UNIVERSITY OF DHAKA
BANGLADESH

COURSE CURRICULUM
FOR
B. Sc. IN FOOTWEAR ENGINEERING

(FOUR YEAR COURSE)

Institute of Leather Engineering and Technology
University of Dhaka, Hazaribagh, Dhaka-1209.

ACADEMIC RULES AND REGULATIONS APPLICABLE FOR THE FOOTWEAR ENGINEERING DEPARTMENT OF THE INSTITUTE OF LEATHER ENGINEERING AND TECHNOLOGY:

1. The Institute of Leather Engineering and Technology (ILET), Hazaribagh, Dhaka shall be deemed to be an institute of the University of Dhaka.
2. The degree to be awarded by the University of Dhaka shall be designated as B. Sc. in Footwear Engineering.
3. The Courses for the B. Sc. in Footwear Engineering shall extend over four academic years.
4. The medium of instruction and examination shall be in English.
5. Every year there will be an admission test for new intakes. The rules and regulations and other necessary works for the admission purpose will be performed by the central admission committee of the University.
6. Candidates for admission to the first year B. Sc. in Footwear Engineering shall be required to have passed the Higher Secondary Certificate in Science with Physics, Chemistry and Mathematics or its equivalent from a recognized Board or Institution. Foreign students with requisite qualification may be admitted with the approval of the University of Dhaka.
7. Admission to the first year B. Sc. in Footwear Engineering programme shall be based on the results of S.S.C. and H.S.C. or its equivalent examinations and the admission test to be conducted based on current rules by the Central Admission Committee.
8. The detail syllabus for degree of Footwear Engineering shall be approved by Academic Council of the University of Dhaka.
9. An Examination Committee for each year consisting of 4 (four) members of which 3 (three) shall be internal and 1 (one) from other departments of the Institute or the university or research organization shall be constituted by the departmental academic committee. Any full time teacher of the concerned department of the Institute shall be the chairman of the examination committee.
10. There shall be a Departmental Academic Committee consisting of all the full-time teaching staff to help academic matters.
11. Every year before the commencement of Academic session the list of part time teachers (if required) shall be prepared course wise and must be approved by the dean of the concern Faculty of Dhaka University. Dean will have the right to modify the list with the consultation with the concern head of the department and the Director of the institute.
12. The question paper setters and the examiners will be selected by the Examination Committee from a panel approved by the University.
13. The question papers shall be moderated by the Examination Committee.

14. No candidate shall be eligible for degree of B. Sc. in Footwear Engineering unless he or she has undergone the approved courses of study for a minimum period of four academic years and maximum of six academic years.
15. There shall be 15, 1-class hour lectures for 1 credit of theory classes. There shall be 30 hour lectures for 1 credit of Practical classes. Each of the class duration is 50 minutes.
16. No student shall be allowed to study any other degree programme during his/her study in Institute of Leather Engineering and Technology.

CURRICULUM AND EXAMINATION RULES

17. The subjects to be studied and the scheme of examinations for B. Sc. in Footwear Engineering courses are given in Annexure-A.
18. There shall be a final examination at the end of each academic year to be conducted by the University of Dhaka.
19. Two examiners, of whom one will be the course teacher and the others, shall be from other departments of the Institute or University or research organization. The average of two will be taken as final. In case of the difference of more than 20% marks between the two examiners, the script/scripts will be evaluated by a third examiner appointed by the Examination Committee from the approved panel and the average of nearest two marks will be taken as final. In the case of equal difference between the marks of three examiners the middle marks will be taken as final.
20. Final practical examinations will be conducted jointly by Four examiners, 3 (three) internal and 1 (one) external appointed by the examination committee.
21. Grades and grade points will be awarded on the basis of marks obtained in the written, oral or practical examinations and/or laboratory performance according to the following scheme:

Marks Obtained (%)	Grade	Grade Point
80-100	A^+	4.0
75-79	A	3.75
70-74	A^-	3.50
65-69	B^+	3.25
60-64	B	3.00
55-59	B^-	2.75
50-54	C^+	2.50
45-49	C	2.25

40-44	D	2.00
Marks Obtained (%)	Grade	Grade Point
<40	F	0.00
	I	Incomplete
	W	Withdrawn

A student obtaining 'D' or higher grade will be counted as credits earned by him/her. A student obtaining 'F' grade will not be counted towards his earned credits.

The GPA (grade point average) will be calculated according to the following formula:

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

CGPA = Cumulative GPA for different years.

22. The total performance of a student in a given course is based on continuous assessment and course final examinations.

(i) For theory courses the assessment is made through in-course assessment, and final examinations;

(ii) The assessment of laboratory and / or field courses will be made through observation of the student at work, viva-voce, assignments and evaluation of practical reports.

An examination committee for each year shall be constituted at the beginning of the session.

The distribution of marks for a course will be as follows:

(a) Theory courses:

In-course assessment: 30% of total marks shall be taken as in-course assessment. 5% marks will be awarded on the basis of attendance as follows:

90% and above	5%
85% to less than 90%	4%
80% to less than 85%	3%
75% to less than 80%	2%
60% to less than 75%	1%
Less than 60%	0 (Zero)

(iii) Course final examination 70% of total marks

(iv) Continuous assessment for practical courses — 40% of total marks

(v) Practical Final Examination — 60% of total marks

(b) In-course assessment for theory courses: In-course assessment will be done by taking class tests.

(i) Maximum duration of in-course tests will be one class hour.

(ii) Questions for in-course tests may preferably be of multiple choice (MCQ) type. Students may also be evaluated using short questions as decided by the course teacher.

(iii) At least one test for 2 credits hour courses and two tests for 3 or 4 credit hour courses will be taken.

(iv) Course teachers must announce results within 4 weeks of holding the examination.

(v) The course teacher will show the assessed in-course scripts to the students.

(vi) Marks for in-course assessment must be submitted by the course teacher to the Chairman of the Examination Committee and Controller of Examinations before holding the final examination.

(c) Continuous assessment for Practical courses: Continuous assessment will be done on the basis of class performance, report writing and class attendance.

(d) Year-final examination (Theory & Practical courses):

(i) Student having attendance 75% or more (Collegiate) are eligible to appear in the final examination.

(ii) Students having attendance 60-74% are eligible for sitting in the final examination on payment of fees as decided by the University.

(iii) Student having attendance less than 60% are not allowed to sit in the final examination.

(iv) The year final examination will be conducted centrally by Controller of examinations as existing system.

(v) The duration of theoretical examinations will be follows:

Credit	**Duration of theory examination**
4 credit theory course	4 hours
3 credit theory course	3 hours
2 credit theory course	2.5 hours

(vi) Duration of practical examinations will be from 4-6 hours irrespective of credit hours.

(vii) For final examinations, there will be two examiners: first examiner will be one of the course teachers and the second examiner will be from other departments of the Institute or University or Research organization. Evaluation will be made under the existing rule.

(viii) Marks for final examination will be evaluated by broad and short answer questions. Practice of giving options should be avoided as far as possible.

23. A student has to take the required courses for a particular year, appear at the annual examination and score a minimum specified GPA/CGPA to be promoted to the next year.

Promotion to the next year will be given if a student scores minimum GPA/CGPA as follows:

1st year to 2nd year:	GPA	2.00	(D)
2nd year to 3rd year:	CGPA	2.25	(C)
3rd year to 4th year:	CGPA	2.25	(C)

(i) If students obtain a grade C+ or lower in a course in any year, he/she will be allowed to repeat the term

24. The requirements for the award of the Bachelor of Engineering degree are as follows of the Department:

(i) Completion of the courses for the minimum required credits in a maximum period of six academic years;

(ii) Appearing at the final examination in all the required courses;

(iii)Scoring a CGPA of 2.5, after considering the grades of improvement Examinations.

25. A student must complete his/her studies for a Bachelor's Degree within a maximum period of six academic years

26. Improvement/retake will be followed by:

(i) final examination only once with the following batch for the purpose of grade improvement, but he/she will not be eligible to get a grade better than 'B^+' in such a course. A student failing to improve his/her grade in a course can retain the earlier grade.

(ii) Grade improvement will not be allowed in those courses in which a student obtains grade better than 'C^+'.

(iii) A student will be allowed to repeat a maximum of 20 credits in four years B.Sc. Program for grade improvement purpose.

(iv) Improvement Examination will be taken only for term-final test. No improvement examination will be taken for in-course, practical course, field work, assignment and oral presentation.

27. Others:

(i) A course in which a student has obtained 'D' or a higher grade will be counted as credits earned by him/her. Any course in which a student has obtained 'F' grade will not be counted towards his earned credits.

(ii) A student who obtains 'F' grade in a course will be allowed to improve the grade two times with any following batches with a condition that he/she has to complete the Bachelor of Engineering Program within period of 6(six) academic years from the date of first admission.

(iii)`F' grade will not be counted for GPA calculation. But will stay permanently on grade sheet and Transcript. When a student will repeat a course in which he/she previously obtained 'F' grade, he/she will not be eligible to get grade better than 'B+' (grade point 3.25) in such a course.

28. Readmission will be followed by:

(i) A student may seek re-admission provided he/she has at least 30% attendance in the present year and may continue studies as a regular student.

(ii) On re-admission grade earned earlier by a student in the class of re-admission shall in general cease to exist and the student has to retake all courses and examination but in case if they do not get the opportunity to repeat the courses due to late admission, marks of in-course assessment and laboratory performance assessment in the previous year may be retained by the students.

29. Drop out will be followed by**:**

A student failing to earn the yearly GPA for promotion from one year to next year after taking improvement / readmission in any year shall be dropped out of the program.

30**.** Dean's Award will be followed by**:**

As a recognition of excellent performance, the names of students obtaining an average CGPA of 3.75 or above in an academic year without appearing any improvement examination may be Published in the list of Dean's award of the Faculty.

31. The failed candidates may seek readmission into the concerned classes on payment of usual fees except university registration fee or may appear in the concerned examination irregular candidates provided they have passed in all practical subjects on payment of examination and center fees as fixed by the University. The marks obtained by the irregular candidates in the practical examinations; in-course assessment and the project work (if applicable) in the earlier session shall be counted in deciding the results of their examinations.

32. The University may from time to time revise, amend or change rules and regulations and scheme of examinations and syllabus. In the case of students already undergoing the course, the changes will take effect from the beginning of the following academic year after the changes are introduced and shall cover the part of the courses that remain to be completed.

33. In the case of any dispute in interpretation of the rules and regulations regarding the degree programme of B.Sc. in Footwear Engineering, the decision of the Academic Council of University of Dhaka shall be final.

FIRST YEAR

Sl. No.	Course No.	Course Name	Credit		Marks Distribution					Total Marks
					Theory			Practical		
			Theory	Practical	A* 70%	B* 25%	C* 5%	A* 60%	B** 40%	
						30%				
01.	FE-101	Manufacturing Technology of Footwear-I	3	-	70	25	5	-	-	100
02.	FE-102	Manufacturing Technology of Footwear-I Practical		4				60	40	100
03.	FE-103	Physical Chemistry	3	-	70	25	5	-	-	100
04.	FE-105	Inorganic Chemistry	3	-	70	25	5	-	-	100
05.	FE-107	Organic Chemistry	3	-	70	25	5	-	-	100
06.	FE-108	Chemistry Practical	-	4	-	-	-	60	40	100
07.	FE-109	Physics	3	-	70	25	5	-	-	100
08.	FE-110	Physics Practical	-	2	-	-	-	60	40	100
09.	FE-112	Engineering Drawing	-	2	-	-	-	60	40	100
10.	FE-113	Computer and Information Engineering	3	-	70	25	5	-	-	100
11.	FE-114	Computer and Information Engineering-Practical	-	2	-	-	-	60	40	100
12.	FE-115	Mathematics-I	3	-	70	25	5	-	-	100
13.	FE-117	Business and Communicative English for Engineers	3	-	70	25	5	-	-	100
Total			**24**	**14**	**560**	**200**	**40**	**300**	**200**	**1300**

A* = Course final examination; B*= In-course assessment ; C*= Attendance; B** =Continuous assessment

For Theoretical courses 1 Credit = 15 class

For Practical courses 1 Credit = 30 class

SECOND YEAR

Sl. No..	Course No	Course Name	Credit		Marks Distribution					Total Marks
					Theory			Practical		
			Theory	Practical	A* 70%	B* 25%	C* 5%	A* 60%	B** 40%	
						30%				
01.	FE-201	Manufacturing Technology of Footwear-II	3	-	70	25	5	-	-	100
02.	FE-202	Manufacturing Technology of Footwear-II Practical		4				60	40	100
03.	FE-203	Applied Chemistry and Chemical Engineering	3	-	70	25	5	-	-	100
04	FE-204	Applied Chemistry and Chemical Engineering Practical		4				60	40	100
05	FE-205	Materials Science & Technology	3	-	70	25	5	-	-	100
06	FE-207	Mathematics-II	3	-	70	25	5	-	-	100
07	FE-209	Statistics	3	-	70	25	5	-	-	100
08	FE-211	Mechanical Engineering for Footwear Manufacture	3	-	70	25	5	-	-	100
09	FE-212	Mechanical Engineering for Footwear Manufacture Practical	-	2	-	-	-	60	40	100
10	FE-213	Electrical and Electronic Engineering	3	-	70	25	5	-	-	100
11	FE-214	Electrical and Electronic Engineering Practical	-	2	-	-	-	60	40	100
12	FE-215	Industrial Management for Footwear Manufacture	3	-	70	25	5	-	-	100
13	FE-216	Computer Graphics Design	-	2	-	-	-	60	40	100
Total			**24**	**14**	**560**	**200**	**40**	**300**	**200**	**1300**

A* = Course final examination; B*= In-course assessment ; C*= Attendance, B** =Continuous assessment

For Theoretical courses 1 Credit = 15 class

For Practical courses 1 Credit = 30 class

THIRD YEAR

Sl. No..	Course No	Course Name	Credit		Marks Distribution					Total Marks
					Theory			Practical		
			Theory	Practical	A* 70%	B* 25%	C* 5%	A* 60%	B** 40%	
						30%				
01.	FE-301	Manufacturing Technology of Footwear-III	3	-	70	25	5	-	-	100
02.	FE-302	Manufacturing Technology of Footwear-III Practical		4				60	40	100
03	FE-303	Analytical Chemistry for Footwear Manufacture-I	3	-	70	25	5	-	-	100
04	FE-304	Analytical Chemistry for Footwear Manufacture Practical	-	2	-	-	-	60	40	100
05	FE-305	Leather Technology-I	3	-	70	25	5	-	-	100
06	FE-306	Leather Technology-I Practical	-	2	-	-	-	60	40	100
07	FE-307	Testing of Footwear and Allied Materials	3	-	70	25	5	-	-	100
08	FE-308	Testing of Footwear and Allied Materials Practical	-	2	-	-	-	60	40	100
09	FE-309	Computer Aided Design and Pattern Making	3	-	70	25	5	-	-	100
10	FE-310	Computer Aided Design and Pattern Making -Practical	-	2	-	-	-	60	40	100
11	FE-311	Leather Products Technology	3	-	70	25	5	-	-	100
12	FE-312	Leather Products Technology Practical	-	4	-	-	-	60	40	100
13	FE-313	Industrial and Production Engineering for Footwear Manufacture	3	-	70	25	5	-	-	100
14	FE-315	Managerial Economics	3	-	70	25	5	-	-	100
Total			**24**	**16**	**560**	**200**	**40**	**360**	**240**	**1400**

A* = Course final examination; B*= In-course assessment ; C*= Attendance B** =Continuous assessment

For Theoretical courses 1 Credit = 15 class

For Practical courses 1 Credit = 30 class

FOURTH YEAR

Sl. No..	Course no	Course name	Credit		Marks Distribution					Total Marks
					Theory			Practical		
			Theory	Practical	A* 70%	B* 25%	C* 5%	A* 60%	B** 40%	
						30%				
01.	FE-401	Manufacturing Technology of Footwear-IV	3	-	70	25	5		-	100
02.	FE-402	Manufacturing Technology of Footwear-IV Practical		4				60	40	100
03.	FE-403	Analytical Chemistry for Footwear Manufacture-II	3		70	25	5			100
04.	FE-405	Footwear Design and Pattern Making	3	-	70	25	5		-	100
05.	FE-406	Footwear Design and Pattern Making Practical		2				60	40	100
06.	FE-407	Polymer Science and Engineering	3	-	70	25	5			100
07.	FE-408	Polymer Science and Engineering Practical		2				60	40	100
08.	FE-409	Environmental Science and Pollution Control	3	-	70	25	5		-	100
09.	FE-410	Environmental Science and Pollution Control Practical	-	2	-	-		60	40	100
10.	FE-411	Leather Technology-II	3	-	70	25	5		-	100
11.	FE-412	Leather Technology-II Practical	-	4	-	-		60	40	100
12.	FE-413	Production Planning and Quality Control	3	-	70	25	5			100
13.	FE-415	Entrepreneurship and Business Development	3		70	25	5			100
14.	FE-416	Project Work and Seminar	-	2	-	-	-	75+25	-	100
15	FE-418	Industrial Training [2 Months]	-	2	-	-		50		50
16.	FE-420	Course Viva	-	2	-	-	-	50	-	50
Total			**24**	**20**	**560**	**200**	**40**	**500**	**200**	**1500**

A* = Course final examination; B*= In-course assessment ; C*= Attendance B** =Continuous assessment

For Theoretical courses 1 Credit = 15 class

For Practical courses 1 Credit = 30 class

FE-101: MANUFACTURING TECHNOLOGY OF FOOTWEAR-I

Class per week	Credit	Marks
2	3	Course final Exam: 70, In-course assessment: 25, Class Attendance: 5. Total Class: 45

Introduction to the course: This course is a part one (out of four) for Manufacturing Technology of Footwear in obtaining Bachelor of Science in Footwear Engineering Degree. It contains details about the human foot related for shoe design, comfort and fitting. Then it contains the topics for getting the preliminary idea about footwear anatomy, types, materials, tools, machinery and manufacturing first stages cutting and sewing operations.

Course Objectives: Specific objectives of this course are

- to impart basic concept about human foot for making comfortable shoe for the footwear market.
- to make the students understand the fundamental of footwear anatomy, materials, types, tools, machinery and manufacturing first stages cutting and sewing operations.

Course Contents:

Human Foot: Function of foot, Types of foot, Normal foot, Foot function, Biomechanics terminology, Foot dynamics- weight bearing foot, walking foot, running foot, gait analysis, foot motion, foot stances, foot support, Foot care and their relationship to footwear.

Foot Anatomy: Necessity of foot anatomy, Bones, Muscles, Ligament, Nerves and vessels, Joint, Arches, Skin etc. Foot anatomy of infants and children, Development of human foot from infants to adult. Characteristic features of infant, children and adult foot, Biometry of human foot, Details of foot parameters, Foot measurement-necessity, biometry, Foot parameters and measuring procedure.

Foot measurement: Introduction, Importance of foot measuring, measurement for Bespoke footwear, foot surveys, length and width of the foot, foot imprint, foot from different angle, simple device to measure various anatomical parameters of the foot, measurement of the foot plan, girth measurement, width numbering, foot ID, foot fitting, fitting- identification, multi-fittings, Brannock device for foot measurement, measuring with a tape.

Foot Troubles: Skin lesions- calluses, corns, plantar warts, ingrown nail, athletes foot, hypoallergenic feet, excessive foot perspiration, foot odors, diabetic foot, arch problems- flat foot, claw foot, arch strains, metatarsalgia, foot fatigue, burning feet, rigid feet, aching in calf , toe problems- hallux valgus, bunion, tailor's bunion, hammer toe, children foot problems- in toeing, out toeing, pronation, crooked toes.

Footwear: Definition, history of footwear, foot gear, purpose of footwear, comfortable footwear, types of footwear- oxford, Derby, Court, Moccasin, Sandal, Casual, Boot, Sports, casual, mule, clogs, safety footwear, occupational footwear, sports shoe styles and fashion of footwear, feature of comfortable shoes, shoes and foot ills.

Parts of Shoe: Shoe section, Parts of upper- vamp, toe caps and wing caps, apron and vamp wings, tongues and tabs, peeptoes, quarters, counters, appliqués- mudguards, saddle and bars, backstraps, fastenings, Lining- counter lining, quarter lining, backers, bottom- insole, welt, bottom filler, mid sole, runner, sole, heel, components- toe puff, stiffener, shank piece, sock, eyelets, ornamentations, foot and footwear care.

Footwear Materials: Various materials of footwear, suitability of leather as shoe upper, defects of leather, poromerics , synthetics, fabrics, foils, plastic, rubber etc. sole- PVC, PU, TPR, Insole- leather board, cellulose board, impregnated non- woven, fibre board, plastics, toe puff- solvent activated impregnated fabric, thermoplastic filmic, stiffener- fully moulded leather and fibre board, thermoplastic and solvent activated impregnated fabric, shank- wood, fibre board, steel, bamboo, heel- wood, plastic, ABS, EPDM, adhesive- solvent based, hot-melt, pressure sensitive adhesive, thread materials.

Tools and Machineries: Tools and equipments for footwear manufacture- knife, scissor, roughee, pincher, pricker etc, sewing machine- types, parts and function, stitch formation, threading system for different types of stitching machine, needle insertion, skiving machine- parts and function, splitting machine- parts and function, safety practice.

Cutting and Stitching: Defination of cutting, principle of cutting, hand cutting- tools, components, process, quality required for cutter, stitching- definition, types of stitch- lock stitch, chain stitch, decorative stitch, subsidiary stitching operation.

Learning Outcomes:
Upon completion of this course the students will be able to

- Describe human foot related to footwear design, comfort, measurement, fitting, foot troubles, Understand the fundamental of footwear anatomy, materials, types, tools, machinery and manufacturing first stages cutting and sewing operations

References:

1. Martin , Shoben , Janet P. Ward - Pattern Cutting and Making Up
2. Swayam Siddha - The Art of Cutting Kid and Goat Skin
3. Swayam Siddha - The Art of Cutting a Buffalo Leather
4. Swayam Siddha - The Art of Cutting Corrected Grain Leather
5. Venkatappaiah B.- Introduction To The Modern Footwear Technology-
6. Miller R. G. (Editor) - Manual Of Shoe Making
7. Korn J. (Editor) - Boot and Shoe Production
8. Thornton J. H.- Text Book of Footwear Manufacture
9. SATRA Bulletin
10. Pencer Crookenden - K Shoes -The first 150 years 1842-1992
11. Ruth Thomson - Making Shoes
12. Swayam Siddha - Product Knowledge
13. Swayam Siddha - The Skill of Seam Reducing
14. Thornton J. H.-Text Book of Footwear Materials -

FE-102: MANUFACTURING TECHNOLOGY OF FOOTWEAR-I PRACTICAL

Class per week	Credit	Marks
2	4	Continuous assessment : 40, Course final examination 60

Introduction to the course: This course is a part one (out of four) for Manufacturing Technology of Footwear Practical in obtaining Bachelor of Science in Footwear Engineering Degree. It contains practical works about the human foot related to foot anatomy, comfort and fitting. Then it contains the topics for practical work about cutting and sewing practice.

Course Objectives:

Specific objectives of this course are:

- To identify human foot related to comfortable shoe manufacture.
- To identify cutting and sewing tools and machineries used in footwear manufacture.
- To able better cutting and sewing operations by making practice.

Course Contents:

Cutting:

1. Foot measurement and foot impression-taking techniques.
2. Identification of bones nerves muscles from skeleton and model.
3. Handling and introduction of working tools of footwear.
4. Cutting exercise with paper.
5. Hand cutting practice with brown paper, pattern paper using template.
6. Machine cutting practice with brown paper and pattern paper.
7. Hand cutting practice with synthetic material using templates.
8. Parts, functions and setting up of different types of clicking machines.
9. Machine cutting practice with synthetic material.
10. Hand cutting practice with leather using templates.
11. Machine cutting practice with leather.

Stitching:

1. Introduction to various sewing machines and their parts and functions.
2. Practice for the controlling of sewing machine.
3. Sewing exercise with paper without thread.
4. Practice of threading system for different types of sewing machines.
5. Sewing exercise with paper and thread.
6. Sewing exercise with synthetic material and thread.
7. Sewing exercise with leather and thread.
8. Skiving exercise with leather.
9. Practice of edge folding.
10. Practice of edge coloring.
11. Practice for different types of seams.
12. Practice for different types of binding.

Learning Outcomes:
Upon completion of this course the students will be able to

- Identify human foot related to comfortable shoe manufacture.
- Identify cutting and sewing tools and machineries used in footwear manufacture.
- Able better cutting and sewing operations by making practice.

FE-103: PHYSICAL CHEMISTRY

Class per week	Credit	Marks
2	3	Course final Exam: 70, In-course assessment: 25, Class Attendance: 5 Total Class: 45

Introduction to the course: This is a course in basic Physical Chemistry for undergraduate student. With the development of a variety of exciting new areas of research involving computational chemistry, nano- and smart materials, and applications of the recently discovered graphene, there can be no doubt that physical chemistry is a vitally important field. It is also perceived as the most daunting branch of chemistry, being necessarily grounded in physics and mathematics as well as kinetics, thermodynamics and osmosis.

Course Objectives: Converting raw hides and skins into finished leather many chemical reactions are occurred in different steps in industrial process. This course will help the students to understand chemical reactions, physical and chemical change of hides and skins during process.

Course Contents:
Dilute solution: Colligative properties- lowering of vapor pressure, elevation of boiling point, depression of freezing point, osmotic pressure and osmosis, deduction of their chemical formula & molecular weight from Raoult's Law, their experimental determination.

Thermodynamics: Work, heat, energy, internal energy and enthalpy, some thermodynamic terms, first law of thermodynamics, reversible and irreversible processes, isothermal and adiabatic expansion of ideal gas, molar heat capacity at constant pressure and constant volume and their relation, second law of thermodynamics, spontaneous process, entropy, entropy changes for ideal gas, Carnot’s cycle, free energy and work function, Gibbs-Helmholtz's equation.

