NEP-2020 Aligned Curriculum for

Three Year (Six Semester) Diploma Programme in

LEATHER TECHNOLOGY (TANNING)

For the State of Uttar Pradesh

(Effective from Session 2025-26)

Prepared by:

Curriculum Development Centre

Institute of Research Development & Training

U. P. Kanpur

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PREFACE

An important issue generally debated amongst the planners and educator's world over is how technical education can contribute to sustainable development of the societies struggling hard to come in the same bracket as that of the developed nations. The rapid industrialization and globalization have created an environment for free flow of information and technology through fast and efficient means. This has led to the shrinking of the world, bringing people from different culture and environments together and giving rise to the concept of world turning into a global village. In India, a shift has taken place from the forgettable years of closed economy to knowledge based and open economy in the last few decades. To cope with the challenges of handling new technologies, materials and methods, we have to develop human resources having appropriate professional knowledge, skills and attitude. Technical education system is one of the significant components of the human resource development and has grown phenomenally during all these years. Now it is time to consolidate and infuse quality aspect through developing human resources in the delivery system. Polytechnics play an important role in meeting the requirements of trained technical manpower for industries and field organizations. The initiatives being taken by Technical Education, UP to revise the existing curricula of diploma programmes as per the needs of the industry and making them NEP-2020 compliant, are laudable.

In order to meet the requirements of future technical manpower, we will have to revamp our existing technical education system and one of the most important requirements is to develop outcome-based curricula of diploma programmes. The curricula for diploma programmes have been revised by adopting time-tested and nationally acclaimed scientific method, laying emphasis on the identification of learning outcomes of diploma programme.

The real success of the diploma programme depends upon its effective implementation. However best the curriculum document is designed, if that is not implemented properly, the output will not be as expected. In addition to acquisition of appropriate physical resources, the availability of motivated, competent and qualified faculty is essential for effective implementation of the curricula.

It is expected of the polytechnics to carry out job market research on a continuous basis to identify the new skill requirements, reduce or remove outdated and redundant courses, develop innovative methods of course offering and thereby infuse the much-needed dynamism in the system

Director

Institute of Research Development &Training.

Kanpur

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5. Faculty/Subject Experts from U.P. Government polytechnics

6. All the participants from industry/field organizations, engineering colleges, polytechnics, and other technical institutions for their professional inputs during curriculum workshops.

Coordinator

Institute of Research Development & Training,

Kanpur, U.P.

1. SALIENT FEATURES

- Name of the Programme: Diploma Programme Leather Technology (Tanning)
- Duration of the Programme: Three years (Six Semesters)
- Entry Qualification: Matriculation or as Prescribed by State BTE, UP
- Intake: As prescribed by the Board
- Pattern of the Programme: Semester Pattern
- Ratio between theory and Practical: 40 : 60 (Approx.)

2. EMPLOYMENT OPPORTUNITIES

➢ JOB POTENTIAL / JOB OPPORTUNITIES

The following are the job opportunities for diploma holders in leather technology.

1. As a leather technologist to manufacture various types of heavy and light leathers, sports goods leathers, garment leather etc.
2. As supervisor/production manager in the tanneries/leather and allied industries in the following sections:
   Liming Department, Tanning Department, Dyeing Department, Curing Department, Finishing Department, Testing and Quality control.
3. As research assistant for developing tanning processes for manufacture of various types of leathers.
4. As technical officer/sales officer in chemicals and auxiliary manufacturing companies.
5. As supervisor in quality control and purchases (Finished leather)
6. As an analyst in tanneries.
7. As supervisor or manager in raw hide curing, preservation and flaying centre.
8. As a field officer for procurement of new materials in shoe industry/Tannery
9. As a marketing officer in tanneries and allied industries.
10. As a laboratory assistant in leather test laboratories.
11. 11.As assistant/ Deputy Director leather in Govt. departments.
12. 12.As a design/planning supervisor in leather goods manufacturing and allied industries.
13. As a maintenance supervisor in leather industry

PROGRAM OUTCOMES (POs)

PO1: Basics and Discipline specific Knowledge
Assimilate knowledge of basic mathematics, science, engineering fundamentals, and electronics and communication engineering.

PO2: Problem's Analysis and solution
Identify, analyse and solve problems using standard methods and established techniques.

PO3: Design and Development
Design solutions for technical problems.
Assist in designing components, systems, or processes to meet specific requirements.

PO4: Engineering Tools, Experimentation, and Testing
Use modern engineering tools and appropriate techniques to conduct experiments as per BIS standard.
PO5: Socio/ Economic /Environmental impact assessment/remedy.

Apply relevant technologies while considering societal needs, environmental impact keeping in view sustainable and ethical responsibilities.

PO6: Project Management and Communication
Apply engineering management principles, work effectively as an individual or in a team, and communicate clearly on activities.

PO7: Lifelong Learning
Recognize the importance of continuous learning and actively pursue self-improvement to keep pace with technological developments.

STUDY AND EVALUATION SCHEME FOR DIPLOMA PROGRAMME IN LEATHER TECHNOLOGY (TANNING)

THIRD SEMESTER

Sr. No.	SUBJECTS	STUDY SCHEME Periods/Week			Credits	MARKS IN EVALUATION SCHEME								Total Marks of Internal & External	Exam Type
						INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT						
		L	T	P		Th	Pr	Tot	Th	Hrs	Pr	Hrs	Tot		
3.1	Skin Proteins and PreTannage	2	0	8	6	-	60	60	-	-	40	6	40	100	Practicum
3.2	Inorganic and Organic Tanning	3	0	0	3	40	-	40	60	3	-	-	60	100	Theory
3.3	Elementary Microscopy and Microbiology	0	0	6	3	-	60	60	-	-	40	3	40	100	Practical
3.4	Elements of Footwear Technology	2	0	6	5	-	60	60	-	-	40	3	40	100	Practicum
3.5	Open Elective-I	2	0	0	2	50	-	50	-	-	-	-	-	-	Qualifying
	Advance Skill Development	-	-	-		-	-	-	-	-	-	-	-	-	Certification
3.6	Summer Internship-I	0	0	0	1	-	50	50	-	-	-	-	-	50	-
#Student Centred Activities (**SCA**)		0	0	7	0	-	50	50	-	-	-	-	-	50	-
Total		**09**	**0**	**27**	**20**	**40**	**280**	**320**	**60**	**-**	**120**	**-**	**180**	**500**	**-**

* Common with other diploma programmes

\# Student Centred Activities will comprise of co-curricular activities like extension lectures, self-study, games, hobby clubs e.g. photography etc., seminars, declamation contests, educational field visits, N.C.C.,NSS, Cultural Activities, disaster management and safety etc.

Open Elective-I

SR. NO.	SUBJECT NAME
1.	Economic policies in India
2.	Energy Conservation & Audit
3.	Any Course Of Minimum 02 Credit From (Advance Skill Development) • NPTEL • MOOCS THROUGH SWAYAM • AICTE-ELIS AND CENTRALLY FUNDED TECHNICAL INSTITUTES • C-DAC • CERTIFICATES CONDUCTED BY THE INSTITUTE OF NATIONAL IMPORTANCE (IIT, NIT, IIT ETC.) • ISRO E-LEARNING • COURSES OFFERED BY TATA TECHNOLOGY (Annexure-1) OR OTHER REPUTED ORGNISATION.

Advance Skill Development:

To fulfill the requirements for Advanced Skill Development, a minimum of 20 hours of skill certification is necessary. This certification must be obtained from a recognized national or international agency or institute. The assessment and certification process will be conducted by the respective agency or institute. Students must present their certificate to earn 02 credits for this subject.

STUDY AND EVALUATION SCHEME FOR DIPLOMA PROGRAMME IN LEATHER TECHNOLOGY (TANNING)

FOURTH SEMESTER

Sr. No.	SUBJECTS	STUDY SCHEME Periods/Week			Credits	MARKS IN EVALUATION SCHEME								Total Marks of Internal & External	Exam Type
						INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT						
		L	T	P		Th	Pr	Tot	Th	Hrs	Pr	Hrs	Tot		
4.1	Post Tanning and Finishing Operation	2	0	10	7	-	60	60	-	-	40	3	40	100	Practicum
4.2	Process Heavy and Sports Leather	0	0	10	5	-	60	60	-	-	40	3	40	100	Practical
4.3	Leather Trade Engineering	0	0	4	2	-	60	60	-	-	40	3	40	100	Practical
4.4	Tannery Waste Management	4	0	0	4	40	-	40	60	3.0	-	-	60	100	Theory
4.5	Essence of Indian Knowledge And Tradition(Q)	2	0	0	0	50	-	50	-	-	-	-	-	-	Qualifying
4.6	Open Elective-II	2	0	0	2	50	-	50	-	-	-	-	-	-	Qualifying
	Advance Skill Development	-	-	-		-	-	-	-	-	-	-	-	-	Certification
#Student Centred Activities (**SCA**)		0	0	2	0	-	50	50	-	-	-	-	-	50	-
Total		**10**	**-**	**26**	**20**	**40**	**230**	**270**	**60**	**-**	**120**	**-**	**180**	**450**	**-**

* Common with other diploma programmes

+ 4 weeks structured and supervised, branch specific, task oriented Summer Internship-II to be organized After IV Semester theory exam. Students will require to submit the report.

\# Student Centred Activities will comprise of co-curricular activities like extension lectures, self study, games, hobby clubs e.g. photography etc., seminars, declamation contests, educational field visits, N.C.C., NSS, Cultural Activities, disaster management and safety etc.

Open Elective-II

List of Subjects for Open Elective-II (Any One)

SR. NO.	SUBJECT NAME
1.	Internet of Things
2.	Project Management
3.	Any Course Of Minimum 02 Credit From (Advance Skill Development) • NPTEL • MOOCS THROUGH SWAYAM • AICTE-ELIS AND CENTRALLY FUNDED TECHNICAL INSTITUTES • C-DAC • CERTIFICATES CONDUCTED BY THE INSTITUTE OF NATIONAL IMPORTANCE (IIT, NIT, IIT ETC.) • ISRO E-LEARNING • COURSES OFFERED BY TATA TECHNOLOGY (Annexure-1) OR OTHER REPUTED ORGNISATION.

Advance Skill Development

To fulfill the requirements for Advanced Skill Development, a minimum of 20 hours of skill certification is necessary. This certification must be obtained from a recognized national or international agency or institute. The assessment and certification process will be conducted by the respective agency or institute. Students must present their certificate to earn 02 credits for this subject.

