Department of Leather Engineering

Khulna University of Engineering & Technology

B. Sc. Engineering 4^{th} Year 1^{st} Term Examination-2023

LE 4111

Footwear Engineering III

Time: 3.0 Hours | Full Marks: 210

N.B. i) Answer any **THREE** questions from each section in separate scripts.
ii) Figures in the right margin indicate full marks.
iii) Assume reasonable data if any missing.

SECTION–A

1(a) Discuss the impact of cutting knife design on the precision and efficiency of the cutting process in shoe manufacturing. How do the design elements, such as single vs. double edged, different widths and cutting edges, affect the overall production quality? 09

1(b) Explain the process of making strip steel knives. What are the critical steps involved and how do they contribute to the effectiveness and accuracy of the cutting knives? 09

1(c) Analyze the key benefits of dieless cutting systems in the footwear industry. How do these benefits compare to traditional cutting methods in terms of efficiency, precision and material waste reduction? 09

1(d) Suppose, you have been given 160 sqdm of A-grade leather to cut various parts for size 37 court shoes. If each pairs require 11.50 sqdm of leather, how many complete pairs of size 35 shoe uppers can you cut from the provided leather? 08

2(a) Evaluate the factors affecting the cutting results in Russ and Small method (RSM) for calculating material allowance. Explain how each factor contributes to the overall material consumption. 12

2(b) Describe the challenges related to thread breakages in shoe construction. How can these issues be effectively managed to maintain production flow? 11

2(c) Write short notes on (i) English binding (ii) Ghillie topline and (iii) Nicking and Pleating. 12

3(a) State the significance of topline in shoe construction. How does the topline tape contribute to the shoe's durability and aesthetic? 08

3(b) Make a sequence of operations for closing court shoe upper including their specifications. 10

3(c) Explain the purpose of a footwear specification sheet. What key information does it contain and why is it crucial for the production process? 09

3(d) "Effective packaging of footwear can reduce damage. enhance product appeal and improve storage efficiency", Explain it. 08

4(a) Mention the steps involved in introducing a new article in a footwear industry. 10

4(b) List out the criteria for a good factory lay out in the footwear industry and their impact on production efficiency. 08

4(c) Critically asses the role of humidity control during the storage and shipping of footwear. What are the recommended practices to prevent damage of different footwear materials? 08

4(d) Write short notes on **(i)** Depreciation cost **(ii)** Royalty cost and **(iii)** Semi-variable cost. 09

SECTION–B

5(a) Why finishing operation is carried out after shoe manufacturing? 07

5(b) How applied heat works on the shoe surface during wrinkle chasing operation? Expound the disadvantages of wrinkle chasing process on a shoe surface. 12

5(c) What are the practices you needed to follow during cleaning process? Explain the cleaning principles of solvent based cleaners and polishers. 08

5(d) Why repairing is needed after shoe making process? Write down the preface of filler as a repairing agent in shoe finishing operation. 08

6(a) Why temporary attachment by adhesive is done before shoe lasting operation? 10

6(b) Write down the complete sequence of operations in a lasting department. 15

6(c) Differentiate among hot melt, polychloroprene, latex and rubber solution according to their adhesive properties. 10

7(a) What is meant by Californian slip lasted construction. How does this method differ from other shoe constructions? 08

7(b) Write down the sequence of a string lasting process. 10

7(c) Define vulcanized shoe construction. Discuss the sequential operation of direct vulcanized shoe construction process. 12

7(d) Draw a cross-sectional view of a Californian slip-lasted shoe. 05

8(a) Why drying out and wetting out is needed during cleaning operation? 08

8(b) Write down the role of creams, polishes and waxes during top dressing operation. 07

8(c) Mention some commonly used upper and soling materials used in footwear production. Also write down the recommended bonding system for shoe materials. 10

8(d) Mention the faults that are occurred during shoe spraying and their possible causes. 10

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LE 4029

Tannery Waste Management

Time: 3.0 Hours Full Marks: 210

N.B. i) Answer any **THREE** questions from each section in separate scripts.
ii) Figures in the right margin indicate full marks.
iii) Assume reasonable data if any missing.