Photochemistry: Laws of photochemistry, quantum yield, decomposition of hydrogen halide, photosensitized reaction, fluorescence and phosphorescence, luminescence, chemiluminescence.

Surface chemistry: Adsorption, de-sorption and absorption, physical and chemical adsorption, types of adsorption isotherms, adsorption of gas by solid, adsorption of solid from solution, application adsorption.

Colloid: Classification, general methods of preparation and purification, general properties (Physical, colligative, kinetic, optical and electrical properties) of sol, protective action and application of colloid, emulsion, types and preparation of emulsion, emulsifier, stability of emulsions.

Chemical kinetics: Rate of reactions, order and molecularity, determination of order of reactions, temperature dependence of reaction rate, simple theories of reaction rate, energy of activation, collision theory of reaction rates, complex reactions: (i) reversible or opposing reactions, (ii) side reactions or parallel reactions, (iii) consecutive reactions.

pH and its determination : pH and buffer solutions, standard buffers, methods of determining the pH, accuracy of pH measurements, colourimetric determination of pH, universal indicators, potentiometric determination of pH, hydrogen electrode as pH indicating electrode, advantages and disadvantages of hydrogen electrode, glass electrode as pH indicating electrode, factors affecting pH measurements with the glass electrode, advantages and disadvantages of glass electrode, pH meters- potentiometric, portable pH meters.

Learning Outcomes: After completion of this course the students will be able to Explain:

- Colligative properties, Raoult's law and related problems
- Thermodynamic laws, solve problems on enthalpy changes, heat of reactions, Carnot cycle, entropy etc.
- Laws of Photochemistry, Photoluminescence and Chemiluminescence, Quantum Yield, Photosensitized reactions.
- Adsorption processes with reference to Langmuir Freundlich and other isotherms and their application.
- Detail mechanism, preparation and properties of colloid formation, Implication of HLB values of surfactants and selection of surfactants.
- Rate equation of chemical reactions with graphical plots and significance, half-life of chemical reactions, activation energy and its significance, role of catalysts in chemical reactions, related problems.
- pH and its implications, determination of pH applying potentiometric method, different type of electrodes and their uses.

References:

1. G. M. Barrow- Physical Chemistry.
2. W. J. Moore- Physical Chemistry.
3. Bahl And Tuli- Essentials Physical Chemistry.
4. Sharma and Sharma- A Text Book of Physical Chemistry.
5. S. Glasstone-Text Book of Physical Chemistry.
6. P. W. Atkins- Physical Chemistry.
7. Robert A. Alberty- Physical Chemistry.
8. Taylor and Taylor- Elementary Physical Chemistry.
9. Moron and Lando- Fundamentals of Physical Chemistry.
10. Donald H. Andrews- Introductory Physical Chemistry.
11. Ira N. Levine- Physical Chemistry.
12. J. Bruce Brackenridge & Robert M. Rosenberg- The Principle of Physical Chemistry.
13. Palit - Elementary Physical Chemistry.
14. B. D. Khosla- Physical Chemistry.

15. N. Kundu & S. K. Jain- Physical Chemistry.
16. Samuel H. Maron & Carl F. Prutton- Principle of Physical Chemistry.
17. Joseph H. Noggle- Physical Chemistry.
18. M. Mahbubul Haque & M. Ali Nawab- Principle of Physical Chemistry.

105: INORGANIC CHEMISTRY

Class per week	Credit	Marks
2	3	Course final Exam: 70, In-course assessment: 25, Class Attendance: 5 Total Class: 45

Introduction to the course: This course is designed for first year B.S. students of Leather Engineering. The first part of the course includes mastery of topics in periodic classification of elements and their relevant properties, different types of chemical reaction like acid-base reactions, redox reactions etc. The remainder of this course includes a survey of different types of chemical bonds and their formation mechanism. Another interesting part of this course is study of transition metal and different theories of coordination chemistry which are related to these metals. Transition metal containing materials are the oldest materials of the earth and are indispensable to our daily life. The spectacular uses of the transition metals in leather tanning justify the importance of these topics in this course. This course will help the student to develop an understanding of chemical principles and the applications of such principles in practical fields. This course will also enable the students to use critical thinking and logic in problem solving, apply chemical principles in the laboratory setting and develop independent and cooperative learning skills.

Course Objectives:
This course serves as a cursory to understand the basic concepts involved in inorganic chemistry including periodic properties, acid-base reactions, redox reaction, chemical bond, transition metals and coordination chemistry that will prepare the student for advanced coursework in chemistry. It explores the unknown world of atoms and molecules and different types of bond exist among them. The course will provide a foundation for further education in chemistry directed towards materials, energy technology and process chemistry.

Course Contents:
Periodic classification: Periodic classification of the elements, general survey of the elements including transition and rare earth elements, periodic nature as related to atomic structure, group properties, periodic nature of some important properties.

Oxidation and reduction reaction: Classification of chemical reactions with special reference to oxidation and reductions, oxidation number and oxidation state, difference between oxidation number and valance, oxidizing agent and reducing agent, equations involving oxidation- reduction reactions.

Acid-Base concept: Early concepts, Arrhenius concept, Bronsted-Lowry concept of acid and bases, Lewis acids and bases, acid and base strength, pH and pH scale, buffer solution and its mechanism, hard and soft acids and bases, acid base indicator.

Transition metal: General chemistry of transition elements with reference to Chromium, Titanium, Zinc, Iron, Cadmium, Nickel, Cobalt, chemical natures and application with special reference to leather production.

Co-ordination chemistry: Coordination or complex compounds, ligands or co-ordinating groups, coordination number, coordination sphere, chelate complexes, application of chelates, nomenclature of coordination compounds, isomerism-structural, geometrical, optical, optical isomerism in 6-coordinate complexes, Werner's coordination theory, effective atomic number (EAN), limitation of EAN rules, valence bond theory (VBT) of structure of inorganic complex with simple examples, crystal field theory (CFT), application of crystal field theory color of transition metal complexes.

Chemical Bond: Introduction, octet rule or rule of eight, ionic or electrovalent bond, covalent bond dipole moment, polarization of ions, Fajan's rule, co-ordinate bond, metallic bond, hydrogen bond, Van der Waal's forcers.

Inorganic Salts used for Tannings: Chromium salts, its behavior in solution, oxidation rate, complex form of trivalent Ti.

Learning Outcomes:
At the end of this course students will able to:

1. Understand the structure of atoms and will apply the periodic laws to predict chemical and physical properties of the elements
2. To describe, identify, determine and balance oxidation reduction reaction
3. Identify the characteristics of acids, bases, and salts, and solve problems based on their quantitative relationships
4. Explain the different definitions of acids and bases and predict the reactions between acids and bases
5. Understand the chemical nature and application of transition metal with reference to leather production
6. To explain the definition of coordination compounds, naming them and decide isomerism

References:

1. G. F. Lipotrot- Modern Inorganic Chemistry.
2. F. Albert Cotton, Geoffrey Wilkinson, Paul L. Gaus- Basic Inorganic Chemistry.
3. Esmarch S. Gilreath- Fundamental Concepts of Inorganic Chemistry.
4. S. Z. Haider- Introduction to Modern Inorganic Chemistry.
5. H. J. Emeleous & A. G. Sharpe- Modern Aspects of Inorganic Chemistry.
6. R. D. Madan- Modern Inorganic Chemistry.
7. A. K. De- A Text Book of Inorganic Chemistry.
8. Manas Chanda- Atomic Structure and Chemical Bond.

9. K. N. Upadhyaya- A Text Book of Inorganic Chemistry.
10. R.D.Madan, Tuli, Basu, Sharma- Advanced Inorganic Chemistry.

FE-107: ORGANIC CHEMISTRY

Class per week	Credit	Marks
2	3	Course final Exam: 70, In-course assessment: 25, Class Attendance: 5 Total Class: 45

Introduction to the course: Organic chemistry is the study of "living" things—not in the same way that biology is the study of life. Rather, organic chemistry takes a look at what composes the living things, and how they're structured. Organic chemistry breaks down living things not only into organs seen in organisms, but goes a step further to break down those organs into atoms and molecules. It focuses mainly on carbon, which is highly essential to maintaining life, and particularly zeroes in on the hydrocarbon, which is a molecule composed of hydrogen and carbon. Hydrocarbons not only compose what we're made of, but also what we consume, including carbohydrates, proteins, steroids, fats, and more. As a matter of fact, it may be surprised to know that everyday things, such as leather, paint, dye, adhesive and plastic are all composed of hydrocarbons.

Course Objectives: The course will provide the important topics in Organic chemistry characteristic reactions, isomerism, functional groups including aromatic compounds, phenols, carboxylic acids and its derivatives, aldehydes & ketones, amines, and ester synthesis. This helps students to gain experience to predict the functional group transformations, simple reaction mechanisms, and the synthesis of organic molecules by multi-step synthesis strategies. In addition of that, the course will also help students to understand the leather based reaction.

Course Contents:

Characteristic reactions and reaction mechanism of organic compounds: Types of organic reactions, fundamentals of organic reaction mechanism (Fission of bond, carbonium ion, carbanion), factors affecting organic reaction, attacking reagents and its role (electrophile and nucleophile), broad concept of the mechanism of substitution, elimination and addition reactions, reaction kinetics, energy requirements of organic reaction, mechanism of different reactions, nucleophilic substitution: SN^1 and SN^2 reactions, electrophilic substitution reaction, free radical substitution reaction, addition reaction:- nucleophilic, electrophilic and free radical addition reaction, elimination reaction:- E_1 and E_2 reactions.

Isomerism: Classification of isomerism, classification of stereoisomerisms, optical isomerism:- plane polarized light, specific rotations, isomerism of substance containing one and two asymmetric carbon atoms, D.L. and R.S. configuration. Geometric isomerism- condition for geometric isomerism, determination of configuration of cis-trans isomerism.

Functional groups: Different functional groups of organic compounds, reactivity of functional groups, activation and de-activation of functional groups, positioning of functional groups and its importance on chemical and physical nature of organic compounds.

Monocyclic aromatic hydrocarbon: Benzene, structure of benzene, Kekule structure, nomenclature, stability of benzene ring, resonance energy, delocalization, aromaticity-conditions and theories, substitution of benzene ring, mechanism of aromatic substitution.

A. A thorough study of the following benzene derivatives: Structure, preparation, reactivity and uses of

i) Halogen compounds- fluoro and chloro- chemicals.
ii) Hydroxy compounds- phenol, β-naphthol, cresol, anthrasol.
iii) Nitro compounds-nitro benzene and its derivatives.

B. A through study of the following class of compounds-

i) Aldehydes and Ketones (Formaldehyde, acetaldehyde, glutaraldehyde, acetone).
ii) Aliphatic mono and di-carboxylic acids (Formic acid, acetic acid, acrylic acid, oxalic acid and succinic acid) and their important derivatives (Amide, ester, etc.).

Atmospheric Pollutants: Organic solvent vapours, isocyanate vapours, rubber fume.

Renewable Resources and green footwear: Upper and lining materials, sole units, insole boards, sewing threads and adhesives, packaging.

Safety audit checking: walking or working areas, storage lofts, second floor, etc, stairs and ladders, egress, occupational health and environmental control. Occupational noise exposure, hazardous materials, general environmental controls.

Management of emergency situations: basic first aid, spillage of chemicals, fires, machinery safety.

Learning Outcomes: Students will gain an understanding of

- the hybridization and geometry of atoms and the three-dimensional structure of organic molecules.
- the fundamental properties, reactivity and stability of an organic molecule based on structure, including conformation and stereochemistry, nucleophiles, electrophiles, electronegativity, and resonance, the prediction of mechanisms for organic reactions, how to use their understanding of organic mechanisms to predict the outcome of reactions, how to design syntheses of organic molecules,
- the atmospheric pollutants, renewable resources, green footwear, safety audit checking and management of emergency situation in the leather industries.

References:

1. Morrison and Boyd- Organic Chemistry.

2. B. S. Bahl and Arun Bahl- Organic Chemistry.
3. I. L. Finar- Organic Chemistry.
4. Andrew Streitwieser, Clayton H. Heathcock, Edward M. Kosower- Introduction to Organic Chemistry.
5. Philip Mathews- Advanced Chemistry.
6. Amend, Mundy, Armold- General Organic and Biological Chemistry.
7. Solomons - Organic Chemistry.
8. Stanley H. Pine- Organic Chemistry.
9. Michael B. Smith- Organic Chemistry.
10. P. S. Kalsi- Organic Reactions and Their Mechanism.

FE-108: CHEMISTRY PRACTICAL

Class per week	Credit	Marks
2	4	Continuous assessment : 40 Course final examination 60

Introduction to the course: The aim of this course is to analyze inorganic salts, organic compounds and preparation of some inorganic compounds and quantitative analysis by titration. The qualitative analysis of single salt consists of preliminary research and analysis of cation and anion separately. The analysis and identification of unknown organic compounds constitutes a very important aspect of experimental organic chemistry.

Course Objectives: The general concept of the practical part of this course is to train students the fundamental laboratory skills. This includes the practical work of qualitative and quantitative analysis techniques with some simple inorganic preparations which are required for experimental chemistry. The students will acquire skills to observe and record scientific experiments. They will familiarize themselves with the laboratory equipment, various chemicals, and set up various instruments to ensure safe.

Course Contents:

Inorganic:

1. Qualitative analysis of inorganic mixtures containing not less than four radicals including the interfering and insoluble radicals by classical or semi-micro methods; Preliminary and Confirmation tests for the following ions: -

a) Anions: Chloride, bromide, iodide, sulphide, sulphite, sulphate, carbonate, nitrate, nitrite, formates, oxalates, acetates.

b) Cations: Lead, copper, zinc, cobalt, calcium, sodium, barium, magnesium, nickel, aluminium, chromium, manganese, iron, tin, arsenic, bismuth, potassium, ammonium, silver, mercury, cadmium, zirconium, titanium.

2. **Volumetric analysis**:

(A) Acidimetry - Alkalimetry:

i) Preparation of standard solutions of sodium thio-sulphate, sodium carbonate, oxalic acid.

ii) Standardization of hydrochloric acid with standard sodium carbonate solution
iii) Determination of degree of alkalinity.

(B) **Oxidation -Reduction Titration**:

i) Preparation and standardization of $KMnO_4$ using standard $(COOH)_2$ or sodium oxalate.
ii) Determination of ferrous (II) ion using $K_2Cr_2O_7$ solution as primary standard titrant.

(C) Iodometric Titration:

i) Standardizing sodium thiosulphate solution using dichromate solution.

3. Organic Practical:

Qualitative analysis: Identification of organic compounds containing one functional group out of the following compounds: ethyl alcohol, isopropyl alcohol, phenol, acetone, acetaldehyde, formaldehyde, formic acid, acetic acid, oxalic acid, benzoic acid, aniline and nitrobenzene.

Analysis should include the following:

i) Physical examination
ii) Melting point and boiling point
iii) Detection of sulphur, nitrogen and halogen in an organic compound
iv) Solubility in the following solvents only-
   a) Water
   b) 5% solution on $NaHCO_3$/NaOH and HCl acid
   c) Conc. H_2SO_4
   d) Acetone
   e) Isopropyl alcohol
   f) Detection of different functional groups: -OH, >C=O, -CHO, $-NH_2$, $-NO_2$, -COOH.

v) Detection of different functional groups:-OH, >C=O, -C=O, -CHO, $-NH_2$, -COOH

4. Inorganic crystal Preparation Practical:

a) Inorganic Preparation: Alum, ferrous ammonium sulfate, potassium carbonate, basic chromium sulphate, potassium permanganate, chrome yellow.

Learning Outcomes: Students will gain an understanding of

- the use of an analytical balance graduated cylinders, graduated pipettes, and volumetric pipettes, thermometers and temperature probes, pH meters.
- quantitative and qualitative analysis of Inorganic salts and organic compounds and preparation of some inorganic compounds.

References:

1. A. I. Vogel -Elementary Practical Organic Chemistry, Part -1: Small Scale Preparation.
2. A. I. Vogel-Elementary Practical Organic Chemistry, Part-2: Qualitative Organic Analysis.
3. A. I. Vogel-Elementary Practical Organic Chemistry, Part-3: Quantitative Organic Analysis
4. A. I. Vogel- A Text Book of Practical Organic Chemistry, ELBS 6th Edition.
5. A. Jabbar Mian and M. Mahbubul Haque - Practical Chemistry.
6. N. Haque and M. Uddin -Practical Chemistry Introduction.

7. H. Dupont Durst, George W. Gokel-Experimental Organic Chemistry.
8. M. Latimer, E. Powell - A Laboratory Course of General Chemistry.
9. Alan Sherman, J. Sherman, Russikoff-Laboratory Experiment of Basic Chemistry.
10. J. B. Yadav-Advanced Practical Physical Chemistry.
11. Gert G. Schlessinger - Inorganic Laboratory Preparations.
12. A. Khalique - A Text Book of Practical Chemistry.
13. 12.A. Faraday -Practical Physical Chemistry.
14. G. Svehla- Vogel's Qualitative Inorganic Analysis.
15. 14.N. K. Vishnoi -Advanced Practical Organic Chemistry.
16. Hein, Best, Miner-Foundation of Chemistry in the Laboratory.

FE-109: PHYSICS

Class per week	Credit	Marks
2	3	Course final Exam: 70, In-course assessment: 25, Class Attendance: 5 Total Class: 45

Introduction to the course: Physics is one of the most fundamental branches of all sciences which is the basis of our scientific knowledge of the physical world. Physics course is offered to all the undergraduate students of the Institute of Leather Engineering and Technology. This course is designed to cover most of the core scientific fundamentals of physics, basic electrical and mechanical engineering principles. Main contents of this course are elasticity, surface tension, heat and thermodynamics, optics, static and current electricity, and modern physics. This course will help the students to identify, formulate and solve problems related to their core subjects.

Course Objectives: Objectives of this course are to provide a broad training in physics and demonstrate the students on various skills including; expertise with core physics concepts and their applications to relate the physical phenomenon with the practical problems in engineering purposes, proficiency in problem solving, critical thinking, and analysis. In future it will help the students to function effectively in laboratory environment and pursue independent research towards the development of new devices and products using sophisticated physical concepts.

Course Contents:
Elasticity: Rigid body, perfectly elastic body, plastic body, stress and strain, elastic limit and elastic fatigue, Hooke's law and different elastic constants-moduli of elasticity, poisson's ratio, determination of elastic constants factors affecting elasticity.

Surface Tension: Surface energy and surface tension, excess of pressure inside a spherical liquid drop, capillarity.

Optics: Light and light sources, electromagnetic spectrum, prism and dispersion of light, power of a lens, defects of images, spherical aberration, astigmatism, coma, curvature and distortion., chromatic aberration, optical instruments: compound microscope, polarizing microscope, camera and photographic techniques, spectrophotometer, Interference of light, Fresnel's bi-prism, Newton's rings, diffraction of light: Fresnel and Fraunhoffer diffraction, diffraction gratings, resolving power of a grating, polarization, polarized and unpolarized light, polarization by reflection and refraction, Brewster's law, double refraction, nicol prism, polarization by scattering, scattering of light, optical rotation, polarimeter.

Transmission of heat: Conduction, convection and radiation, thermal conductivity of solids and liquids, coefficient of thermal conductivity, good and bad conductor of heat, determination of thermal conductivities of bad conductors- Lee's method.

Radiation: Electromagnetic theory of radiation, black body radiation, emissive power and absorptive power, Kirchoff's law of radiation and its experimental verification, displacement law, Stefan Boltzmann law, quantum theory of radiation, Plank's law, Raleish-Jeans's law, Planck's radiation pyrometers, temperature of the sun, solar constant.

Static electricity: Electric charge, Coulomb's law, electric field- calculation of the electric field strength due to a point charge, intensity of electric fields, electric dipole, electric flux and Gauss's law, potential and field strength, equipotential surface, potential due to a point charge, capacitor and dielectrics, combination of capacitors in series and parallel, dielectrics and Gausses law, three electric vectors, energy storage in an electric field.

Current electricity: Electromotive force, electric current and current density, electric circuits, resistance, resistivity and conductivity, Ohm's law, energy transfer in an electric circuit- Joules law. Combination of resistances, Kirchhoff's laws, Wheatstone bridge, varying current, growth and decay of currents in LR, CR and LCR circuits, magnetic field due to a current, Ampere's law, magnetic induction for a solenoid, magnetic induction near a long wire, Ampere's circuital law, electromagnetic induction-Faraday's laws, Lenz's law, Leus's law and the law of conservation of energy, Fleming's right hand rule, eddy current, self and mutual induction, unit of inductance. Alternating currents- concept of r.m.s. and average values of alternating current and voltage, A-C circuits containing LR, CR and LCR in series, calculation of expression for current and power, power factor, resonance.

Modern physics: The atomic structures, atom models, orbital energy, radioactivity, laws of radioactive disintegration, half life and mean life, laws of successive disintegration, alpha, beta, gamma and X-ray and their applications, photoelectric effect, Compton effect, Plank's radiation formula, Einstein's photon theory.

Learning Outcomes:
Successful completion of this course will help students with following outcomes:

1. Work efficiently in leather, leather products, and footwear industries where proper application of engineering knowledge requires the basics of physics.
2. Skills for a successful career as well as to collaborate with other to solve problems with critical thinking and effective communication.

3. Entrance to entry level research and development positions in industry.
4. Recognition for students in other majors who wish to enhance their understanding and mastery of a broader range of subjects than is provided in their core courses alone.
5. Ability to communicate their ideas with others and function effectively in multidisciplinary terms.
6. Start career as a practicing engineer in fields such as design, research, development, testing, manufacturing, operations, and service systems.

References:

1. C. L. Arora -B.Sc. Physics, Vol-I & II.
2. Charles Kittel/Herbert Kroemer -Thermal Physics.
3. Resnick/Halliday/Krane-Physics, Vol I & II.
4. Alvin Hudson/Rex Nelson-University Physics.
5. Arther Beiser-Concepts of Modern Physics.
6. David Halliday/Robert Resnick/Jearl Walker-Fundamentals of Physics.
7. Harvey E.White/Francis A. Jenkins-Fundamentals of Optics.
8. D.W.Tenquist/R. M. Whittle/J. Yarwood-University Optics.
9. S.C.Arrora/S. Domkundwar-A Course in Heat & Mass Transfer.
10. Marcelo Alonso/Edward J. Finn-Physics.

FE-110: PHYSICS PRACTICAL

Class per week	Credit	Marks
1	2	Continuous assessment : 40 Course final examination 60

Introduction to the course: Physics is one of the most fundamental branches of all sciences which is the basis of our scientific knowledge of the physical world. Physics practical course is offered to all the undergraduate students of the Institute of Leather Engineering and Technology. This course is designed to cover experiments and laboratory apparatus related to some of the core scientific fundamentals of physics and basic electrical engineering principles. For instance, modulus of rigidity, Young's modulus, acceleration due to gravity, thermal conductivity, specific heat, electrochemical equivalent, mechanical equivalent of heat, post office box, galvanometer, ammeter, voltmeter, Ohm's law, refractive index, diffraction grating, wavelength of light, magnetometer, velocity of sound. It will help the students to be able to design and conduct experiments, as well as to analyze and interpret data. It will also help the students to identify, formulate and solve problems related to their core subjects.

Course Objectives: Objectives of this course are to provide a broad training in physics with laboratory experiments and demonstrate the students on various skills including; expertise with core physics concepts and their applications to relate the physical phenomenon with the practical problems in engineering purposes, proficiency in measurements and dimensioning, critical thinking and data analysis. In future it will help the students to function effectively in laboratory environment and pursue independent research towards the development of new devices and products using sophisticated physical concepts.

Course Contents:

1. Determination of the radius of curvature of a lens by Newton's ring method (wavelength of light to be given).
2. Determination of the refractive index of a material of a given prism by a spectrometer.
3. Determination of the grating constant of a plane diffraction grating.
4. Determination of the specific sugar solution (at six different concentrations) with the help of a polarimeter.
5. Determination of the value of M and H by magnetometer.
6. Verification of the laws of combination resistance by P.O. Box (at least three different resistances are to be used).
7. Determination of the resistance of a galvanometer by half deflection method.
8. Determination of the figure of merit (current sensitivity) of a galvanometer.
9. Measurement of low resistance by ammeter and voltmeter.
10. Verification of Ohm's law.
11. Determination of the value of low resistance by the method of fall of potential.
12. Determination of the electrochemical equivalent (ECE) of copper-by copper voltameter.
13. Determination of the J (mechanical equivalent of heat) by electrical method.
14. Determination of the temperature coefficient of resistance of a coil.
15. Graphical representation of the variation of the elongation of the given wire with load and determination of the Young's modulus of the material of the wire by Searle's apparatus.
16. Determination of the modulus of rigidity of a cylindrical wire by dynamic method.
17. Determination of the value of "g" by Kater's reversible pendulum.
18. Determination of the thermal conductivity of rubber.
19. Determination of the thermal conductivity of bad conductor by Lee's method.
20. Determination of the specific heat of a liquid by the method of cooling.
21. Determination of the velocity of sound at N.T.P by resonance column.
22. Determination of the frequency of a tuning fork by Meld's experiment (use either transverse or longitudinal arrangement).

Learning Outcomes:

Successful completion of this course will help students with following outcomes:

1. Work efficiently in leather, leather products, and footwear industries where proper application of engineering knowledge requires the basics of physics.
2. Ability to design and conduct experiments, as well as to analyze and interpret data.
3. Entrance to entry level research and development positions in industry.
4. Recognition for students in other majors who wish to enhance their understanding and mastery of a broader range of subjects than is provided in their core courses alone.
5. Ability to communicate their ideas with others and function effectively in multidisciplinary terms.

