Exam, Final Exam	CLO1, CLO2
Week -02	Introduction of AI, Historical development, Intelligent Systems, Types of Intelligent Agents, Components of AI, Foundations of	Lecture, Group Discussion, Multimedia Presentation,	In-course Exam, Final Exam	CLO1, CLO2

	AI, Scope of AI, Current trends in AI, Relevance to Leather, Products and Footwear Engineering	literature review		
Week - 03	Boolean Algebra and Logic Circuits: Various logic gates, Truth tables, Logic functions, Boolean Laws, Karnaugh maps.	Lecture, Multimedia Presentation, Problem solving	Assignment, In-course Exam, Final Exam	CLO1, CLO2 CLO3, CLO4
Week - 04	Block diagram of PLC, Programming languages of PLC, Basic instruction sets, Networking of PLC, Overview of safety of PLC with case studies. Process Safety Automation: Levels of process safety through use of PLCs.	Lecture, Group Discussion, Multimedia Presentation,	In-course Exam, Final Exam	CLO1, CLO2 CLO3, CLO4
Week - 05	Controllers: Control Modes, PID and Digital Controllers, Velocity Control, Adaptive Control, Microprocessor and Microcontrollers	Lecture, Group Discussion, Multimedia Presentation	Case study, In-course Exam, Final Exam	CLO1, CLO2 CLO3
Week - 06	Important characteristics of sensors, Main industrial sensors, Classification of sensors and their usage, Description of different kinds of sensors	Lecture, Group Discussion, Multimedia Presentation	In-course Exam, Final Exam	CLO2, CLO3
Week - 07	Overview of Actuators, usage of Actuators in Robotics, Classification of Actuators (Pneumatic, Hydraulic, Electric), Basics of Pneumatic and Hydraulic Actuation Systems, Mechanical Actuation Systems, Electrical Actuation Systems	Lecture, Group Discussion, Multimedia Presentation	Case Study, In-course Exam, Final Exam	CLO2, CLO3, CLO4
Week - 08	Robots and their applications: Introduction to robots, Types, Classifications, Selection of robots, Robot Degrees of freedom, Robot configuration, Accuracy and	Lecture, Group Discussion, Multimedia Presentation	Group Presentation, In-course Exam,	CLO1, CLO2

	repeatability, Specification of a robot, Robot feedback controls		Final Exam	
Week - 09	Point to point control and Continuous path control, Control system for robot joint, Adaptive control, Drives and transmission systems, End effectors, Industrial robot applications of robots	Lecture, Group Discussion, Multimedia Presentation	In-course Exam, Final Exam, Assignment	CLO3, CLO4,
Week - 10	Concept and Algorithms, No programming or numerical: Problem Solving: Tree and Graph Search, Uninformed v/s informed search, uninformed methods: depth first search, breadth first search, Informed search: heuristic search	Lecture, Group Discussion, Multimedia Presentation	In-course Exam, Final Exam	CLO1, CLO3, CLO4
Week - 11	Best first search, branch and bound; Machine Learning: Introduction, types of machine learning: supervised, unsupervised, reinforcement learning; Learning with Decision Trees: Introduction to Decision Trees	Lecture, Group Discussion, Multimedia Presentation, problem solving	In-course Exam, Final Exam	CLO1, CLO3, CLO4
Week - 12	Classification and Regression Trees, K means clustering algorithm, K nearest neighbors algorithm, hierarchical clustering, Concept of ensemble methods	Lecture, Group Discussion, Multimedia Presentation	In-course Exam, Final Exam	CLO2, CLO3 CLO4
Week - 13	Concept of ANN, Basic Models, Important Terminologies of ANNs McCulloch-Pitts Neuron, NN architecture, perceptron, delta learning rule, backpropagation algorithm, Gradient Descent algorithm, feed forward networks, activation functions	Lecture, Group Discussion, Multimedia Presentation	Oral Presentation, In-course Exam, Final Exam	CLO1, CLO2
Week - 14	Introduction to AI Technologies in the realm of Automation Concept of Natural Language Processing, Machine Vision, Deep learning,	Lecture, Group Discussion, Multimedia	In-course Exam, Final Exam	CLO1, CLO3, CLO4,

	Expert systems, Genetic Algorithms, Industry 4.0	Presentation,		
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Part C

15. Assessment and Evaluation

i) Assessment Strategy

Class attendance and participation	10%
In-course Exam/Class Test	30%
Semester Final Examination (3 hours duration)	60%
Total	100%

ii) Marks distribution:

- a) Continuous Assessment: 40%
- b) Summative: 60%
- c) Make-up Procedures: Two in-course exams will be taken and average marks will be counted. Feedback on continuous assessment is given to the students immediately after the test. Based on the students' feedback additional class/assignment may be taken by the course teacher

Part D

16. Learning Materials

i) Recommended Readings

- a) Handbook of Industrial Automation-Richard L. Shell, Ernest L. Hall
- b) Introduction to Industrial Automation- Stamatios Manesis, George Nikolakopoulos
- c) Introduction to Artificial Intelligence by Wolfgang Ertel

ii)Supplementary Readings

- a) Introduction to Mechatronics and Measurement Systems by David G. Alciatore.

iii) Others: Hand notes/Lecture materials will provide by the course teacher.