SECTION–A

1(a) State the sources and environmental effects of the following pollution parameters generated in the tannery effluent: (**i**) Sulphides, (**ii**) TKN and (**iii**) COD. 12

1(b) Categorize the tannery effluent. State the key considerations for the treatment of tannery effluent. 08

1(c) Write notes on the flow equalization system with advantages and limitations. 09

1(d) Give the discharge standard of the pollution parameters of the tannery wastewater to the surface water based on ECR 2023. 06

2(a) What are colloids? How do colloids get electrical charges on its surface? Explain with examples. 09

2(b) Distinguish between the mechanism of coagulation based on sweep-floc formation and adsorption & charge neutralization. 10

2(c) To produce drinkable water from biologically treated tannery wastewater which treatment methods could be used and how? 06

2(d) A tannery is planning to install a wastewater treatment plant to remove turbidity. A coagulation-flocculation plant has been proposed within the following design parameters. Wastewater flow rate, 0.55 m^3/s, slow mixing time 20 minutes, velocity gradient, $G = 30$ s^{-1} and water temperature is 20^0 C. Now design a 3-compartment flocculation tank and size the mixing equipment of the first compartment. [Power of the variable speed motor, JTQ 50 is 0.37 kW and rotational speed is 30 rpm. You have to use 3 blades one pitch propeller type impeller with the impeller constant of 0.32] 10

3(a) Describe the environmental pollution during carrying out the leather coating. 07

3(b) Write down the environmental factors that control the biological treatment process by influencing the health and growth of microorganisms. 10

3(c) Write down the advantages and limitations of trickling filter with its schematic diagram. 08

3(d) An activated sludge process is used to treat tannery soaking wastewater with a flow rate of 1250 m^3/d and BOD_5 concentration of 275 mg/L. The aeration tank is operated at an MLSS of 2250 mg/L, and HRT of 360 min. The sludge is wasted at 21 m^3/d with solids concentration of 7500 mg/L. The effluent BOD_5 concentration is 65 mg/L. calculate the volume of the aeration tank, SRT, volumetric loading rate, F/M ratio of the process and also identify the nature of the plant based on F/M value. 10

4(a)	Give the schematic diagram of a rectangular sedimentation tank and illustrate the outlet zone of the basin.	10
4(b)	A tannery must treat about 15000 m^3/d of wastewater. Flocculation particles are produced by coagulation, on a column analysis indicates that an overflow rate of 20 m^3/d will produce satisfactory removal at a depth of 3.5 m. Now determine the size of the required circular settling tanks and also find the necessary retention time.	08
4(c)	Why does Alum consume alkalinity in water treatment? Explain. Give the advantages and limitations of the Alum coagulation process.	08
4(d)	State the significance of the following operational parameters in activated sludge process. **(i)** Oxygen uptake rate (OUR), **(ii)** MLVSS and **(iii)** Sludge age.	09