Start career as a practicing engineer in fields such as design, research, development, testing, manufacturing, operations, and service systems.

References:

1. C. L. Arora -B.Sc. Physics, Vol-I & II.
2. Charles Kittel/Herbert Kroemer -Thermal Physics.
3. Resnick/Halliday/Krane-Physics, Vol I & II.
4. Alvin Hudson/Rex Nelson-University Physics.
5. Arther Beiser-Concepts of Modern Physics.
6. David Halliday/Robert Resnick/Jearl Walker-Fundamentals of Physics.
7. Harvey E.White/Francis A. Jenkins-Fundamentals of Optics.
8. D.W.Tenquist/R. M. Whittle/J. Yarwood-University Optics.
9. S.C.Arrora/S. Domkundwar-A Course in Heat & Mass Transfer.
10. Marcelo Alonso/Edward J. Finn-Physics.

FE-112: ENGINEERING DRAWING

Class per week	Credit	Marks
1	2	Continuous assessment : 40 Course final examination 60

Introduction to the course: Engineering Drawing is a performance based practical course. It makes in students the idea of planning of productions, precision of measurement and dimension, difference in 2D and 3D drawing etc.

Course Objectives: (i) To draw orthographic views (2D) from isometric view (3D) with precision; (ii) can perform Development Drawing; (iii) can perform the product design and layout drawing

Course Contents:

Introduction, drawing equipment and the use of instruments; Basic drafting techniques and standards; Geometrical curves including plane curves; Cycloid, Hypocycloid, and the Involutes. Intersections at various positions of geometrical bodies such as prisms, pyramids, cylinders and cones. Development of surfaces of prisms. Pyramids, cylinders, cones, drum, gear-box guard, knife-guard, coating machine, hand spray, spray coater, roller coater, etc. Freehand sketching of machine and engine components; Locking arrangements; Foundation bolts; Stuffing box; Shaft couplings; Foot-step bearing; Pulleys; Engine connecting rod. Concept of working drawing of component parts of machines and engines; Size, description, dimensions, and specifications; limit dimensioning and geometric tolerance; limits; Fits and tolerances, conventional symbols. Sectioning of machine and engine components; Orthographic projections and standard practices Isometric views with particular reference to piping and ducting. Layout drawing of a modern Footwear Industry.

Learning Outcomes: From the practice of the course a student can perform to draw orthographic views (2D) from isometric view (3D) with precision; can perform the product design and layout drawing of a modern Footwear Industry.

References:

1. Spencer and Hill-Technical Drawing
2. Mandal., Dr. Amalesh Chandra and Islam., Dr. Md. Quamrul-Mechanical Engineering Drawing
3. Giesecke, F.E. and et al, "Technical Drawing", 7th Edition, 1985, McMillan Publishing Co., Inc., New York.
4. French, T.E., Vierck, C.J. and Foster, R.J., "Engineering Drawing and Graphic Technology", 14th Edition, 1993, McGraw Hill International Edition, U.S.A.
5. Dhawan.,R.K.; "Engineering Drawing"
6. Parkinson.,A.C.; "A First Year Engineering Drawing"
7. Verma.,C.L.; "Engineering Drawing"
8. Gupta.,R.B.; "A Text Book of Engineering Drawing"

FE-113: COMPUTER AND INFORMATION ENGINEERING

Class per week	Credit	Marks
2	3	Course final Exam: 70, In-course assessment: 25, Class Attendance: 5. Total Class: 45

Introduction to the course: This course discusses the fundamental knowledge of computer and Information Technologies. It covers computer hardware as well as with computer software with the internal mechanism of hardware and the development process of a software system and its classifications. Additionally, it also discusses the basic of a computer network with its classification and the peripheral devices used in networking. It also describes the Internet and the basic of mobile and wireless communication technology.

Course Objectives:

The course is designed to aim at imparting a basic level computer knowledge for the students. After completing the course, the incumbent is able to understand how a computer operates, how does everything work on the computer? How does a computer process and store data? Moreover, students will learn the basic knowledge on a computer network and other associated things related computers. The computer for basic purposes of preparing his personal/business letters, viewing information on Internet (the web), sending emails, using internet banking services etc.

Course Contents:

Introduction to computer: History and development of computer, types of computers, Scope of computer, impact of computers on society and technology, working principle of a computer system, single and multi-user systems.

Hardware: Organization and architecture, motherboards & microprocessors, memory units: primary memory, secondary memory, Input/Output device, other peripheral devices like pointing devices, display devices, printing devices etc

System software: Operating system concepts, importance, components and basic functions of DOS, Windows and LINUX operating systems.

Application software: Desktop publishing: Desktop publishing includes effective page layout techniques, ways to add graphics, manipulating text and print. Word processing: Word processing software includes creating documents, printing documents, changing the appearance of text or lines of text, changing page formats and other writing tools. Spreadsheets: Spreadsheets software includes basic concepts of spreadsheets, making basic worksheets entries, entering formulas to perform calculations, altering column options, working with ranges versus all of the worksheets, basic print options, file commands and basic graphing. Database: Database management system, database concepts, creating a database file structure, entering and editing data, displaying, organizing and printing data, modifying the data structure, creating queries and building and printing custom reports or forms.

Maintenance: Power supply stability, grounding, effects of surge, sag current and its protection, classification of stabilizer and UPS, effect of static charge on computer devices, handling of computers cards and chips, computer viruses and protections, operating system setting, disk-partitioning, software troubleshooting and maintenance.

Computer networks: Concepts of network, different types of network, study of LAN concepts and operation, hardware and software for networks, data transmission, network architectures, protocols and standards are examined, as well as install and uninstall network components and peripheral devices, study of connectivity between LAN and wide area networks.

Internet: Worldwide web including navigating the internet, task-oriented skill sessions on logging on, Internet services: Telnet, FTP, e-mail, www, internet, Intranet etc.

Mobile and wireless Communication: 1G, 2G, 2.5G and 3G mobile, GSM and CDMA, bluetooth, WiFi Max etc.

Learning Outcomes:

Makes students aware of the computer and information Technologies, their internal mechanism and classifications.

Teaches the basic of the Internet, mobile, and wireless communications.

Describes the software development process and networking.

References:

1. S. Frence - Computer Science.
2. Warford- Computer Science.
3. Peter Norton – An Introduction to Computer Science
4. L. Rosch- Hardware Bible, Baraddy Publishing, Indianapolis.

5. Clive Finkelstein – An Introduction to Information Engineering
6. Ian Macdonald - Information Engineering
7. James Martin - Information Engineering: Introduction

FE-114: COMPUTER AND INFORMATION ENGINEERING PRACTICAL

Class per week	Credit	Marks
1	2	Continuous assessment : 40 Course final examination 60

Introduction to the course: This course reifies the fundamental knowledge of computer and information Technologies to the students. It teaches Office Word, Excel and PowerPoint to the students. After completing the course, students can able to write reports in a better and organized way, can make power point presentation, and finally become capable of performing excel operations for their different purposes. It also teaches students how to use the internet in a better way and how to be safe while using social networking and browsing the internet.

Course Objectives: This course teaches Office Word, Excel and PowerPoint to students. And also describes the basic of preparing his personnel/business letters, viewing information on Internet (the web), sending emails, using internet banking services etc.

Course Contents:
Operating system: Students will learn how to operate a computer in two basic environments- dos and windows and to install DOS, windows operating system. Word processor: students will learn to use a popular word processor to create a camera-ready test file complete with figures, columns and tables. Spread sheet: students will learn how to use a popular spread sheet to maintain a minor book keeping, statistical and graphical analysis off data. Database: students will learn how to design a database structure/table. Computers assemble: students will assemble a computer. Internet: e-mail access, browsing, downloading.

Learning Outcomes:
- Students learn how to operate a computer in two basic environments- dos and windows and to install DOS, Windows operating system.
- Students learn to use a popular word processor to create a camera-ready test file complete with figures, columns, and tables.
- Students learn how to use a popular spreadsheet to maintain a minor book keeping, statistical and graphical analysis of data.
- Students learn how to design a database structure/table.
- Students assemble a computer. Internet: e-mail access, browsing, downloading.

FE-115: MATHEMATICS-I

Class per week	Credit	Marks
2	3	Course final Exam: 70, In-course assessment: 25, Class Attendance: 5 . Total Class: 45

Introduction: Mathematics-I course is primarily concerned with developing the students' understanding of the concepts of matrix and calculus that providing experience with its methods and applications. The course emphasizes a multi representational approach to calculus and system of linear equations, with concepts, results, and problems being expressed geometrically, numerically, analytically, and verbally. The connections among these representations also are important. Broad concepts and widely applicable methods are emphasized.

Technology should be used regularly to reinforce the relationships among the multiple representations of functions, to confirm written work, to implement experimentation, and to assist in interpreting results. Through the use of the unifying themes of derivatives, integrals, limits, approximation, and applications and modeling, the course becomes a cohesive whole rather than a collection of unrelated topics. These themes are developed using all the functions listed in the prerequisites

Course Objectives:

- Learn to find the determinant of a matrix, inverse matrix, and use them to solve the system of linear equations.
- Learn to find the vectors properties and use them in applications.
- Learn to find and use limits of functions, continuity & derivatives of functions.
- Learn to find the derivatives of elementary algebraic functions and trigonometric functions.
- Learn to use derivatives for graphing algebraic and trigonometric functions and to solve optimization problems.
- Learn to evaluate definite and indefinite integrals and use them in applications.

Course Contents:

Algebra: Determinant, matrix, inequalities.

Vector algebra and vector calculus: Introduction, scalar and vector products, solutions of vector equations, applications of vectors in geometry, vector calculus: vector function of scalar variables, differentiation of vector functions: grad, div and curl of functions, line, surface and volume integrals: green, gauss and stokes theorems-verification and applications.

Differential calculus: Functions of real variable and their graphs, limit, continuity and derivative, physical meaning of derivative of a function, evaluation of indeterminate forms of limit, L' Hospitals theorem, higher derivatives, Leibnitz theorem, Role's theorem, mean value theorem, Taylor's theorem, Taylor's and Maclaurin's series, maximum and minimum values of functions, functions of two and three variables, partial and total derivatives, Euler's theorem, concavity and convexity of a function.

Integral calculus: Definition of integration, integration by the method of substitution, integration by parts, standard integrals, method of successive reduction, definite integral, its properties and use in summing series, Walli's formulae, improper integral, beta function and gamma function, area under a plane curve in Cartesian and polar coordinates, area of the region enclosed by two curves in Cartesian and polar coordinates, Trapezoidal rule, Simpson's rule, area, lengths of curves in Cartesian and polar coordinates, parametric and pedal equation, intrinsic equation, volumes of solids of revolution, volume of hollow solids of revolution by shell method, area of surface of revolution.

Learning Outcomes: Upon successful completion of this course students will be able to

1. Use computational techniques and algebraic skills essential for the study of systems of linear equations, matrix algebra, vector spaces, eigenvalues and eigenvectors, orthogonality and diagonalization (Computational and Algebraic Skills).
2. Critically analyze and construct mathematical arguments that relate to the study of introductory linear algebra. (Proof and Reasoning).
3. Use technology, where appropriate, to enhance and facilitate mathematical understanding, as well as an aid in solving problems and presenting solutions (Technological Skills).
4. Communicate and understand mathematical statements, ideas and results, both verbally and in writing, with the correct use of mathematical definitions, terminology and symbolism (Communication Skills).
5. Work collaboratively with peers and instructors to acquire mathematical understanding and to formulate and solve problems and present solutions (Collaborative Skills).
6. Interpret a function from an algebraic, numerical, graphical and verbal Perspective and extract information relevant to the phenomenon modeled by the function.
7. Verify the value of the limit of a function at a point using the definition of the limit
8. Calculate the limit of a function at a point numerically and algebraically using appropriate techniques including L'Hospital's rule.
9. Find points of discontinuity for functions and classify them.
10. Interpret the derivative of a function at a point the as the instantaneous rate of change in the quantity modeled and state its units.
11. Interpret the derivative of a function at a point as the slope of the tangent line and estimate its value from the graph of a function
12. Sketch the graph of the derivative from the given graph of a function.
13. Compute the value of the derivative at a point algebraically using the (limit. Definition).
14. Interpret the tangent line geometrically as the local linearization of a function
15. Compute the expression for the derivative of a composite function using the chain rule of differentiation.
16. Differentiate a relation implicitly and compute the line tangent to its graph at a point
17. Differentiate exponential, logarithmic, and trigonometric and inverse trigonometric functions.
18. Obtain expressions for higher order derivatives of a function using the rules of differentiation
19. Interpret the value of the first and second derivative as measures of increase and concavity of a functions.
20. Identify the extrema of a function on an interval and classify them as minima, maxima or saddles using the first derivative test.
21. Understand the consequences of Rolle's Theorem and the Mean Value theorem for differentiable functions

22. Interpret the definite integral geometrically as the area under a curve
23. Interpret differentiation and anti-differentiation as inverse operations (Fundamental Theorem of Calculus, part 1)
24. Use substitution to find the anti-derivative of a composite function and apply basic optimization techniques to selected problems arising in various fields such as physical modeling, economics and population dynamics and engineering.

References:

1. Bali N. P. Ashok Saxena and Sriman Narayana - A Text Book on Engineering Mathematics.
2. P. Kandasamy, K. Thilagavathi and K.Gunavathi - Engineering Mathematics, Vols. I and II.
3. S. Narayanan, T. K. Manicavachagam Pillay and G. Ramanaiah - Advanced Mathematics for Engineering Students, Vols. I and II.
4. E. Kreyszig- Advanced Engineering Mathematics.
5. R. V. Churchill and J. W. Brown -Complex Variables and Applications.
6. S. S. Sastry -Inductory Methods of Numerical Analysis.
7. Finney and Thomas-Calculus and Analytical Geometry.
8. Mohammad & Bhattacharjee-Differential Calculus.
9. M. R. Spiezel- Advanced Calculus.
10. R. A. Sardar -Differential Calculus.
11. H. T. H. Piaggio -Differential Equations.

FE-117: BUSINESS AND COMMUNICATIVE ENGLISH FOR ENGINEERS

Class per week	Credit	Marks
2	3	Course final Exam: 70, In-course assessment: 25, Class Attendance: 5. Total Class: 45

Introduction of the course: What sounds true about the incalculable potency of language is that it can hold the whole gamut of human culture. Likewise, what is creditably measurable by the linguistic phenomena is attributable to the fact that there appeared a form of English that can retain a myriad of components from science, technology, economy and business. The people's insight in a context of technologically-affluent society is inextricably tied up with Business English. Apart from understanding the functioning of the linguistic phenomena, it goes impossible to inherit, analyze and assess the up-to-date trends in modernist culture. Conscious about the aforementioned factors in connection with English, three departments under **Institute of Leather Engineering & Technology** (ILET), namely Department of Leather Engineering; Department of Leather Products Engineering; and Department of Footwear Engineering offered a language course for the learners entitled ***Business and Communicative English for Engineers***.

Course Objectives: The course is identical with certain objectives hereinafter following namely:

- Generating awareness among the learners about the art of Business English; and

- ❖ Enabling them to adopt the communicative English skillfully and purposively as an effective means of expression.

Course Contents:
Introduction to English grammar and its usage: Basic English Grammar and its standard usage.

English language: Its function as a primary means of communication to the technologists in writing, speaking, listening and reading.

Writing: Planning – technique, style and form, paragraph headings context, vocabularies writing for specific purposes.

Technical writing: Technical and industrial report including various types of technical reports with emphasis on preparation, data collection and research, organization style format graphics technical descriptions and report writing. Proposal for new equipment increasing production, description of visits

Business / commercial Writing: Job application, Business Letters

Speaking and Listening: Effective communication between speaker and listener through presentation. Use of visual aids.

Reading and Understanding: Technical and scientific books and journals.

Style of letters: Full blocked, Semi-blocked, Blocked

Parts of writing official letters: Techniques of writing (Heading, Reference, date, inside address, topic, greetings, complementary closing, Signature, Supplements.

Types of format documentation (in English)

Application with Curriculum Vitae (C.V)
Appointment letter
Joining Report
Letter of enquiry, orders, cancellation
Letter of compensation and complaint
Letter to the print and Electronic media
Application for opening a Bank Account
Application for Bank Solvency Certificate
Application for Bank Loan
Office note
Memorandum
Notice Writing
Listening: Phonetics and phonology, Sound practice.

Learning Outcomes:
The expected outcome is that the students after a perusal of the course will be able to use English skillfully in order to serve academic and practical needs.

References:
1. Orient Longman- English for Engineers' and Technologist, Vol. 1 and Vol. 2.

FE-201: MANUFACTURING TECHNOLOGY OF FOOTWEAR-II

Class per week	Credit	Marks
2	3	Course final Exam: 70, In-course assessment: 25, Class Attendance: 5. Total Class: 45

Introduction of the course: Shoe sizing and fitting, Last, Pattern making, Cutting, Skiving and Splitting, Closing, Lasting, Shoe construction.

Course Objectives:
To develop the basic knowledge of footwear Engineering.
To understand the human engineering in footwear design.
To acquaint with the knowledge of shoe last, its types and features.
To familiarize with the different types of shoe sizing and fitting systems.
To develop knowledge and skills on Pattern Making process.
To gather knowledge of different types of cutting systems.
To provide the knowledge required to understand the principles and practice of the closing technique.
To build up skill on the development of various shoe construction.
To make understand the basic concept and techniques of shoe lasting.

Course Contents:

Shoe sizing and fitting: Definition, principle of shoe sizing, length size, shoe size classification- UK shoe sizing, Parish point, American shoe sizing, centimeter scale, Mondo point, comparison among different shoe sizing systems, conversion of sizes from one scale to another. Standardize shoe sizes, inconsistency of shoe sizing, fitting- definition and principle, purpose of shoe fitting, different fitting system, advance principle of shoe fitting, fitting of infant shoes, fitting of children shoes, difficulties in perfect shoe fitting, factor and procedures of shoe fitting, shoe fitting checking procedures, shoe fitting devices, fitting problem feet , shoe adjustment in fitting, related maths.

Last: Definition, its importance, difference between last and feet, classification of last, measurement of last, symmetric lasts, custom made last , after care of last / storage of last , raw materials used for last manufacturing, last styling and model making, last milling and manufacturing – wooden and synthetic last , last co-ordination, last features for different styles of footwear.

Pattern Making: Definition, types of pattern, sequence of pattern making, tools and equipment for pattern making, mean form, standard form, sectional pattern, tooling up, 3D-2D-3D conversion. Grading.

Cutting: Assessment of materials, cutting- definition, tightness and stretchiness of leather, parts of leather, grading and sorting leather, upper materials used in footwear manufacturing, area measurement, area discrepancy, cuttability of leather, net coefficient of leather , true price, grading system of leather, table run, instruction or job sheet, press cutting, clicking press knives, environmental factors, storage of knives, modern clicking press, advantages of various types of cutting machine, press cutting process, safety method of clicking, comparison between hand cutting and machine cutting, sorting of leather for cutting, variation in upper materials and their effects on clicking, cutting principle of leather and synthetic materials, related maths.

Skiving and Splitting: Skiving- definition, purpose of skiving, procedure, hallow skive, types of skiving - raw edges, burnished edge, folded edge, underlay edge, close seam, lasted margin, Splitting- definition, purpose, procedure, safety practice.

Closing: Definition, preparatory operation- identification making, notch marking, sizing marking, stitch marking, lining stamping, punching/perforation, gimping, blocking, performing, reinforcing, embossing, crimping, edge coloring, burnishing, folding, binding, top line treatment, eyeleting, punching, edge burnishing, edge binding, upper assembling ,lining assembling, upper and lining attaching.

Lasting: Definition, objects of lasting, principal of lasting, preparatory operations, methods of lasting, hand lasting procedures.

Shoe construction: Definition, types, purpose, cement construction, construction of sandal, court shoe and oxford shoe.

Learning Outcomes:

Identify different human foot and defects of unfit shoes & practice on size system & last. Prepare different types of mean form and computer aided design. Identify and use of different tools and equipments and perform various process of pattern making. Care and maintenance of tools equipments and machines observing safety precautions. Identify source of leathers, their characteristics and practice on various component direction of cutting & sharpening of tools. Practice various type of leather measurement and Cutting by hand & machine. Plan and carryout various stitching & topline treatment practice. Identify, operate, troubleshoot & maintain of different equipment used in footwear making. Designing, pattern cutting and template making of different types of footwear. Apply method of Economical cutting of components and Stitch by hand and machine to produce footwear. Perform different types of application like closing, skiving, folding and identify types of adhesives & their application. Identify different sorting & matching cut components, bottom components, prepare toe & counter stiffer, drafting & lasting. Prepare & practice Insole, drafting, lasting, sole attaching, sole stitching, welt stitching, bottom filling, heel fixing

& finishing. Component cutting from suitable areas is preformed. Different parts of a shoe are identified and components are cut by hand or by using clicking press. Sorting of leather by identifying common defects is performed. Different parts of leather cutting machines are identified and maintenance/preventive maintenance performed. Sketches of different basic styles of footwear are drawn. Pattern cutting and template making for different types of footwear are practiced. Identify of basic design of different types of shoes. Construct and design of different type styles/fashion open and closed shoes. Different parts of the shoe components viz. upper, lining, insole, stiffener etc. are identified and economical cutting of these components are performed. Identify different types of clicking of upper components and linings. Operations like skiving, splitting, preparatory/bench, folding, closing etc. are performed for making upper. Prepare different types edge treatment. Surface preparation and practice roughening, scouring, priming, wiping of the surfaces. Sorting and matching of cut components of footwear are performed. Prepare of toe and counter stiffeners. Prepare drafting and lasting. Prepare different types of lasting. Prepare different types of construction and operation for lasting the upper. Drafting, lasting, sole attaching, sole stitching, welt stitching, bottom filling, heel fixing and finishing of shoe is performed. Prepare manufacture of moulded shoes and back part moulding. Prepare toe puff attachment and toe puff conditioning. Identify various part and section of pulling and toe lasting machine. Identify various parts and section of sole stitching machine.

References:

1. Martin , Shoben , Janet P. Ward - Pattern Cutting and Making Up
2. Swayam Siddha - The Art of Cutting Kid and Goat Skin
3. Swayam Siddha - The Art of Cutting a Buffalo Leather
4. Swayam Siddha - The Art of Cutting Corrected Grain Leather
5. Venkatappaiah B.- Introduction To The Modern Footwear Technology-
6. Miller R. G. (Editor) - Manual Of Shoe Making
7. Korn J. (Editor) - Boot and Shoe Production
8. Thornton J. H.- Text Book of Footwear Manufacture
9. SATRA Bulletin
10. Spencer Crookenden - K Shoes -The first 150 years 1842-1992
11. Ruth Thomson - Making Shoes
12. Swayam Siddha - Product Knowledge
13. Swayam Siddha - The Skill of Seam Reducing
14. Thornton J. H.-Text Book of Footwear Materials -

FE-202: MANUFACTURING TECHNOLOGY OF FOOTWEAR-II PRACTICAL

Class per week	Credit	Marks
2	4	Continuous assessment : 40 Course final examination 60

1. Mean form-making technique, dead form, standard making.
2. Working pattern making technique for Oxford/ Derby/Court Shoe.

3. Preparation of different types of quarter, counter, vamp, facing, toecap, collar, vamp apron, wing cap etc. for mens' Oxford/Derby/Brogue shoe.
4. Preparation of different types of quarter, counter, vamp, facing, toe cap, collar, vamp apron, wing cap for Boys' Oxford/Derby shoe/Court Shoe.
5. Sandal making: Toe peg, Toe band, V-Strap, Instep-band, Crossed bands, Multi-straps.
6. Attachment of Straps of sole.
7. Baby shoe making, slipper making, fancy ladies sandal making.
8. Study the method of grading of upper and practical grading of upper leather.
9. Theoretical area drawing.
10. Paper skin tracing and calculation of wastage allowance.
11. Practical manipulation following the principles of cutting.
12. Prepare cutters performance sheets.

FE-203: APPLIED CHEMISTRY AND CHEMICAL ENGINEERING

Class per week	Credit	Marks
2	3	Course final Exam: 70, In-course assessment: 25, Class Attendance: 5. Total Class: 45

Introduction to the course: This course is designed to provide the basic concept**s** of fatty oils and fats, waxes and understanding related to extraction and refining method of vegetable oils, mechanism of soap and detergent and their manufacturing process. It also covers glue and gelatin, adhesives and different cosmetics. Moreover, fundamental of material balance, principles of energy conversion and conservation**,** fluid mechanics are also discussed.

Course Objectives : The learning objectives of this course are:

- To understand basic concept and mechanism of fat, oil and waxes.
- To know the extraction and refining method of vegetable oils.
- To introduce the cleansing mechanism of soap, raw materials of soap manufacturing.
- To learn about different types of manufacturing process of different cosmetics.
- To understand the fundamental of material balance, energy balance**,** fluid mechanics etc.

Course Contents:

Oils, Fats and waxes:

Oils and its classification, animal fats, characteristics and uses of fatty oils and fats, waxes and its classification, saponification value, acid value, iodine value of oils, fats and waxes, extraction and refining method of vegetable oils, rancidity of oils, hydrogenation of vegetable oils.

Soaps and Detergents: Cleansing mechanism of soap, raw materials of soap manufacturing, Batch-kettle process and modern process of soap manufacture, detergent and its classification, manufacture of ABS detergent, glycerine and its manufacture.

Glue, Gelatin and Adhesives:
Introduction, characteristics and uses of glue and gelatin, adhesives and its uses, gelatin manufacture and by products, animal glue.

Cosmetics:
Introduction, types of cosmetics, hair products (shampoo, hair straightener), face powder, cleansing cream and lotion, lipstick, eye makeup, preshave, shaving & aftershave preparation.