4. GUIDELINES FOR ASSESSMENT OF STUDENT CENTRED ACTIVITIES (SCA)

It was discussed and decided that the maximum marks for SCA should be 50 as itinvolves a lot of subjectivity in the evaluation. The marks may be distributed as follows:

i. 10 Marks for general behaviour and discipline
(by HODs in consultation with all the teachers of the department)

ii. 10 Marks for attendance as per following:
(by HODs in consultation with all the teachers of the department)

a) 75 - 80% 8 Marks
b) 80 - 85% 9 Marks
c) Above 85% 10 Marks

iii. 30 Marks maximum for Sports/ NCC/ Cultural/ Co-curricular/ NSS activities as per following:

(by In-charge Sports/NCC/Cultural/Co-curricular/NSS)

a) 30 - State/National Level participation
b) 25 - Participation in two of above activities
c) 15 - Inter-Polytechnic level participation

3.1 SKINS PROTEINS AND PRETANNAGE

L	T	P
2	0	8

RATIONALE

To provide students with comprehensive knowledge of the structure and chemistry of animal skins, the role of proteins in skin composition, and the pre tannages processes essential for leather production.

LEARNING OUTCOME

After undergoing the subject, the students will be able to

- Describe the sources, types, and basic characteristics of animal skins and hides used in the leather industry. "Understand different footwear manufacture processes.
- Identify and explain the major proteins found in skins and hides, including their structure and role in leather production."
- Explain the methods of curing and preservation of hides and skins, and their importance in preventing degradation before leather processing."
- Describe the key pre tanning processes such as soaking, liming, and deliming, and explain their purpose in preparing hides and skins for tanning."
- Differentiate between the main types of tannages—such as vegetable, chrome, and synthetic—and explain their processes and effects on leather properties."

DETAILED CONTENTS

Unit No.	Content	Periods
1	**Introduction to Skins and Hides** 1. Overview of animal skins: Types (cattle, sheep, goat, pig) and their industrial significance. 2. Classification of hides and skins based on animal origin 3. Structure and composition of animal skin 4. Morphology of skin layers: epidermis, dermis, hypodermis 5. Defects in raw hides and skins: Antemortem & Postmortem Defects **Practicals** 1. Grading/Selection Of Raw Hides And Skins As Per Indian / International Standard 2. Knowledge of various defects of Raw materials. 3. Knowledge of various Raw materials in different areas.	08
2	**PROTIENS OF THE SKIN AND HIDES** 1. Histological /Anatomical Structure Of Hides And Skins - Cow, Buff, Goat, Sheep 2. Grain Pattern Of Different Hides And Skins 3. Introduction to proteins: structure and function (amino acids,	08

	polypeptides). 4. Brief Study Of Various Fibrous And Non Fibrous Proteins 5. Important Role Of Collagen in tanning and leather formation **Practicals** 1. Study of Grain Pattern Of Different Hides And Skins 2. Study of Anatomical Structure Of Hides And Skins under microscopic	
3	**CURING / PRESERVATION** 1- Flaying 2- Methods Of Curing/ Preservation Of Hides /Skins 3- Merit And Demerits Of Each Methods of Curing/ Preservation 4- Types of Preservatives Agents 5- Storage Of Raw Hides / Skins and quality assessment. **Practicals** 1. Study of Each Methods of Curing. 2. Applying the curing method by Salting.	09
4	**PRETANNING OPERATIONS** 1. Introduction Of All Tannery Operation- Pre-tanning Operation, Tanning Operation , Post Tanning & Finishing Operation. 2. Basic Principles & Object involved In Pre-tanning Operation- Soaking, Liming, Deliming, Bating, Pickling, Depickling, Degreasing 3. Methods, Temperature, pH, Time, Check, Control Of Each Process Of Pre tanning Operations 4. Mechanical processes involved in Pre tanning Operations. 5. Role of Enzymes Of Pre-tanning Operation. 6. Common pre-tannage issues: over-liming, incomplete bating etc 7. Sequence & Flowchart of beam house and tanning operations **Practicals** 1. Study of Pre tanning Operations. 2. Study of Mechanical processes involved in Pre -tanning Operation. 3. Knowledge Of Various Defects in Pre- tanning Operations 4. Use of pH/indicators & chemicals in Beam House Operations	08
5	**TYPES OF TANNAGES** 1. Object of Tanning & Types of tannages 2. Introduction Of All Types Of tannages Like- Chrome Tanning, Vegetable Tanning, Aluminum Tanning, Zirconium Tanning, Iron Tanning , Aldehyde Tanning & Oil Tanning etc 3. Properties Of All Types Of Tanned Leathers Like- Chrome Tanning, Vegetable Tanning, Aluminum Tanning, Zirconium Tanning, Iron Tanning , Aldehyde Tanning & Oil Tanning etc	09

	4. Manufacturing Process Of Wet Blue From Raw Hides / Skins. **Practicals** 1. Study of Chrome Tanning Operations. 2. Manufacturing Process Of Wet Blue From Raw Hides / Skins 3. Determination of Boil Test. 4. Selection of wet-blue for different Leathers.	

NOTE :

All the above noted operations should be practically demonstrated to the students in the tanneries, so that students should be able command practical leather making knowledge. Every week students should be taken to lather processing units as a part of structured-cum-industrial visit. Well designed and detailed programme of such visits should be chalked out in advance for result orientation and skill improvement during their course of study

Each visit of the students to tanneries should be guided be the subject teacher and technical observations, etc. may be observed and verified by the subject teacher.

INSTRUCTIONAL STATREGY

The teacher should give emphasis on understanding of concept and various terms used in the subject. Practical exercises will reinforce various concepts.

.**MEANS OF ASSESSMENT**

- Class Test
- Home Assignment – Attendance
- Sessional Test

RECOMMENDED BOOKS

1. Theory & practice of Leather manufacture by K.T. Sarkar
2. Fundamentals of Leather manufacture by Heidmann, Ad.Tata McGraw Hill Publishers, New Delhi.
3. Analytical Chemistry of Leather Manufacture – P.K.Sarkar, I.L.T.A., Calcutta,
4. The Chemistry & Technology of Leather, Vol. – IV – F.O' Flahorty, W.T.Roddy & R.M.Lollar, original edition, Krieger Publishing
5. Leather Processing and Tanning Technology Handbook by NIIR Board of Consultants & Engineers.
6. Principles of Leather Manufacture by S.S. Dutta.
7. Proteins: Structure and Function by David Whitford
8. Handbook of Collagen by Matthew Shoulders and Robert Mecham.

SUGGESTED DISTRIBUTION OF MARKS

Topic	Time Allotted (Periods)	Marks Allotted (%)
1	8	15
2	8	15
3	9	25
4	8	20
5	9	25
Total	**42**	**100**

3.2 INORGANIC AND ORGANIC TANNING

L	T	P
3	0	0

RATIONALE

The Objective Of The Course Is To Give Focus On The Manufacture Of Different Tanned Leather And Application Of Tanning Materials And Used In Leather Manufacturing Process.

LEARNING OUTCOME

After undergoing the subject, the students will be able to

- Understand the inorganic & organic tanning materials.
- Understand the application of different tanning materials.
- Understand the principles of different tanning materials.
- Understand the properties of different tanning materials.

DETAILED CONTENTS

Unit No.	Content	Periods
1	**INTRODUCTION TO TANNING PROCESSES** 1. Definition And objectives of Tanning 2. Historical Evolution of Tanning 3. Classification of Tanning Agents: a. Mineral (Inorganic) b. Vegetable, Synthetic, Oil, Aldehyde (Organic) 4. Basic Chemistry of Tanning Reactions 5. Role of Collagen Structure in Tanning 6. Comparative Overview: inorganic vs. organic Tanning Systems.	08
2	**INORGANIC (MINERAL) TANNING AGENTS)** **A. Chrome Tanning** 1. Definition and objectives of Chrome Tanning 2. Chemistry of Basic Chromium Sulfate 3. Werner's co-ordination theory of chrome compounds 4. Types Of Chromium Salts Used in Chrome Tanning 5. Olation, Oxolation, Polymerization 6. Chromium complexes and chrome Tanning Mechanism. 7. Factors Affecting Chrome Tanning Process (pH, Temperature, Time, Masking Agents etc.) 8. Basification, Boil Test – Shrinkage Temperature.	08

	9. Process Flow Chart For Wet-Blue 10. Properties Of Chrome-Tanned Leather 11. Environmental impact of chrome tanning process	
3	**ALTERNATIVE INORGANIC TANNING AGENTS** **A-Aluminium Tanning:** 1. Alum Tannage and theory of Aluminum tanning 2. Chemistry of Aluminium Salts (Alum, Aluminium Sulphate) 3. Mechanism And Properties of Alum-Tanned Leather 4. Difference Between Chromium & Aluminum Tanned Leather. **B-Zirconium Tanning:** 1. Zirconium Tannage And Theory of Zirconium Tanning 2. Chemistry of Zirconium Sulphate 3. Mechanism And Properties *o*f Zirconium Tanned Leather. *4.* Controlling Factors For Zirconium Tanning. **C-Iron Tanning & Titanium Tanning:** 1. Theory of Iron & Titanium tanning 2. Application of iron & titanium tanning processes.	07
4	**ORGANIC TANNING – VEGETABLE TANNING** 1. Sources of vegetable tannins (bark, wood, roots, fruit, leaves) 2. Types of vegetable tannins: hydrolysable vs condensed 3. Importance of polyphenolic content & Non tans. *4.* Extraction of vegetable tannins materials (e.g. mimosa, quebracho, chestnut etc) by leaching Method *5.* Factors involved in vegetable tanning process 6. Advantages and limitations of vegetable tanning *7.* Properties of vegetable tanned leather. 8. Bleaching & Environmental and sustainability aspects	08
5	**OTHER ORGANIC TANNING AGENTS** **A. Aldehyde Tanning** 1. Formaldehyde and Glutaraldehyde tanning process 2. Properties & Application of Formaldehyde and Glutaraldehyde Tanned Leather 3. Hazardous behavior of formaldehyde & glutaraldehyde	07

	during processing. **B. Oil Tanning** 1. Oil tanning/Oil tannage 2. Selection of fish oil 3. Manufacture process of Oil tanned leather (chamois leather) 4. Properties & application of chamois leather	
6	**COMBINATION TANNAGES** 1. Objectives of combination tannage 2. Chrome/ Vegetable 3. Formaldehyde / Vegetable 4. Formaldehyde / Chrome 5. Formaldehyde / Oil	04

INSTRUCTIONAL STATREGY

The teacher should give emphasis on understanding of concept and various terms used in the subject. Practical exercises will reinforce various concepts.