Course Outline of 0723-LPE-6219

Part A

1. **Course Code:** 0723-LPE-6219

2. **Course Title:** Products Design and Development

3. **Course Type:** Core Course

4. Year/ Semester: Semester: II

5. Academic Session: 2022-23

6. Course Teacher: Kawsar Akhtar, Lecturer, ILET, DU
Md. Arafat Hossain, Lecturer, ILET, DU

7. Prerequisite(s): N/A

8. Credits: 3.0

9. Contact Hours: 42

10. Total Marks: 100

11. Rationale of the Course: Product design and development is a very important stage for any kind of product. This program is designed to deliver the latest knowledge about the product development stages and its further stages for successful product launching. This program comprises product development processes, product concept development, product planning, product architecture, industrial design, design for manufacturing, prototyping and robust design, patents and intellectual property, product development economies, managing projects, design for environment.

Course contents

Introduction: Characteristics, duration, cost, the challenges of product development.

Development Processes and Organizations: A generic development process, adapting the generic product development process, product development process flows, product development organizations, organizational links with functions, projects.

Product Planning: The product planning process, identify opportunities, evaluate and prioritize projects, allocate resources and plan timing, complete pre-project planning, reflect on the results and the process.

Product Concept Development: Identifying customer needs, product specifications, concept generation, concept selection and concept testing, present the key activities of the concept development phase.

Product Architecture: The implications of product architecture on product change, product variety, component standardization, products performance, manufacturing cost, and project management.

Industrial Design: Assessing the need for industrial design, the impact of industrial design, the industrial design process, management of the industrial design process, assessing the quality of industrial design.

Design for Manufacturing (DFM): Overview the steps of DFM process; estimate the manufacturing costs, reduce the costs of components, reduce the costs of assembly, reduce the costs of supporting production, consider the impact of DFM decisions on other factors.

Prototyping and Robust design: Basics, types, importance, principles of prototyping, prototyping technologies, planning for prototypes. Definition, design of experiments (DOE) , robust design processes.

Patents and Intellectual Property: Definition, overview of patents, utility patents, preparing a disclosure in seven steps.

Product Development Economics: Elements of economic analysis, time of economic analysis, and economic analysis process steps.

Managing Projects: Understanding and representing tasks, Gantt Charts, PERT Charts, the critical path, baseline project planning, project execution, assessing project status, corrective actions, postmortem project evaluation.

Design for Environment (DFE): Basic concept, importance of DFE, four kinds of integration, a sense of timelessness, contemporary footwear and leather products design, functional planning, specific problems, studio projects.

12. Course Objectives

- a) To provide the basic knowledge of product design, process design, production planning, product concept development, product architecture, product prototyping, product development economics and design for environment etc.
- b) To impart the idea generations of different products design, process planning of a product and will learn how to provide visual representation of a product initially through prototyping.

13. Course Learning Outcomes (CLOs) and Mapping of CLOs with Program

- a) **Course Learning Outcomes (PLOs):**

Upon successful completion of this course, students will be able to

CLOs	Course Learning Outcomes (PLOs)	Learning Level
CLO1	Identify different terms and phrases associated with product development.	C1, A1

CLO2	Explain products design through prototype.	C2, P2
CLO3	Analyze different product development processes and planning.	C4
CLO4	Justify different manufacturing problems and solutions.	C5, A3
CLO5	Evaluate product market opportunities and future of the product.	C5

b) Mapping of Course Learning Outcomes (CLOs) with Programs Learning Outcomes (PLOs)

CLOs	Program Learning Outcomes (PLOs)							
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8
CLO1	3		2	2				
CLO2	3	2	3	2	2			
CLO3	3		3			3	1	2
CLO4	3	2		2		3		2
CLO5	3	2		2	2	3		2

Rank: 3-High match, 2-Medium match, 1-Low match

c) Mapping of Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO-1	Lecture, Multimedia presentation.	Group Presentation, In-course Exam; Final Exam
CLO-2	Lecture, group discussion.	Group Presentation, In-course Exam; Final Exam
CLO-3	Lecture, Multimedia presentation and group discussion.	In-course Exam, and Final Exam
CLO-4	Lecture, multimedia presentation, group discussion.	Group Presentation, In-course Exam, and Final Exam
CLO-5	Lecture, group discussion	In-course Exam, and Final Exam

Part B

14. Course plan specifying content, CLOs, co-curricular activities (if any), teaching learning and assessment strategy mapped with CLOs