Material balance:
Fundamental of material balance: Types of balances, steady state and unsteady state operations, principle and procedure of material balance, material balance calculations of problems without chemical reactions.
Material balance on reactive system: Stoichiometry, stoichiometric equation, stoichiometric coefficient, stoichiometric ratio, stoichiometric proportion, limiting and excess reactant, recycle, purge and by-pass, mass balance involving chemical reactions.

Energy balance:
Principles of energy conversion and conservation, form of energy, total energy balance, heat of reaction, heat of combustion, heat of formation, theoretical and excess air of combustion, energy balance calculation without and with chemical processes.

Absorption:
Principle of absorption, operational and constructional features of packed absorption tower, mass balance equation of packed absorption tower, tower packings and their characteristics.

Refrigeration:
Introduction, vapor-compression refrigeration cycle, absorption refrigeration cycle, refrigerants, refrigerants classification, refrigerants properties and uses.

Fluid mechanics: Introduction, fluid flow and its measurement, laminar flow, turbulent flow, Reynold's number, Euler's differential equation of hydrostatic pressure, basic equation of hydrostatic equilibrium and its application, fluid machinery- pumps.

Learning Outcomes: At the end of this course students will be able to:

- Understand the basic concept and sources of raw materials of fat, oil and waxes.
- Differentiate between fat, oil and waxes. Characterization and properties of fat, oil and waxes.
- Know the extraction and refining method of vegetable oils.
- Interpret the cleansing mechanism of soap, raw materials of soap manufacturing.
- Learn about different types of manufacturing process of different cosmetics.
- Identify different faults in manufacturing process.

References:

1. W. J. Moore- Physical Chemistry.
2. Bahl and Tuli- Essentials Physical Chemistry.

3. Sharma and Sharma- A Text Book of Physical Chemistry.
4. S. Glasstone-Text Book of Physical Chemistry.
5. P. W. Atkins- Physical Chemistry.
6. M. Mahbubul Haque & M. Ali Nawab- Principle of Physical Chemistry.
7. McCabe and Smith- Introduction to unit operation
8. Perry- Handbook of chemical engineering.
9. Fogler- Element of chemical reaction engineering
10. A text book of engineering Chemistry –M.M. Uppal.

FE-204: APPLIED CHEMISTRY AND CHEMICAL ENGINEERING PRACTICAL

Class per week	Credit	Marks
2	4	Continuous assessment : 40 Course final examination 60

Introduction to the course: This course is designed to develop and improve the practical skill of students. The students have the opportunity to prepare several industrially important raw materials and products. This course will assist students to know the characteristics and properties of oils and fats, waxes and understanding related to extraction and refining method of vegetable oils, mechanism of soap and detergent and their manufacturing process. In addition, various analytical techniques are specifically focused in this course.

Course Objectives: The learning objectives of this course are

- To improve the practical knowledge and analytical skills in applied chemistry.
- To introduce learners with analysis of Industrial raw materials.
- To help them understand the importance of some specific chemical reactions.
- To familiarize with different analyzing techniques of industrial products.
- To understand specific instrumental analysis for analytical purposes.

Course Contents:

Lab I: Analysis of Industrial Raw materials:

1. Water 2. Sulphur 3. Oil seeds 4. Cellulose raw materials 5. Raw hides and skins

6. Different types of Leather 7. Effluent of raw hides and skins 8. Sea salt 9. Chrome powder

Lab II: Analysis of Industrial Products:

1. Soap 2. Acids and alkaline 3. Fish oils 4. Hydrogenated fats 5. Animal fats and oils

6. Wet-blue hides and skins 7. Crust Leather 8. Different type of finished Leather

Lab III: Instrumental analysis

1. study of kinetics of chemical reactions using:

a) Polarimeter b) Conductance bridge c) Spectrophotometer and d) Chemical analysis

2. Electrochemical measurements: P^H measurements
3. Spectrophotometric analysis
4. Chromatographic analysis

Learning Outcomes: At the end of this course students will be able to

- Understand the fundamentals of raw materials of fat, oil and waxes.
- Interpret the mechanism of soap manufacturing.
- Know the extraction and refining method of vegetable oils.
- Utilize various analytical techniques.
- Identify different faults in manufacturing process.

References:

1. W. J. Moore- Physical Chemistry.
2. Bahl and Tuli- Essentials Physical Chemistry.
3. Sharma and Sharma- A Text Book of Physical Chemistry.
4. S. Glasstone-Text Book of Physical Chemistry.

FE-205 MATERIALS SCIENCE AND TECHNOLOGY

Class per week	Credit	Marks
2	3	Course final Exam: 70, In-course assessment: 25, Class Attendance: 5. Total Class: 45

Introduction to the course: The curriculum for undergraduate program in materials science and technology leading to the award of B.Sc. in Footwear Engineering Degree is in accordance with the criteria set forth by University of Dhaka so that each student can understand about manufacturing requirements, properties and application of different materials used in footwear manufacturing.

Course Objectives: Provide an overview of materials science and technology related with footwear engineering as a basis for understanding how structure/property/processing/application relationships are developed and used for different types of materials in footwear manufacturing.

Course Contents:

Leather and Synthetic Upper Materials: Ideal properties of upper materials, leather identification, parts of a leather, Influence of temperature and humidity on leather. Effect of structure on the properties of leather, types of finished leather, Production of PVC coated fabrics and PU coated fabrics, Comparison between leather and synthetics.

Solings: Properties, compounding and uses of different soling materials, preparation of soling materials before sole attaching, moulding techniques of soling materials.

Insole: Properties of insole materials, types of insole materials, raw materials for insole, manufacture of insole materials- leather board, cellulose board, impregnated non-wovens, fibre board, plastics, comparisons of insole materials, insole preparation for shoe making, selection criteria's of insole for shoe making aspects, insocks and footbed.

Reinforcements: Types of reinforcement materials, the use of reinforcement in toplines, different seam reinforcing materials for shoes, boot, slip-on, sandal, straps and stripping; reinforcement for strengthening loops (Ghillies, D-rings), lasting strains, buckle straps; attaching system of general reinforcement, selection criteria for reinforcement, indirect tape and reinforcement applications, advantages and disadvantages of reinforcement, physical properties of reinforcement, optimum reinforcement combination.

Heel: Definition, different materials for heels, Wood heels, plastic heels, ABS, EPDM, injection moulded heels- mould design, raw materials selection- injection moulding and finishing,

Toe puffs and stiffeners: The purpose of toe puffs, different kinds of toe puffs- solvent activated impregnated fabric, thermoplastic filmic, selection criteria of toe puff, application and positioning of toe puffs, toe puff faults and their effects on footwear, the purpose of shoe stiffeners, pre-moulded stiffeners, stiffeners needed back moulding, types of stiffeners- fully moulded leather board, fully moulded fibre board, thermo impregnated leather board, thermo impregnated fibre board, thermoplastic fabric based, solvent activated impregnated fabric, selection criteria of stiffeners for different footwear, fitting of stiffeners, faults of stiffeners.

Needle and Thread: Parts of a needle, sizing, system, points of needle, needle manufacturing, needle-thread relation, needle-material relationship;

Thread: Types of thread, thread identification, thread consumption, thread packaging.

Shank: Raw material, wood, fibre board, steel, bamboo, shank manufacturing.

Shoe finishes: Cleaners: Cleaners types, properties, selection criteria, repairing wax, edge colouring chemicals, Fillers/sealers: types, properties, selection criteria, application method, combination, Polishes: types, properties, selection criteria, application, Spray/Modifiers/Revivers/Renovators, chemical used for oily/waxy upper. Dubbin, Wax polishes and creams, bottom finishes, heel and edge finishes, upper leather finishes, The water containing finishing creams and some recipes, white polishes. Top dressing, Wrinkle chasing.

Abrasives: Types of abrasives, natural abrasives, artificial abrasives, coated abrasives, abrasive wheels, use of abrasives in shoe making

Fasteners & Accessories: L*ace fabrics:* Raw materials, manufacture technique and finishing, Different types eyelets, slide fasteners and their uses. Accessories: Ornaments, embellishments, methods of manufacture, moulding, electroplating and polishing.

Packing materials: Shoebox, wrapping paper, shape retainers, cartoon box etc.

Learning Outcomes: Students will be able

a. To know about the properties, applications and manufacturing requirements of different types of leather used as components in footwear manufacturing.
b. To know about the properties, applications and manufacturing requirements of different types of artificial leather/synthetic materials used in footwear manufacturing.
c. To know about the properties, applications and manufacturing requirements of different types of fabrics used in footwear manufacturing.
d. To know about the properties, applications and manufacturing requirements of different types of soling materials (insole, mid sole, out sole, Bottom filler etc) used in footwear manufacturing.
e. To know about the properties, applications and manufacturing requirements of different types of shoe room/shoe dressing materials used in footwear manufacturing.
f. To know about the properties, applications and manufacturing requirements of different types of reinforcing materials (toe puff/stiffener/shank etc) used in footwear manufacturing.
g. To use the techniques, skills and modern engineering tools necessary for engineering practice.

References:

1. Venkatappaiah B. -Introduction to the Modern Footwear Technology
2. Miller R. G. (Editor) - Manual of Shoe Making
3. Korn J. (Editor) - Boot and Shoe Production
4. Thornton J. H. -Text Book of Footwear Manufacture
5. SATRA Bulletin
6. Spencer Crookenden -K Shoes -The first 150 years 1842-1992
7. Ruth Thomson -Making Shoes
8. Swayam Siddha -Product Knowledge
9. Thornton J. H. -Text Book of Footwear Materials

FE-207: MATHEMATICS-II

Class per week	Credit	Marks
2	3	Course final Exam: 70, In-course assessment: 25, Class Attendance: 5. Total Class: 45

Introduction to the course:

Mathematics-II combines different interesting and cardinal branches of Mathematics. Coordinate geometry is one of the central part of mathematics and it provides a foundation to understand different phenomenon

by plotting them and deriving their properties. This will shape to create a foundation for advance trigonometry also. Laplace and Fourier transformation will be used to transform derivatives, integrals, periodic functions etc. In addition, Fourier series will be conducive to understand some intricate phenomenon like harmonic analysis. Methods of Ordinary and Partial differential equations are most useful mathematical techniques for developing mathematical models of real life problems like bacterial growth with the change of time, predator-prey model etc.

Course Objectives:

(i) To provide students a comprehensive idea on solving problems involving science and engineering.
(ii) To develop conceptual ideas of two and three dimensional geometry.
(iii) To understand the techniques of Laplace and Fourier transformations and Fourier series which are necessary tools for solving real life problems.
(iv) To enhance knowledge on advance trigonometry.
(v) To garner knowledge of the methods of ordinary and partial differential equations that will provide ideas for developing real life models involving one or more dependent variables with respect to one or more independent variables as well as their solution procedures.

Course Contents:

Two-dimensional geometry: Change of axes, pair of straight lines, general equation of second degree, circle, system of circle, parabola, hyperbola.

Three dimensional geometry: Plane and lines - co-ordinates, direction ratios and cosines of a line, equations of a line and a plane, intersecting planes, symmetric form of a straight line, angle between lines and planes, coplanar lines, skew lines, shortest distance, curved surfaces, equations of a sphere, section by a plane, tangent plane, standard equations of cone, cylinder and conchoids properties.

Trigonometry: Complex numbers and functions: De Moivres theorem and application, summation of finite trigonometric series, hyperbolic function.

Laplace transforms: Transforms of simple functions, basic operational properties, transforms of derivatives and integrals, periodic functions, convolution theorem, inverse transforms, initial and final value theorem, applications of Lap lace transforms to linear differential equations.

Fourier series : Dirichets conditions, general Fourier series, half range sine and cosine series, parsevals identity, harmonic analysis.

Fourier transforms: Fourier integral representation, Fourier transform pairs, properties, Fourier sine and cosine transforms, transforms of simple functions, transform of derivatives, the convolution integrals of Fourier, application to one dimensional wave and diffusion equation.

Differential equation: Ordinary differential equation: formation of differential equation, solution of first order differential equation by various methods, solutions of general linear equations of second and higher order with constant co-efficient, solutions of homogeneous linear equation.

Partial differential equations: Formation, solution of standard types of first order equation and Lagrange's equation, classification of second order partial differential equations, linear partial differential equations of second order and higher order with constant coefficients.

Learning Outcomes:

- At the end of Two-dimensional geometry students will be able to do transformations of axes. They will also be able to determine different properties of straight lines, circles and conics with identification of curves.
- At the end of Three-Dimensional geometry students will be able to determine directional cosines and directional ratios of straight lines manually with geometric interpretations, and different properties of conics and straight lines in three dimensions.
- At the end of Trigonometry they will be adroit to apply the idea of De Moivre's theorem, and also to determine sum of infinite trigonometric series.
- At the end of the Laplace and Fourier transformation and Fourier series students will learn about transformations of integrals, derivatives, periodic functions, half range sine and cosine series, harmonic analysis.

References:

1. Bali N. P. Ashok Saxena and Sriman Narayana- A Text Book on Engineering Mathematics.
2. P. Kandasamy, K. Thilagavathi and K. Gunavathi- Engineering Mathematics, Vols. I and II.
3. S. Narayanan, T. K. Manicavachagam Pillay and G. Ramanaiah- Advanced Mathematics for Engineering Students, Vols. I and II.
7. E. Kreyszig - Advanced Engineering Mathematics.
8. R. V. Churchill and J. W. Brown -Complex Variables and Applications.
9. S. S. Sastry -Introductory Methods of Numerical Analysis.
10. Finney and Thomas-Calculus and Analytical Geometry.
11. Mohammad & Bhattacharjee-Differential Calculus.
12. M. R. Spiezel- Advanced Calculus.
13. R. A. Sardar -Differential Calculus.

FE-209: STATISTICS

Class per week	Credit	Marks
2	3	Course final Exam: 70, In-course assessment: 25, Class Attendance: 5 Total Class: 45

Introduction to the course: Statistics play an important role in many aspects of engineering including forecasting, optimization of industrial processes, quality assurance and design of reliable systems. This course provides an introduction to the theory and practice of probability and statistics in the context of engineering. Topics covered are: review of descriptive statistics and basic probability, random variables, commonly used discrete and continuous distributions including Bernoulli, binomial, Poisson, and normal

probability distribution, central limit theorem, hypothesis tests, single sample, two independent samples, paired samples, inference for proportions; acceptance sampling, general control charts, regression and correlation, simple linear regression, least squares estimation, prediction and estimation, index number and z-transformation.

Course Objectives:

- Students will be taught on how to use and incorporate statistical tools for solving engineering statistics problem.
- This course covers the role of statistics in engineering.

Course Contents:

Introduction: Historical development of the subject, its nature and scope, nature of statistical data, attributes and variables, population and sample, collection and condensation of data. Frequency distribution, graphical representation of data.

Measures of location: Arithmetic mean, median and mode, geometric mean, harmonic mean. quadratic mean, deciles and percentiles.

Measures of dispersion: Range, mean deviation, standard deviation, variance, quartile deviation. Coefficient of variation, moments and cumulates of a distribution, skew ness and kurtosis.

Regression and correlation: Bivariate data, relationship between the varieties, method of least squares, regression line, correlation and regression coefficients, rank correlation.

probability: Definition of probability and related concepts, laws of probability, discrete and continuous random variables, mathematical expectation, conditional probability, Binomials, Poisson's and normal distribution and their properties.

Sampling: Population and sample, census and sampling, methods of sampling, random sampling, stratified sampling, systematic sampling, two stage sampling errors and non sampling errors, population projection.

Statistics for industry: Introduction, level of significance, hypothesis, important steps in a test of significance, testing the difference between two-sample mean and population mean. Acceptance sampling procedure, introduction, acceptance sampling by attributes, consumer's and producer's acceptance sampling by variables, continuous sampling plan, sequential sampling. Control charts natural tolerance limits and specification limit.

Index number: The concept of an index number, problems in construction of index number. Construction of price, quantity, value and cost of living indices, their uses. Laspeyere, paasche and Fisher's ideal indices, test of index number, cost of living index number. National income & wealth.

Educational statistics: Introduction, education and psychology, scaling measurement of different scores, IQ, planning, reliability and validity of tests.

Difference Equations and Z-Trannsform: Linear difference with constant coefficients, elementary properties of z transform, applications of z transform, application of z transform to difference equations.

Learning Outcomes:

After successfully completing the course, students should be able to do the following:

1. Compute and interpret descriptive statistics using numerical and graphical techniques for both categorical and continuous data.
2. Understand the basic concepts of probability, random variables, probability distribution, and joint probability distribution.
3. Know and apply the concepts of expected value and variance for discrete and continuous variables.
4. Know and apply the Central Limit Theorem, which is crucial for inference.
5. Understand confidence intervals and hypothesis tests.
6. Carry out and interpret one-sample and two-sample analyses for means and proportions.
7. Carry out and interpret statistical modeling using linear regression analysis.
8. Know and apply basic quality control procedures.
9. Understand and use process monitoring charts.
10. Understand and apply index number.

References:

1. Barlow R. J. - Statistics.
2. Meyer A.- Probability and Statistics.
3. Mosteler, Rourke and Thomas - Probability with Statistical Applications.
4. Ross S.M. - A First Course in Probability.
5. Toha H.A.- Introduction to Operation Research.
6. Hoel P.- Introductory Statistics.
7. Mostafa M. G.- Methods of Statistics.
8. Weatherburn- First course in Mathematical Statistics.
9. Yule and Kendal- An Introductory to the Theory of Statistics.
10. Duncan A. J.- Quality Control and Industrial Statistics.
11. Grant- Statistical Quality Control.
12. Guilford J. P. - Educational Statistics and Psychometric Methods.

FE-211: MECHANICAL ENGINEERING FOR FOOTWEAR MANUFACTURE

Class per week	Credit	Marks
2	3	Course final Exam: 70, In-course assessment: 25, Class Attendance: 5. Total Class: 45

Introduction to the course: Mechanical Engineering is an applied science theory and performance based practical course. It makes in students the idea of implementation of force, use of heat and mass transfer,

safe heat and mass transfer, use of fluid energy, protection against corrosion and use of Engineering Materials, Refrigeration and Air-conditioning etc.

Course Objectives: Students have to try to understand Engineering materials, Corrosion, Engineering Mechanics, Fluid mechanics, Heat and mass transfer, Refrigeration and Air-conditioning, welding etc.

Course Contents:

Engineering materials: Introduction, properties of engineering materials, characteristics & specification of brick, composition & uses of sand, constituents of cement, cement concrete (c.c), reinforce cement concrete (r.c.c.), abrasives; types of abrasives, abrasive wheels, use of abrasives in leather-goods, normal abrasive, artificial abrasive, paints & their constituents, fuels & lubricants, types of iron & steels, reason for alloying, iron-carbon equilibrium diagram.

Corrosion: Definition of corrosion, behavior of iron and steel in atmosphere, types of corrosion atmospheric, soil, high temperatures, stray current, protection from corrosion and its types, inorganic coatings, metallic coatings, non-metallic inorganic enamel and cathodic coatings.

Engineering mechanics: Introduction, force, moments and their applications; lever, center of gravity, moment of inertia, work, power and energy, friction on inclined surfaces; wedge, simple stress and strain, pressure vessel, torsion of circular shafts.

Fluid mechanics: Introduction, fluid flow and its measurement, boundary layer equations, laminar flow, turbulent flow, compressible flow, fluid machinery; pumps, lifting machines, etc. compressors; type of compressors, pneumatic compressor; preparation of compressed air, use of compressed air in leather-products machinery, blowers, **hydraulics**; the pressurization, hydraulic clicking press operation, hydraulic devices.

Heat and mass transfer: Introduction, different modes of heat transfer, heat transfer through plane wall, composite wall and cylindrical wall, overall heat transfer co-efficient, critical thickness of insulation, solution of energy balance equations, heat exchangers.

Refrigeration and air-conditioning: Introduction, vapor-compression refrigeration cycle, refrigerants, fundamentals of air-conditioning, summer air-conditioning system.

Learning Outcomes: From learning and practice of the course a student can perform to understand Engineering materials, Corrosion, Engineering Mechanics, Fluid mechanics, Heat and mass transfer, Refrigeration and Air-conditioning, welding etc.

References:

1.Virgil Moring Faires- Analytic Mechanics.
2. R.S. Khurmi-A Text Book of Mechanical Technology.
3. Mark's Standared Handbook for Mechanical Engineers.
4. Ferdinand P. Beer, E. Russel Johnston, Jr.- Vector Mechanics for Engineers.
5. R.S. Khurmi,J.K. Gupta- Theory of Mechanics.

6. G.J.Kulkarni- Engineering Materials
7. Dr. M.A. Aziz- Engineering Materials
8. J.P. Holman-Heat Transfer.
9. Rogers and Mathew- Engineering Thermodynamics.
10. R.S. Khurmi- A Text of Engineering Mechanics.
11. K.L. Kumar-Engineering Fluid Mechanics.
12. Stocker/Jones- Refrigeration & air conditioning.
13. G.C. Mostley- Leather Goods Manufacture.
14. W.A. Attwater- Leathercraft.
15. Hamlyn- Leatherwork- A step by step guide.
16. Sylvia Grainger- Leatherwork.
17. R.S.Khurmi-Applied Mechanics and Strength of Materials

FE-212: MECHANICAL ENGINEERING FOR FOOTWEAR MANUFACTURE PRACTICAL

Class per week	Credit	Marks
1	2	Continuous assessment : 40 Course final examination 60

Introduction to the course: Mechanical Engineering is an applied science theory and performance based practical course. It makes the students practice on different mechanical machines, welding practice and machine elements and their maintenance.

Course Objectives: (i) To perform fitting works; (ii) To perform machining on lathe, shaper, milling, drilling and grinding machine; (iii) To perform DC/AC arc welding and gas welding

Course Contents:

Mechanical Machines: Introduction, hand tools & accessories, measuring tools, machine tools, uses of steel vice, working bench, lapping machine, lathe, shaper, milling, drilling and grinding machine, air compressor, knife bending machine, knife cutting machine and leather crushing machine etc.

Welding: Shop safety practice, acquaintance with arc and gas welding tools, machines, electrodes, gas cylinders and their identification, types of gas flames, safety and precaution for welding. Practice on gas, arc welding and gas cutting on ms sheets and plates, non-ferrous metal working, cast-iron welding, soldering and brazing, study of welding defects.

Machine elements and their maintenance: Introduction, power transmission system, gear, pulley and chain, bearing, wood and machine screws, simple lifting machine; efficiency of machine, steam boiler and their accessories and mountings, pre-heater, heater, super-heater and economizers, planning and scheduling of preventive maintenance, break-down maintenance and trouble shooting, computerized machine maintenance systems.

Learning Outcomes: From the practice of the course a student can perform to work on different machines and their maintenance, fitting work, welding, etc.

Reference:

1.R.S. Khurmi-A Text Book of Mechanical Technology.
2. Mark's Standared Handbook for Mechanical Engineers.
3. R.S. Khurmi-Workshop Technology
4. R.S. Khurmi,J.K. Gupta- Theory of Mechanics.
5. Roy., Uttam Kumar-Mechanical Engineering Workshop Practice for Footwear Manufacture

FE-213: ELECTRICAL AND ELECTRONIC ENGINEERING

Class per week	Credit	Marks
2	3	Course final Exam: 70, In-course assessment: 25, Class Attendance: 5. Total Class: 45

Introduction to the course: Electrical and Electronic Engineering (EEE) is one of the dynamic and time demanding branches in engineering sector. EEE course is offered to all the undergraduate students of the Institute of Leather Engineering and Technology. This course is designed to cover most of the core scientific fundamentals related to basic electrical and mechanical engineering principles. Main contents of this course include different types of symbols used in electrical circuits, circuit laws, network transformation, network-analysis, network theorems, magnetic circuits, magnetic properties of matter, basic construction, principle, and operation of DC and A.C. machines.

Course Objectives:

- To have the skills for a successful career as well as the ability to collaborate with others to solve problems with creative thinking and effective communication.
- To function effectively in laboratory environment and pursue independent research towards the development of new devices and products using sophisticated EEE concepts.
- To work efficiently in leather, leather products, and footwear industries where proper application of engineering knowledge requires the basics of electronics, communication systems, signal processing, control systems, and computer-based systems

Course Contents:

Electrical: Different types of symbol used in electrical circuits, types of wires and cables and their uses, domestic and factory wiring, Delta-wye transformation, network-analysis methods of branch and loop currents, method of node-pair voltages, Thevenin's and Norton's theorems, magnetic field, right-hand rule, megnetic flux density, Biot-savart law, magnetic properties of matter, poles and dipoles, Gausse's law for magnetism, para magnetism, diamagnetism and ferromagnetism, nuclear magnetism, magneto motive force, magnetic field intensity, permeability, susceptibility, energy in a magnetic field, magnetization curves, Hysteresis, magnetic field intensity, measurement of magnetic flux, energy of magnetic field,

theory of ferromagnetism. Electrical machines: Introduction to magnetic circuit, eddy current loss, core loss, elementary A.C. generator, Transformer: single-phase transformer-equivalent circuit, laboratory testing, introduction to three-phase transformer, D.C. generator: principles, types, performances and characteristics, D.C. motor: principles, types, performances, speed control, Ward Leonard system, starters and characteristics. A.C. machines: three phase induction motor principles, equivalent circuit, introduction to synchronous machines and fractional horse power motors, choice of motor and generator for specific load, armatures and their types, winding and rewinding of armature, manual and automatic star-delta starters, Driver Servo-motors: basic theory and application. Measuring instruments and their classification, working principles and uses (Ammeter, voltmeter, wattmeter, energy meter, AVO-meter, frequency-meter, earth-tester, clamp-tester and A.C. maggers etc.)