.**MEANS OF ASSESSMENT**

- Class Test
- Home Assignment – Attendance
- Sessional Test

RECOMMENDED BOOKS

1. Introduction to the principles of leather manufacture -S.S.Dutta.
2. Indian leather technology association, Calcutta.
3. Practical leather technology - j.c. Thorstenson, e. Kreiger publishing company – Malabar, Florida – 1993.
4. Theory and practice of leather manufacture - k.T. Sarkar
5. Leather technician hand book – J..H. Sharp House Leather Producer association, north Hampton – 1995.Clri publications, madras.

SUGGESTED DISTRIBUTION OF MARKS

Topic	**Time Allotted (Periods)**	**Marks Allotted (%)**
1	8	15
2	8	15
3	7	20
4	8	20
5	7	20
6	4	10
Total	**42**	**100**

3.3 ELEMENTRY MICROSCOPY AND MICROBIOLOGY

L	T	P
0	0	6

RATIONALE

The Quality Of The Final Leather Depends On The Quality Of Raw Material, Process Variations And Preservation Techniques. Systematic Microbiological Techniques Are Aimed To Develop The Understanding And Application Skills In The Student For Better Raw Material Selection, Better Process Variations, Up Gradation Of Lower Quality Materials In Leather Making.

LEARNING OUTCOME

After undergoing the subject, the students will be able

- To Know The Basic Techniques Of Microscopy Histology And Bacteriology.
- To Understand The Use Of These In Studying The Skin Structure And Action Of Bacteria, Fungi, Insects And Parasites Of Skin.
- To Identify The Defects During The Selection Of Raw Material
- To Apply The Methods For Effective Control Of Micro Organisms To Produce And Preserve The Quality Of Leathers.

DETAILED CONTENTS

	List of Practicals	
	1. Study Of Compound Microscope. 2. Examination of Grain Pattern of Buff Finished Leather Under Microscopic 3. Examination of Grain Pattern of Cow Finished Leather Under Microscopic 4. Examination of Grain Pattern of Goat Finished Leather Under Microscopic 5. Examination of Grain Pattern of Sheep Finished Leather Under Microscopic 6. Slide preparation techniques fixation, embedding, sectioning, staining, mounting 7. Preparation of Slide to examination of Anatomical Structure of Buff Finished Leather 8. Preparation of slide to examination of Anatomical Structure Of Cow	

	Finished Leather 9. Preparation of slide to examination of Anatomical Structure of Goat Finished Leather 10. Preparation of slide to examination of Anatomical Structure of Sheep Finished Leather 11. Microscopical examination of buff/cow leather effected by moulds. 12. Microscopical examination of goat/sheep leather effected by moulds 13. Microscopical examination of buff/cow leather effected by bacteria, 14. Microscopical examination of goat/sheep leather effected by bacteria	

INSTRUCTIONAL STRATEGY

The teacher should give emphasis on understanding of concept and various terms used in the subject. Practical exercises will reinforce various concepts.

MEANS OF ASSESSMENT

- Class Test
- Home Assignment – Attendance
- Sessional Test

RECOMMENDED BOOKS

1. Progress in leather science, BLMRA, London.
2. A.J.Salle, fundamental principles of bacteriology, MC.Graw Hill book company.
3. Histological characteristics of Indian Hides and Skins – CLRI publication.
4. J.C.Tancouse, Skin, hide and leather defects.
5. Veterinary, Parasitology, E.Gurr.
6. B.S malik – Practical Manual of Veterinary Bacteriology, Mycology and Virology – Tata Mcgrawhill Co.
7. F.W. Tanner, Practical Bacteriology, John wiley.

3.4 ELEMENTS OF FOOTWEAR TECHNOLOGY

L	T	P
2	0	6

RATIONALE

The syllabus is designed to provide foundational knowledge of footwear materials, manufacturing processes, design principles, and industry practices.

LEARNING OUTCOME

- To Understand The Construction Of A Shoe And Its Components.
- To Understand The Design And Pattern Development.
- To Understand The Cutting, Preclosing And Closing.
- To Understand The Method Of Lasting

DETAILED CONTENTS

Unit No.	Content	Periods
1	**INTRODUCTION TO FOOTWEAR AND ITS SIGNIFICANCE** 1. Classification of footwear: Casual, formal, sports, orthopaedic, safety etc. 2. Overview of the Global and Indian footwear industry: Market size & key players. 3. Components of footwear: upper, lining, insole, sole, heel, counter etc. **Practicals** 1. Study of History and evolution of footwear. 2. Study of footwear in fashion trends, and cultural contexts. 3. Study of Components of footwear.	06
2	**FOOTWEAR MATERIALS** 1. Types of leather used in footwear: grain, suede, nubuck 2. Non-leather materials: synthetics, textiles, polymeric materials (PU, PVC, TPR, rubber) 3. Footwear adhesives – types and applications 4. Footwear linings, socks, toe puff, stiffeners, shanks, sole materials **Practicals** 1. Study of footwear materials like leather, synthetics, textiles, polymeric materials PU, PVC, TPR, rubber. 2. Study of Footwear adhesives. 3. Study of Footwear component like linings, socks, toe puff,	06

	stiffeners, shanks, sole materials	
3	**FOOTWEAR DESIGN AND PATTERN MAKING** 1. Fundamentals of footwear design and Pattern making 2. Anatomy of the foot and its relation to footwear design 3. Introduction to last and its types 4. Tools used in designing and pattern cutting **Practicals** 1. Study of shoe size system (U.S, English &French) 2. Study of different types of last. 3. Study of Tools used in pattern cutting	06
4	**FOOTWEAR MANUFACTURING PROCESSES** 1. Overview of manufacturing stages: Cutting, stitching, lasting, sole attachment, and finishing. 2. Cutting techniques: Hand Clicking, Clicking by machine, and laser cutting. 3. Stitching methods: Lock stitch, chain stitch, and decorative stitching. 4. Lasting process: Toe lasting, Sheet lasting, Slip on lasting. 5. Sole attachment techniques: Cementing, direct injection, vulcanizing, and stitching. 6. Finishing processes: Polishing, edge trimming, and quality inspection & packing **Practicals** 1. Preparation of Inner Form, Outer form & Mean Form. 2. Preparation of upper of its different components. 3. Lasting process different types of shoes. 4. Study of Sole attachment techniques.	05
5	**UNIT- V: (Footwear Machinery and Tools)** 1. Machines used in cutting, closing, lasting, and bottoming 2. Maintenance and safety of footwear machinery 3. Tools used in footwear making – hammers, knives, measuring tools **Practicals** 1. Preparation of Derby& Oxford shoe standard & its components (upper & lining). 2. Upper Preparation of Oxford & Derby.	05

INSTRUCTIONAL STATREGY

The teacher should give emphasis on understanding of concept and various terms used in the subject. Practical exercises will reinforce various concepts.

.**MEANS OF ASSESSMENT**

- Class Test
- Home Assignment – Attendance
- Sessional Test

RECOMMENDED BOOKS

1. Sarkar K.T THEORY & PRACTICEOF LEATHER MANUFACTURE
2. Dutta S.S AN INTRODUCTION OF THE PRINCIPLES OF LEATHER MANUFACTURE.
3. Compressive FOOTWEAR TECHNOLOGY MR. SOMNATH GANGULY

SUGGESTED DISTRIBUTION OF MARKS

Topic	Time Allotted (Periods)	Marks Allotted (%)
1	5	15
2	5	15
3	6	20
4	6	25
5	6	25
Total	**28**	**100**

3.5 Open Elective-I

L T P
2 0 0

3.5.1 Energy Conservation & Audit

Course Learning Objectives:

- To Identify demand supply gaps in present scenario.
- To understand conservations approaches to an industry.
- To draw the energy flow diagram of an industry.
- To identify energy wastage and suggest alternative methods.
- To understand the concepts energy audit.

Course Content:

UNIT-I: Introduction: General energy problem, Sector wise Energy consumption, demand supply gap, Scope for energy conservation and its benefits; Energy Efficiency Principle – Maximum energy efficiency, Maximum cost effectiveness; Mandatory provisions of EC act; Features of EC act-Standards and labeling, designated consumers, Energy Conservation Building Codes (ECBC);

Unit-II: Energy Conservation Approaches In Industries: Methods and techniques of energy conservation
in ventilation and air conditioners- compressors pumps, fans and blowers - Area Sealing, Insulating the Heating / cooling fluid pipes, automatic door closing- Air curtain, Thermostat / Control;
Energy conservation in electric furnaces, ovens and boilers.

Unit-III: Energy Conservation Option: New equipment, technology, staffing, training; Calculation and costing of energy conservation project; Depreciation cost, sinking fund method. Cost evaluation by Return On Investment(ROI) and pay back method etc.

Unit-IV: Performance improvement of existing power plant: cogeneration, small hydro, DG Set; Demand side management; Load response programmes; Types of tariff and restructuring of electric tariff Technical measures to optimize T and D losses.

Unit-V: Energy Audit: Energy audit and its benefits; Energy flow diagram; Preliminary, Detailed energy audit; Methodology of -preliminary energy audit and Detailed energy audit – Phase I, Pre audit, Phase II- Audit and Phase III- Post audit; Energy audit report; Electrical Measuring Instruments
- Power Analyzer.

Reference Books:

1. Electric Energy Generation, Utilisation and Conservation Sivaganaraju, S Pearson, New Delhi, 2012
2. Project Management, Prasanna Chandra, Tata Mcgraw Hill, New Delhi
3. O.P. Jakhar, Energy Conservations in Buildings, Khanna Publishing House, New Delhi
4. Financial Management, Prasanna Chandra Tata Mcgraw Hill, New Delhi.
5. Energy management Handbook, Prasanna Chandra, Tata Mcgraw Hill, New Delhi.
6. O.P. Gupta, Energy Technology, Khanna Publishing House, New Delhi (ed. 2018)

3.5.2 Economic Policies in India

Course Learning Objectives:

The objective of this course is to familiarize the students of different streams with the basic concepts, structure, problems and issues concerning Indian economy.

Course Content:

UNIT-I: Basic features and problems of Indian Economy: Economic History of India; Nature of Indian Economy, demographic features and Human Development Index, Problems of Poverty, Unemployment, Inflation, income inequality, Black money in India.

UNIT-II: Sectoral composition of Indian Economy: Issues in Agriculture sector in India, land reforms Green Revolution and agriculture policies of India,

UNIT-III: Industrial development, small scale and cottage industries, industrial Policy, Public sector in India, service sector in India.

UNIT-IV: Economic Policies: Economic Planning in India, Planning commission v/s NITI Aayog, Five Year Plans, monetary policy in India, Fiscal Policy in India, Centre state Finance Relations, Finance commission in India. LPG policy in India

UNIT-V: External sector in India: - India's foreign trade value composition and direction, India Balance of payment since 1991, FDI in India, Impact of Globalization on Indian Economy, WTO and India.