Week	Course Content	Teaching Learning Methodology	Assessment Method	CLOs

Week-01	Introduction: Characteristics, duration, cost, the challenges of product development.	Lecture	In-course Exam, Group Presentation, Final exam	CLO1, CLO3
Week-02	Development Processes and Organizations: A generic development process, adapting the generic product development process.	Lecture	In-course Exam, Final exam	CLO1, CLO3
Week-03	Development Processes and Organization: Product development process flows, product development organizations, organizational links with functions, projects.	Lecture, Multimedia presentation and group discussion.	In-course Exam, Final exam	CLO1, CLO3
Week-04	Product Planning: The product planning process, identify opportunities, evaluate and prioritize projects, allocate resources and plan timing, complete pre-project planning, reflect on the results and the process.	Lecture, Multimedia presentation	In-course Exam, Group Presentation, Final exam	CLO1, CLO3, CLO4
Week-05	Product Concept Development: Identifying customer needs, product specifications, concept generation, concept selection and concept testing, present the key activities of the concept development phase.	Lecture, Multimedia presentation	In-course Exam, Group Presentation, Final exam	CLO1, CLO3,
Week-06	Product Architecture: The implications of product architecture on product change, product variety, component standardization, products performance, manufacturing cost, and project management.	Lecture, Multimedia presentation and group discussion.	In-course exam, Final exam	CLO1, CLO2, CLO4
Week-07	Industrial Design: Assessing the need for industrial design, the impact of industrial design, the industrial design process, management of the industrial design process, assessing the quality of industrial design.	Lecture, Multimedia presentation and group discussion.	In-course Exam, Final exam	CLO1, CLO2,
Week-08	Design for Manufacturing (DFM): Overview the steps of DFM process; estimate the manufacturing costs, reduce	Lecture, Multimedia presentation	In-course Exam, Final exam	CLO1, CLO3, CLO4

	the costs of components, reduce the costs of assembly, reduce the costs of supporting production, consider the impact of DFM decisions on other factors.			
Week-09	Prototyping and Robust design: Basics, types, importance, principles of prototyping, prototyping technologies, planning for prototypes. Definition, design of experiments (DOE), robust design processes.	Lecture, Multimedia presentation and group discussion.	In-course Exam, Group Presentation, Final exam	CLO1, CLO2, CLO4
Week-10	Patents and Intellectual Property: Definition, overview of patents, utility patents, preparing a disclosure in seven steps.	Lecture, Multimedia presentation	In-course Exam, Final exam	CLO1, CLO3,
Week-11	Product Development Economies: Elements of economic analysis, time of economic analysis, and economic analysis process steps.	Lecture	In-course Exam, Group Presentation, Final exam	CLO1
Week-12	Managing Projects: Understanding and representing tasks, Gantt Charts, PERT Charts, the critical path, baseline project planning, project execution, assessing project status, corrective actions, postmortem project evaluation.	Lecture, Multimedia presentation	In-course Exam, Final exam	CLO1, CLO3
Week-13	Design for Environment (DFE): Basic concept, importance of DFE, four kinds of integration, a sense of timelessness, contemporary footwear and leather products design, functional planning, specific problems, studio projects.	Lecture, Multimedia presentation and group discussion.	In-course Exam , Final exam	CLO1, CLO3
Week-14	Design for Environment (DFE): Basic concept, importance of DFE, four kinds of integration, a sense of timelessness, contemporary footwear and leather products design, functional planning, specific problems, studio projects.	Lecture, Multimedia presentation	In-course Exam , Group Presentation, Final exam	CLO1, CLO3

Part C

15. Assessment and Evaluation

I) Assessment Strategy

Class participation and attendance	10%
In-courses/Class assessment	30%
Term Final Examination (3 hours duration)	60%
Total	100%

II) Marks distribution

- a) Continuous Assessment: 40%
- b) Summative: 60%
- c) Make-up procedures:
 - Feedback on continuous assessment is given to the students immediately after the In-course.
 - The minimum number of class-test/assignment are (n+1) with best n will be counted (here, n is number of credit). Based on the students' feedback additional class-test/assignment may be taken by the course teacher

Part D

16. Learning Materials

i) Recommended Readings

- a) Product Design and Development, TATA McGraw-Hill, Third Edition, New Delhi, 2008-Ulrich, Karl T.and Eppinger, Steven D.
 - b) The Mechanical Design Process, TATA McGraw-Hill, Second Edition, 1997-Ullman, David G.
 - c) Design through discovery -Marjorie Elliott Bevin.
- iii) **Others:** Handout/lecture material provided by the course teacher.

Course Outline of 0723-LPE-6221

Part A

1. **Course Code:** 0723-LPE-6221

2. **Course Title:** E-Commerce and International Trade

3. **Course Type:** Core Course

4. **Year / Semester:** Semester: II

5. **Academic Session:** 2022-23

6. **Course Teachers:** Kawsar Akhtar, Lecturer, ILET, DU.