Electronics: Different types of symbol used in electronic circuits, color code of resistors and capacitors, concept of conductor, semiconductor and insulator, emission of electron, thermo ionic valves, principles of operation & applications of semiconductor diode, zener diode, LED, LCD, LDR, Photo diode. Transistors: (bipolar and FETs), silicon controlled rectifier (SCR), DIAC, TRIAC Characteristics and application of CB, CE & CC and class (ABC) amplifiers, feedback in amplifiers, oscillators, inverters, clipping & clamping ckts, timer, voltage regulators. OP-amp, digital logic gates (combination and sequential) and its truth table, basic idea about microprocessors, different types of sensors and transducer, strain, pressure, temperature, speed and torque measurement, Microcomputer based systems & Industrial robots.

Learning Outcomes:

1. Understand the mathematical and physical foundations of electrical engineering and how these are used in electronic devices and systems.
2. Apply knowledge of mathematics, science, and engineering to identify, formulate, and solve engineering problems.
3. Employ as a practicing engineer in fields such as design, research, development, testing, manufacturing, operations and service systems.
4. Design and conduct experiments as well as to analyze and interpret data.
5. Communicate effectively to function on multidisciplinary teams.
6. Use the techniques, skills, and modern engineering tools necessary for engineering practice.

References:

1. V.K.Metha - Principles of Electronics.
2. Paul D. Malvino - Electronic principles.
3. Chut & Chut - Electronics in Industry.
4. B.L. Therera & A.K. Therera - Solid State Electronics
5. B. L. Therja, A. K. Theraja- A Textbook of Electrical Technology.
6. V. K. Mehta- Principles of Electrical Engineering and Electronics.
7. Kurt S. Lion- Elements of Electrical and Electronic Instrumentation.
8. A. K. Sawhney- A course in Electrical & Electronics Measurement and Instrumentation.
9. Robert P. Ward- Introduction to Electrical Engineering.

10. George J. Angerbauer- Principles of DC and AC circuits.

FE-214: ELECTRICAL AND ELECTRONIC ENGINEERING PRACTICAL

Class per week	Credit	Marks
1	2	Continuous assessment : 40, Course final examination 60

Introduction to the course: Electrical and Electronic Engineering (EEE) is one of the dynamic and time demanding branches in engineering sector. EEE practical course is offered to all the undergraduate students of the Institute of Leather Engineering and Technology. This course provides a broad training on electrical engineering, analogue, digital, and power electronics, and electrical AC & DC machines with laboratory experiments in order to develop their skills in basic engineering. In future it will help the students to function effectively in laboratory environment and pursue independent research towards the development of new devices and products using sophisticated engineering concepts.

Course Objectives:

The specific objectives of this course are to expertise the students for the following skills

1. Understand the machines and their functions related to electrical and electronic engineering in practical classes.
2. Provide necessary knowledge to adapt in a world of constantly evolving and innovative technology.
3. Function effectively in laboratory environment and pursue independent research towards the development of new devices and products using sophisticated EEE concepts.
4. Work efficiently in leather, leather products, and footwear industries where proper application of engineering knowledge requires the basics of electronics, communication systems, signal processing, control systems, and computer.

Course Contents:

1. Measurement of high resistance by magger and bridge magger.
2. Calibration of voltmeter, ammeter and watt hour meter.
3. Measurement of voltage, current and power by voltmeter and wattmeter.
4. Measurement of internal resistance of a storage cell.
5. Measurement of resistance of a bulb in (i) cold and (ii) hot condition.
6. Star and delta connection of three phase circuit.
7. Connection of a three phase transformer in an AC circuit.
8. Connection of one lamp controlled by single way switch and by two way switch.
9. Connection of two lamps with the main to work as series with no switch and parallel with switch.
10. Connection of a fluorescent lamp controlled by a switch.
11. Connection of an electric bell controlled from two points with lamp indication.
12. Changing of storage battery from DC mains.

13. Detection of defects of DC and AC.
14. Study of AC and DC starters.
15. Load test of a DC motor.
16. Speed control of a three phases induction motor.
17. Measurement of self-inductance by Raleigh's method.
18. Study the characteristic of a general purpose & Zener diode.
19. Study the characteristic of a transistor in CB configuration.
20. Study the characteristic of a transistor in CE configuration.
21. Study the characteristic of a single stage amplifier.
22. Study the basic characteristic of logic gates.
23. Study the basic characteristic of SCR, LDR & TRIAC,
24. Study the basic operation of Microprocessors.
25. Study the basic operation of different sensors & Transducers.

Learning Outcomes:

- Understand the mathematical and physical foundations of electrical engineering and how these are used in electronic devices and systems.
- Design and conduct experiments, as well as to analyze and interpret data.
- Employed as a practicing engineer in fields such as design, research, development, testing, manufacturing, operations, and service systems.
- Use the techniques, skills, and modern engineering tools necessary for engineering practice.
- Use the fundamental aspects of electrical and electronic engineering in careers in industry.
- Continue to learn through advance study or engagement in professional development activities within physics, electrical engineering or other technically related fields.

FE- 215: INDUSTRIAL MANAGEMENT FOR FOOTWEAR MANUFACTURE

Class per week	Credit	Marks
2	3	Course final Exam: 70, In-course assessment: 25, Class Attendance: 5. Total Class: 45

Introduction to the course: This course aims to facilitate student understanding of management scope, importance, functions, principles, social responsibilities, management process, skills, roles, effectiveness and efficiency. It offers an overview of management theories and applications including planning, organizing, leading, controlling and global management. Moreover, industrial policies of Bangladesh are also introduced in this course.

Course Objectives:

The specific objectives of this course are to expertise the students for the following skills

- To familiarize students with different management principles.
- To help students develop an understanding of managerial functions, types, skills and roles.
- To familiarize students with different concepts including planning, organizing, leading, controlling and global management.
- To introduce different industrial policies, nationalization, privatization, foreign investment, role of Government.
- To prepare students to practice professionally in the fields of industrial management and product manufacturing.

Course Contents:

Introduction: Definition of Management- scope, importance, functions, principles, objectives and their attainments- social responsibilities, historical evolution, management process, skills, roles, effectiveness and efficiency.

Planning: Nature and meaning, importance, types, steps, process, tool and techniques, limitation.

Organizing: Definition, principles, importance, types of structures, delegation and decentralization, authority, span of supervision.

Leading: Definition of directing, importance, principles, consultative direction, coordination need, aids, means, motivation, theories, types of needs, means, motivation level in Bangladesh, definition of leadership, theories, and styles.

Controlling: Meaning, types, methods, process, requirements, budgetary control.

Environment: Internal and external, components, merits and demerits.

Global management: Nature and characteristics, management of multinational corporations (MNCS), role of recipient countries, demerits, problems for developing countries like Bangladesh.

Industrial policy of Bangladesh: Nationalization, privatization, foreign investment, role of MNCS, export processing zone, problems of industrialization in Bangladesh, ways to overcome, Government role.

Technology transfer: Definition of technology, types, appropriate technology-technology policy and base, lessons from Japan, Malaysia, Korea, Pakistan, India. Drawbacks of technology transfer.

Management structure in Bangladesh: Features of financial and industrial management, patterns, problems, measures, prospects.

Learning Outcomes:

- Understand the and basic principles of management.

- Describe the most well-known theories and perspectives on management employed as a practicing engineer in fields such as design, research, development, testing, manufacturing, operations, and service systems.
- Work professionally in the fields of industrial and systems engineering in either manufacturing or service sectors, and able to work in a wide range of areas such as systems engineering, sustainability, quality engineering, and advanced manufacturing.
- Able to work with multidisciplinary teams.
- Identify, formulate, and solve engineering problems.
- Use the fundamental aspects of professional and ethical responsibility.
- Capable of applying different principles to solve relevant Industrial problems.

References:

1. Khan M. Y. & Jain P. K. - Financial Management.
2. Van Horne J. C. - Financial Management & Policy.
3. Pandey I. M. - Financial Management.
4. Woodward-Industrial Organisation.
5. Moore-Manufacturing Management
6. Gitman L. J. & Moses E. A. - Financial Management Cases
7. Kuchhal S. C. - Financial Management- An Anlytical and conceptual approach.
8. Weston J. F. & Brigham E. F - Managerial Finance.
9. Ashraf Ali A. F. M. - Arthikh Babosthapona.
10. Block S. B. & Hirt G. A - Foundation of Financial Management.
11. Johnson R. W. - Financial Management.

FE: 216 COMPUTER GRAPHICS DESIGN

Class per week	Credit	Marks
1	2	In-course assessment : 40, Course final assessment: 60

Course Contents:

Adobe Photoshop

Work area: using tools, viewing images, working with palettes.

Basic photo corrections: Resolution and image size, straightening and cropping an image, adjusting the tonal range, removing a color cast, replacing colors in an image, adjusting lightness with the dodge tool, adjusting saturation with the sponge tool.

Selections: making selections, moving selection contents, selecting with the magic wand tool, selecting with the lasso tool, transforming a selection, selecting with the magnetic lasso, cropping an image and erasing within a selection.

Layer basics: Layers, rearranging layers, editing text, flattening and saving files, creating a layer set and adding a layer.

Masks and Channels: Creating a quick mask, editing a quick mask, saving a selection as a mask, editing a mask, loading a mask as a selection and applying an adjustment, extracting an image, applying a filter effect to a masked selection, creating a gradient mask.

Retouching and repairing: repairing areas with the clone stamp tool, pattern stamp tool, healing brush and patch tools, retouching on a separate layer.

Painting and editing: custom workspace, blending an image with the background,
changing image with the history tool, brush tool.

Basic pen tool techniques: paths and pen tool, drawing straight paths, drawing curved paths, combining straight and curved path segments, editing anchor points, using paths with artwork, adding layers to complete the effect.

Creating special effects: automating a multi step task.

3D Studio Max

Introduction: MAX interface, customizing MAX interface

Objects: Referencing External objects, Importing and Exporting, Cloning objects and using arrays, selecting and grouping objects, modifying objects.

Modeling: creating primitive objects, working with spline shapes, meshes, creating patches, creating loft objects, building compound objects.
Materials and Maps: material editor, material maps.

Lights and Cameras: Controlling lights, lighting special effects, controlling cameras, camera matching and tracking.
Particle systems and space wraps: creating and controlling particle systems, space wraps, particle system special effects.

Model systems: Building linked hierarchies, schematic view, creating an inverse kinematics system.

Animation: Animation basics, track view, animating with controllers, expressions, dynamic simulation.

Rendering and post production: Backgrounds, environments and atmospheric effects, setting rendering parameters, render effects.

AutoCAD

Getting familiar with AutoCAD, understanding the drafting tools, drawing 2D objects, editing AutoCAD objects, editing with the modify panel tools, Drawing fundamentals:
Use of line, circle, square, rectangle, triangle, ellipse, polygon.
Creating 3D drawings, getting organized with layers, using blocks, groups, design center, creating text, using dimensions, gathering information, laying out and painting drawing.

References:

1. Adobe Creative Team – Adobe Photoshop 7.0 Classroom in a book
2. George Omura – Mastering AutoCAD 2009.
3. Jon A. Bell – 3D Studio MAx R 2.5 f/x
4. Kelly L. Murdock – 3D Studio Max R3 Bible
5. Alf Yarwood - Introduction to AutoCAD 2009
6. Frede Uhrskov - AutoCAD Tutorials
7. George Omura – Mastering AutoCAD 2009.

FE-301: MANUFACTURING TECHNOLOGY OF FOOTWEAR –III

Class per week	Credit	Marks
2	3	Course final Exam: 70, In-course assessment: 25, Class Attendance: 5 Total Class: 45

Introduction to the course: The course is outlined to disseminate thorough knowledge to the students regarding the footwear manufacture. It covers all manufacturing aspects of shoe making from cutting to finishing. The course provides in-depth knowledge on cutting, closing, lasting, shoe construction and finishing.

Course Objectives:

1. To develop knowledge on material allowance calculation and material saving during cutting.
2. To acquaint with assembly techniques of different styles of shoe upper.
3. To be familiar with pre-lasting, lasting and post lasting operations with process control.
4. To acquire knowledge on the various types of lasting methods and shoe constructions.
5. To achieve skill on surface preparation and sole bonding techniques.
6. To learn about shoe finishing and it impacts on value addition and product diversification.
7. To prepare the standard operation procedure (SOP) of individual operation.
8. To understand the different faults driven from clicking, closing, lasting & making and finishing operations.

Course Contents:

Cutting: Introduction, materials, characteristics and variations in leather, Quality control in cutting room, Productivity of cutting department, Clicking faults, their effects and remedies, material storage, Measurement of leather and synthetic materials, Material economy and its important to cutting department,

Lay out of cutting room, Materials allowances and consumption- definition, purpose, Calculation of material allowance- various system- RSM method, SLM method, marking up method, square board method , check method, different type of wastages, nesting technique of full grain leather, corrected grain leather, suede and nubuck leather.

Closing: Stitching- Definition, purpose, different types of stitches- hand stitching, machine stitching, automatic stitching, Seam- Definition, function, different types of seam- closed seam, open seam, lapped seam, butted seam, Brooklyn seam, welted seam, piped seam, thread consumptions for different types of stitches, working environment of closing room, sewing fault and remedies, fitting the upper component, sequence of operation for closing- oxford, Derby, Court, Moccasin, Sandal, Casual, Boot, Sports shoe.

Lasting and Making: Pre- lasting operation- definition, toe puff attaching, back part moulding, upper conditioning, upper and lining attaching, insole preparation and moulding, insole attaching, Lasting definition, principle of lasting operation, different techniques of lasting, post lasting- definition, heat setting, heel preparation, sole preparation, sole pressing and attaching, the relation between heel pairing and heel scouring, edge trimming and setting, the need of machine lasting, adjustment of lasting machine, machine parts and function and its parameter setting, problem finding in machine lasting and remedies, detail controlling of forepart, seat and side lasting operation for different types of footwear, operational sequence in lasting line for - oxford, Derby, Court, Moccasin, Sandal, Casual, Boot, Sports shoe.

Shoe Construction: Definition, cemented construction, veldtschoen construction, sewon construction, and moccasin construction.

Shoe Room Treatment and Finishing: Definition, the aim object of shoe finishing and their utility, identification of leather finishes, characteristics of bottom finishes, edge and heel finishes, upper leather dressing, cleaning, wrinkle chasing, different types of edge trimming, forepart and waist trimming, heel scouring, heel front buffing, bottom finishing, fitting the sock, shoe lacing, various tools, equipments and machinery employed for finishing, their use and general maintenance, recognition and elimination of faults, different types of finishing agent and polishers, spraying- types, techniques, machine faults and remedies.

Packaging: Types of packing, materials use for packing, export packing, use of fungicides for export packing, labeling, dispatching etc.

Learning Outcomes:

At the end of the course, the following outcomes will be visible:

1. Students will be capable to optimize and save materials.
2. They will learn techniques of assembly of different shoe styles.
3. They will understand the various pre lasting, lasting, and post lasting operations.
4. Students will have sufficient knowledge on different types of shoe constructions
5. They will acquaint and gather knowledge on the preparation of SOP.
6. They will be able to identify defects driven from various sections of production.

FE-302 : MANUFACTURING TECHNOLOGY OF FOOTWEAR -III PRACTICAL

Class per week	Credit	Marks
2	4	Continuous assessment : 40, Course final examination 60

Introduction to the course: The curriculum for undergraduate program in manufacturing technology of footwear-III practical leading to the award of B.Sc. in Footwear Engineering Degree is in accordance with the criteria set forth by University of Dhaka so that each student can understand practically about footwear manufacturing.

Course Objectives:
Provide a realistic and practical idea of footwear manufacturing as a basis for understanding how different types of footwear will be manufactured.

Course Contents:
1. Mean forme-making technique, dead forme, and standard making for court, oxford, and derby.
2. Working pattern making technique for court, oxford, and derby.
3. Sandal making: Toe peg, toe band, v-strap, instep- band, and crossed bands, multi-straps.
4. Attachment of straps of sole.
5. Baby shoe making, slipper making, fancy ladies sandal making
6. Sandal making – Toe peg, Toe band, V-strap, instep-band, Crossed bands, multi-straps.
7. Men's Shoe making- Oxford shoe, Gibson/Derby shoe, Brogue shoe, Monk shoe, Army boot, Riding boot, orthopedic shoe, miner's boot, moccasin, Slippers.
8. Women's Shoe Making- Fancy shoes, Court shoe, Mule, Bar Shoe, Tie Shoe, Ankle Strap, Sling- back.
9. Closing of court, oxford, derby, sandal, casual, moccasin and sport shoe.
10. Lasting and making of court, oxford, derby sandal, casual, moccasin and sport shoe.

Learning Outcomes:
Students will be able to know-
1. Mean form-making technique, dead form, and standard making for court, oxford, and derby.
2. Working pattern making technique for court, oxford, and derby.
3. Sandal making: Toe peg, toe band, v-strap, instep- band, and crossed bands, multi-straps.
4. Attachment of straps of sole.
5. Baby shoe making, slipper making, fancy ladies sandal making
6. Sandal making – Toe peg, Toe band, V-strap, instep-band, Crossed bands, multi-straps.
7. Men's Shoe making- Oxford shoe, Gibson/Derby shoe, Brogue shoe, Monk shoe, Army boot, riding boot, orthopedic shoe, miner's boot, moccasin, Slippers.
8. Women's Shoe Making- Fancy shoes, Court shoe, Mule, Bar Shoe, Tie Shoe, Ankle Strap, Sling- back.
9. Closing of court, oxford, derby, sandal, casual, moccasin and sport shoe.
10. Lasting and making of court, oxford, derby sandal, casual, moccasin and sport shoe.

References:

1. Venkatappaiah B. -Introduction to The Modern Footwear Technology-
2. Miller R.G. (Editor) -Manual of Shoe Making
3. Korn J. (Editor) -Boot and Shoe Production
4. Thornton J. H. -Text Book of Footwear Manufacture
5. SATRA Bulletin
6. Spencer Crookenden -K Shoes -The first 150 years 1842-1992
7. Ruth Thomson -Making Shoes
8. Swayam Siddha -Product Knowledge
9. Swayam Siddha -The Skill of Seam Reducing
10. Thornton J. H. -Text Book of Footwear Materials

FE-303 - ANALYTICAL CHEMISTRY FOR FOOTWEAR MANUFACTURE-I

Class per week	Credit	Marks
2	3	Course final Exam: 70, In-course assessment: 25, Class Attendance: 5. Total Class: 45

Introduction to the course: Analytical chemistry is too broad and too active a discipline for us to define completely. In this course we will try to say a little about different methods and techniques of analysis. Analytical chemistry is often described as the area of chemistry responsible for characterizing the composition of matter, both qualitatively and quantitatively.

Course Objectives: Throughout this course, we will focus on the following learning objectives: Errors and statistics, gravimetric and volumetric methods chromatographic technics analytical spectrometry, thermal technics, chemical analysis of leather and related chemicals, environmental analysis, laboratory automation and safety practice in laboratory.

Course Contents:

Introduction: Evaluation of analytical results, accuracy and precision, errors, minimization of errors, significant figure and computation, rejection of data- the Q test, sampling.

Gravimetric and volumetric methods: Principles of gravimetric methods, conditions for precipitation co-precipitation and post–precipitation, precipitation from homogeneous solution. Principles of volumetric analysis, Acid-Base titration, complexometric titration, precipitation titration, oxidation-reduction titration. Determination of end point.

Chromatographic techniques: Introduction, principles, classification of chromatographic methods, instrumentation and application of paper, thin layer chromatography (TLC) and high performance liquid chromatography (HPLC). Application in leather science.

Analytical spectrometry: *Ultraviolet /Visible spectroscopy:* Introduction, absorption laws, deviation from Beer's Law, instrumentation, principles, applications, molar extinction coefficient, measuring unknown concentration, absorbing species, absorption spectrum and λ_{MAX}, application of transmission spectrophotometry to dyes. *Reflectance spectrophotometry*- Introduction, principles, Kubelka-Munk equation, reflectance measurement, instrumentation, determination of surface colour of solid substrates, application of reflectance spectrophotometry for the surface colour determination of leather.

Thermal techniques Differential thermal analysis (DTA**),** Differential scanning calorimetry (DSC), Thermogravimetry (TG): Basic principles and application in leather science.

Chemical analysis of leather and related chemicals: Tanning materials- Routine analysis of vegetable, analysis of chrome extract: Cr_2O_3, basicity.
Analysis of leather- vegetable tanned leathers: moisture, oils and fats, water solubles, insoluble ash, nitrogen and hide substance, degree of tannage, pH of water solubles, oxidized fat, combined fat, differential number, glucose, total ash, epsom salt, analysis of chrome tanned leather; Leather auxiliaries: casein, shellac, oils, fats, and waxes: moisture, acid value, saponification value, iodine value, unsaponifiable matter; determination of sulphide in alkaline liquors, determination of chlorides in alkaline liquors, determination of total available strong alkali.

Environmental analysis: Sampling procedures of waste water for analysis. Analysis of tannery wastewater sample: pH, alkalinity, acidity, total solids, dissolved solids, suspended solids, sulphate, sulphide, chromium, settleable solid.

Laboratory automation: Introduction, approaches to laboratory automation, principles of automation, planning for laboratory automation, automated instruments, microprocessor-controlled instruments: "smart" instruments, computers in analytical chemistry.

Safety practice in laboratory: Introduction, MAK values of working material that involved health hazard, list of harmful materials, carcinogenic working materials, emission protection law, danger symbols, regulations concerning the transportation of materials classified as dangerous goods, prevention of accidents and first aid in laboratory, hazard and hazard agents identification, hazard classification, hazard control, safety management, safety promotion and awareness creation, safety and emergency provisions.

Learning Outcomes: On completing this course:

- The students will have a thorough theoretical and practical understanding of advanced analytical instruments.
- They will be able to analyze leather and leather related chemicals.
- They will be able to assess the quality of leather, footwear and leather products.
- They will be able to work in environmental research.

References:

1. Gary D. Christian- Analytical Chemistry
2. John Kenkel- Analytical Chemistry for Technicians
3. Skoog, Holler & Nieman- Principles of Instrumental Analysis
4. Sharma B. K. - Instrumental Methods of Chemical Analysis
5. Skoog, West & Holler- Fundamental of Analytical Chemistry
6. Browning D. R. - Chromatography
7. Hatakeyama T. and Quinn F.X. - Thermal analysis.
8. Vogel A. I. - Text Book of Quantitative Chemical Analysis
9. Roderick McDonald-Colour Physics for Industry.
10. P.K. Sarker - Analytical Chemistry for Leather Manufacture.
11. Williams D. H. and Ian Fleming- Spectroscopic methods in Organic chemistry.
12. Kalsi P.S. - Spectroscopy of organic compounds.
13. Venkatachalam P.S. - Lecture Notes on Leather.
14. John A. Dean. -Analytical Chemistry Handbook.
15. Dr. Sethi P.D. - High Performance Liquid Chromatography.
16. Banwel l C. N. -Fundamentals of Molecular Spectroscopy.
17. Hamilton, Hamiltoan-Thin Layer Chromatography.
18. Fifield & Haines-Environmental Analytical Chemistry.
19. UNIDO- Tannery and Environment.
20. Chhatwal G .R. - Encyclopedia of Environmental Analysis (vol.1, 2 & 3)

FE-304 - ANALYTICAL CHEMISTRY FOR FOOTWEAR MANUFACTURE PRACTICAL

Class per week	Credit	Marks
1	2	Continuous assessment : 40, Course final examination 60

Introduction to the course: This course is designed for the 3rd year B.Sc. (Hons.) students at aiming to introduce analytical chemistry practical utilizing their previous knowledge on basic chemistry. This course deals with the methodologies for the estimation of heavy metals, anions, pH, dye, ash, moisture, fat in the leather products and liquors using volumetric, spectroscopic, chromatographic, thermal, and gravimetric analyses to ensure the quality of leather products and the validity of used methods.

Course Objectives:

The objectives of this course are to

Familiarize the students with the practical knowledge on analytical chemistry for the analysis of leather products, waste liquor and extracts from different tanning materials for the estimation of chromium, fat, moisture, pH, acid value, iodine value, dissolved substances and so on.

Course Contents:

1. Determination of fats, oils and other solubles.

2. Determination of water-soluble matter, water -soluble inorganic matter and water-soluble organic matter.
3. Determination of sulphated total ash and sulphated water-insoluble ash.
4. Determination of nitrogen and hides substance from different types of leather.
5. Determination of chromium content from different types of leather.
6. Determination of chromium content from different commercial chrome tanning agents.
7. Determination of sulphide from sodium sulphide.
8. Test for the identification of vegetable tanning materials.
9. Determination of moisture/total solids/ total solubles/non-tannin constituents/insolubles/colour/ pH from vegetable tanning materials.
10. Determination of moisture/ soluble matter/ ash/ alkalinity of ash/ pH/non-tannin of hide powder.
11. Determination of sulphur dioxide in bleaching extracts.
12. Determination of iron and copper in vegetable tanning extracts.
13. Determination of strong alkali in solution.
14. Determination total available strong alkali.
15. Determination of acid /iodine value of oil/fat.
16. Determination of unsaponifiable matter.
17. Determination of chloride content from alkaline liquor.
18. Determination of unknown concentration of dye solution.
19. Determination of thermal response of raw hide/limed pelt/pickled pelt/tanned/Crust leather/ finished leather.
20. Determination of dissolved solid/ suspended solid/total solids from wastewater sample.

Learning Outcomes

Upon completion of this course the students will be able to

- handle with the equipment and apparatus safely and properly
- familiarize with techniques for the treatment of leather products
- know the principle and use of machines such as spectrophotometer
- gain knowledge about chromatographic processes
- prepare samples for characterizing leather and liquor from different tanning processes
- investigate heavy metals by various techniques
- know the process how to analyze iodine value and saponification value
- investigate chloride, sulphated total ash and so on
- perform and use pH meter for the estimation of pH
- determine solubles and insoluble materials from liquor and tanning materials

References:

1. Gary D. Christian- Analytical Chemistry
2. John Kenkel- Analytical Chemistry for Technicians
3. Skoog, Holler & Nieman- Principles of Instrumental Analysis
4. Sharma B. K. - Instrumental Methods of Chemical Analysis
5. Skoog, West & Holler- Fundamental of Analytical Chemistry
6. Browning D. R. - Chromatography
7. Hatakeyama T. and Quinn F.X. - Thermal analysis.