Reference Books:

1. Dutt Rudder and K.P.M Sunderam (2017). Indian Economy. S Chand & Co. Ltd. New Delhi.

2. Mishra S.K & V.K Puri (2017). Indian Economy and –Its Development Experience. Himalaya

Publishing House.

3. Singh, Ramesh, (2016): Indian Economy, Tata-McGraw Hill Publications, New Delhi.

4. Dhingra, I.C., (2017): March of the Indian Economy, Heed Publications Pvt. Ltd.

5. Karam Singh Gill, (1978): Evolution of the Indian Economy, NCERT, New Delhi

6. Kaushik Basu (2007): The Oxford Companion to Economics of India, Oxford University Press.

Advance Skill Development

To fulfill the requirements for Advanced Skill Development, a minimum of 20 hours of skill certification is necessary. This certification must be obtained from a recognized national or international agency or institute. The assessment and certification process will be conducted by the respective agency or institute. Students must present their certificate to earn 02 credits for this subject.

Summer Internship-I (4 weeks)

RATIONALE

It is needless to emphasize further the importance of Industrial/summer Training of students during their 3 years of studies at Polytechnics. It is industrial training, which provides an opportunity to students to experience the environment and culture of industrial production units and commercial activities undertaken in field organizations. It prepares student for their future role as diploma engineers in the world of work and enables them to integrate theory with practice. Polytechnics have been arranging industrial training of students of various durations to meet the above objectives.

DETAILED CONTENT

This document includes guided and supervised industrial/summer training of 4 weeks duration to be organised during the semester break starting after first year i.e. after 2nd semester examinations. The concerned HODs along with other teachers will guide and help students in arranging appropriate training places relevant to their specific branch. It is suggested that a training schedule may be drawn for each student before starting of the training in consultation with the training providers. Students should also be briefed in advance about the organizational setup, product range, manufacturing process, important machines and materials used in the training organization.

Equally important with the guidance is supervision of students training in the industry/organization by the teachers. Students should be encouraged to write daily report in their diary to enable them to write final report and its presentation later on.

An Internal assessment of 50 marks has been provided in the study and evaluation scheme of 3th Semester. Evaluation of summer training report through viva-voce/presentation aims at assessing students understanding of materials, industrial process, practices in industry/field organization and their ability to engage in activities related to problem solving in industrial setup as well as understanding of application of knowledge and skills learnt in real life situations.

Teachers and students are requested to see the footnote below the study and evaluation scheme of 2nd semester for further details.

The teacher along with field supervisors will conduct performance assessment of students. The components of evaluation will include the following:

a)	Punctuality and regularity	15%
b)	Initiative in learning new things	15%
c)	Presentation and Viva	15%
d)	Industrial training report	55%

4.1 POST TANNING AND FINISHING OPERATIONS

L	T	P
2	0	10

RATIONALE

To provide a comprehensive understanding of post-tanning and finishing operations in leather processing, focusing on the chemical, mechanical, and aesthetic transformations required to produce high-quality finished leather. Students will learn the principles, techniques, and environmental considerations involved in these processes.

LEARNING OUTCOME

After undergoing the subject, the students will be able to

- Understand The Post Tanning & Finishing Operation.
- Understand The Application of All Tannery Machines.
- Understand The Application of All Wet End Chemicals.

DETAILED CONTENTS

Unit No.	Content	Periods
1	**PREPARATION FOR POST-TANNING OPERATIONS** 1. Sorting/ Selection of Wet Blue. 2. Mechanical operation in Post Tanning: Sammying, Splitting, Shaving operation. 3. SEQUENCE OF POST-TANNING PROCESSES: FROM WET BLUE TO CRUST LEATHER 4. Weighing: Determining Shaved Weight For Chemical dosing in Subsequent Processes. 5. Wet-back / Acid wash, Re-chroming Process. **Practicals** 1. Study of Preparation of Post – Tanning Operations 2. Study of Selection of Wet Blue. 3. Knowledge of Various Defects In All Post Tanning Operations.	06
2	**NEUTRALIZATION & RETANNING PROCESS** **NEUTRALIZATION**:	06

	1. Object*:* Adjusting pH in wet blue 2. Chemicals used: sodium bicarbonate, sodium formate and other neutralizing agents 3. Effect of neutralization on dyeing/fat liquoring process. 4. Effect Of Neutralization With Organic Salts and Syntans 5. Process control: pH monitoring, time, and temperature etc 6. What Is Spue. **RETANNING** 1. Retanning & its object. 2. Types of Retanning agents: a. Vegetable tannins (e.g., mimosa, quebracho). b. Synthetic tannins (syntans). c. Resins 3. Process parameters: Drum speed, temperature, and chemical concentration etc. 4. Selection of Retanning agents based on leather type (garment, upholstery, shoe upper) 5. Bleaching, its object and methods **Practicals** 1. Study of Process control: pH monitoring, time, and temperature in Neutralization process etc 2. Study of Chemicals used in Neutralization process. 3. Study of Chemicals used in retanning process.	
3	**UNIT-III:** ***(DYEING & FAT LIQUORING PROCESS)*** **DYEING**: 1. Purpose: Imparting colour to leather for aesthetic appeal. 2. Types of dyes: Acid dyes, basic dyes, metal-complex dyes, and natural dyes. 3. Dyeing techniques: Drum dyeing, spray dyeing and brush dyeing. 4. Principles of dyeing and colour matching of dyeing 5. Factors affecting dye uptake: pH, temperature, and leather type etc 6. Fastness properties (light, rubbing, perspiration) 7. Role of auxiliaries in leather dyeing process 8. Restricted/Banned Aryle Amine (Azo Dyes) **FATLIQUORING**:	06

	1. Objective: Lubricating leather fibres to improve softness and flexibility. 2. Types of fat liquors: Natural (e.g., sulfated oils) sulphonated oils, and synthetic. 3. Emulsion stability, penetration depth and application stages. 4. Control of softness vs. grain firmness 5. Comparison of natural vs. synthetic fat liquors 6. Issues: Fat spew, uneven softness, stickiness **Practicals** 1. Study of Dyeing techniques in Dyeing process etc *2.* Study of Auxiliaries used in leather dyeing process. 3. Study of Types of Fat liquors 4. Study of Fat liquoring Issues: Fat spew, uneven softness, stickiness.	
4	**FIXATION, DRYING AND CONDITIONING** **FIXATION**: 1. Fixation of Leather and Choice of Chemicals For Fixing/Fixation Process 2. Check & Drain / Wash & Piling Over Night & Ageing 3. Sammying (If Need) And Setting . **DRYING** *1.* Drying & Its Object. 2. Types Of Drying Methods. 3. Crust 4. Conditioning and staking/Mollisa **Practicals** 1. Manufacturing Processing of Upper Leather From Wet Blue To Crust Leather. 2. Study of Chemicals Used To Make Crust Leather.	05
5	**UNIT- V: (FINISHING PROCESS)** 1. OBJECTS & TYPES OF FINISHES/ FINISHING 2. FINISHING LAYERS/ COATS 3. FINISHING MATERIALS 4. SPECIALIZED FINISHING TECHNIQUES (WAXY, NUBUCK, SUEDE, METALLIC ETC**)** 5. MACHINERY USED IN LEATHER FINISHING 6. Properties, Defects & Selection Of Finished Leather 7. Application Of Measuring Machines, Packing/Dispatch.	05

	Practicals 1. Manufacturing Processing Of Upper Leather From Crust To Finished Leather. 2. Study Of Chemicals Used To Make Finished Leather 3. Study Of Post Tanning & Finishing Machines.	

INSTRUCTIONAL STATREGY

The teacher should give emphasis on understanding of concept and various terms used in the subject. Practical exercises will reinforce various concepts.

.**MEANS OF ASSESSMENT**

- Class Test
- Home Assignment – Attendance
- Sessional Test

RECOMMENDED BOOKS

1. Modern Practice Of Retanning, Dyeing And Finishing By K.T.Sarkar – Chennai.
2. Leather Technician Hand Book By J.H.Sharp House, Leather Producers Association – North Hampton – 1995.
3. C.Koteswara Rao And M.S.Olivannan Lecture Notes On Dyeing And Finishing Of Leathers –Clri – Chennai – 20. C.L.R.I Publication – Madras – 20
4. Practical Leather Technology By J.Thornstein, E.Krieger Publishing Company – Malabar – Florida – 1993.
5. Introduction To The Principles Of Leather Manufacture - S.S.Dutta.
6. Practical Leather Technology - J.C. Thorstenson, E. Kreiger Publishing Company – Malabar, Florida – 1993.
7. Theory And Practice Of Leather Manufacture - K.T. Sarkar
8. Leather Technician Hand Book By J.H. Sharphouse Leather Producer Association, North Hampton – 1995

SUGGESTED DISTRIBUTION OF MARKS

Topic	**Time Allotted (Periods)**	**Marks Allotted (%)**
1	6	25
2	6	25
3	6	20
4	5	15
5	5	15
Total	**28**	**100**

4.2 PROCESS OF HEAVY AND SPORTS LEATHER

L	T	P
0	0	10

RATIONALE

The objective of the course is to give focus on the manufacture of heavy & sports leather and application of different types of heavy & sports leather.

LEARNING OUTCOME

After undergoing the subject, the students will be able to

- Understand The Manufacturing Process Of Heavy & Sports Leather.
- Understand The Selection Of Raw Materials & Wet Blue & Crust & Finished Leather.
- Understand The Checking Point Of Each Process.

DETAILED CONTENTS

Unit No.	List of Practicals	Periods
	MANUFACTURE PROCESS OF SOME IMPORTANT HEAVY & SPORTS LEATHER. **A- Manufacture process of some important heavy leathers like**: 1. Sole leather, 2. Saddlery leather 3. Belting leather, 4. Safety leather, 5. Industrial Glove Leather, 6. Waterproof leather, 7. Luggage leather, 8. Picking band leather. **B- Manufacture process of some important Sports leathers like**: 1. Cricket ball leather 2. Football leather 3. Glove leather for wicket keepers 4. Hockey ball leather 5. Basket ball leather 6. Rugby ball leather 7. Volley ball leather	

INSTRUCTIONAL STRATEGY

The teacher should give emphasis on understanding of concept and various terms used in the subject. Practical exercises will reinforce various concepts.

MEANS OF ASSESSMENT

- Class Test
- Home Assignment – Attendance
- Sessional Test

RECOMMENDED BOOKS

- Choichi Ogiwara, 'A Practical Guide To Heavy Leather Processing', Fuel And Leather Research Centre Kavachi – 1980.
- K.T.Sarkar. Theory And Practice Of Leather Manufacture.
- S.S.Dutta. Introduction To The Principles Of Leather Manufacture.
- Indian Leather Technological Association. Calcutta – 1980. CLRI, Publication, Chennai.