7. **Prerequisite(s):** N/A

8. Credits: 3.0

9. Contact Hours: 42

10. Total Marks: 100

11. Rationale of the Course: This course comprises basic concept of e-commerce, mobile commerce, website evaluation and usability testing, internet marketing, e-security, e-core values, e-Commerce, which will help students to establish online business channel. Also, this course includes introduction to international trade, modes of operations, export strategy and marketing, which will deliver ideas to students how the leather, footwear, and leather products export market can be enlarged. Therefore, this course is crucial in this program for professional life of the students.

Course Contents:

Introduction to e-commerce: Conceptual understanding of e-commerce, e-business and e-strategy, E-commerce Drivers, Benefits of the Internet, Role of E-strategy, Value-chain in e-commerce, Analyzing Value Chain Activities, and supply-chain management and how they relate to e-commerce and e-business, Business models of the e-environment, Path to Successful E-commerce, A trend toward integrating e-commerce, E-commerce Business Models.

Mobile Commerce: Concept of Mobile Commerce, benefits of M commerce, M-Commerce Services and Applications available, Attributes of M-Commerce, Services of mobile commerce, Mobile payment, Mobile Commerce Application, Challenges of Mobile commerce, Advantages, and disadvantages of M commerce.

Web Site Evaluation and Usability Testing: Characteristics of Lame Web Sites, Common Mistakes, Questions When Evaluating a Web Site, Basic Web Site Anatomy, Color and Its Psychological Effects, Consumer Association with Key Shapes, Site Evaluation Criteria, Components of Personalization, Steps to Operationalize Personalization, Popular Myths About Cookies, Web Site Usability, Effective Web Site Design, User Testing, Site Performance Issues, Managing Content and Site Traffic.

Internet Marketing: The Pros and Cons of Online Shopping, Justifying an Internet Business, Internet Marketing Techniques, and Applications, Aggressive Internet Marketing, Pop-up Advertising, Permission Marketing, The E-cycle of Internet Marketing, Examples of the “Best” and “Worst” Web Sites, New Format Brand Ads, Personalization - the fifth “P”, Important Personalization Rules, Marketing Implications, Guidelines for Attracting Customers to your Site,

Getting the Money: Real-world and electronic cash and their unique features and uses, the key requirements for Internet-based payments, The many ways people pay to purchase goods and services on the Internet, Business-to-business methods of payment: DigiCash, E-Cash and E-Wallet, Paying for goods and services via the mobile phone, Issues and implications behind electronic money transactions and payments.

E-Security and the USA Patriot Act: Equal Credit Opportunity Act, Maine's Anti-Hacker laws, Spyware and Adware, Spyware Solutions, Compliance Legislation, Levels of Virus Damage, Steps for Antivirus Strategy, Steps to Prevent E-Commerce Fraud, Security Protection and Recovery, Creating Strong Password, Firewall Design and Implementation Issues, Corporate Networks and Firewalls, Cycle of Recovery from Attack, Biometric Security, Types of Biometrics and Select Application Areas, Terrorism, How Modern Terrorism Uses the Internet, National Strategy to Secure Cyberspace,

E-Core Values: Ethical issues and how to improve the ethical climate in e-commerce, Legal issues in terms of liability, warranties, copyrights, trademarks, and trade names, Taxation issues, legal disputes, and domain name disputes, Encryption laws and what they mean, international issues, especially with regard to intellectual property and developing countries.

Building online store with osCommerce: Introduction to E-Commerce with osCommerce, Setting Up the Development Environment, How osCommerce Works, Basic Configuration, Working with Data, Customization, Taxes, Payments, and Shipping, Securing Your Store, Advanced Features, Tools, Tips, and Tricks, Deployment and Maintenance, Building Your Business, A case study on building online store with osCommerce.

International trade: Introduction, International trade theory, Barriers to trade, non-tariff barriers to trade, Foreign Exchange Exposure and Foreign Trade, foreign exchange market, Exchange rate, Traditional Foreign exchange Instruments: Currency swaps, Futures contracts. Export and Import: characteristics, types, Export Documentation.

Modes of Operations: Modes of operation in International Business and the Economic Environments facing businesses. Factors influencing the choice of a particular mode of international business. Various forms of contractual entry mode and challenges in choosing a particular mode. Importance of economic environments, Elements of the economic environment and its impact, Balance of Payments and Balance of Trade.

Export Strategy and Export Marketing: Marketing strategies, Export marketing plan, setting of marketing objectives, market research, product characteristics, export pricing, distribution channels, find export opportunities, deciding on exports marketing objectives, and preparing action plans to achieve the objectives

12.Course Objectives: The learning objectives of this course are:

- a) To provide the terms and phrases associated with E-Commerce and International Trade.
- b) To introduce the importance of E-Commerce and International Trade.
- c) To impart the role of e-commerce and international trade in leather, leather products and footwear.

- d) To expose to various techniques employed in internet marketing, e-security and e-core values.
- e) To acquire knowledge on how to develop ecommerce online store, international trade and Export Strategy and Export Marketing.