8. Vogel A. I. - Text Book of Quantitative Chemical Analysis
9. Roderick McDonald-Colour Physics for Industry.
10. P.K. Sarker - Analytical Chemistry for Leather Manufacture.
11. Williams D. H. and Ian Fleming- Spectroscopic methods in Organic chemistry.
12. Kalsi P.S. - Spectroscopy of organic compounds.
13. Venkatachalam P.S. - Lecture Notes on Leather.
14. John A. Dean. -Analytical Chemistry Handbook.
15. Dr. Sethi P.D. - High Performance Liquid Chromatography.
16. Banwel l C. N. -Fundamentals of Molecular Spectroscopy.
17. Hamilton, Hamiltoan-Thin Layer Chromatography.
18. Fifield & Haines-Environmental Analytical Chemistry.
19. UNIDO- Tannery and Environment.
20. Chhatwal G .R. - Encyclopedia of Environmental Analysis (vol.1, 2 &3)

FE- 305: LEATHER TECHNOLOGY-I

Class per week	Credit	Marks
2	3	Course final Exam: 70, In-course assessment: 25, Class Attendance: 5. Total Class: 45

Introduction to the course: This course covers the knowledge, skills and attitudes required to identify and interpret histological structure and chemical composition of hides and skins, process of slaughtering and procurement of hides & skins, preservation / curing of hides and skins, defects of hides and skins, sorting and gradation of raw hides and skins, different process of leather making like soaking, liming, deliming, bating, pickling and tanning.

Course Objectives:
It specifically includes the structure of raw hides and skins- their composition and histo-chemical properties, slaughtering and flaying of animals, objectives and principles of preservation / curing, advantages and disadvantages of different types of curing, pre-mortem and post-mortem defects of hide and skin and their effect on leather, sorting and grading of hides and skins, soaking, liming, deliming, bating, pickling and degreasing.

Course Contents:
Histological structure and chemical composition: Structure of raw hides and skins. Structural difference between hides and skins of different origin, chemical composition of hides and skins

Slaughtering and procurement of hides & skins: Slaughtering and flaying of animals, tools, equipment and techniques for slaughtering and flaying, hides and skins of slaughtered and fallen animals, cares to be taken during flaying, handling and storage of raw hides and skins, collection practice in Bangladesh.

Preservation / curing of hides and skins: Introduction, objectives and principles of preservation, short and long terms preservation, methods of preservation/curing, advantages and disadvantages of different types of curing, factors affecting preservation / curing process.
Defects of hides and skins: Definition, pre-mortem and post-mortem defects of hide and skin and their effect on leather, methods of identification of defects, common defects of hides and skins in Bangladesh and their remedies.

Sorting and gradation of raw hides and skins: Principles; objectives, methods of sorting and grading of hides and skins, importance of sorting and grading in leather processing.

Beam house operations: Introduction and role of beam house operations in leather making.

Soaking: Objectives and different controls in soaking operation. different methods of soaking.

Liming: Chemistry of unhairing, unhairing by different methods, objectives of liming, effects of liming of collagen, enzymatic controls in liming operation to achieve different physical properties of leather.

Deliming and Drenching: Objectives, principles and controls of deliming and drenching.

Bating: Chemistry of proteolytic enzymes used for bating, necessity of bating, Its preparation and controls for desired properties of leather.

Pickling: Acid binding capacity of collagen, use of organic acids or salts in pickling, its necessity and controls, concept of, depickling.

Degreasing: Objects and necessity of degreasing, different systems and methods.
Tanning: Basic concept, theoretical background, tanning potentials of various metals, non-metals, natural and synthetic materials, tanning characteristics, hydrothermal stability and shrinkage temperatures of various tanning materials

Chrome tanning: Historical development, chromium complexes, theories of chrome tanning, factors affecting chrome tanning, basicity and its effect on chrome leather production, masked and self-basified chrome tanning and their advantages and disadvantages.

Other tanning Operations:
Aluminum and titanium tanning, Vegetable tanning, Synthetic tanning, Aldehyde tanning, Oil tanning.

Learning Outcomes:
After completion of this unit the students will able to:

- identify and interpret histological structure and chemical composition of hides and skins.
- interpret the process of slaughtering and procurement of hides & skins.
- interpret preservation/curing of hides and skins.
- identify defects of hides and skins.
- perform sorting and gradation of raw hides and skins.

- demonstrate different process of leather making like soaking, liming, deliming, bating, pickling and tanning.

References:

1. Jean J. Tancous-Skin, Hide and Leather Defect.
2. Krysztof Bienkiewicz-Physical Chemistry of Leather making.
3. K.T.Sarkar-Theory and Practice of Leather Manufacture.
4. S.S. Dutta- An introduction to the principles of Leather Manufacture.
5. O'Flaherty, Roddy, Robert W.T.M. Lollar (Ed)-The Chemistry and Technology of Leather, Volume -1
6. Gerhard John- Possible Defects in Leather Production.
7. R.Reed - Science for the students of the Leather Technology.
8. H.R. Proctor - The principles of Leather Manufacture.
9. R. Puvanarishnan Susil C. Dhar- Enzyme Technology in Beam House Practice.
10. Jotirmay Dey - Practical Aspects of the Manufacture of upper Leathers
11. Hidemann. E - Fundamentals of Leather Manufacture.
12. Sharphouse - Leather Technicians Hand books.

FE- 306: LEATHER TECHNOLOGY-I PRACTICAL

Class per week	Credit	Marks
1	2	Continuous assessment : 40, Course final examination 60

Introduction to the course: This course covers the knowledge, skills and attitudes required to demonstrate and perform manufacturing of various types of leather.

Course Objectives:

It specifically includes the tasks of performing manufacturing of shoe upper leather, fur skin leather**,** screen/block printed leather, glaze kid leather, nubuck leather, nappa leather and suede leather

Course Contents:

1. Manufacturing of Shoe upper leather.
2. Manufacturing of Fur skin leather.
3. Manufacturing of Screen/block printed leather.
4. Manufacturing of Glaze kid leather.
5. Manufacturing of Nubuck leather.
6. Manufacturing of Nappa leather/ suede leather.

Unit-wise Learning Outcomes:

After completion of this unit the students will able to:

- perform manufacturing of shoe upper leather.

- demonstrate manufacturing of fur skin leather**.**
- perform manufacturing of screen/block printed leather.
- perform manufacturing of glaze kid leather.
- perform manufacturing of nubuck leather.
- perform manufacturing of nappa leather/ suede leather

References:

1. Theory and Practice of Leather Manufacture- K.T. Sarkar
2. Principles of Leather Manufacture- S.S. Dutta
3. The Principles of Leather Manufacture- H.R. Procter
4. Modern Practice in Leather Manufacture- J.A. Wilson
5. Fundamentals of Leather Manufacturing- Heidemann
6. Leather Technicians Handbook- Sharphouse
7. Possible Defects in Leather Production- G. John
8. Science for Students of Leather Technology- R. Reed
9. The Chemistry & Technology of Leather (vol. 1, 2, 34)- Roddy, Lollar

FE-307: TESTING OF FOOTWEAR AND ALLIED MATERIALS

Class per week	Credit	Marks
2	3	Course final Exam: 70, In-course assessment: 25, Class Attendance: 5. Total Class: 45

Introduction to the course: This course covers the knowledge, skills and attitudes to assess different properties (strength, comfort and aesthetic appeal) for upper and lining leather, sole, insole and other allied materials.

Course Objectives:

- Interpret the knowledge and skill of different tests to assess the quality of leather and allied materials.

- Carrying out physical testing of leather, few popular thumb tests for upper leathers, disadvantage of thumb tests, classification of physical testing methods.

Course Contents:

Sampling: Introduction, statistical aspects of the sampling problem, collection of samples, sections of raw hides and skins and of leather, sampling positions, conditioning of test pieces.

Strength and stretch of leather: Tensile strength and elongation, stitch tearing strength, tearing strength, tongue tearing strength, buckle tear strength, split tear strength, distension and strength of grain by ball

burst test, effect of splitting on strength, area stability, effect of relative humidity, effect of oil content, effect of kind of tannage and method of finishing, measurement of the initial strain energy of leather, temper of leather, resilience properties of leather.

Tests for upper and lining materials: Flexing endurance test, principles of flexing, water vapours permeability test, Improving of WVP of upper leather, Water Vapour Absorption and Water vapour co-efficient, Wrinkelometer test. air permeability of leather, dynamic water proofness test, principles of water proofness test, shrinkage temperature, control of shrinkage temperature, Martindale abrasion test, chisel scuff resistance, softness test, how to improve scuff resistance, dry and wet rub fastness, the gray scale.

Tests for finish film: Introduction, bond strength between the leather surface and the finish film, how to improve this bondage, heat resistance of finish film, cold crack resistance, light fastness of finish film, wet and dry rub fastness, test for bleeding, water fastness, elasticity of finish film, resistance to solvent, resistance to washing and cleaning agents, resistance to dressing agents, resistance to water stains, moisture fastness, resistance to plasticizer, resistance to buffing of suede leather, resistance to ageing.

Tests for Soling Materials: Apparent and real densities, abrasive resistance, absorption of water by kubelka method, dynamic water proofness test of sole leather, resistance to cracking of grain crack index, why sole leather cracks and how to pervert it, perspiration resistance of leather, how to improve perspiration resistance of leather, Relative porosity. Hydrolysis test, Flexing test (SATRA BATA Ross flex, Bennewart flex) compression set test, adhesion test oil swelling resistance test.

Test for Insole and other Accessories: Insole, Flexing Index, Tensile strength and extension at break, scuff resistance, peel strength, Laminar strength, Water uptake, water absorption and desorption. Laces: Breaking strength and elongation at break, Bodkin attachment strength, abrasion resistance, lace to eyelet abrasion test.. Velcro: Peel test, shear resistance. Hook, Eyelet's, D-Rings: Attachment in leather, corrosion test, Breaking strength. Buckles: Corrosion test, Tensile strength, strength buckle and strap attachment. Top piece: Top piece attachment strength. Stiffener and Toe puffs: Tear strength, Adhesion strength, Shanks: Longitudinal stiffens.

Tests for safety Footwear: Impact resistance of toecap, compression resistance, electrical resistance. Penetration resistance of metal insole. Upper/outsole and sole interlayer bond strength, insulation against heat, insulation against cold, resistance to fuel oil, corrosion resistance of metallic part.

Learning Outcomes: After completion of this unit the Students will able to

- Identify the quality of upper and lining leather, sole, insole and other allied materials.
- Understanding the procedure of different international SOP of different tests for upper leather, lining leather, sole, insole and other allied materials.

FE-308: TESTING OF FOOTWEAR AND ALLIED MATERIALS PRACTICAL

Class per week	Credit	Marks
1	2	Continuous assessment : 40, Course final examination 60

Introduction to the course: This course demonstrates and conducts different tests methods to assess different properties (strength, comfort and aesthetic appeal) for upper and lining leather, sole, insole, other allied materials and complete footwear.

Course Objectives: To conduct and demonstrate various tests for assessment of the quality of footwear and allied materials.

Course Contents:

1. Determination of tensile strength and % of elongation at break.
2. Determination of tear strength / stitch tear strength / tongue tear strength/ split tear strength.
3. Determination of flexing endurance.
4. Determination of water-vapor permeability of leather.
5. Determination of water vapor absorption and their co-efficient.
6. Determination of scuff, heat, bending resistance of leather.
7. Determination of wash fastness, of leather used in products manufacture.
8. Determination of break/pipiness/wrinkles of supplied leather.
9. Determination of adhesion of finish film of supplied finished.
10. Different strength tests of adhesive.
11. Different thread tests.
15. Different tests of accessories.
16. Determination of softness for upper leather.

Learning Outcomes:

After completion of this unit the students will able to

- identify the quality of upper and lining leather, sole and insole materials and complete footwear.
- conduct different tests according to different international SOP for upper leather, lining leather, sole and insole materials, other allied materials and complete footwear.
- carry out different tests according to different international SOP for casual, safety, sports and ladies shoes.

References:

1. Society of Leather Technologists and Chemists-Official Methods of Analysis- 1996.
2. Dutta S.S. - An Introduction to the Principles of Physical testing of Leather.
3. O'Flaherty, William. And Roddy-The Chemistry and Technology of Leather, Vol-IV
4. Heidemann E. -Fundamentals of Leather Manufacturing.
5. Dutta S.S. - An Introduction to the Principles of Leather Manufacture.
6. John Arthur Wilson-Modern Practice in Leather Manufacture.

7. Venkatachalam P.S. - Lecture Notes on Leather.

FE- 309: COMPUTER AIDED DESIGN AND PATTERN MAKING

Class per week	Credit	Marks
2	3	Course final Exam: 70, In-course assessment: 25, Class Attendance: 5. Total Class: 45

Introduction to the course: The goal of this course is to expose the student to basic CAD, CAM, CIM, CAD/CAM, CAD for footwear, CAM for footwear and industrial automation concepts and their applications. The students will practice their knowledge with modern CAD/CAM software like shoe master and Crispin for footwear engineering.

Course Objectives:

- To impart full theoretical knowledge and to develop practical skills required for Computer-Aided Design and especially preparing pattern for production of various styles of footwear.
- To impart full theoretical knowledge about CAD software for footwear.
- To impart theoretical knowledge about computer aided and integrated manufacturing as well as industrial automation.

Course Contents:

Industrial automation: Definition types of automation, development of automation, development of computers, and application of computers to manufacturing.

Computer Integrated Manufacturing (CIM): Principles of CIM, essentials of computer-integrated manufacturing systems, effectiveness of CIM, advantages and disadvantages of CIM.

Computer Aided Design (CAD): Introduction to CAD and its application in different sector of footwear technology, fundamental concepts on coordinate systems; draw line, square, rectangle, triangle, etc. using absolute and incremental system, application to simple operations like moving, copying, rotating, trimming, breaking, linear, angular and dimensioning system, CAD facilities; Geometric modeling-2D and 3D models, surface models, solid models; of optimum design. Computer-automated process planning, automated manufacturing planning-function involved in AMP, computer-aided routing (CAR), CAR system flow.

CAD/CAM: Principles and scope of CAD hardware & software in CAD and introduction to CAM, NC, CNC devices for computer aided cutting including laser and water jet; computer aided stitching, robots in footwear manufacture. Digitization: 2D and 3D coordinate extraction, principles of digital to analog conversion, digital input/output processing systems, programming techniques and languages, computerized techniques, principles and strategies for collection of data for imaging, rendering, data reduction and

processing techniques with special reference to footwear design, CAD/CAM system-integrated CAD and CAM. Automatic machine tools for mass production; computer-controlled manufacturing systems; automated assembly, automatic materials handling, industrial robots, industrial robots in manufacturing.

CAD for footwear: Introduction to input and out-put devices required for CAD and their working principles for footwear and leather-products manufacturing; Capabilities of CAD for styling purposes-color, basic primitives; etc.; use of 2D and 3D techniques for ladies, gents and babies footwear; designing, pattern design and grading, pattern production; scrap materials calculation, Shoe master and Crispin designing system, their application, advantages and limitations.

CAM for footwear: Tools required in CAM; applications CAM in footwear manufacturing.

Learning Outcomes:
Upon successful completion of the Computer Aided Design and Pattern Making course, the learner will be able to

- Recall drawing and modification functions of CAD software.
- Identify and interpret information provided in technical drawing.
- Produce two-dimensional drawings using traditional visualization techniques.
- Demonstrate the use of CNC commands on NC control simulators and on CNC machine
- related to footwear manufacturing.
- Understand the history, theory, objectives and tools of automatic manufacturing.
- Identify the main elements in computer integrated manufacturing systems.
- Apply knowledge of computer aided process planning, feature and group technology, and data exchange in manufacturing processes.
- Implement quality improvement techniques and support smart automation systems.

References:
1. Harrington, J.- Computer Integrated Manufacturing.
2. Singh, N.- Systems Approach to Computer-Integrated Design and Manufacturing.
3. Boothroyd G.- Assembly Automation and Product Design.
4. Chang T.C.- Wysk, R.A and Wang, H.P.- Computer-aided manufacturing.
5. Pivecka J.- Practical Handbook on Shoe Production.
6. Americal Shoe Making, Shoe Trades Publishing Co.
7. Hitomi K.- Manufacturing System Engineering.
8. Sadhu Singh- Computer Aided Design and Manufacturing.
9. Shoemaster- World Leaders in CAD/CAM technology “PATTERNS USRES GUIDE”.
10. Leather Technology Mission- SHOE DESIGNING

FE – 310: COMPUTER AIDED DESIGN AND PATTERN MAKING PRACTICAL

Class per week	Credit	Marks
1	2	Continuous assessment : 40, Course final examination 60

Introduction to the course: The course will provide an overview of how computer-aided design and CAD software like Shoe master and Crispin can be applied to the traditional skills of pattern cutting, grading, fashion design and manufacturing. Student will learn to use various CAD/CAM software packages which include Shoe master and Crispin.

The course will start with teaching student how to use CAD software for designing and pattern making skills for footwear and then move onto using Shoe master and Crispin for pattern development as well as creating a pattern to industry standards for footwear.

Course Objectives:

- To develop Computer Aided Shoe Design.
- To develop the student as a designer with the capability to conceptualize, designing, Pattern developments & Grading by using latest shoe designing software like Shoemaster and Crispin.

Course Contents:

1. Tree-dimensional extruded drawings are created with Elevation and Thickness.
2. Wire-frame models can be constructed by; (a) co-ordinate input (b) referencing existing entities (c) using Auto-CAD's editing commands.
3. Addition to texts on any surface of a 3-D model by appropriate UCS set.
4. Addition of dimensions to 3-D wire-frame models.
5. Use of ARRAY 3D, MIRROR 3D, ROTATE 3D commands.
6. Hatching addition to the surfaces of a 3-D wire-frame model.
7. Modifications to the actives view port are displayed in the other view-port.
8. Use 3D FACE command to add surfaces to a wire-frame models.
9. Creating 3D MESH command for a cubic smooth surface.
10. Application of 3D POLY command to create splinted hill.
11. Application of the edge surface command with four TOUCHING entities.
12. Application of tabulated surface in 2-D of 3-D.
13. Addition of ruled surfaces between lines, arcs and poly lines.
14. Make Auto CAD design for the major components of men's Derby using Shoemaster/Crispin.
15. Make Auto CAD design for the major components of men's Monk Derby using Shoemaster/Crispin.
16. Make Auto CAD design for the major components of men's Apron Derby using Shoemaster/Crispin.
17. Make Auto CAD design for the major components of women's Derby using Shoemaster/Crispin.
18. Make Auto CAD design for the major components of men's Oxford using Shoemaster/Crispin.
19. Make Auto CAD design for the major components of women's Oxford using Shoemaster/Crispin.
20. Make Auto CAD design for the major components of men's Pantafola using Shoemaster/Crispin.
21. Make Auto CAD design for the major components of Ladies Court Shoe using Shoemaster/Crispin.

22. Make Auto CAD design for the major components of women's Sandal using Shoemaster/Crispin.
23. Make Auto CAD design for the major components of men's Ankle Boot using Shoemaster/Crispin.
24. Make Auto CAD design for the major components of men's Moccasin using Shoemaster/Crispin.

Learning Outcomes:
Upon successful completion of the Computer Aided Design and Pattern Making course, the learner will be able to:

- Recall drawing and modification functions of CAD software as well as Shoemaster and Crispin.
- Produce two-dimensional and three dimensional drawings of various footwear using Shoemaster and Crispin.
- Produce several design variation of Men's Derby, Monk, Oxford, Pantafola, Ankle Boot, Moccasin and Women's Derby, Oxford, Sandal, Court shoe within short time using Shoemaster and Crispin Software.

FE-311: LEATHER PRODUCTS TECHNOLOGY

Class per week	Credit	Marks
2	3	Course final Exam: 70, In-course assessment: 25, Class Attendance: 5. Total Class: 45

Introduction to the course: The curriculum for undergraduate program in Leather Products Technology leading to the award of B.Sc. in Footwear Engineering degree is in accordance with the criteria set forth by University of Dhaka so that each student can gather basic to advanced knowledge on fashion, design, pattern making for leather goods and garments, materials used in leather goods and garments manufacturing, tools and techniques, unit operations, and machinery used in leather goods and garments manufacturing.

Course Objectives:

1. To know the basic ideas on fashion, elements of fashion, style, and design techniques.
2. To gather knowledge on pattern making process.
3. To understand the unit operations for leather goods and garments manufacturing.
4. To know the materials used in leather goods and garments manufacturing.
5. To acquire knowledge on body proportion for garments manufacturing.
6. To know the different types of garments elements like sleeve, pockets, collar, waist bands for garments manufacturing.
7. To gather knowledge on skirt and jacket manufacturing process.

Course Contents:
Design techniques for leather garments: Clothing and its function, Development of a collection, fashion and fashion accessories, Materials and components for leather garments and their selection criteria. Machineries for leather garments production elements of cutting, types of cutting, lining cutting, different parts simple jacket, sketches and making up complete industrial pattern, use of

body proportions, different types of sleeve, pockets, collar, waist bands, modification to basic block, design and pattern making, basic sewing exercise for components assembly computers in pattern grading and design, different parts of a simple trouser, basic trouser block.

Skirt: Classification, Basic measurements, Designing and pattern making of straight skirt, assembling and stitching of skirt.

Jacket: Classification, Basic measurements, Block making for casual jacket and waist coat, Designing and pattern making of jacket and waist coat, Assembling, stitching and finishing of jacket.

Learning Outcomes: Students will be able

- To classify and identify various leather goods and garments.
- To make creative design and their patterns for leather goods and garments manufacturing.
- To realize the functions and working procedure of various machinery used in leather goods and garments manufacturing.
- To carry out the various unit and supplementary operations for leather goods and garments manufacturing.
- Overall, to understand the theoretical knowledge of leather goods and garments manufacturing process.

FE-312: LEATHER PRODUCTS TECHNOLOGY PRACTICAL

Class per week	Credit	Marks
2	4	Continuous assessment : 40, Course final examination 60

Introduction to the course: The curriculum for undergraduate program in Leather Products Technology Practical leading to the award of B.Sc. in Footwear Engineering degree is in accordance with the criteria set forth by University of Dhaka so that each student can acquire basic to advanced knowledge on i) tools and their uses in leather goods manufacturing, ii) pattern making process, iii) how to carry out the various unit operations related to leather goods and garments manufacturing, iv) stitching and assembling techniques v) manufacturing process of various leather goods and garments.

Course Objectives:

a) To know the functions of tools and machinery used in leather goods and garments manufacturing.
b) To know the pattern making process for specific design.
c) To know the unit operations for leather goods and garments manufacturing.
d) To gather knowledge on different materials like lining, reinforcement materials, accessories, and thread.

e) To know the manufacturing process of various leather goods like key case, card holder, coin purse, belts, and bags.
f) To know the manufacturing process of pocket, collar, gusset, sleeve for garments manufacturing.
g) To know the manufacturing process of various leather garments like skirt, jacket, waist coat.

Course Contents:

Leather Products: (Practical)

1. Introduction of tools and their uses and tooling technique.
2. Leather decoration technique: Stamping, engraving, batik, screen-printing, molded work, embroidery, carving, beveling, shading, appliqué, perforating.
3. Hand stitching, thong or lacing technique, button or repeat attaching.
4. Introduction of pattern cutting technique, consideration of allowance, lining construction, working pattern making.
5. Assembly of pleated pocket and flap, Gusset pocket, assembly of gusset pocket and flap, piping pocket, false pocket. Conical shape pattern making.
6. Shaven edged collar, sheash collar, shaver edge cuff, sleeve without cuff, turned cuff, and short sleeve with cuff. Coinpurse making.
7. Fixing of Zipper, back pleat, double pleat. Card holder making, Key ring making
8. Skirt manufacture
9. Belts, bags, Waist coat manufacture making.

Learning Outcomes: Students will be able

a) To make creative design and patterns based on design.
b) To know how the unit operations are carried out in the leather goods and garments manufacturing.
h) To manufacture various leather goods like key case, card holder, coin purse, belts, and bags.
i) To manufacture the variety of garments products like skirt, jacket, and waist coat.

References:

1. S.S. Dutta- Introduction to the principles of leather manufacture
2. K.T. Sarkar- Theory and practice of leather manufacture
3. Batsford- Fashion with leather
4. Attwater W.A.-Leather Craft
5. Roland Kilgus- Clothing Technology
6. Moseley G.C. – Leather Goods Manufacture
7. Kathryn Mc. Kelvey- Fashion source book
8. Gerhard John- Possible defects in leather production.
9. Swayam Siddha -Product Knowledge
10. Swayam Siddha -The Skill of Seam Reducing
11. Martin M. Shoben and Janet P.Ward-Pattern Cutting And Making Up

FE-313: INDUSTRIAL AND PRODUCTION ENGINEERING FOR FOOTWEAR MANUFACTURE

Class per week	Credit	Marks
2	3	Course final Exam: 70, In-course assessment: 25, Class Attendance: 5. Total Class: 45

Introduction to the course: This course is a combination of Industrial Engineering and Production Engineering. It is also a Manufacturing course which gives idea on Metal casting, Bulk deformation process, Sheet metal work, Material removal process, Leather Manufacturing machines and their maintenance, Standardization, etc.

Course Objectives: Students have to get the idea on Metal casting, Bulk deformation process, Sheet metal work, Material removal process, Leather Manufacturing machines and their maintenance, Standardization, etc.