4.3 LEATHER TRADE ENGINEERING

L	T	P
0	0	4

RATIONALE

The objective of the course is to give focus on the selection of tannery sites, evolution and application of tannery machines and maintenance used in leather manufacture.

LEARNING OUTCOME

After undergoing the subject, the students will be able to know

- Leather Production, Which Involves Lot Of Machinery Operation.
- Understand The Working Principles Of Various Machines Will Provide Effective Supervision For Getting Finished Leather Of Good Quality.
- The Student Will Be Able To Select A Site For Starting A Tannery, Select The Machinery, Can Visualize The Trouble Shooting And Can Attend To Minor Maintenance.

DETAILED CONTENTS

Unit No.	**List of Practicals**	
	1. Draw A Tannery Layout To Make Wet Blue 2. Draw A Tannery Layout To Make Crust 3. Draw A Tannery Layout To Make Finished Leather) 4. Study The Functions of Various Pre-taining Machines. 5. Study The Functions of Various Post Tanning Machines 6. Study The Functions of Various Finishing Machines 7. Study of General Maintenance of Various Pre-taining Machines. 8. Study of General Maintenance of Various Post Tanning Machines 9. Study of General Maintenance of Various Finishing Machines 10. Study of Drum 11. Study of Pits, 12. Study of Paddles 13. Study The Application of Boiler Used In Tannery. 14. Study of Safety Engineering & First Aid	

INSTRUCTIONAL STRATEGY

The teacher should give emphasis on understanding of concept and various terms used in the subject. Practical exercises will reinforce various concepts.

MEANS OF ASSESSMENT

- Class Test
- Home Assignment – Attendance
- Sessional Test

RECOMMENDED BOOKS

1. SARKAR K.T THEORY & PRACTICEOF LEATHER MANUFACTURE
2. DUTTA S.S AN INTRODUCTION OF THE PRINCIPLES OF LEATHER MANUFACTURE.
3. LEATHER TECHNICIANS HANDBOOK J.H SHARPHOUSE

4.4 TANNERY WASTE MANAGEMENT

L T P
4 0 0

RATIONALE

The objective of the course is to give focus on the tannery wastes, how to minimization of this and application of techniques to clean production in the leather processing.

LEARNING OUTCOME

After undergoing the subject, the students will be able

- To understand TANNERY WASTES
- To understand the treatment of effluent.
- To understand the recovery & reuse of chromium.
- To understand the utilization of solids of tannery.
- To understand the cleaner process technology

DETAILED CONTENTS

Unit No.	Content	Periods
1	**INTRODUCTION TO TANNERY WASTES)** 1. Overview of Indian Leather Industry 2. Overview of Leather Manufacturing Process 3. Classification of Tannery Waste : a. SOLID WASTE: FLESHINGS, TRIMMINGS, SHAVINGS, SLUDGE, HIDES, ETC. b. LIQUID WASTE: HIGH BOD, COD, TDS, SULFIDES, CHROMIUM, AMMONIA c. GASEOUS EMISSIONS: VOCS, HYDROGEN SULFIDE, AMMONIA, SULFUR DIOXIDE 4. CHARACTERISTICS OF TANNERY WASTEWATER: a. PHYSICAL, CHEMICAL, AND BIOLOGICAL PARAMETERS 5. SOURCES & CHARACTERISTICS OF TANNERY WASTE (BEAMHOUSE, TANNING, POST-TANNING & FINISHING)	08
2	**ENVIRONMENTAL REGULATIONS AND COMPLIANCE** 1. ENVIRONMENTAL IMPACTS OF TANNERY WASTE 2. STANDARDS FOR TANNERY DISCHARGE (GLOBAL & NATIONAL) 3. NATIONAL AND INTERNATIONAL REGULATION NORMS (CPCB, SPCB, BIS, REACH ,WHO STANDARDS) 4. ISO 14001 CERTIFICATION	08

	5. PUBLIC HEALTH AND OCCUPATIONAL SAFETY	
3	**CHROMIUM RECOVERY & E.T.P** 1. CHROMIUM IN TANNING OPERATIONS 2. PRECIPITATION AND RECOVERY METHODS (LIME, MAGNESIUM OXIDE, ETC.) 3. Process Flow Diagram Of Chrome Recovery & Reuse System 4. REUSE OF RECOVERED CHROMIUM (CHROME LIQUOR) IN TANNING OPERATION **E.T.P** 1. **PRIMARY TREATMENT** i. SCREENING, EQUALIZATION, SEDIMENTATION ii. COAGULATION AND FLOCCULATION (E.G., USING FECL3, ALUM) 2. **SECONDARY TREATMENT (**BIOLOGICAL PROCESSES**)**: i. AEROBIC AND ANAEROBIC BIOLOGICAL SYSTEMS ii. ANAEROBIC DIGESTION FOR BIOGAS PRODUCTION 3. **TERTIARY TREATMENT**: FILTRATION, ADSORPTION (E.G., ACTIVATED CARBON), AND REVERSE OSMOSIS.	07
4	**SLUDGE & SOLID WASTE MANAGEMENT** 1. Sludge From CETP& ETP 2. Quantity & Types Of Sludge 3. Sludge Treatment & Disposal Method 4. Solid Waste From Tannery 5. Quantity & Types Of Solid Waste 6. Reuse & DISPOSAL OF SOLID TANNERY WASTE	08
5	**GLUE/GELATIN, LEATHER BOARD, DOG CHEW LEATHER** 1. Manufacturing Process/Properties/Application of Glue/ Gelatin 2. Manufacturing Process /Properties/Application of Leather board 3. Manufacturing Process /Properties/Application of Dog chew Leather.	07

6	**CLEANER PRODUCTION TECHNIQUES** 1. Waste minimization & WATER CONSERVATION 2. POLLUTION PREVENTION HIERARCHY: REDUCE → REUSE → RECYCLE → IN TANNERY WASTE MANAGEMENT 3. Clean technology/Cleaner production & its importance and barriers 4. Short notes on clean technological options in leather processing unit. 5. Zero-Liquid Discharge (ZLD)	04

INSTRUCTIONAL STATREGY

The teacher should give emphasis on understanding of concept and various terms used in the subject. Practical exercises will reinforce various concepts.

MEANS OF ASSESSMENT

- Class Test
- Home Assignment – Attendance
- Sessional Test

RECOMMENDED BOOKS

1. An introduction to the principal of leather manufacture dutta s.s
2. Sharp House J.H Leather Technician's Handbooks.
3. Thorestensen T.C. Practical Leather Technology.
4. Sarkar K.T. Theory & Practice Of Leather Manufacture.
5. Waste Water Engineering – Treatment, Disposal, Reuse By Mcaffe And Eddy – Inc. Tata, Mc. Graw Hill Publishing Co. Ltd., New Delhi.

SUGGESTED DISTRIBUTION OF MARKS

Topic	Time Allotted (Periods)	Marks Allotted (%)
1	8	15
2	8	15
3	7	20
4	8	20
5	7	20
6	4	10
Total	**42**	**100**

4.5 ESSENCE OF INDIAN KNOWLEDGE AND TRADITION
(Qualifying)

L	T	P
2	-	-

COURSE OBJECTIVE:
Understand the fundamental aspects of the Indian Knowledge System, its integration with modern science, principles of Yoga and holistic healthcare, and practical applications in contemporary contexts.

LEARNING OUTCOMES:
Upon completion of the course, the student will be able to demonstrate knowledge of the following topics:

- Overview, importance, and relevance of the Indian Knowledge System, including Vedas, Upavedas, Vedangas, and Upangas.
- Relevance of science and spirituality, and contributions of ancient Indian science and technology.
- Basic principles of Yoga, benefits of holistic healthcare, and integration with modern healthcare.
- Practical applications and case studies of the Indian Knowledge System's relevance today.

COURSE CONTENTS

Unit 1: Introduction to Indian Knowledge System (16 Periods)

Overview of Indian Knowledge System

- Importance and relevance
  - Introduction to the Vedas
  - Upavedas
  - Vedangas
  - Upangas

Unit 2: Modern Science and Indian Knowledge System (06 Periods)

- Relevance of Science and Spirituality,
- Science and Technology in Ancient India,

Unit 3: Yoga and Holistic Healthcare (04 Periods)

- Basic principles of Yoga
- Benefits of holistic healthcare practices
- Integration with modern healthcare

Unit 4: Case Studies / Assignment (02 Periods)

- Practical Applications / Case studies demonstrating the relevance of Indian Knowledge System in modern times

MEANS OF ASSESSMENT

- Assessment
- Viva -Voce Exam

4.6 Open Elective-II

L T P
2 0 0

4.6.1 Internet of Things

Course Content:

Unit I - Introduction to Internet of Things

• Define the term “Internet of Things”
• State the technological trends which have led to IoT.
• Describe the impact of IoT on society.

Unit II - Design consideration of IoT

• Enumerate and describe the components of an embedded system.

• Describe the interactions of embedded systems with the physical world.

• Name the core hardware components most commonly used in IoT devices.

Unit III Interfacing by IoT devices

• Describe the interaction between software and hardware in an IoT device.

• Explain the use of networking and basic networking hardware.

• Describe the structure of the Internet.

SUGGESTED LEARNING RESOURCES:

1 Internet of Things Raj Kamal McGraw Hill Education; First edition (10 March 2017) ISBN 978-9352605224

2. Internet of Things: A Hands-On Approach Arsheep Bahge and Vijay Madisetti Orient Blackswan Private Limited - New Delhi; First edition (2015) ISBN : 978-8173719547

SUGGESTED SOFTWARE/LEARNING WEBSITES:

1. https://www.raspberrypi.org/blog/getting-started-with-iot/

2. https://www.arduino.cc/en/IoT/HomePage

3. https://www.microchip.com/design-centers/internet-of-things

4. https://learn.adafruit.com/category/internet-of-things-iot

5. http://esp32.net/

4.1.2 PROJECT MANAGEMENT

Course Learning Objectives:

• To develop the idea of project plan, from defining and confirming the project goals and objectives, identifying tasks and how goals will be achieved.

• To develop an understanding of key project management skills and strategies.

Content:

UNIT-I: Concept of a project: Classification of projects- importance of project management- The project life cycle- establishing project priorities (scope-cost-time)project priority matrix- work break down structure.

UNIT-II: Capital budgeting process: Planning- Analysis-Selection-Financing-Implementation-Review. Generation and screening of project ideas- market and demand analysis- Demand forecasting techniques. Market planning and marketing research process- Technical analysis

UNIT-III: Financial estimates and projections: Cost of projects-means of financing-estimates of sales and production-cost of production-working capital requirement and its financing-profitability projected cash flow statement and balance sheet. Break even analysis.