13. Course Learning Outcomes (CLOs) and Mapping of CLOs with Program Learning Outcomes (PLOs)

a) **CLOs:** Upon completion of this course, students will be able to:

	Course Learning Outcomes (CLOs)	Learning Level
CLO1	Explain e-commerce, international trade, mode of operations, export strategy and export marketing and identify the most favorable way for their business.	C2, A2
CLO2	Identify various Business-to-business methods of payment, E-Security and E-Core Values and also recognize the ethical responsibilities in business.	C3, A3
CLO3	Analyze the value chain activities and supply chain management related to e-commerce and integrate teamwork in e-business.	C4, A5
CLO4	Create an e-commerce website to explore their theoretical knowledge on professional life.	C6
CLO5	Summarize and integrate the impact of e-commerce and international trade on global economy and environmental sustainability.	C6, A5

b) **Mapping of CLO with PLO**

(CLOs)	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8
CLO1	3				2	2		
CLO2	3		3		3		2	
CLO3	3			2		2	2	3
CLO4	3					2	2	2
CLO5	3	3		2	2	2	2	

Rank: 3-High match, 2-Medium match, 1-Low match

c) **Mapping of Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy**

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO-1	Lecture, Multimedia presentation, demonstration and problem-based exercises	Group Presentation, In-course Exam; Final Exam
CLO-2	Lecture, group discussion and problem-based exercises	Group Presentation, In-course Exam; Final Exam
CLO-3	Lecture, guided reading and problem-based learning	Assignment, Group Presentation, In-course Exam, and Final Exam
CLO-4	Lecture, multimedia presentation, group discussion, literature review, demonstration, and problem-based exercises	Group Presentation, In-course Exam, and Final Exam
CLO-5	Lecture, group discussion, literature review, and problem-based exercises	Group Presentation, Assignment, In-course Exam, and Final Exam

Part B

14. Course plan specifying content, CLOs, co-curricular activities (if any), teaching learning and assessment strategy mapped with CLOs

Time Period	Topic	Teaching-Learning Strategy	Assessment Strategy	Corresponding CLOs
Week-01	Introduction to e-commerce: Conceptual understanding of e-commerce, e-business and e-strategy, E-commerce Drivers, Benefits of the Internet, Role of E-strategy.	Lecture, Multimedia presentation, demonstration and problem-based exercises	Group Presentation, In-course Exam, Final Exam	CLO1
Week -02	Value-chain in e-commerce, Analyzing Value Chain Activities, and supply-chain management and how they relate to e-commerce and e-business, Business models of the e-environment, Path to Successful E-commerce, A trend toward integrating e-commerce, E-commerce Business Models.	Lecture, Multimedia presentation, demonstration, guided reading and problem-based learning	Group Presentation, In-course Exam, Final Exam	CLO1, CLO3

Week - 03	Mobile Commerce: Concept of Mobile Commerce, benefits of M commerce, M-Commerce Services and Applications available, Attributes of M-Commerce, Services of mobile commerce, Mobile payment, Mobile Commerce Application, Challenges of Mobile commerce, Advantages, and disadvantages of M commerce.	Lecture, group discussion and problem-based exercises	Group Presentation, In-course Exam, Final Exam	CLO1, CLO2
Week - 04	Web Site Evaluation and Usability Testing: Characteristics of Lame Web Sites, Common Mistakes, Questions When Evaluating a Web Site, Basic Web Site Anatomy, Color and Its Psychological Effects.	Lecture, multimedia presentation, group discussion, literature review, demonstration, and problem-based exercises	Group Presentation, In-course Exam, Final Exam	CLO4
Week - 05	Consumer Association with Key Shapes, Site Evaluation Criteria, Components of Personalization, Steps to Operationalize Personalization, Popular Myths About Cookies, Web Site Usability, Effective Web Site Design, User Testing, Site Performance Issues, Managing Content and Site Traffic	Lecture, multimedia presentation, group discussion, literature review, demonstration, and problem-based exercises	Group Presentation, In-course Exam, Final Exam	CLO4
Week - 06	Internet Marketing: The Pros and Cons of Online Shopping, Justifying an Internet Business, Internet Marketing Techniques, and Applications, Aggressive Internet Marketing. Pop-up Advertising, Permission Marketing, The E-cycle of Internet Marketing, Examples of the “Best” and “Worst” Web Sites, New	Lecture, Multimedia presentation, demonstration , guided reading and problem-based learning	Group Presentation, In-course Exam, Final Exam	CLO2, CLO3