Course Contents:

Metal Casting Processes: casting processes for ferrous and non-ferrous metals; sand, die, centrifugal, slush, plaster mold, loam mold, precision investment casting etc. casting defects, design of moulds, riser, gate sprue and core, cost analysis, metals for casting, product design considerations.

Bulk Deformation Processes in Metal Working: rolling and other deformation processes related to rolling, forging and other deformation processes related to forging, extrusion and other deformation processes related to extrusion, wire and bar drawing.

Sheet Metal Working: cutting operations, bending operations, drawing, other sheet metal forming operations, deep drawing, dies and presses for sheet metal processes, sheet metal operation not for performed on presses, bending of tube stock.

Material Removal Processes: single point cutting tool, chip formation in metal machining, types of chips, various operations performed on turning, milling, drilling, shaping, grinding, broaching etc., cutting tool materials and cutting fluids, tool wear and tool life, economics of machining.

Footwear Manufacturing Machines and their Maintenance: Pattern making section: Automatic shoe pattern grading machine, pattern cutting tools and machine, pattern shear machine, last copying machine, upper marking machine. Cutting and preparation section: Swing arm clicking press, traveling head-cutting machine, cutting knife production unit, skiving machine, leather splitting machine, stamping and numbering machine for lining, strap-cutting machine, embossing machine with design plates, fusing and pneumatic thermo adhesive attaching machine, vamp crimping machine for boots. Bottom component preparation section: Insole molding machine, injection molding machine, reaction injection molding, extruder, beveling machine, riveting machine, sole splitting machine. Sewing section: Toe puff attaching machine, edge folding machine, use of various

types of sewing machine for footwear manufacture- zigzag sewing machine, cylinder bed sewing machine, flat bed single & double needle lock stitch sewing machine, post bed single & double needle lock stitch sewing machine, Moccasin sewing machine, lining trimming machine, seam rubbing and taping machine, thread burner, upper leather perforating machine, eyeleting machine, punching and riveting machine. Lasting and finishing section: Counter molding machine, mulling machine, insole attaching machine, toe lasting machine, seat and side lasting machine, heat setting machine, roughing and scouring machine, sole attaching press, ironing machine, last removing machine, heel nailing machine, brushing machine, hand spraying machine, heel marking and sole decorating machine, sock stamping machine, box stamping machine etc.

Standardization: Introduction, product simplification and diversification, interchangeability, selective assembly, principles, preparation of standards, application of standards in design and manufacturing, applying for patents, international and national standard organization.

Learning Outcomes: From learning this course the students can understand the Metal casting, Bulk deformation process, Sheet metal work, Material removal process, Leather Manufacturing machines and their maintenance, Standardization, etc.

References:

1. Production Technology- R.K. Jain
2. Production Process-Degarmo
3. Production Process- Dole
4. Manufacturing Process-Kalpakjain

FE-315: MANAGERIAL ECONOMICS

Class per week	Credit	Marks
2	3	Course final Exam: 70, In-course assessment: 25, Class Attendance: 5. Total Class: 45

Introduction of the course: Understanding the economic environment is essential for the successful management of virtually any business activity ranging from placement to production and marketing decisions. Indeed, making decisions is what management is all about. However, making the right decision is the biggest challenge any manager faces. Markets are fickle, and competition can be intense, leaving managers faced with a wide variety of information and choices that need to be acted upon. Managerial Economics can help students with structuring these difficult decisions by giving them the adequate tools.Managerial Economics provides a conceptual framework for understanding the economic forces at work in firms and markets and supplies models and tools for improving managerial decision making.

Course Objectives:

- List the different goals and constraints that firms face

- Apply the economic way of thinking to individual decisions and business decisions
- Use calculus (first and second order derivatives) to solve for an optimum solution
- Understand how prices get determined in markets, how market participants benefit in the form of consumer surplus and producer surplus, and what are the consequences of government intervention
- Measure the responsiveness of consumers' demand to changes in the price of a good or service, the price of other goods and services, and income
- Understand the different costs of production and how they affect short and long run decisions
- Derive the equilibrium conditions for cost minimization and profit maximization

Course Contents:

Managerial economics: Introduction to macro and micro, nature and scope, theories and constructions, firm goals, firm size, location of firm, fundamental concepts and techniques for business decisions.

Demand and supply analysis: Meanings, laws, exceptions, types, determinants and elasticity of demand and supply, demand forecasting for consumer durable like leather, theory of production and supply.

Determination of Prices and Profits under different market conditions: Perfect competition, monopoly and oligopoly costs of production and distribution, pricing practices with special reference to leather, decision making under risk and uncertainty.

Market economy: Meaning, features, markets and prices, operation, dominance of developed countries, impact on developing countries, impact on the economy and industrialization process of Bangladesh.

Monetary policy: Fiscal policy, inflation, devaluation, budgets of Bangladesh, monetary policy for export oriented industries-specially for leather, footwear, leather products, hand- gloves, leather garments, horns and hooves and other by-products based industries, matching grant funds and other special funds for leather, footwear and leather products industries, incentives and other financial supports for leather, footwear and leather products sectors.

Documentation for international business: Up to date govt. documents: export-import policy, monetary policy, duty on import & export, L/C opening, clearing & forwarding, shipment, value added tax (VAT), tariff and non-tariff barriers etc.

Plant & production costing: Selection of machines, cost involved in production system, machine depreciation, material costing, costing for individual item, competitiveness, local & international market price, labor & manpower cost, other overhead cost, cost involved in export/import of goods, gross profit & net profit, break-even point.

Learning Outcomes:

After the completion of the course, students will be able to –

- Understand the roles of managers in firms
- Understand the internal and external decisions to be made by managers
- Analyze the demand and supply conditions and assess the position of a company
- Design competition strategies, including costing, pricing, product differentiation, and market environment according to the natures of products and the structures of the markets.

- Analyze real-world business problems with a systematic theoretical framework.
- Make optimal business decisions by integrating the concepts of economics, mathematics and statistics.

References:

1. Benjamin Higgins- Economic Development.
2. Meir & Boldwen- Economic Development.
3. Dwivedi D.N - Managerial Economics, Vikas publishing, India.
4. Export Quality Management, ISO 9000 Quality Management systems,
5. Hyder R. M. - Managerial Economics, Abdullah & Sons, Dhaka.
6. Hossain A. M., Azad G.M., Sibli S.A - Managerial Economics, Dhaka.
7. Kranse- Economic Development
8. Eilis and Buchanon-Approaches to Economic Development.

FE-401: MANUFACTURING TECHNOLOGY OF FOOTWEAR-IV

Class per week	Credit	Marks
2	3	Course final Exam: 70, In-course assessment: 25, Class Attendance: 5. Total Class: 45

Introduction to the course: This course is a part four (out of four) for Manufacturing Technology of Footwear in obtaining Bachelor of Science in Footwear Engineering Degree. It contains details about the footwear manufacture through cutting, sewing and lasting operations. Then it contains the topics for getting the details idea about specific types of footwear such as sports, safety shoe.

Course Objectives:

Specific objectives of this course are:

- To impart details concept about footwear manufacture through cutting, sewing and lasting operations.
- To make the students understand about specific types of footwear such as sports, safety shoe

Course Contents:

Cutting: Initiation in knife, Re-inforcement for clicking knife, Knife management, Break-even point, Tin pattern for hand cutting, Cutters controlling technique, Documentation for cutting department, Synthetic costing, Bottom components cutting- sole cutting, Sole preparation, Matrix skiving.

Closing: Sequence of operation for closing- oxford, Derby, Court, Moccasin, Sandal, Boot, Monk Shoe, Mule, Slipper, Machine requirement for different types of shoes, Machine setup and line balancing, Fault analysis and remedies of closing, Causes of thread breakage, Needle breakage and their remedies, Quality parameters for closing department.

Lasting: Lasting procedure for flat lasting, force lasting, string lasting, veldtschoen, slip lasted, strobel construction, Operation sequence in lasting line for oxford, Derby, Court, Moccasin, Sandal, Boot, Monk Shoe, Mule, Slipper.

Shoe Construction and Moulding Technique: Injection moulding(Direct), Direct vulcanizing, Casting(Direct) moulding shoe, Footwear construction, Stitch down construction, Veldtschoen construction and Goodyear welt construction, Californian slip lasted construction, String lasting construction.

Standard Workshop Guide Cemented: Machine requirements for 1000 pairs per day production, Machinery documentation and specification, Operator requirement, Workshops layout, List of equipment and hand tools, Equipment documentation, and Rink system.

Specific types of footwear: Safety footwear- purpose of safety footwear, required standards for safety, protective and occupational footwear and application field of safety footwear, construction and operational procedure of safety footwear. Welted footwear- general features of welted footwear, preparation of insole, position of lip in relation to insole edge, Preparation of upper, Last for welted footwear, attachment of welt and sole for making welted footwear. Sports footwear- The need of footwear for sports, special features f sports footwear for specific sports, Types of sports footwear, fitting of footwear, Turn shoe.

Medicated Footwear: Diabetic and Orthopedic footwear- Definition, selection of material, purpose, design, last, manufacturing procedure.

Learning Outcomes:

Upon completion of this course the students will be able to

- Describe details about footwear manufacture through cutting, sewing and lasting operations.
- Understand the about specific types of footwear such as sports, safety shoe

References:

1. Martin, Shoben, Janet P. Ward - Pattern Cutting and Making Up
2. Swayam Siddha - The Art of Cutting Kid and Goat Skin
3. Swayam Siddha - The Art of Cutting a Buffalo Leather
4. Swayam Siddha - The Art of Cutting Corrected Grain Leather
5. Venkatappaiah B.- Introduction To The Modern Footwear Technology-
6. Miller R. G. (Editor) - Manual Of Shoe Making
7. Korn J. (Editor) - Boot and Shoe Production
8. Thornton J. H.- Text Book of Footwear Manufacture
9. SATRA Bulletin
10. Spencer Crookenden - K Shoes -The first 150 years 1842-1992
11. Ruth Thomson - Making Shoes
12. Swayam Siddha - Product Knowledge
13. Swayam Siddha - The Skill of Seam Reducing

14. Thornton J. H.-Text Book of Footwear Materials –

FE-402: MANUFACTURING TECHNOLONY OF FOOTWEAR-IV PRACTICAL

Class per week	Credit	Marks
2	4	Continuous assessment : 40, Course final examination 60

Introduction to the course: This course is a part four (out of four) for Manufacturing Technology of Footwear Practical in obtaining Bachelor of Science in Footwear Engineering Degree. It contains practical works about the different types of footwear manufacture.

Course Objectives:
Specific objectives of this course are:

- To prepare hand tools
- To practice different preparations for closing operations.
- To manufacture different types of footwear.
- To learn sole and heel attachment procedure

Course Contents:

1. Preparation of hand tools required in finishing departments
2. Practice in heel attachment by hand and machine
3. Practice in trimming sole and heel by hand and machine.
4. Marking and pairing of components
5. Practice of splitting and skiving, marking, edge colouring, stamping, folding, reinforcing of the components
6. Punching, gimping, eye-letting and trims fittings
7. Assembling the lining for quarter, vamp and other parts
8. Sandal making – Toe peg, Toe band, V-strap, instep-band, Crossed bands, multi-straps.
9. Men's Shoe making- Oxford shoe, Gibson/Derby shoe, Brogue shoe, Monk shoe, Army boot, Riding boot, orthopedic shoe, miner's boot, moccasin, Slippers.
10. Women's Shoe Making- Fancy shoes, Court shoe, Mule, Bar Shoe, Tie Shoe, Ankle Strap, Sling- back.
11. Baby Shoes Making.
12. Sole preparation: PU, PVC, TPR, Rubber, EVA/Leather

Learning Outcomes:
Upon completion of this course the students will be able to

- To be able to prepare the upper and bottom component for closing and sole attaching
- To be able for lasting and finishing operations.

References:

1. Martin, Shoben, Janet P. Ward - Pattern Cutting and Making Up
2. Swayam Siddha - The Art of Cutting Kid and Goat Skin
3. Swayam Siddha - The Art of Cutting a Buffalo Leather
4. Swayam Siddha - The Art of Cutting Corrected Grain Leather
5. Venkatappaiah B.- Introduction To The Modern Footwear Technology-
6. Miller R. G. (Editor) - Manual Of Shoe Making
7. Korn J. (Editor) - Boot and Shoe Production
8. Thornton J. H.- Text Book of Footwear Manufacture
9. SATRA Bulletin
10. Spencer Crookenden - K Shoes -The first 150 years 1842-1992
11. Ruth Thomson - Making Shoes
12. Swayam Siddha - Product Knowledge
13. Swayam Siddha - The Skill of Seam Reducing
14. Thornton J. H.-Text Book of Footwear Materials

FE-403: ANALYTICAL CHEMISTRY FOR FOOTWEAR MANUFACTURE—II

Class per week	Credit	Marks
2	3	Course final Exam: 70, In-course assessment: 25, Class Attendance: 5. Total Class: 45

Introduction to the course:

The course gives an introduction to inorganic and organic analytical chemistry, including basic analytical methods and application in leather products.

Course Objectives:

The objectives of this course are to provide:

- An introduction to analytical chemistry for leather products manufacture and an overview of important analytical methods and their range of application in leather within detection of inorganic, organic and other toxic compounds.
- Important analytical quantitative techniques from classical methods, electrochemical methods, spectroscopic / spectrophotometric methods, and separation techniques are reviewed.
- The course also includes risk assessment of chemical experiments, important steps and procedures in analytical chemistry, and evaluation/interpretation of results.

- The course gives an overview of important use of selected classical and instrumental chemical quantitative analytical methods leather product manufacturing and a short introduction to their basic theory.

Course Contents:

Chromatography:

Ion-exchange methods: Introduction, ion-exchange resins, synthetic organic ion-exchangers, use of ion-exchange resins. Anion and cation exchange resins, properties of ion exchange resin, application of ion-exchange resins, ion-exchange chromatography, ion-exchange columns, application of ion exchange chromatography, ion -chromatography.

Gas chromatography: Introduction, classification, principles of gas-liquid chromatography, gas-solid chromatography, techniques of gas-liquid chromatography, carrier gas, sample injector, gas chromatograph columns and detectors: different types of detectors- thermal conductivity detector (TCD), flame ionization detector (FID), electron capture detector (ECD), nitrogen/phosphorus detector (NPD), qualitative and quantitative, Application of gas-liquid chromatography in leather industries.

High-Performance liquid chromatography: Basic concept, comparison of HPLC with gas–liquid chromatography, apparatus for HPLC, solvent delivery, sample injector, selection of column Different detectors: UV & RI detectors, Qualitative and quantitative analysis, effect of temperature in HPLC, application of HPLC.

Spectrometry:

Infrared spectroscopy: Principles, instrumentations and applications.

Nuclear magnetic resonance spectroscopy: Principles, instrumentations and applications.

Mass spectrometry: Principles, instrumentations and applications.

Atomic absorption spectroscopy: Introduction, basic principles, instrumentation, effect of flame temperature, chemical & spectral interference, recent developments, applications.

Surface characterization by spectroscopy and microscopy: Introduction to the study of surfaces, spectroscopic surface methods, scanning electron microscopy, scanning probe microscopes, principles involved in the morphological investigation on leather and polymers, imaging techniques for surface applications, ESCA, Auger spectroscopy.

Particle size measurements: Introduction, working principles, qualitative and quantitative information, applications.

Environmental analysis: Introduction, Banned amines, Identification of carcinogenic amine from a mixture of dyes, identification of benzidine-based dye, ***Air pollution in Tannery***-determination

of volatile organic compound (VOC), formaldehyde content in finishing area, Total Organic carbon (TOC) analyzer and its application for determining TOC, determination of COD & BOD of tannery effluent.

Chemical analysis of leather and related chemicals: Introduction, *Tanning materials*-routine analysis of synthetic tanning materials, analysis of alum tanning agents; formaldehyde.

Analysis of leather analysis of alum tanned leather; formaldehyde tanned leather. Leather auxiliaries: analysis of sulphated oils: moisture, acid value, soaps, organically combined SO_3 existing as neutralized sulphuric esters and as neutralized sulphonic esters, sodium sulphate, sodium chloride, unsaponifiable matter, qualitative identification of surface active groups, determination of hydroxyproline in materials containing collagen.

Learning Outcomes: Upon completion of this course the students will be able to

- Introduce analytical chemistry for leather products manufacture and an overview of important analytical methods and their range of application in leather within detection of inorganic, organic and other toxic compounds.
- Interpret different analytical quantitative techniques from classical methods, electrochemical methods, spectroscopic / spectrophotometric methods, and separation techniques.
- Learn about risk assessment of chemical experiments, important steps and procedures in analytical chemistry, and evaluation/interpretation of results.
- Understand and use of selected classical and instrumental chemical quantitative analytical methods and a short introduction to their basic theory.

References:

1. Gary D. Christian- Analytical Chemistry
2. John Kenkel- Analytical Chemistry for Technicians
3. Skoog, Holler & Nieman- Principles of Instrumental Analysis
4. Sharma B. K. - Instrumental Methods of Chemical Analysis
5. Skoog, West & Holler- Fundamental of Analytical Chemistry
6. Browning D. R. - Chromatography
7. Hatakeyama T. and Quinn F.X. - Thermal analysis.
8. Vogel A. I. - Text Book of Quantitative Chemical Analysis
9. Sarker P.K. - Analytical Chemistry for Leather Manufacture.
10. Williams D. H. and Ian Fleming- Spectroscopic methods in Organic chemistry.
11. Kalsi P.S. - Spectroscopy of Organic Compounds.
12. Venkatachalam P.S. - Lecture Notes on Leather.
13. John A. Dean. -Analytical Chemistry Handbook.
14. Dr. Sethi P.D. - HPTLC (High Performance Thin Layer Chromatography).
15. Banwell C. N. - Fundamentals of Molecular Spectroscopy.
16. Hamilton, Hamiltoan-Thin Layer Chromatography.

17. Fifield & Haines-Environmental Analytical Chemistry.
18. UNIDO- Tannery and Environment.
19. Chhatwal G .R. - Encyclopedia of Environmental Analysis (vol.1, 2 &3)
20. Robert L. Grob- Modern Practice of Gas Chromatography
21. Dyer A., Hudson M.J. and Williams P.A. -Progress in Ion Exchange -Advances and applications.

FE-405: FOOTWEAR DESIGN & PATTERN MAKING

Class per week	Credit	Marks
2	3	Course final Exam: 70, In-course assessment: 25, Class Attendance: 5. Total Class: 45

Introduction to the course: The curriculum for undergraduate program in footwear design and pattern making leading to the award of B.Sc. in Footwear Engineering Degree is in accordance with the criteria set forth by University of Dhaka so that each student can understand about design and pattern making for footwear manufacturing.

Course Objectives: Provide an overview and realistic idea of design and pattern making related with footwear engineering as a basis for understanding how different types of footwear will be manufactured.

Course Contents:

Art & Design: Definition and brief idea and discussion on art, design, motif , fashion, style, fads, craze, newness, degree of newness, crafts, Application of design, motif , fashion , style in footwear, exploration of design source and influence available for footwear design, art and craft relationship.

Footwear fashion & style: History of shoes, shoes used in myth, story, and social life, World renowned designer and their life style. Product sketching, sketching variety of shoe styles and design covering men's, women's children's footwear, effective use of line, shape and texture, sketching as an art form for shoe interpretation, use of line, light, shade and color to create impact, illustration, accessories material drawing.

Foot and Last: Last suitability and features for full range of shoes for men's, women's and children's, Detail study about foot measurement.

Product Development: Product development procedure, color board preparation, story board, theme board preparation, motif analysis, creativity analysis, logo design, value addition, design process, research and inspiration , cultural value in design.

Range building and collection building: Pre design stage, market segmentation, market analysis , brain storm product outline , draft production, marketing plan, design stage, prototype making, selection stage, analyze customer reaction, set selling price, path finder, tooling stage, Design

specification making and costing. Detail design specification sheet making for every single component, costing procedure.

Color: Basic knowledge and information about Color, color forecasting, different color scheme, interpretation of color, color keying, influenced of color in design, color combination.

Pattern Cutting: Techniques of pattern cutting for moccasin, boot, sandal, monk, court, loafer, sports, jogger, and asymmetrical oxford \derby ,pattern cutting technique for bottom components, reinforcement, and interlining ,pattern cutting techniques for strobel , stitch down , Californian and turn construction shoes

Bottom components pattern cutting: Last bottom patterns, stiffener or counter patterns, toe puff patterns, sock patterns, insole patterns, sole patterns, and heel patterns.

Grading: Introduction, enlarging and reducing shapes, redial projections, geometric or proportional grade, arithmetic grade, straight grading, restricted grading, coordinated grading, group grading, centre grading, grading exercises by hand, pantograph, machine.

Supporting design concept: Sole tread pattern designing and outline of sole mould design, packaging design and logo design. Changing language from craft workshops to factory assembly line, how different methods of production and target markets shape the critical approach to discussing design.

Fashion Marketing: Market segmentation, demographic and psychographics design implication for different customer groups aspects of consumer \buyer behavior, customer profiles, customer needs and wants, product pricing, brand image, market research

Design Analysis: Subjective judgment, Taste and aesthetics subjectivity, Objectivity; High and low cultural values in design, Criticism in Fashion design Issues of luxury and utility.

FE-406: FOOTWEAR DESIGN & PATTERN MAKING PRACTICAL

Class per week	Credit	Marks
2	2	Continuous assessment : 40, Course final examination 60

Course Contents:

1. Standard and pattern making of the following shoes:
   a) Oxford b) Derby c) Gibson d) Moccasin
   e) Slip-on f) Monk shoe g) Sandals h) Court shoes
   i) Sports shoe j) Boot

2. Pattern making of the followings:
    a) Flat lasting
    b) String lasting
    c) Force lasting
    d) Lasting up
    e) Stitch down
    f) Good year welted

3. Pattern cutting of bottom components:
    a) Stiffener / Counter patterns
    b) Toe puff patterns
    c) Sock patterns
    d) Insole patterns
    e) Sole patterns
    f) Heel patterns

Learning Outcomes: Students will be able

a. To know about art and design in footwear manufacturing.
b. To know about footwear fashion & style in footwear manufacturing.
c. To know about foot and last in footwear manufacturing.
d. To know about product development in footwear manufacturing.
e. To know about range building and collection building in footwear manufacturing.
f. To know about pattern cutting and grading in footwear manufacturing.

To know about bottom components pattern cutting in footwear manufacturing**.**

References:

1. Martin, Shoben , Janet P. Ward - Pattern Cutting and Making Up
2. Swayam Siddha - The Art of Cutting Kid and Goat Skin
3. Venkatappaiah B.- Introduction To The Modern Footwear Technology-
4. Miller R. G. (Editor) - Manual Of Shoe Making
5. Korn J. (Editor) - Boot and Shoe Production
6. Thornton J. H.- Text Book of Footwear Manufacture
7. SATRA Bulletin
8. Spencer Crookenden - K Shoes -The first 150 years 1842-1992

FE-407: POLYMER SCIENCE AND ENGINEERING

Class per week	Credit	Marks
2	3	Course final Exam: 70, In-course assessment: 25, Class Attendance: 5. Total Class: 45

Learning Objective: Specific objectives of the course are to

- Provide a general idea of polymeric compounds, their molecular weight distribution, properties of liquid polymer, methods of preparation and mechanical properties and apply the advanced concepts in polymer industry.
- To face the challenge of the coming modern civilization with polymer sciences as per demand.

Course Contents:

Polymeric materials: Definition and classification of polymers, chemistry and mechanism involved in different polymerization process such as stepwise, addition, ring opening, free radical polymerization, polymerization techniques-Bulk, solution, suspension and emulsion polymerization. Co-polymerization, anionic and cationic polymerizations. Chemistry & Technology involved in - Natural & synthetic rubber, PVC, polystyrene, PU, LDPE & HDPE polypropylene, EVA, ABS, acrylics, fibre reinforced plastics, poromerics /PVC or PU coated fabrics. Polymeric materials as adhesives and binders.

Macromolecules: Introduction, classification, structure of macromolecules in solid and solution state.

Structure and properties of polymers: Chemical and geometrical structure of polymer molecules, glass transition temperature and related topics of polymers properties, crystallinity in polymers.

Properties of commercial polymers: Introduction, polyamide and related polymers, phenol-formaldehyde polymers, urea-formaldehyde polymers and melamine-formaldehyde polymers, cellulose and related polymers, silicones, epoxies and biopolymers.

Polymers Degradation and Environmental issues: Introduction, types of degradation, management of plastics in the environment, polymer recycling, incineration, biodegradation, impact on environment of various types of polymers.

Polymers, additives, blends and Composites: Additives, plasticizer, filler and reinforcements, other important additives, polymer blends and interpenetrating networks- polymer blend.

Polymers used in Leather, Footwear and Leather products industry: Introduction, important polymers used in leather industry and application in leather processing.

Polymer processing: Basic processing operations, Plastic technology, Fibre technology, Elastomer technology.

Learning Outcomes: Upon completion of this course student will be able to

- Describe the different polymerization processes, polymerization techniques involved in the synthesis of leather chemistry.
- Explain the thermodynamics of polymer solutions and methods for the determination of molecular weights.
- Identify amorphous and crystalline state and mechanical properties of industrial polymer.
- Discuss viscoelasticity and rubber elasticity.

- Understanding the stability, degradation and recycling process of polymer used in different aspact.
- Explain the preparation and properties of additives, blends and composites.
- Identify the structure and properties of biopolymers, natural polymers and fibres.
- Develop the concept for preparing of new polymers with improved properties.