UNIT-IV: Basic techniques in capital budgeting: Non discounting and discounting methods-payback period- Accounting rate of return-net present value-Benefit cost ratio-internal rate of return. Project risk. Social cost benefit analysis and economic rate of return. Non-financial justification of projects**.**

UNIT-V: Project administration: progress payments, expenditure planning, project scheduling and network planning, use of Critical Path Method (CPM), schedule of payments and physical progress, time-cost trade off. Concepts and uses of PERT cost as a function of time, Project Evaluation and Review Techniques/cost mechanisms. Determination of least cost duration. Post project evaluation. Introduction to various Project management softwares.

Reference Books:

1. Project planning, analysis, selection, implementation and review – Prasannachandra – Tata McGraw Hill

2. Project Management – the Managerial Process – Clifford F. Gray & Erik W. Larson - McGraw Hill

3. Project management - David I Cleland - Mcgraw Hill International Edition, 1999

4. Project Management – Gopala krishnan – Mcmillan India Ltd.

5. Project Management-Harry-Maylor-Peason Publication

Advance Skill Development

To fulfill the requirements for Advanced Skill Development, a minimum of 20 hours of skill certification is necessary. This certification must be obtained from a recognized national or international agency or institute. The assessment and certification process will be conducted by the respective agency or institute. Students must present their certificate to earn 02 credits for this subject.

	Summer Internship-II	L	T	P	C
	(4-6 weeks) after IVth Sem	0	0	0	2

RATIONALE

It is needless to emphasize further the importance of Industrial/summer Training of students during their 3 years of studies at Polytechnics. It is industrial training, which provides an opportunity to students to experience the environment and culture of industrial production units and commercial activities undertaken in field organizations. It prepares student for their future role as diploma engineers in the world of work and enables them to integrate theory with practice. Polytechnics have been arranging industrial training of students of various durations to meet the above objectives.

DETAILED CONTENT

This document includes guided and supervised industrial/summer training of 4-6 weeks duration to be organised during the semester break starting after first year i.e. after 4th semester examinations. The concerned HODs along with other teachers will guide and help students in arranging appropriate training places relevant to their specific branch. It is suggested that a training schedule may be drawn for each student before starting of the training in consultation with the training providers. Students should also be briefed in advance about the organizational setup, product range, manufacturing process, important machines and materials used in the training organization.

Equally important with the guidance is supervision of students training in the industry/organization by the teachers. Students should be encouraged to write daily report in their diary to enable them to write final report and its presentation later on.

An Internal & External assessment of 60 & 40 marks has been provided in the study and evaluation scheme of 5th Semester. Evaluation of summer training report through viva-voce/presentation aims at assessing students understanding of materials, industrial process, practices in industry/field organization and their ability to engage in activities related to problem solving in industrial setup as well as understanding of application of knowledge and skills learnt in real life situations.

Teachers and students are requested to see the footnote below the study and evaluation scheme of 2nd semester for further details.

The teacher along with field supervisors will conduct performance assessment of students. The components of evaluation will include the following:

a)	Punctuality and regularity	15%
b)	Initiative in learning new things	15%
c)	Presentation and Viva	15%
d)	Industrial training report	55%

10. RESOURCE REQUIREMENT

10.1 PHYSICAL RESOURCES

(A) Space requirement

Norms and standards laid down by All India Council for Technical Education (AICTE) are to be followed to work out space requirement in respect of class rooms, tutorial rooms, drawing halls, laboratories, space required for faculty, student amenities and residential area for staff and students.

(B) Equipment requirement:

Following Laboratories are required for diploma programme in Leather Technology (Tanning):

- Communication Laboratory /Language Lab
- Applied Physics Laboratory
- Applied Chemistry Laboratory
- Engineering Drawing
- Electrical and Electronic Laboratory
- Basics of IT/Computer lab
- Footwear Workshop
- Leather Goods Workshop
- Testing and Quality Control Lab
- Footwear Clicking
- Elements of Leather Technology
- Shoe Design Lab
- Footwear Closing Lab
- CAD/CAM Lab For Footwear
- Footwear Machinery
- Footwear Construction Lab
- Leather Goods Manufacturing Lab
- Footwear Material Testing Lab

QUALITY CONTROL (LEATHER) LAB & TESTING AND QUALITY CONTROL OF FOOTWEAR LAB		
Sr.	Particulars	Unit
A	**CHEMICAL TESTING LAB**	
1-	Proctor Extractor	01
2-	Muffle Furnace	01
3-	Water distillation plant	01
4-	Platinum Crucible	02
5-	Gas Plant	01
6-	Oven	02
7-	Soxhlet Apparatus	02
8-	pH Meter	02
9-	Magnetic Stirrer	01
10-	Hot plate & Mantle Heater	02
11-	Refrigerator	01
12-	Fuming cup board	01
13-	Mantle Heater set	01
14-	Weighing Balance	01
B	**PHYSICAL TESTING LAB**	
1.	Shrinkage Tester	01
2.	Humidity & Temperature Control chamber	01
3.	Thickness Measuring Gauge	01
4.	Hardness tester	01
5.	Ross Flexing M/C	01
6.	Flexometer For Upper Leather	01
7.	Colour Fastness Tester (Dry & Wet)	01

8.	Lasto meter & Tensometer	01
9.	Sole adhesion tester	01
10	Shoe Hardness Tester for Rubber	01
11	Furniture & Fixture	As req.
12.	Kubelka apparatus	02
13.	Water Absorption Machine Dynamic (Heavy Leather)	01
14	Water vapour permeability tester	01
15.	Abrasion Tester	01
16	Dynamic water Absorption tester	01
17.	Tensile Testing machine (Computerized)	01
18.	Compressibility & Resiliency for Sole Leather	01

TANNERY WORKSHOP **(Experimental Tannery/Leather Trade Engg.)**		
Sr.	Particulars	Unit
1-	Wooden paddle	02
2-	Small experimental drum steel	02
3-	Spray booth with exhaust fan etc	01
4-	Wooden horses	02
5-	Fleshing and scudding Knives	02
6-	Fleshing and scudding beams	02
7-	Misc tools	
8-	Sammying Machine	01
9-	Splitting Machine	01
10-	Shaving Machine	01
11-	Setting Machine	01
12-	Toggling Frame	02

13-	Toggles clips	100
14-	Drying Chamber	01
15-	Molisha Machine	01
16-	Buffing Machine 1800 mm (Double Width)	01
17-	Hydraulic Press (Ironing & Embossing)	01
18-	Plate for hydraulic press(Different Grain Pattern)	05
19-	Electronic Balance	01
20-	Compressor	01
21-	Seasoning Table-II	01
22-	Spray Gun	01
23-	Thickness Measuring Gauge	01
24-	Baby Boiler	01

MICROSCOPY & MICROBIOLOGY LAB		
Sr.	**Particulars**	**Unit**
1-	Refrigerator (Medium Size)	1
2-	Clinical Microscope	2
3-	Microtome	1
4-	Slide Cabinet	1
5-	Stereo Microscope	1
6-	Compound Microscope	10
7-	Humidifying Chamber	1
8-	Autoclave	1
9-	Weighing Balance	1
10-	Optical Microscope	1

Sr. No.	Description	**Qty**	**Total Price (Rs)**
COMMUNICATION LABORATORY/Language Lab (As per the DTE Specification)			
1.	Computer Server	01	1,28,000
2.	Headphone With Mic	01	
3.	Webcam: HD	01	
4.	Server OS; Windows/Linux	01	
5.	Monitor	01	
6.	Desktop Computer	30	13,20,000
7.	UPS 5KVA Online (At Least 30 Min. backup)	01	1,25,000
8.	Computer Chair and Table	30	2,40,000
9.	AC	02	80,000
10.	Laser Printer	01	10,000
11.	LAN Setup	-	20,000

12.	Language lab Software License/ Open Source	01	1,00,000
13.	Misc. Items	-	10,000

APPLIED PHYSICS LABORATORY

1.	Vernier calipers Working length 160 mm, Internal and external dia with locking arrangement	12	2,000
2.	Screw Gauges Working length 15 mm, pitch 0.5 mm, least count .005 mm	12	2,000
3.	Spherometers Distance between legs 2.5 mm, pitch 0.5 mm, least count .005 mm.	12	2,000
4.	Mirrors (convex, concave)	5 Each	1,500
5.	Pendulum Setup	02	4,000
6.	Gravesand's Apparatus	02	3,000

7.	Inclined Plane Setup	02	2,000
8.	Flywheel Setup	02	4,000
9.	Prism	05	1,500
10.	Spectrometer	02	25,000
11.	DC Ammeters Moving coil weston-type ammeter with ebonite stand	10	3,500
12.	DC Miliammeters	2	1,000
13.	DC Microammeters	2	700
14.	DC voltmeters	10	700
15.	DC Millivoltmeters	10	2,000
16.	Sensitivity Galvanometer	2	800
17	Student Galvanometers	10	4,000
18.	Demonstration type DC Ammeters Range; 0 to 1 Amp.	2	1,000

19.	D type DC Voltmeter Range : 0 to 1 Volt	2	1,000
20.	D type Galvanometers Sensitivity : 20 microamperes per scale division,	8	8,000
21.	Resistance boxes (dial type) assorted	8	8,000
22.	Rheostats	10	4.000
23.	Miscellaneous items (Spring, Pan, Glycerine, Optic fibre, Ferromagnetic material)	LS	2,000
24.	Fortin's Barometer (Wall type)	2	20,000
25.	Stoke's Apparatus	2	10,000
26.	Gumther's Apparatus	2	16,000
27.	Resonance Tube Apparatus with accessories and Tuning fork set	2	14,000
28.	Sodium Lamp setup with Biprism	2	10,000
29.	Ohmic resistance coil	10	5,00

30.	Slide wire bridge	2	8,000
31.	PN Junction diode Apparatus	2	10,000
32.	Laser (as per requirement)	1	1,00,000
33.	Numerical aperture setup	1	25,000
34.	Miscellaneous	LS	3,000
APPLIED CHEMISTRY LABORATORY			
1.	Digital Balance	1	80,000
2.	Burette 50ml	30	3,000
3.	Pipette 25ml	60	4,000
4.	Beakers 100ml	60	4,000
5.	Burette stand	30	30,000
6.	Glazed tile	30	1,000
7.	Conical flask 50ml (Titration flask)	60	4,000