	Format Brand Ads, Personalization - the fifth “P”, Important Personalization Rules, Marketing Implications, Guidelines for Attracting Customers to your Site,			
Week - 07	Pop-up Advertising, Permission Marketing, The E-cycle of Internet Marketing, Examples of the “Best” and “Worst” Web Sites, New Format Brand Ads, Personalization - the fifth “P”, Important Personalization Rules, Marketing Implications, Guidelines for Attracting Customers to your Site,	Lecture, group discussion and problem-based exercises	Group Presentation, In-course Exam, Final Exam	CLO2
Week - 08	Getting the Money: Real-world and electronic cash and their unique features and uses, the key requirements for Internet-based payments, The many ways people pay to purchase goods and services on the Internet, Business-to-business methods of payment: DigiCash, E-Cash and E-Wallet, Paying for goods and services via the mobile phone, Issues and implications behind electronic money transactions and payments.	Lecture, group discussion and problem-based exercises	Group Presentation, In-course Exam, Final Exam	CLO2
Week - 09	E-Security and the USA Patriot Act: Equal Credit Opportunity Act, Maine’s Anti-Hacker laws, Spyware and Adware, Spyware Solutions, Compliance Legislation, Levels of Virus Damage, Steps for Antivirus Strategy, Steps to Prevent E-Commerce Fraud, Security Protection and Recovery, Creating Strong Password,	Lecture, group discussion and problem-based exercises	Group Presentation, In-course Exam, Final Exam	CLO1, CLO2

	Firewall Design and Implementation Issues, Corporate Networks and Firewalls, Cycle of Recovery from Attack, Biometric Security, Types of Biometrics and Select Application Areas, Terrorism, How Modern Terrorism Uses the Internet, National Strategy to Secure Cyberspace,			
Week - 10	E-Core Values: Ethical issues and how to improve the ethical climate in e-commerce, Legal issues in terms of liability, warranties, copyrights, trademarks, and trade names, Taxation issues, legal disputes, and domain name disputes, Encryption laws and what they mean, international issues, especially with regard to intellectual property and developing countries.	Lecture, group discussion and problem-based exercises	Group Presentation, In-course Exam, Final Exam	CLO2
Week - 11	Building online store with osCommerce: Introduction to E-Commerce with osCommerce, Setting Up the Development Environment, How osCommerce Works, Basic Configuration, Working with Data, Customization, Taxes, Payments, and Shipping, Securing Your Store, Advanced Features, Tools, Tips, and Tricks, Deployment and Maintenance, Building Your Business, A case study on building online store with osCommerce.	Lecture, multimedia presentation, group discussion, literature review, demonstration, and problem-based exercises	Group Presentation, In-course Exam, Final Exam	CLO4
Week - 12	International trade: Introduction, International trade theory, Barriers to trade, non-tariff barriers to	Lecture, Multimedia presentation,	Group Presentation, In-course	CLO1, CLO5

	trade, Foreign Exchange Exposure and Foreign Trade, foreign exchange market, Exchange rate, Traditional Foreign exchange Instruments: Currency swaps, Futures contracts. Export and Import: characteristics, types, Export Documentation.	demonstration, literature review and problem-based exercises	Exam, Final Exam	
Week - 13	Modes of Operations: Modes of operation in International Business and the Economic Environments facing businesses. Factors influencing the choice of a particular mode of international business. Various forms of contractual entry mode and challenges in choosing a particular mode. Importance of economic environments, Elements of the economic environment and its impact, Balance of Payments and Balance of Trade.	Lecture, Multimedia presentation, demonstration , and problem-based exercises	Group Presentation, In-course Exam, Final Exam	CLO1
Week - 14	Export Strategy and Export Marketing: Marketing strategies, Export marketing plan, setting of marketing objectives, market research, product characteristics, export pricing, distribution channels, find export opportunities, deciding on exports marketing objectives, and preparing action plans to achieve the objectives.	Lecture, Multimedia presentation, demonstration, literature review and problem-based exercises	Group Presentation, In-course Exam, Final Exam	CLO1, CLO5

Part C

15. Assessment and Evaluation

i) Assessment Strategy:

Class attendance and participation	10%
In-course Exam/Class Test	30%
Semester Final Examination (3 hours duration)	60%
Total	100%

ii) Marks distribution

- a) Continuous Assessment: 40%
- b) Summative: 60%
- c) Make-up Procedures: Two in-course exams will be taken and average marks will be counted. Feedback on continuous assessment is given to the students immediately after the test. Based on the students' feedback additional class/assignment may be taken by the course teacher.

Part D

16. Learning Materials

i) Recommended Reading

- a) Electronic Commerce: From Vision to Fulfillment by Elias M. Awad, Pearson College Div, 3rd edition.
- b) Building Online Stores with osCommerce: Professional Edition by David Mercer, PACKT Publishing, Mumbai.
- c) Francis Cherunilam, International Business, Text and Cases, Himalaya Publishing Company

ii) Supplementary Readings

- a) T. A. S. Balagopal: Export Management, Himalaya Publishing House
- b) D. C. Kapoor: Export Management, Vikas Publishing House Pvt Ltd

iii) **Others:** Hand notes/Lecture materials will be provided by the course teacher.