References:

1. T. Morrison and R. N. Boyd: Organic Chemistry, 6th Edition, Prentice-Hall of India, New Delhi, 1989, Problem and their solution in Organic Chemistry.
2. Textbook of polymer science, F. W. Billmeyer, JR.
3. Polymer Science, V. R. Gowariker, N. V. Viswanathan and Jayadev Sreedhar, New Age International (P) Limited, Publishers, New Delhi, Bangalore, Calcutta, Chennai, Guwahati, Hyderabad, Lucknow, Mumbai, Pune.
4. Introduction to Synthetic Polymers, 2nd Edition, Ian M. Campbell, Oxford University Press

FE-408: POLYMER SCIENCE AND ENGINEERING PRACTICAL

Class per week	Credit	Marks
2	2	Continuous assessment : 40, Course final examination 60

Introduction to the course: The curriculum for undergraduate program in Polymer Science and Engineering Practical leading to the award of B.Sc. in Footwear Engineering degree is in accordance with the criteria set forth by University of Dhaka so that each student can acquire basic to advanced knowledge on properties and requirement of different types of polymeric materials used in leather, footwear and leather products manufacturing.

Course Objectives:

a) To know the identification characteristics of polymeric materials used in leather, footwear and leather products manufacturing.
b) To know the chemical compositions of a given polymer.
c) To determine the various properties of a given polymer.
d) To justify the quality requirements of a particular polymer.

To determine chemical composition, viscosity, film hardness, water resistance etc. of a particular polymer.

Course Contents:

1. Identification of polymers use in leather, footwear and leather products manufacturing.
2. Determination of chemical compositions of selected polymers.
3. Determination of ionic character of selected polymers and surfactants.
4. Determination of viscosity of acrylic, polyurethane, butadiene binders.

5. Determination of electrolyte stability of acrylic, polyurethane, butadiene binders.
6. Determination of solvent stability of acrylic, polyurethane, butadiene binders
7. Determination of film hardness of acrylic, polyurethane, butadiene binders.
8. Determination of adhesive strength of acrylic, polyurethane, butadiene binders.
9. Determination of tensile strength and elongation of the finish film formation by acrylic, polyurethane, butadiene binders
10. Determination of ironing effect of acrylic, polyurethane, butadiene binders
11. Determination of flexibility of finish film based on acrylic, polyurethane, butadiene binders.
12. Determination of water resistance of finish film based on acrylic, polyurethane, butadiene binders, silicones based compounds and nitrocellulose based compounds
13. Chromatographic analysis of plasticizer.

Learning Outcomes: Students will be able

a) To identify various polymeric materials used in leather products manufacturing.
b) To assess the quality requirements of a particular polymer.

References:

1. Billmeyer F.W. Jr. - Text Book of Polymer Science.
2. Fried J.R. - Polymer Science & Technology.
3. Gowariker V. R. -Polymer Science.
4. Arora M.G. & Singh M. - Polymer Chemistry.
5. Reed R. (Ed.) - Science for Students of Leather Technology.
6. Misra G.S. - Polymer Chemistry.
7. Bienkiewicz K. - Physical Chemistry of Leather Making.
8. Heidemann E. - Fundamentals of Leather Making.
9. Parry D.A.D. & Creamer L.K. - Fibrous Proteins: Scientific, Industrial and Medical aspects.
10. Finar I. L. - Organic Chemistry Volume-II
11. Winding C.C. & Hiatt G.D. - Polymeric Materials.
12. Ghosh P. - Polymer Science and Technology of Plastics and Rubbers.
13. Sandler S. R. & Karo W. - Polymer Synthesis.
14. Gustavson-The chemistry & Reactivity of Collagen

FE-409: ENVIRONMENTAL SCIENCE AND POLLUTION CONTROL

Class per week	Credit	Marks
2	3	Course final Exam: 70, In-course assessment: 25, Class Attendance: 5. Total Class: 45

Introduction to the course: The course has been designed to improve the understanding of the students primarily about the leather manufacturing unit operations carried out in tanneries, types of tannery wastes, exposure pathways and evaluate their impacts to environmental quality and human health. It aims to enable students to understand the necessity of installation of pre-treatment and recycling plant for treating the tannery wastes for their reuse or safe disposal to the environment. The course will also be dealing about the sources of pollution in water, air and soil, control strategies and the skills of application of remediation techniques to combat pollution in these three environmental compartments. In addition, the students will be given the training to develop the particular skills required in pollution related structured research.

Learning Outcomes: The learning objectives of this course are to

- Provide the basics about three major types of pollutions (water pollution, air pollution and soil pollution) that degrade the environmental quality poses a serious threat to human health worldwide.
- Present up to date information and data with regard to existing tanneries/leather manufacturing units in operation, type of tanning processes and chemicals employed, and storage of raw materials.
- Inform about the volume, types of tannery discharge, how they pollute the water, air and soil, causing ecological imbalance and the spreading of different kinds of fatal and contagious disease among the tannery workers and other individuals.
- Offer the fundamentals of tannery effluent treatment processes, and demonstrate the necessity of installation of a pre-treatment and recycling plant based on processes developed locally and internationally and other aspects of environmental pollution and its control.
- Aware about the health and safety policies developed for the tannery workers to reduce the accidents in the tanneries and how to use the emergency facilities in case of a problem.

Course Contents:
Environment and ecology: Introduction, components of environment, factors affecting environment.

Tannery and environment: Tanning process and their environmental implications, major process sequences, chemical inputs and wastes -curing of hides and skins, beam house operations, tanning, post tanning activity - wet and mechanical processes, and finishing.

Water pollution: Introduction, definitions of water pollution, sources of water pollution, different types of water pollution and their harmful impacts on ground and surface water, factors affecting surface water pollution, classification of water pollutants and effects of the various types of pollutants.

Air pollution: Introduction, composition of air, sinks of atmospheric gases, chemical reactions occur in different spheres, smog formation in air, major sources of air pollution and impact on the environment, global and modeling climate change, green house gases and green house effect, acid rain and its effect, air pollutant and their characteristics, hazardous air pollutant (HAPs).

Soil pollution: Introduction, sources of soil pollution, detrimental effects of soil pollutants, disease caused by soil pollution, treatment of soil pollutants, control of soil pollution.

Waste management: Definition of waste, integrated waste management, waste generation, separation, storage, collection, transformation of solid waste, transfer and transport, disposal water and air pollution control. Purification and reuse of water during leather processing, low float techniques using updated equipment, recycling of individual process liquors. International standard and exposure limits.

Recovery, regeneration, reuse and disposal of tannery wastes: Recovery of residues of effluents, organic materials, dissolved salts, energy, solid waste, recycling of lime /sulphide liquors, dehair, high chrome exhaustion techniques in chrome tanning, chrome recovery and recycling, oil and grease recovery, disposal of effluents

Biodegradability and biodegradation: Introduction, methods of measuring biodegradation, characteristics of tannery discharges, biological treatment of tannery effluents.

Tannery chemicals and waste generated in different tanning operations: Introduction, brief discussion of different types of chemicals used in leather processing.

Impact of tannery discharge on receiving waters: Introduction, presentation of receiving water and techniques used, results obtained and physico-chemical study, biological study and results obtained, specific analysis of chromium traces.

Pollution due to sulfur, chlorine and nitrogen: Introduction, ecotoxicity of chlorine, nitrogen and sulfur compounds; sulfur, chlorine and nitrogen in tannery effluents, study of effluents and treatment plants, balance in residual baths, tests for demonstrating nitrification.

Ecotoxicology: Introduction, toxic hazards and their control, controls of substance hazardous to health, hazard evaluation, risk assessment and control.

Safety manual on leather processing: Introduction, chemical safety, raw material handling, ranking of chemicals based on their hazard potential, storage instructions for hazardous and other chemicals, use of safety wares or personal protective equipment, upkeep of working and working surfaces.

Treatment technology: General outline of treatment-necessitated processes, types of treatment. Introduction, principle of pre, primary and secondary treatments, screening, settling. Chemical precipitation, removal of grease and oil, sulphide liquors, chromium, solid waste, primary treatment plant**.** Sedimentation tank, trickling filters system, biological fluidized beds. Different types of technologies used for the treatment of tannery wastes, primary and secondary treatment plant tertiary and quaternary treatment of tannery wastes.

Environmental Law and Industrial Pollution: Environmental pollution control, enforcement, monitoring and auditing, technical services government and industry policies, self-regulations by industry.

Learning Outcomes: Upon completion of this course the students will be able to

(i) Understand the diverse environmental problems, looking at causal linkages between pollution sources, exposure pathways and impacts to environmental quality and human health.
(ii) Know the adverse effect associated with the operation of tanning and leather finishing facilities primarily include exposure to chemicals, biological and physical hazards, and proper management procedures required for personal safety from potential risks.
(iii) Understand and design the type of effluent treatment plant that is required for treating the tannery wastes for their reuse or safe disposal to the environment.
(iv) Illustrate the safety recommendation and regulations for the workers working in the tanneries.
(v) Obtain the specific competencies necessary for working as a mentor in a tannery industry.

FE-410: ENVIRONMENTAL SCIENCE AND POLLUTION CONTROL PRACTICAL

Class per week	Credit	Marks
2	2	Continuous assessment : 40, Course final examination 60

Introduction to the course: The course has been designed to teach the students to measure the level of water pollution originates mainly from tannery effluents that help to identify trends or changes in water quality parameters. It also enables students to estimate the amount of chemicals that absorb/adsorp on leather during the beamhouse, tanning and post-tanning operations.

Course Objectives: The learning objectives of this course are to

- demonstrate the laboratory techniques used for quantification of various parameters of environmental samples,
- offer the chance of gaining practical experience of analyzing various leather or environmental samples by titrimetric/spectrophotometric method,
- impart practical knowledge on separation and quantification of chemicals extracted from leather by thin layer and/or high performance liquid chromatography.

Course Contents:

1. Determination of chloride content in alkaline solution.
2. Test for the identification of surface active groups.
3. Determination of bio-chemical oxygen demand from wastewater sample.
4. Determination of chemical oxygen demand from wastewater sample.
5. Determination of particle size and shape of supplied pigments.
6. Determination of chromium (VI) content from spent liquor using UV-VIS Spectrophotometer
7. Determination of Penta-chlorophenol using High Performance Liquid Chromatography
8. Determination of extractable fat content from leather sample
9. Identification of Phenolic components from leather using High Performance Liquid Chromatography
10. Identification of banned amines from leather using High Performance Thin Layer Chromatography

Learning Outcomes: Upon completion of this course the students will be able to

(i) Identify, properly use, and care for equipment and supplies used in analytical laboratory.
(ii) Analyze various leather or environmental samples by titrimetric/spectrophotometric method.
(iii) Design and carry out environment related scientific experiments as well as accurately record, analyze and present the results of these experiments.
(iv) Gain the specific laboratory skills necessary for working as an environmentalist in a research institution.

References:

1. Thierry Chambolle-Environment and Tannery
2. DE A.K. - Environmental chemistry
3. Society of Leather Technologists & Chemists - Official Methods of Analysis (1996).
4. UNIDO- Tannery and Enviroment.
5. Chhatwal, G.R.-Environmental Analysis.
6. Mensink Ir. J.S.-Environmental Quick Scan Leather Products.
7. Chhatwal G .R. - Encyclopedia of Environmental Analysis (vol. 1, 2 &3)
8. Fifield & Haines. -Environmental Analytical Chemistry.
9. Environmental Chemistry-B.K. Sharma and H. Kaur.
10. Roy M. Harrison-Pollution causes, Effects, and Control.
11. Richard J. Watts- Hazardous wastes: Sources, Pathways Receptors.
12. Thierry Chambolle-Environment and Tannery

FE-411: LEATHER TECHNOLOGY-II

Class per week	Credit	Marks
2	3	Course final Exam: 70, In-course assessment: 25, Class Attendance: 5. Total Class: 45

Introduction: This course provides for the footwear stream student to building-block knowledge of overall leather tanning, post tanning and finishing manufacturing process.

Course Objectives: The objectives of this course are to make students to be able to recognize the production methods and the tanning, post tanning and finishing leather properties for the best leather manufacturing.

Course Contents:

Tanning: Introduction, vegetable tanning- hydrolysable tanning and condensed tanning, resin tanning, synthetic tanning, aldehyde tanning, chrome-vegetable combination tanning.

Mechanical operation prior to post tanning operation: Sammying, splitting, shaving,

Re-chroming & Neutralization : Re-chroming- Objectives, chemicals used for rechroming, influencing factors for rechroming operation, Neutralization- Objectives, chemicals used for neutralization, influencing factors of neutralization, quality control during neutralization.

Retanning: Objectives, chemicals used for retanning, influencing factors of the retanning operation, quality control during retanning.

Dyeing: objectives, dyes and their classification, selection of dyes for specific leather production, influencing factors of the dyeing operation.

Fat liquoring- Objectives, selection of fat-liquors and oils, influencing factors of the fat-liquoring operation, quality control during fat -liquoring.

Finishing: Definition, Classification of finishes, Structure of finishes, Materials for leather finishing, Theory of film formation Preparation of leather for finishing-buffing, snuffing, de-dusting, flesh coating, staining/color impression, ground coating, season coating, top coating, ironing, glazing, plating, selection.

Finishing techniques: Shoe upper leather, nappa leather, glaze kid leather, nubuck leather, suede leather, patent leather, corrected grain leather, pull-up leather, and clothing leather.

Insole leather: lining leather, split leather.

Sole leather: Vegetable tanned sole leather, chrome tanned sole leather, and combination tanned sole leather.

Learning Outcomes:

1. To be able to recognize the necessity of high performance leather production.
2. To be able to recognize the methods of water repellency methods for cross section and surface of leathers.
3. To be able to recognize the high and low temperature resistance properties.
4. To be able to recognize the importance of antimicrobial properties.
5. To be able to relate the contact between the chemicals used in leather production and flame resistance.
6. To be able to recognize the chemical resistance property.
7. To be able to relate the contact between production methods and high strength properties

FE-412: LEATHER TECHNOLOGY-II PRACTICAL

Class per week	Credit	Marks
2	4	Continuous assessment : 40, Course final examination 60

Introduction: The purpose of this course is to gain knowledge to students about the production methods and techniques of specific leather types having different fields of final use

Course Objectives: The aim of the course is to assure to be perceived by our students the quality criteria of leather.

Course Contents:

1. Standard upper leather manufacture
2. Manufacture of suede/nubuck/nappa/chamoise leather.
3. Standard lining leather manufacture
4. Manufacture of glaze kid finish
5. Manufacture of shrunken grain leather
6. Manufacturing process of patent finish leather
7. Manufacture of garments/clothing/gloving leather.
8. Manufacture of fur skin.
9. Manufacture of screen/block/boutik printed leather.

Learning Outcomes:

1. to have knowledge about specific leather productions
2. to able to predict the problems and defects that might occur in specific leather processes

to be able to compare old and recent techniques in specific leather production, to be able to make design for new leather types

FE-413: PRODUCTION PLANNING AND QUALITY CONTROL

Class per week	Credit	Marks
2	3	Course final Exam: 70, In-course assessment: 25, Class Attendance: 5. Total Class: 45

Introduction to the course: This course covers the knowledge and skills about the concept, models, issues, and concerns in quality planning, quality control and total quality management. This course also provides the current practices in material handling, inventory management and control, production engineering design, development and management to sustain in the competitive market.

Course Objectives: The specific objectives of this course are to expertise the students for the following skills:

- To familiarize students with different basic concept of production Planning.
- To introduce different industrial practices in material handling, inventory management and control.

- To prepare students to practice professionally in the fields of productivity improvement in leather products industry.
- Understand and interpret the knowledge and skills about the production planning and quality control.

Course Contents:

Introduction: Concept of production system, scope and importance of production, elements of production, production planning, determination of factors of production and their control.

Plant Layout: Types of plant layout-production, process layout, activities and layout design, departmental space requirements, departmental arrangement.

Materials handling: Classification of material handling system, objectives of material handling, description and design of belt, chain conveyors, handling of raw materials, crust and finished leather, handling of chemicals (adhesive, primer, colouring materials)

Inventory management: Types of inventory control, inventory costs and control, classification of stocks-raw hides and skins stock, wet-blue stock, crust and finished stock, stock-in-process, safety-stock, out of stock, lead-time, reorder point, economic order quantity (EOQ), inventory models under certainty, inventory control under risk.

Resource scheduling: Introduction, objectives, scheduling and sequencing, gantt chart, linear programming, transportation model, network analysis, critical Path Method (CPM), programme evaluation and review technique (PERT), critical path and determination of minimum member of works.

Sales forecasting*:* Introduction, purpose of sales forecasting, methods of sales forecasting, time series analysis of sales forecasting, forecasting for new products, co-ordination between sales, manufacturing and purchase departments

Productivity concept: Introduction, productivity of materials, land, building, machine and manpower, factors contributing to productivity improvement. Techniques for productivity improvement:
Introduction, work content and ineffective time, productivity improvement by reducing work content, productivity improvement by reducing ineffective time, management of productivity. Work study: Introduction, basic procedure, prerequisites of conducting a work study, human factors, the influence of working condition, Ergonomics. Method study and Work measurement

Quality: Definition of quality and quality control, important terminology used in quality control, quality function, quality planning and improvement, parameters for fitness for use.

Quality policies and objectives: Need for quality policies, corporate quality policies, quality policies for specific parameters and formulation of quality policies, quality objectives, zero defects.

Total quality management (TQM): Total quality management concept, internalization of quality, customer driven quality activity, system development for TQM, ideal TQM system, application of TQM on leather industry.

Standards for leather products testing: International Standards, national standards, Testing soling materials, Testing adhesives, Testing other products components, Using computers for quality control in the leather products industries.

Quality control for different stages of leather-products manufacturing: Quality control in pattern cutting- cutting of bags, wallets, belts, jackets, dresses etc; quality control during skiving and splitting, closing -cementing, priming, sewing, decoration creating with different accessories; quality control during finishing- spraying, ironing, polishing, handing, storage, preservation, packaging and delivery.

Health and safety in leather products manufacture: Hazards and potential accidents, safety measures.
Quality assurance in leather products manufacture: Quality assurance, quality control, raw materials, design department, production planning and control in cutting department, during preparation for sewing, in the sewing room, intermediate inspection, final inspection, cost of quality, cost of conformance, cost of non-conformance.

Quality management systems: Perceptions of quality, development of ISO-9000 series, content and application field of ISO-9000-9004 series.

Environmental management systems: Introduction, ISO 14000 series: structure of the ISO 14001 standard, occupational health hazards and industries, environmental impact assessment (EIA) and audit, environmental audit (EA), environmental management plan.

Learning Outcomes: After completion of this unit the students will able to-

- Discuss current concept and theoretical models, issues, and concerns in quality planning, quality control and total quality management.
- Describe current practices in material handling, inventory management and control.
- Evaluate existing method and production layout and apply the general problem solving process and tools to improve productivity in leather products industry.
- Work effectively in small groups through well-developed problem solving skills and be able to organize the group to optimize performance and results.
- Possess the skills in production engineering design, development and management to sustain in the competitive market.
- Understand ISO 9000 and ISO 14000 series issues and impact on the organization.

References:

1. European Organization of Quality Control; Glossary *of Terms Used in Quality Control*. Berne, Switzerland.
2. Juran J.M, Gryna F.M - *Juran's Quality Control Hand Book.* McGraw-Hill Book Company.
3. Ott ; *Process Quality Control.*. McGraw-Hill Book Company.

4. Taylor - *Quality Control Systems.* McGraw-Hill Book Company.
5. Juran J. M.- *Juran on Planning for Quality.* The Free Press, New York.
6. UNIDO, Acceptable Quality standards in the Leather and Footwear Industry.
7. Roland Kilgus - Clothing Technology

FE-415: ENTREPRENEURSHIP AND BUSINESS DEVELOPMENT

Class per week	Credit	Marks
2	3	Course final Exam: 70, In-course assessment: 25, Class Attendance: 5. Total Class: 45

Introduction to the course: The course is about entrepreneurship and entrepreneurial business development. Entrepreneurship is the act of being an entrepreneur or one who undertakes innovations, finance and business acumen in an effort to transform innovations into economic goods. This may result in new organizations or may be part of revitalizing mature organizations in response to a perceived opportunity. The most obvious form of entrepreneurship is that of starting new businesses (referred as a startup strategy); however, in recent years, the term has been extended to include social and political forms of entrepreneurial activity. When entrepreneurship is describing activities within a firm or large organization it is referred to as intra-preneurship and may include corporate venturing, when large entities spin-off organizations. Entrepreneurship is generally synonymous with resourcefulness, ingenuity, and the ability to take calculated risks in order to introduce a new, untested product or service into the marketplace.

Course Objectives:

- To give an overview of fundamental issues, concept, principles, functions, objectives, modus operandi of entrepreneurship and business development.
- To facilitate acquiring necessary knowledge and skills required for organizing and carrying out entrepreneurial activities.
- To develop the ability of analyzing and understanding business situations in which entrepreneurs act
- To help master the knowledge necessary to plan entrepreneurial activities.
- To develop the ability of analyzing various aspects of entrepreneurship especially of taking over the risk, and the specificities as well as the pattern of entrepreneurship development
- To contribute to their entrepreneurial and managerial potentials.

Course Contents:

Business- Meaning, element, characteristics, function, importance, advantages, relation with economics

Entrepreneurs- Meaning, function, qualities, factors, role of business entrepreneurs

Business method and Business organization – Meaning, importance, distinction, types, principles, evolution, factors influence

Sole proprietorship business – Meaning, features, advantages, importance, fields suitable for sole proprietorship business

Partnership business - Meaning, element, advantages,
disadvantages, contents of Partnership deed, power of Partner, reconstruction of Partnership business, difference between sole trade ship and Partnership business.

Joint Stock Company - Meaning, characteristics, advantages,
disadvantages, difference between JSC & Partnership business, classification of JSC & Private and public limited company.

Export Management – Meaning, Function, Principles, Factors, types, Leather export: Introduction-A profile of industry- Leather manufacture; basic steps in leather making-Grading – quality control-Animal and tannery by-products-Leather products- Technical aspects of footwear manufacture-Garment construction- Machinery- Role of council for Leather Exports- Schemes for Government for leather Exports; Medium term export Strategy for 2002-2007;EPCG schemes; Duty exemption schemes; Duty remission schemes etc.- Schedule of rates under duty entitlement Pass book scheme and draw back.

Learning Outcomes:

- Students will be able to sell themselves and their ideas. They will master oral and visual presentation skills and establish a foundation of confidence in the skills necessary to cause others to act.
- They will be able to find problems worth solving and advance their skills in customer development, customer validation, competitive analysis, and iteration while utilizing design thinking and process tools to evaluate in real-world problems and projects.
- They will be able to mobilize people and resources and identify and secure customers, stakeholders, and team members through networks, primary customer research, and competitive and industry analyses in order to prioritize and pursue an initial target market in real-world projects.
- Students will be able to create value and to create presentations and business plans that articulate and apply financial, operational, organizational, market, and sales knowledge to identify paths to value creation through 1) company formation (for-profit); 2) social innovation (nonprofit); or 3) intellectual property licensing.
- They will develop and cultivate endurance and increase their awareness and deliberately practice the skills and disciplines necessary to increase confidence and agency; foster self-efficacy and self-advocacy; improve communication and problem-solving skills, manage strong impulses and feelings; and identify personal purpose.

References:

1 Business systems & commercial letter- Md. Khalekhuzaman
2 W. H. Newman – Business Policies Management
3 I. B Ghosh – Business organization, A. Mukherjess Co

4 M. C. Shukla – Business organization & Management.

FE-416: PROJECT WORK AND SEMINAR

Credit: 2	Project Work: 75 Seminar: 25

Introduction to the course: Each student is required to submit a report on the project assigned to him/her by the department. Prior to the submission of the project report, each student should present a seminar based on the work done.

Course Objectives: The objective of this course is

- To help students to develop research skills and competencies.
- To acquaint them with contemporary real life aspects of Footwear Engineering.
- To improve the effectiveness of their independent research work, which is required for the successful completion of the degree.

Learning Outcomes: After completion of this unit the Students will able to:

- Professional orientation of students to help them choose the field and topic of their field.
- Poses academic skills, including preparing and conducting project in the field of Footwear Manufacturing.
- Gather knowledge systematize and process information and prepare analytic reports and documents.
- Acquaint students with the standard workflow.
- Able to write and publish papers and articles.

FE-418: INDUSTRIAL TRAINING

Credit:2	Marks: 50

Introduction to the course: Industrial Training refers to practical contact with and observation of facts or events during the program of study that is relevant to professional or practical development prior to the completion of the theoretical courses. In this course student will go to the industry for **two months** training at any suitable time of 4^{th} year based on the availability of the industry located in the suitable area of the country.

Course Objectives: The learning objectives of this course are

- To prepare students for future employment in their chosen industrial discipline.
- To boost up the practical knowledge by experiencing the theoretical knowledge into practical perspective.
- To develop understanding of the functioning and organization of a industrial process.
- To permit students to practice what they have learned.
- To learn problem solving process for sustainable development.

Learning Outcomes: By the end of the course, students will be able to-

- Demonstrate and apply practical knowledge of basic leather products designing, including pattern making and product manufacturing.
- Understand the concepts of industrial process.
- Possess the skills in problem solving process.
- Analyze and evaluate the existing production layout.
- Use the techniques, skills, and modern engineering and Management tools necessary for leather products engineering.
- Work effectively in small groups through well-developed problem solving skills and be able to organize the group to optimize performance and results.
- Adopt a factual approach for decision making.

FE-420: COURSE VIVA

Credit:2	Marks: 50

At the end of the 4th year (after completing all the courses of 4 years) a student will sit for an oral examination. Members of the examination committee will evaluate the students by asking questions relevant to the courses of the 4 years. The teacher panel interviews the students on subjects studied 4 years-long and measure their competency and understanding.

Course Objectives: The learning objectives of this course are

- To prepare the students to face interview both at the academic and the industrial sector.