8.	Standard (Measuring) flask (to prepare standard solution) 250ml/100ml	30	6,000
9.	Able's Flash Point apparatus	2	10,000
10.	(1/10)°C thermometer	06	6,000
11.	Candles	20	100
12.	Crucible with lid	06	2,000
13.	Muffle furnace	1	18,000
14.	Decicators	06	8,000
15.	Pair of tongue (small and big)	24 (small) 2 (big)	2,000
16.	Chemicals		
	- EDTA-1 kg - Eriochrome Black-T(solochrome black T)-200g - Buffer solution (NH_3 - 2.5 ltr, NH_4Cl – 1 kg) - Zinc sulphate- 500g - H_2SO_4- 2.5 ltr - Phenolphthalein (as per	LS	20,000

	indicator requirement) - Methyl orange indicator (as per requirement) - Charcoal (as per requirement) - Kerosene- 1 ltr		
17.	Miscellaneous	LS	2,000

ENGINEERING DRAWING			
1.	Drawing Boards (700 x 500mm)	60	25,000
2.	Draughtsman Tables	60	1,80,000
3.	Draughtsman Stools	60	40,000
4.	Computer Aided Drawing (CAD) Software	30 User	5,00,000
5.	Model of different wooder joints	1	1,000
6.	Model of different screw threads	1	1,000
7.	Model of various locking devices	1	1,000
8.	Model of various joints	1	1,000
9.	Cut section Model of various couplings	1	3,000
10.	Miscellaneous	LS	5,000
	ELECTRICAL AND ELECTRONICS ENGINEERING LABORTORY		
1.	Voltmeter	5	7,500
2.	Ammeter	5	10,000
3.	CRO	1	15,000
4.	Wattmeter	5	10,000

5.	Multimeter	1	4,000
6.	Resistive load	1	4,000
7.	Regulated supply	1	8,000
8.	Signal generator	1	5,000
9.	Rheostat	2	2,500
10.	Lead acid battery	1	4,000
11.	Cables, Coils, Lamp (as per requirements)	LS	1,500
12.	Resistance, Inductor, Capacitor (as per requirements)	LS	1,500
13.	Miscellaneous/Electronics Components	LS	2,500
	BASICS OF IT /COMPUTER LAB		
1.	Computer System with latest configuration	60	48,00,000
2.	Printer (MFP)	05	250,000

3.	Printer (Laser)	05	250,000

4.	Antivirus Software	LS	60,000
5.	Internet Facility on Computers	LS	2,00,000
6.	LCD Projector	01	35,000
7.	On line UPS	05	500,000
8.	Miscellaneous	LS	5,000
CARPENTRY SHOP			
1	Work benches fitted with carpenter vices	5	20,000
2.	Circular saw grinder	1	6,000
3.	Wood cutting band saw-vertical	1	10,000
4.	Bench grinder	1	5,000
5.	Drilling machine	1	8,000
6.	Wood turning lathe	1	40,000
7.	Wood Planner	1	20,000

8.	Tool accessories measuring and marking Instruments	25	25,000
9.	Band saw blade brazing unit	1	10,000
10.	Miscellaneous	LS	1,500

Sr. No.	Description	Qty	Total Price (Rs)
PAINTING AND POLISHING SHOP			
1.	Spray gun with hose pipe	1	1,000
2.	Paint brushes	20	2,000
3.	Paint/Varnish	LS	2,000
4.	Air Compressor with 2 hp motor	1 set	10,000
5.	Miscellaneous	LS	2,000
ELECTRICAL SHOP			
1.	Tool kit (Plier, Screw driver, Knife, Steel rule, hammer, scriber, pincer steel tape etc.)	20	20,000
2.	Fuses, Switches, Plugs, Sockets, Ceiling rose, Wires, cleats, Clamps, Test lamp, Tester.(as per requirement)		8,000
3.	Electric Iron	1	1,500

4.	Electric kettle	1	1,500
5.	Ceiling fan/table fan	1	2,500
6.	Desert cooler	1	5,000
7.	Lead acid battery	2	8,000
8.	Battery Charger	1	6,000
9.	Miscellaneous		3,000
WELDING SHOP			
1.	Electrical welding transformer set with accessories	3	30,000
2.	Gas Cutting Unit	1	3,000
3.	Work benches with vices	3	5,000
4.	Welding generator set	1	10,000
5.	Oxy acetylene welding set with accessories	1	7,000
6.	Acetylene generating set	1	6,000

7.	Electric welder tool kit	10	10,000
8.	Projection welding machine	1	15,000
9.	Brazing equipment with accessories	1	10,000
10.	Soldering irons	3	1,000
11.	Pedestal grinder	1	10,000
12.	Metal spraying gun	1	10,000
13.	Spot welder	1	25,000
14.	TIG welding set	1	1,00,000
15.	MIG welding set	1	1,00,000
16.	Welding Partition Screen	5	2,500
17.	Miscellaneous	LS	3,000

FITTING AND PLUMBING SHOP

1.	Work benches with vices (4 vices on each bench)	5	30,000

2.	Marking tables with scribers	4	24,000
3.	Surface plates	5	20,000
4.	Accessories like calipers, V blocks, height, gauges steel rules and scribers	25	50,000
5.	Tool kits – taps, dies, drills	25	40,000
6.	Tool kits – chiesels, hammers, files, hacksaw	25	25,000
7.	Drilling machine	2	12,000
8.	Pipe vice	4	1,000
9.	Chain wrenches	5	1,250
10.	Ring spanner set	5	600
11.	Pipe die set 2”	2 set	1,000
12.	Pipe bending device	1	5,000
13.	Various plumbing fittings	LS	2,000
14.	Miscellaneous	LS	1,500

SHEET METAL SHOP			
1.	Hammers	8	3,000
2.	Mallets (Hard & Soft)	5	2,000
3.	Sheet and wire Ganges	LS	8,00
4.	Shearing Machine	1	20,000
5.	Bar folding Machine	1	20,000
6.	Burring machine	1	10,000
7.	Various sheet (black plain, galvanized iron, corrugated, Aluminum)	1 Each	1,000
8.	Hand Shears/Snippers	4	2,000
9.	Nuts, Bolts, Rivets, Screw	LS	5,00
10.	Miscellaneous	LS	1,000
MASON SHOP			

1.	Mason Trowel	10	1,000
2.	Concrete Finishing Trowel	10	1,000
3.	Gauging Trowel	10	1,000
4.	Margin Trowel	10	1,000
5.	Pointing Trowel	10	1,000
6.	Round Trowel	10	1,000
7.	Mason/Brick Hammer	10	3,000
8.	Comb hammer	10	3,000
9.	Blocking chisel	10	1,000
10.	Plumb bob	10	500
11.	Spirit level	10	1,000

12.	Straight Edge	10	1,000
13.	Jointer	10	1,000
14.	Masonry Pan	10	1,500
15.	Steel Measuring Tape	10	500
16.	Miscellaneous (Bricks, Blocks, Stones, Sand, Cement)	10	3,000
MACHINE SHOP			
1.	Centre lathes	10	6,00,000
2.	Grinder	1	10,000
3.	Universal milling machine	1	1,25,000
4.	Shaper	2	1,20,000
5.	Plainer	2	1,20,000

6.	Work bench	3	10,000
7.	Precision instruments	1	10,000
8.	Hand tools and accessories	2	8,000
9.	CNC trainer lathe	1	4,00,000
10.	Miscellaneous	LS	5,000

FOOTWEAR WORKSHOP		
Sr.	Particulars	Unit
01	Upper splitting M/C	01
02	Hydraulic Clicking press	02
03	1 Flat bed sewing M/C 2 Zig Zag sewing M/C 3 Post bed sewing M/C single needle 4 Post bed sewing M/C double needle 6 cylindrical arm sewing machine 5 Cording M/C 6 Strobel Stitching Machine 7 Toe lasting machine 8 Delasting machine 9 Heat setting machine 10 Moulding machine	 05 05 05 05 05 05 05 05 05 05 05
04	Hydraulic clicking press for bottom components	05
05	Strap cutting M/C	02

06	Skiving machine	05
07	Splitting machine	02
08	Stamping machine	02
09	Fusion machine with chiller	02
10	Pounding M/C	02
11	Roughing M/C	
12	• Edge trimming M/C (For lining) • Edge trimming M/C (For Sole) • Heel Attaching machine (For Lining)	05 05 05
13	Heal trimming M/C	02
14	Ironing Machine	02
15	Working Tables with stool	60
16	Decorative punching M/C	02
17	Dies, tools, moulds, lasts etc.	60
18	Tools boxes for students	60
19	Sole attaching machine	02
20	Polishing machine	02
21	Pattern Binding M/C	01
22	Punching/ riveting machine	01

Sr.	Particulars	Unit
23	Tapping & Seam Rubbing M/C complete with devices.	01
24.	Top Cap applicator thermoplastic two stations	01
25.	Lining trimming M/C	01
26.	Automatic Eyeleting & punching M/C	01
27.	Stitch marking M/C	01
28.	Back part moulding M/C	01
29.	Moccasin performing M/C	01
30.	Moccasin performing M/C with one beating head (electric)	01
31.	Vamp clapping M/C	01
32.	Insole trimming & attaching M/C	01
33	Conditioning M/C	01
34.	Forepart Lasting M/C with Adhesive tapes	01
35.	Conditioning for back port	01
36	Heal setting plant with 4 chambers and single vacuum	01
37	Reactivating plant for sales	01
38.	Delasting (Slip Last) M/C	01
39.	Spray booth with sprayer etc.	01
40.	DVP Two station machine	01
41.	Thickness measuring Machine	01
42.	Compressor for Pneumatic machine	01
43.	Punching Machine	01
44.	Simplex Matie 33 mts. conveyor with 1 mech. tier	01
45.	Two colour horizontal injection moulding M/C with moulds etc.	01
46.	D.M.S. M/C 4 bed with moulds etc.	01
47.	Misc. items/equipments	LS

SHOE DESIGNING LAB		
Sr.	Particulars	Unit
1	Pattern Binding Machine	01
2	HINGE AND SOLID LAST(WOOD, PVC)	30
3	Designing Tools	30 Sets
4	Designing Table	30 Sets

LEATHER GOODS WORKSHOP		
Sr.	Particulars	Unit
1	Football panel cutting M/C	01
2	Football shaping M/C	01
3	Belt cutting Machine	01
4	Belt Spliting Maching	01
5	Belt Edge Skiving M/c	01
6	Belt Adhesive Coating M/C	01
7	Belt Pressing M/C	01
8	Belt Side Decorating M/C	01
9	Belt Punching M/C (Manual)	01
10	Belt Colouring M/C	01
11	Belt Eyelet Fixing M/C	01
12	Belt Finishing M/C	01
13	Belt Creasing M/C	01
14	Belt Edge Making M/C	01
15	Leather Round Belt Making M/c	01
16	Spacer for Round Belt	01
17	Strap Cutting M/C	01
18	Belt Punching & Fixing M/C	01
19	Spray Gun	01

SHOE CAD/ CAM LAB

1	SHOE DESIGN SOFTWARE WITH LICENCE	10
2	COMPUTER WITH LATEST CONFIGURATION	30
3	2 D DIGITIZER	10
4	PLOTTER WITH CUTTER	05
5	PRINTER MFP WITH SCANNER	05
6	DESIGN JET PRINTER 2D/3D	05
7	AIR CONDITIONER 2 TON	02
8	FOOT SCANNER	02
9	LAST SCANNER	02
10	COMPUTER TABLE	30
11	REVOLVING CHAIR	30
12	DEIGNING DIGITAL TABLE	30

NOTE:

In addition to the above, laboratories in respect of physics, chemistry, Computer Centre, etc will be required for effective implementation of the course. Provision for photocopiers, PC facilities along with LCD Projection System etc. has also to be made.