Semester-III		
Course Code	Course Title	Credits
0723-LPE-6300	Project	4.0
0723-LPE-6302	Internship	2.0
0723-LPE-6304	Viva Voce	1.0
Total		7.00
Grand Total		40.00

Course Outline of 0723-LPE-6300

Part A

1. **Course Code:** 0723-LPE-6300
2. **Course Title:** Project
3. **Course Type:** Core course
4. **Year/Semester:** Semester: II and III
5. **Academic Session:** 2022-2023
6. **Course Teacher:** Respective Supervisor/Co-supervisor, ILET, DU.
7. **Pre-requisite:** N/A
8. **Credit Value:** 4.0
9. **Contact Hour:** No specific contact hour
10. **Total Marks:** 100
11. **Rational of the Course:** Master's project is the concluding requirement for the M.Sc. in Leather Products Engineering. It is mostly designed to develop research aptitude among the students. Candidates are expected to complete a project that demonstrates their ability to conduct in-depth investigation of a specific problem to find feasible solution.

Course Content

During project work, experimental and theoretical investigation of various problems related to leather and allied industry, environmental science, nanotechnology, industrial engineering, will be carried out. The topic should provide an opportunity to the student in developing problem-solving skills, team work capability, argumentative skills, excellent writing ability, creativity and technical knowledge etc. Student is expected to complete the literature review/survey, selection of suitable methodology for conducting investigation and submission of an individual research proposal. At the end, student is expected to draw conclusion, prepare the dissertation, submit to the committee and appear for the project defense.

12. Course Objectives

- a) To develop values and attitudes related to ethical research work among students.
- b) To ensure utilization of gathered knowledge in solving new real-life problems.
- c) Enhance the ability of the students to analyze and summarize information available in the literature
- d) Develop effective communicative skills to present research on leather and allied issues.

13. Course Learning Outcomes (CLOs) and Mapping of CLOs with Program Learning Outcomes (PLOs)

a) **CLOs:** At the completion of this course students will be able to:

	Course Learning Outcomes (CLOs)	Learning Level
CLO-1	Identify, analyze and formulate a research problem and use extensive investigation for obtaining its solution.	C1
CLO-2	Explain the concept of ethics in research and impact of leather products engineering solutions on society and environment.	C2
CLO-3	Deliver designed project findings through oral presentations, demonstrations, and written technical report format.	C2, C3

b) **Mapping Course Learning Outcomes (CLOs) with Program Learning Outcomes**

(CLOs)	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8
CLO-1	3					2	2	1
CLO-2	3	3	3			3	3	
CLO-3	3			3		2		

(PLOs)

Rank: 3-High match, 2-Medium match, 1-Low match

c) **Mapping of Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy**

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO-1	Discussion, encouragement, self-study	Project defense and report evaluation by external as well as internal
CLO-2	Lecture, discussion, demonstration	
CLO-3	Writing and proofreading	

Part B

14. Course plan specifying content, CLOs, co-curricular activities (if any), teaching learning and assessment strategy mapped with CLOs

Month	Topic	Teaching-Learning Strategy	Assessment Strategy	Corresponding CLOs
1	Interactive Lecture session on Research methodology. Introduction to project and Area of project.	Discussion and encouragement	Project defense and report evaluation by external as well as internal	CLO1
1	Independent Study on selected research area and Topic selection	Self-study		
2-10	Self-work in Laboratory/Field/Industry	Discussion		
11	Motivation builds upon documentation ethics.	Lecture, Discussion and demonstration		CLO1 and CLO2

	Discussion on how Result Analysis and Performance Evaluation are done			
11	Project dissertation preparation	Writing		CLO3
12	Proofing the dissertation, approval from advisor. Submission and Defense.	Writing, Final proofreading.		CLO3

Part C

15. Assessment and Evaluation

i) Assessment Strategy

Strategy	Percentage of total marks
Project defense	40%
Dissertation Submission	60%
Total	100%

ii) Marks distribution:

- a) Continuous Assessment/defense: 40%
- b) Summative: 60%
- c) Make-up Procedures: N/A.

Part D

16. Learning Materials

Recommended Readings:

- a) Writing the Winning thesis or Dissertation: A Step-by-Step Guide - By Allan A. Glatthorn, Randy L. Joyner.
- b) An Introduction to Research Methods- M. Nurul Islam
- c) Relevant books, scientific journals, handbooks, patents and manuals.

Course Outline of 0723-LPE-6302

Part A

1. **Course Code:** 0723-LPE-6302

2. **Course Title:** Internship

3. **Course Type:** Core course

4. **Year/Semester:** Semester: III

5. **Academic Session:** 2022-2023

6. Course Teacher: Respective Guide Teachers, Institute of Leather Engineering and Technology, DU.

7. Pre-requisite: N/A

8. Credit Value: 2.0

9. Contact Hour: 2 months

10. Total Marks:100

11.Rationale of the Course: The course is designed to expose students to the working environment in the industry. The intensive training will enable students to understand the theories studied with more detailed and hands-on practice within a real job situation. Furthermore, students will learn how to do a work following the specified instructions coupled with their own technical knowledge, creativity and artistry.