SECTION–B

5(a)	State the factors should be considered to improve the properties of composites.	07
5(b)	How can you remove the sulfide from tannery wastewater? Explain.	08
5(c)	Discuss the conventional model for safe disposal of tannery sludge as landfill with proper neat sketches.	10
5(d)	Define fiber reinforced composites. Mention some options for the utilization of leather fiber as green byproducts.	10
6(a)	Mechanical and thermal properties of leather fiber reinforced composite depend on fiber length, orientation and volume fraction-Why?	10
6(b)	How can you utilize leather shavings/splitting as poultry feed?	10
6(c)	Mention the objectives and strategies of solid waste management.	07
6(d)	Tannery industries are categorized as red industry by the DoE of Bangladesh. Explain, why?	08
7(a)	Write down the toxicity of heavy metal components present in the tannery solid waste.	10
7(b)	Define sustainable development. Write down the components of sustainable development in tanning industry.	10
7(c)	Write down the principal reasons to consider the use of composting process.	07
7(d)	State the necessary procedures for the recycle or reuse of **(i)** Salt from Curing and **(ii)** Liquor from Lime liquor.	08
8(a)	Briefly discuss the recovery of chromium from chrome containing wastewater by poly electrolyte precipitation with proper diagram and parameters.	10
8(b)	How can you utilize the untanned collagen for the production of gelatin?	10
8(c)	Define environmental management system (EMS). Write down the key elements of an EMS.	07
8(d)	How can you reduce the water consumption from tanning industry? Explain.	08

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LE 4109

Leather Products Engineering III

Time: 3.0 Hours Full Marks: 210

N.B. i) Answer any **THREE** questions from each section in separate scripts.
ii) Figures in the right margin indicate full marks.
iii) Assume reasonable data if any missing.

SECTION–A

1(a)	How clothes communicate our intangible language from culture to culture?	08
1(b)	Depict the influence of culture and geography on clothing array in contemporary time.	10
1(c)	"The future of fashion will incorporate a wardrobe that not only cares about aesthetics but also ethical practices and the environment in mind", Explain briefly.	10
1(d)	Define notches. What is the importance of notches on a pattern?	07
2(a)	Define Blouson jacket. Show the complete set of patterns for a blouson jacket.	12
2(b)	Which type of collar is most suitable for a blouson jacket? Draw and mention the special features of that collar.	08
2(c)	Compare among skirt, coat and blazer.	06
2(d)	Illustrate the following terms with related figures: **(i)** Body rise, **(ii)** Armscye length and **(iii)** Placket.	09
3(a)	Define enlargement. Illustrate the enlargement techniques for blouson jacket with related figures.	20
3(b)	Note the necessary measurements for drafting a jacket block.	07
3(c)	Compare among dart, pleat and tuck.	08
4(a)	Briefly describe the construction process of 12 size straight skirt block.	15
4(b)	What is dart manipulation? Explain the slash and spread method of dart manipulation with necessary sketch.	12
4(c)	Mention the different types of pleats used in skirt with necessary sketch.	08

SECTION–B

5(a)	Define perspective drawing and engineering drawing. Sketch a gent's waist coat and show the frameworks of complete pattern structure.	16
5(b)	Mention the key measurements for developing a waist coat.	04
5(c)	Define waist coat. Write short note on the collar, neck line and pocket used in waist coat.	08
5(d)	Briefly state the measurement technique of scye with sketch.	07

6(a)	What is meant by physiological function of clothing? Narrate the parameters of clothing physiology.	10
6(b)	Classify trouser. Figure out the style introduction of a jeans style trouser.	06
6(c)	Describe the front pocket preparation and fly facing adaptation technique of a trouser with related figures.	15
6(d)	Differentiate between pleated and turn-ups trouser.	04
7(a)	Differentiate accessories from trimmings. Classify garment accessories.	06
7(b)	Mention the components of a rivet.	05
7(c)	State in brief different stiffening process of leather products. List out molded leather goods.	13
7(d)	If a consumer waist is 32 inches, calculate approximate chest and across back.	07
7(e)	Compare drafting from draping.	04
8(a)	What is meant by brand and brand equity? Briefly state the steps to develop a new brand.	12
8(b)	Illustrate the life cycle of a brand with suitable graph.	08
8(c)	Write short notes on the followings: **(i)** Snap fastener, **(ii)** Eyelet, **(iii)** Zero-point perspective and **(iv)** Velcro.	10
8(d)	Cite large abdomen problem. State in brief the troubleshooting of the problem in the case of trouser fitting.	05

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B. Sc. Engineering 4th Year 1st Term Examination-2023

LE 4123

Computer Integrated Manufacturing Systems

Time: 3.0 Hours — Full Marks: 210

N.B. i) Answer any **THREE** questions from each section in separate scripts.

ii) Figures in the right margin indicate full marks.

iii) Assume reasonable data if any missing.