(C) Furniture Requirement

Norms and standards laid down by AICTE be followed for working out furniture requirement for this course.

10.2 Human Resources Development:

Weekly work schedule, annual work schedule, student teacher ratio for various group and class size, staffing pattern, work load norms, qualifications, experience and job description of teaching staff workshop staff and other administrative and supporting staff be worked out as per norms and standards laid down by the AICTE.

11. EVALUATION STRATEGY

11.1 INTRODUCTION

Evaluation plays an important role in the teaching-learning process. The major objective of any teaching-learning endeavor is to ensure the quality of the product which can be assessed through learner's evaluation.

The purpose of student evaluation is to determine the extent to which the general and the specific objectives of curriculum have been achieved. Student evaluation is also important from the point of view of ascertaining the quality of instructional processes and to get feedback for curriculum improvement. It helps the teachers in determining the level of appropriateness of teaching experiences provided to learners to meet their individual and professional needs. Evaluation also helps in diagnosing learning difficulties of the students. Evaluation is of two types: Formative and Summative (Internal and External Evaluation)

Formative Evaluation

It is an on-going evaluation process. Its purpose is to provide continuous and comprehensive feedback to students and teachers concerning teaching-learning process. It provides corrective steps to be taken to account for curricular as well as co-curricular aspects.

Summative Evaluation

It is carried out at the end of a unit of instruction like topic, subject, semester or year. The main purpose of summative evaluation is to measure achievement for assigning course grades, certification of students and ascertaining accountability of instructional process. The student evaluation has to be done in a comprehensive and systematic manner since any mistake or lacuna is likely to affect the future of students.

In the present educational scenario in India, where summative evaluation plays an important role in educational process, there is a need to improve the standard of summative evaluation with a view to bring validity and reliability in the end-term examination system for achieving objectivity and efficiency in evaluation.

11.2 STUDENTS' EVALUATION AREAS

The student evaluation is carried out for the following areas:

- Theory
- Practical Work (Laboratory, Workshop, Field Exercises)
- Project Work
- Professional Industrial Training

A. Theory

Evaluation in theory aims at assessing students' understanding of concepts, principles and procedures related to a course/subject, and their ability to apply learnt principles and solve problems. The formative evaluation for theory subjects may be caused through sessional /class-tests, home-assignments, tutorial-work, seminars, and group discussions etc. For end-term evaluation of theory, the question paper may comprise of three sections.

Section-I

It should contain objective type items e.g. multiple choice, matching and completion type. Total weightage to Section-1 should be of the order of 20 percent of the total marks and no choice should be given in this section. The objective type items should be used to evaluate students' performance in knowledge, comprehension and at the most application domains only.

Section-II

It should contain short answer/completion items. The weightage to this section should be of the order of 40 percent of the total marks. Again, no choice should be given in section-II

Section-III

It may contain two to three essay type questions. Total weightage to this section should be of the order of 40 percent of the total marks. Some built-in, internal choice of about 50 percent of the questions set, can be given in this section

Table II : Suggested Weightage to be given to different ability levels

Abilities	**Weightage to be assigned**
Knowledge	10-30 percent
Comprehension	40-60 percent
Application	20-30 percent
Higher than application i.e. Analysis, Synthesis and Evaluation	Upto 10 percent

B. Practical Work

Evaluation of students performance in practical work (Laboratory experiments, Workshop practicals/field exercises) aims at assessing students ability to apply or practice learnt concepts, principles and procedures, manipulative skills, ability to observe and record, ability to interpret and draw conclusions and work related attitudes. Formative and summative evaluation may comprise of weightages to performance on task, quality of product, general behaviour and it should be followed by viva-voce.

C. Project Work

The purpose of evaluation of project work is to assess student's ability to apply, in an integrated manner, learnt knowledge and skills in solving real life problems, manipulative skills, ability to observe, record, creativity and communication skills. The formative and summative evaluation may comprise of weightage to nature of project, quality of product, quality of report and quality of presentation followed by viva-voce.

D. Professional Industrial Training

Evaluation of professional industrial training report and viva-voce/ presentation aims at assessing students' understanding of materials, industrial processes, practices in the industry/field and their ability to engage

In activities related to problem-solving in industrial setting as well as understanding of application of learnt knowledge and skills in real life situation. The formative and summative evaluation may comprise of weightages to performance in testing, general behaviour, quality of report and presentation during viva-voce.

12. RECOMMENDATIONS FOR EFFECTIVE CURRICULUM IMPLEMENTATION

This curriculum document is a Plan of Action and has been prepared based on exhaustive exercise of curriculum planning and design. The representative sample comprising selected senior personnel (lecturers and HODs) from various institutions and experts from industry/field have been involved in curriculum design process.

The document so prepared is now ready for its implementation. It is the faculty of polytechnics who have to play a vital role in planning instructional experiences for the courses in four different environments viz. class-room, laboratory, library and field and execute them in right perspective. It is emphasized that a proper mix of different teaching methods in all these places of instruction only can bring the changes in stipulated students behaviour as in the curriculum document. It is important for the teachers to understand curriculum document holistically and further be aware of intricacies of teaching-learning process (T-L) for achieving curriculum objectives. Given below are certain suggestions which may help the teachers in planning and designing learning experiences effectively. These are indicative in nature and teachers using their creativity can further develop/refine them. The designers of the programme suggest every teacher to read them carefully, comprehend and start using them.

(A) Broad Suggestions:

1. Curriculum implementation takes place at programme, course and class-room level

   Respectively and synchronization among them is required for its success. The first step towards achieving synchronization is to read curriculum document holistically and understand its rationale and philosophy.

2. An academic plan needs to be prepared and made available to all polytechnics well in advance. The Principals have a great role to play in its dissemination and, percolation upto grass-root level. Polytechnics, in turn are supposed to prepare institutional academic plan.

3. HOD of every Programme Department along with HODs and incharges of other departments are required to prepare academic plan at department level referring to institutional academic plan.

4. All lecturers/Senior lecturers are required to prepare course level and class level lesson plans referring departmental academic plan.

(B) Course Level Suggestions

Teachers are educational managers at class room level and their success in achieving course level objectives lies in using course plan and their judicious execution which is very important for the success of programme by achieving its objectives.Polytechnic teachers are required to plan various instructional experiences viz. theory lecture, expert lectures, lab/workshop

practicals, guided library exercises, field visits, study tours, camps etc. In addition, they have to carry out progressive assessment of theory, assignments, library, practicals and field experiences. Teachers are also required to do all these activities within a stipulated period of time. It is essential for them to use the given time judiciously by planning all above activities properly and ensure execution of the plan effectively.

Following is the gist of suggestions for subject teachers to carry out T-L process effectively:

1. Teachers are required to prepare a course plan, taking into account departmental academic plan, number of weeks available and courses to be taught.

2. Teachers are required to prepare lesson plan for every theory class. This plan may comprise of contents to be covered, learning material for execution of a lesson plan. They may follow steps for preparing lesson plan e.g. drawing attention, state instructional objectives, help in recalling pre-requisite knowledge, deliver planned subject content, check desired learning outcomes and reinforce learning etc.

3. Teachers are required to plan for expert lectures from field/industry. Necessary steps are to plan in advance, identify field experts, make correspondence to invite them, take necessary budgetary approval etc.

4. Teachers are required to plan for guided library exercises by identification of course specific experience requirement, setting time, assessment, etc. The assignments and seminars can be thought of as terminal outcome of library experiences.

5. Concept and content based field visits may be planned and executed for such content of course which is abstract in nature and no other requisite resources are readily available in institute to impart them effectively.

6. There is a dire need for planning practical experiences in right perspective. These slots in a course are the avenues to use problem based learning/activity learning/ experiential learning approach effectively. The development of lab instruction sheets for the course is a good beginning to provide lab experiences effectively.

7. Planning of progressive assessment encompasses periodical assessment in a semester, preparation of proper quality question paper, assessment of answer sheets immediately and giving constructive feed back to every student.

8. The student centred activities may be used to develop generic skills like task

   Management, problem solving, managing self, collaborating with others etc.

9. Where ever possible, it is essential to use activity based learning rather than relying on delivery based conventional teaching all the time.

10. Teachers may take initiative in establishing liaison with industries and field organizations for imparting field experiences to their students.

11. Students be made aware about issues related to ecology and environment, safety, concern for wastage of energy and other resources etc.

12. Students may be given relevant and well thought out project assignments, which are purposeful and develop practical skills. This will help students in developing creativity and confidence for their gainful employment.

13. A Project bank may be developed by the concerned department of the polytechnics in consultation with related Industry, research institutes and other relevant field organizations in the state.

LIST OF EXPERETS

The following experts participated in workshop for Developing the Curricula Structure and Contents of Diploma Programme Leather Technology (Tanning) on dated 09-04-2025 and 24-04-205 to 26—04-2025 for UP State at IRDT, Kanpur:

1- Sh. Jitender Kumar , Head of Department , Government Leather Institute , Agra

2- Sh. Satender Singh, Lecturer, Government Leather Institute , Kanpur

3- Sh. D.N. Swami, Lecturer, Government Leather Institute , Agra

4- Sh. Naresh Kumar, Lecturer Shoe Design, Government Leather Institute , Kanpur

5- Sh. Vipin Kumar Sankhvar, Lecturer (Quality Control,Leather), Government Leather Institute , Agra

6- Sh. Gaurav Kishor Kanaujiya, Assistant Professor/ Course Co-ordinator, IRDT U.P. Kanpur.

Annexure: 1

Proposed Courses by TATA Technology (Advance Skill Certification)

S. No.	Course Name
1	Fundamentals of Innovation and Design Thinking
2	Product Design and Development
3	Product Verification and Analysis
4	Advanced Automobile
5	Electric Vehicle
6	Internet of Things
7	Advanced Manufacturing
8	Advanced Welding & Painting using Simulator
9	Industrial Automation and MES
10	Industrial Robotics
11	Inspection and Quality Control
12	Advanced Plumbing
13	AI and ML