Course Content

Factory inside out, product design and development, cutting, skiving, splitting, sewing and finishing, quality control, merchandising and waste management.

12. Course Objectives: The Course has been designed in a manner

- a) To expose students to the actual working environment and get acquainted with the organization structure, business operations and administrative functions.
- b) To have hands-on experience in unit operation and unit process involved in leather products manufacturing process
- c) To enhance industry- academia collaboration and co-operation.

13. Course learning outcomes (CLOs) and mapping of CLOs with program learning outcomes (PLOs)

- a) **CLOs:** At the completion of this course students will be able to:

	Course Learning Outcomes (CLOs)	Learning Level
CLO-1	Demonstrate acquired skills in the actual working environment.	C3, A3
CLO-2	Analyze and evaluate layout, modern technologies, production process and waste management facilities.	C3, C4
CLO-3	Summarize the collected data to generate technical reports.	C4

b. Mapping course learning outcomes (CLOs) with program learning outcomes (PLOs)

	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8
CLO-1	3				2	2	2	2
CLO-2	3	1				2	2	3
CLO-3	3			2				

Rank: 3-High match, 2-Medium match, 1-Low match

c) Mapping of Course Learning Outcomes (CLOs) with the Teaching-Learning &Assessment Strategy

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO-1	Lecture, display, demonstration, interactive discussion, self-study and motivation	Presentation and Viva voce Report Evaluation
CLO-2	Lecture, display, demonstration, interactive discussion, self-study and motivation	
CLO-3	Interactive discussion, lecture, motivation and self-study	

Part B

14. Course plan specifying contents, CLOs, co-curricular activities (if any), with teaching-learning and assessment strategies mapped with CLOs

Week	Topic	Teaching-Learning Strategy	Assessment Strategy	Corresponding CLOs
Week -1	Introductory discussion on industrial training: Objectives, Plan and Significance	Class lecture by guide teacher	Presentation and Viva voce Report Evaluation	CLO1
Week -2-3	Factory inside out	Display and demonstration at the industry		CLO2
Week 4	Product design and development	Interactive discussion		
Week 5-6	Cutting, skiving, splitting, sewing and finishing	Self-study and interactive discussion		
Week -7	Quality Control, merchandising and waste management	Interactive discussion and motivation at the industry		CLO3
Week -8	Preparation of report and presentation slide	Lectures by guide teacher		

Part C

15. Assessment and Evaluation

i) Assessment Strategy

Strategy	Total Marks
Presentation and Viva voce	40%
Report Submission	60%
Total	100

ii) Marks distribution

- a) Continuous Assessment/defense: 40%
- b) Summative: 60%
- c) Make-up Procedures: N/A

Part D

16. Learning Materials

Recommended Readings

- a) Writing the Winning Thesis or Dissertation: A Step-by-Step Guide - By Allan A. Glatthorn, Randy L. Joyner.
- d) Why (and How) to Take a Plant Tour by and Stephen E. Macadam, published on Harvard Business Review.

Course Outline of 0723-LPE-6304

Part A

1. **Course Code:** 0723-LPE-6304

2. **Course Title:** Viva Voce

3. **Course Type:** Core Course

4. **Year/ Semester:** Semester: III

5. **Academic Session:** 2022-23

6. **Course Teachers:** N/A

7. **Prerequisite(s):** N/A

8. **Credits:** 1.0

9. **Contact Hours:** N/A

10. Total Marks: 50

11. Rational of the Course: This course shall ensure that the students are able to present the knowledge, skills and practical experience they earned throughout the program to the panel of experts'/ Examination committee in the most effective way.

Course Contents

It is based on all the courses the students have studied during the M. Sc. in Leather Products Engineering program.

12. Course Objectives: The learning objectives of this course are-

- a) To equip the students with analytical and evaluation abilities to respond to impromptu questions by the examination panel members.
- b) To train the students to face the expert panel and present the knowledge, skills and problems in well-organized way.

13. Course Learning Outcomes (CLOs) and Mapping of CLOs with Program Learning Outcomes (PLOs)

a) **CLOs:** At the completion of this course students will be able to:

	Course Learning Outcomes (CLOs)	Learning Level
CLO-1	Demonstrate the acquired knowledge and expertise in the interview panel.	C3, A3

b) Mapping of CLO with PLO

(CLOs)	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8
CLO-1	3			3				

Rank: 3-High match, 2-Medium match, 1-Low match

Part B

14. Course plan specifying content, CLOs, co-curricular activities (if any), teaching learning and assessment strategy mapped with CLOs: Not Applicable

Part C

15. Assessment and Evaluation: Comprehensive Viva: 100%

Part D

16. Learning Materials

All the books of all the semesters and the journals, data bases, real problems of leather and allied sector.