SECTION–A

1(a) What is meant by CAPP? Explicate the CIM wheel. 10

1(b) Classify CIMS. What are the challenges for the implementation of CIMS for industry 4.0? 06

1(c) State the information flow diagram of a leather products industry. 07

1(d) A leather goods industry requires more than weeks to complete 220 units of purses. The industry has been accustomed to automation that reduced the average setup time from 3.0 hr. to 2.8 hr., and the average operation time from 4.0 min to 3.5 min., but the sequence of nine (09) operations remains constant in the plant. The average non-operation time due to control, adjournments, inspections, and so on, is 5.0 hrs. Compute how many days require to produce 220 units; the production rate, and assume an 8-hr. shift per day. 12

2(a) What is meant by AI-driven footwear design? How does a robot work? - give an algorithm. 08

2(b) Define Finite Element Analysis (FEA). State the applications of FEA in products design and performance analysis. 12

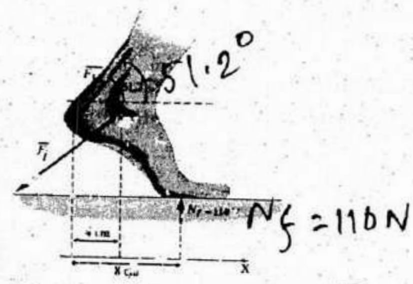
2(c) "Mere introduction of automation in manufacturing shoe, may or may not contribute to the final productivity, quality, or even cost."- justify the comment. 05

2(d) Illustrate the smart nesting. List out the sequential command for vamp construction via Power software. 10

3(a) Define GRF and medical-grade footwear. 05

3(b) Define pattern engineering. Distinguish among pitch, piece and packet regarding footwear pattern engineering. 10

3(c) Since 1949, ADIDAS has worked to increase the functionality of sports shoes by lowering the ground reaction force by design modification of insole. The force during the ADIDAS sports shoe was 220 N in 2D mode and bare foot data was given in the following figure. 20



(i) Draw the lever diagram from the figure and find (ii) Force $|\overline{F_H}|$ exerted on the heel point by CT; (iii) Estimate variation of force; and (iv) Magnitude of the force $|\overline{F_j}|$ exerted on the foot at ankle joint.

4(a) State the principle of CNC and DNC machines. Cite the advantages of the stylus over digital pen, and joystick. 12

4(b) Figure out 2D digitizer. Write down the functions of different buttons in a 2D digitizer. 10

4(c) Cite a few conventional shoe-designing software. Differentiate wireframe model of the footwear from the solid model. 06

4(d) Classify spline. Remark on the importance of various splines in 3D footwear designing. 07

SECTION–B

5(a) Define industrial automation. Distinguish between fixed automation and flexible automation. 08

5(b) Show the relationship between production volume and product variety for different automation system. 07

5(c) Describe how automation system achieve maximum profit in respect of production cost and volume. 12

5(d) Draw an industrial product life cycle and briefly explain its different stages. 08

6(a) Define manufacturing system. Describe the components of a manufacturing system. 10

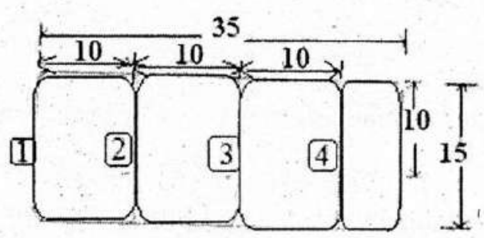
6(b) What do you mean by intermittent production system? Explain the characteristics of different types of intermittent production system. 11

6(c) Briefly describe the Opitz classification system with example. 07

6(d) Mention the principles of material handling system. 07

7(a) Why FAMS is more appropriately used than FMS? 05

7(b) A flexible manufacturing system (FMS) is being planned. It has a ladder layout as picture shown in figure. It uses a rail guided vehicle (RGV) system to move parts between stations in the layout. All work parts are loaded into the system at station 1, move to 1 of three processing stations (2, 3 or 4) and then brought back to station 1 for unloading. Once loaded on to its RGV, each work part stays on board the vehicle throughout its time the FMS. Load and unload times at station 1 is 1 min each. Processing time are: 6.0 min at station2, 8.0 min. at station3; and 10 min. at station 4. Hourly production of parts through the system is: 8.0 parts through station 2; 7 parts through station 3; and 6 parts through station4. Now – (i) Develop the form-to chart for trips and distance. (ii) Develop the network diagram, (iii) Determine the number of RGV that are needed to meet the requirement of the FMS, if vehicle speed = 60m/min. and the anticipated traffic factor = 0.85. Assume reliability = 100%. 15



7(c) Explain the concept of "Group Technology (GT)". Write down the conditions when GT is most appropriate to apply. What are the benefits of implementing GT? 15

8(a) What are the Automated Guided Vehicle (AGV) systems? Briefly describe the following types of conveyors: (i) Roller Conveyor (ii) Belt conveyor (iii) In-floor two-line conveyor 12

8(b) Apply the rank order clustering technique to the part-machine incidence matrix in the following table to identify logical part families and machine groups. Parts are identified by numerically and machines are identified by letter. 15

		Part Numbers				
		1	2	3	4	5
Machine ID	A		1	1		
	B			1		1
	C	1			1	
	D		1	1		1
	E	1				1

8(c) Define vehicle safety and conveyor safety. Mention the unit load principle. 08

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B. Sc. Engineering 4th Year 1st Term Examination-2023

LE 4121

Environmental Science & Engineering

Time: 3.0 Hours Full Marks: 210

N.B. i) Answer any **THREE** questions from each section in separate scripts.
ii) Figures in the right margin indicate full marks.
iii) Assume reasonable data if any missing.

SECTION–A

1(a)	Define and classify ecological pyramids.	07
1(b)	How does tropospheric ozone differ from stratospheric ozone?	06
1(c)	State the significance of wetlands in the context of the Bangladeshi environmental condition.	07
1(d)	Order GHG gases according to Global Warming Potential.	05
1(e)	List out the toxic metals according to leaching potential. Identify their principal sources and discuss their impact.	10
2(a)	What is the Kyoto Protocol? Why did it fail?	08
2(b)	List out the size major air pollutants with sources and impacts	12
2(c)	How is ground level ozone formed? State the consequences of ground level ozone on environment.	08
2(d)	How is ozone depletion and global warming related? Explain your opinion.	07
3(a)	What is Biochemical Oxygen Demand (BOD)? How is it related to surface water quality?	06
3(b)	Suppose a leather industry discharge wastewater into river without treatment. In this case draw an Oxygen sag curve with necessary description.	09
3(c)	A BOD analysis is begun on Monday. 40 ml of wastewater with a DO of 0 mg/L is mixed with 260 mg/L of diluted water with a DO of 10 mg/L. The sample is then put in the incubator. Since the 5th day falls on Saturday, and lab personnel do not work on Saturday, the final DO does not get measured until Monday, the 7th day. The final DO is measured at 3.5 mg/L. However, it is discovered that the incubator was set at 30°C. Assume that K_1 = 0.2/day at 20°C and θ = 1.05. Determine the BOD_5 of the wastewater at 20°C.	15
3(d)	Give the differences between carbonaceous BOD (CBOD) and nitrification BOD (NBOD).	05
4(a)	What are the pollutants present in the wastewater of tannery? How can these pollutants be taken care off?	10
4(b)	State the specific sources of ground water pollution. Why can ground water not cleanse itself very well?	07
4(c)	Write short notes on sources and effects of the following pollutants (i) Heavy metals (ii) Organic matters (iii) Disease-causing organism.	12
4(d)	Which analyses are used to assess the impurities in water?	06

SECTION–B

5(a)	Define sustainability. Depict the equation that shows the environmental impact of human activities.	05
5(b)	Define LCA. How is LCA used in the real world?	05
5(c)	Define self-regulation and state its purpose.	06
5(d)	State the role of baseline studies in EIA.	06
5(e)	What do you know about Battelle Environmental Evaluation System (EES)? State its limitation.	06
5(f)	Define ecotoxicology. How is damage to an ecosystem measured?	07

6(a) **Project Description:** 35

A new export-oriented leather company is being built near the Rupsha River by a China-Bangladesh joint venture, covering an area of 20,000 square feet. The company will have an annual production capacity of five million square feet of finished leather, creating jobs for 3,162 Bangladeshi nationals. Additionally, an Effluent Treatment Plant (ETP) with a capacity of approximately 600 m^3/day will be constructed to discharge treated water into the river. The ETP facility will include units for effluent and sludge treatment and systems for the disposal of treated effluent and sludge.

Instruction:

First, identify only the major interactions in the following table. Then, assume reasonable magnitudes and importance of the identified interactions by assigning a numerical value from 1 to 10 for both magnitude and importance. For the Lohani and Thanh method, assume a relative weight (priority value) from 1 to 10. Avoid using fractional values. To streamline the answer, only use columns 4-11 in your table. Ensure you add the priority value column and total (column & row) in your table for the Lohani and Thanh method.

Question:

Based on the Leopold method and the Lohani and Thanh method, determine the major activities and identify the areas that need more attention.

Evaluation Method	Magnitude / Importance	Sub-categories (3)	Environmental factors (4)	Raw Material Procurement (5)	Construction Operations (6)	Water management (7)	Energy management (8)	Hides/skins processing (9)	Wastewater treatment (10)	Solid waste management (11)	Total
				Action/Activities							
Environmental /social conditions (1)	Physical (2)	Soil	Soil quality								
			Erosion								
			Geomorphology								
		Water	River quality								
			Coastal Zone								
			Groundwater quality								
			Sea quality								
		Air	Air quality								
			Odors								
			Noise								
	Biological	Flora	Forests								
			Agricultural Land								
			Wetlands								
			River flora								
		Fauna	Mammals								
			Birds								
			Fish								
			Other vertebrates								
			Invertebrates								
		Ecosystems	Ecosystem health								
			Ecosystems destruction								
	Social	Land uses	Rural community impact								
			Fisheries								
			Urban impact								
			Industrial impact								
			Recreational uses								
		Patrimony	Landscape aesthetics								
			Historical/cultural sites								
			Heritage preservation								
			Wilderness quality								
		Social	Population density								
			Employment								
			Environmental hazards								
			Total								

7(a) What is the legal status of EIA in Bangladesh? 05

7(b) Explain why mitigation should not be a reactionary response to environmental impacts. 06

7(c) Define environmental standard. 04

7(d) What are the shortcomings of EIA practice in Bangladesh according to the established set of evaluation criteria? 06

7(e) Write down the steps involved in obtaining environmental clearance for a Tannery. 07

7(f) Why are environmental laws and policies in Bangladesh often poorly defined and weakly enforced? 07

8(a) Mention the health hazards and adverse environmental effects of tanneries in Bangladesh. 10

8(b) State the available enforcement tools directed in the Inspection and Enforcement manual of the Department of Environment (DoE), Bangladesh. 07

8(c) Write down the major criticisms of the environmental Court Act. 08

8(d) Define compliance and enforcement. State the principles of enforcement directed in the Inspection and Enforcement manual of the Department of Environment (DoE), Bangladesh. 10