Curriculum

for

Bachelor of Agro Industrial Engineering Technology

Degree

(2023)

Higher Education Commission
Islamabad
Curriculum Division

Acronyms, Abbreviations & Definitions

Acronym/Abbreviation	Definition
NTC	National Technology Council
NCRC	National Curriculum Review Committee
HEI	Higher Education Institution
SMEs	Small and Medium Enterprises
SIT	Supervised Industrial Training
IDTE	Inter Disciplinary Technology Elective
SPE	Society of Petroleum Engineers
IEEE	Institute of Electrical and Electronics Engineers
PVT	Pressure, Volume, Temperature
LPG	Liquid Petroleum Gas
EIA	Environmental Impact Assessment
GPS	Global Positioning System
ASTM	American Society of Testing and Materials
API	American Petroleum Institute
SCA	Special Core Analysis
CBM	Coal Bed Methane
HPHT	High Pressure High Temperature
Th	Theory
Lab	Laboratory
Cr. Hrs.	Credit Hours

Contents

1. Introduction

Curriculum is the total learning experience of a student that occurs in the educational process. The term refers specifically to a planned sequence of instructions, and to the student's experiences in terms of the educator's or institutions instructional goals. Curriculum is a systematic and intended packaging of competencies (i.e., knowledge, skills, and attitudes, underpinned by values) that learners should acquire through organized learning experiences.

Curriculum forges in learners' life-long learning competencies, as well as social attitudes and skills, such as tolerance and respect, constructive handling of diversity, peaceful conflict management, promotion and respect of human rights, gender equality, justice, and inclusiveness. At the same time, curriculum must be singularly aligned to national development goals, and produce human resources that becomes an effective factor-of-production in the economy.

Curriculum is thus the foundation on which rests the edifice of academic programs designed for focused outcomes that equip graduates with desired skill sets. Engineering technology curriculum aims to produce proficient engineering technology graduates who meet demands of both national and international job markets. The curriculum conforms substantially to the Sydney Accord – the international accreditation body regulating local accrediting institutions of partnering countries -- and is in consonance with the essence of Graduates Attributes and Professional Competence defined by International Engineering Alliance (IEA). [See Appendixes A through C]

Curriculum is developed and reviewed by HEC's National Curriculum and Review Committee (NCRC).

2. Curriculum Development Methodology

2.1 Benchmarking

The Curriculum for Bachelor of Agro Industrial Engineering Technology is benchmarked to HEC's Undergraduate Policy and is in accordance with NTC's Curriculum Framework. It conforms substantially to the standards laid out by the Sydney Accord and the International Engineering Alliance pertaining to engineering technology programs [See Appendixes A through C].

The Scheme of Studies clearly defines, and differentiates, the program from Bachelor of Agro Industrial Engineering by contact hours spent in classrooms, laboratories, and the industry.

Ideally an engineering program is designed with classroom to practical training ratio of 70:30 contact hours, with emphasis on design aspects. Whereas for engineering technology programs, the ratio of contact hours is reversed to 30:70, providing more opportunity for hands-on and psychomotor training.

2.2 Curriculum Development Cycle

Curriculum development is a rigorous process and entails the following steps:

- Nominations are requested from academic circles and relevant industry forums to constitute a National Curriculum Review Committee (NCRC) comprising of leading national experts.
- From the nominations received, NCRC is finalized and notified by NTC/HEC.
- A preliminary Meeting of the NCRC, spanning three days, is held to elect a Convenor, a co-Convenor, and a secretary from amongst the Member, establish framework and benchmarking issues, and assign different facets of curriculum development to smaller teams within the NCRC.
- A draft of program curriculum is prepared by NCRC at the end of the Preliminary Meeting and sent to relevant foreign experts for review and feedback.
- After the foreign expert's review and feedback is received, a Final NCRC Meeting, lasting up to three days, is held to finalize the NCRC Members recommendations, and prepare a final curriculum document.
- The entire cycle of curriculum development is completed in two months.

2.3 Historical Timeline of Meetings

Historical timeline of NCRC meetings to develop curriculum for Bachelor of Agro Industrial Engineering Technology are enlisted below:

- Preliminary Meeting of NCRC [See Appendix D]
- Final Meeting of NCRC [See Appendix E]

3. Curriculum Details

Bachelor of Agro Industrial Engineering Technology Program		
Parameter	**HEC Framework**	**Framework - A** **(SIT in 7th & 8th Semesters)**
Program Type	Semester System	Semester System
Program Duration	8 Semesters Min: 4 Years Max: 7 Years	8 Semesters Min: 4 Years Max: 7 Years
Semester Duration	16 weeks of Teaching 2 weeks for Exams	16 weeks of Teaching 2 weeks for Exams
Total Number of Courses	41	40
Engineering Technology Domain Courses	28	26
Non-Engineering Technology Domain Courses	13	14
Total Credit Hours	124 – 136	137
Engineering Technology Domain Credit Hours	85	108
Percentage of Engineering Technology Domain Courses	65-70%	65%
Non-Engineering Technology Domain Credit Hours	39	38
Percentage of Non-Engineering Technology Domain Courses	30-35%	35%
No. of Credit Hours per Semester	15 – 18	16 – 18
1 credit hour is equal to: (1) For theory: 1 contact hour per week for a minimum of 16 weeks. (2) For practical's: 3 contact hours per week for a minimum of 16 weeks.		

Engineering Technology Domain Courses in Recommended Schemes of Studies as per Framework							
Knowledge Area	**Name of Course**	**Credit Hours** (Th+Lab)	**Weekly Contact Hours** (Th+Lab)	**Total Credit Hours**		**Number of Courses**	
				As per Scheme of Studies	**As per Framework**	**As per Scheme of Studies**	**As per Framework**
Computing	Information and Communication Technology	2+1=3	2+3=5	6	6	2	3
	Industrial software applications	2+1=3	2+3=5				
Agro Industrial Engineering Technology (Foundation)	Technical Drawing and Graphics	1+1=2	1+3=4	19	20	7	10
	Workshop Technology	1+2=3	1+6=7				
	Computer Aided Drawing	1+1=2	1+3=4				
	Industrial Material	2+1=3	2+3=5				
	Environment, Health and Safety	2+1=3	2+3=5				
	Industrial Chemistry	2+1=3	2+3=5				
	Applied Thermodynamics	2+1=3	2+3=5				
Agro Industrial Engineering Technology (Breadth)	Introduction to Agro-Based Industry	2+1=3	2+3=5	30	24	10	6
	Total Quality Management	2+1=3	2+3=5				
	Fluid Mechanics	2+1=3	2+3=5				
	Industrial Material Handling and Processes	2+1=3	2+3=5				
	Engine Operation and Maintenance	2+1=3	2+3=5				
	Manufacturing Processes	2+1=3	2+3=5				
	Post-Harvest Processes	2+1=3	2+3=5				
	Instrumentation and Control	2+1=3	2+3=5				
	Automation and Robotics	2+1=3	2+3=5				
	Boiler operation and maintenance	2+1=3	2+3=5				

Engineering Technology Domain Courses in Recommended Schemes of Studies as per Framework							
Knowledge Area	**Name of Course**	**Credit Hours** (Th+Lab)	**Weekly Contact Hours** (Th+Lab)	**Total Credit Hours**		**Number of Courses**	
				As per Scheme of Studies	**As per Framework**	**As per Scheme of Studies**	**As per Framework**
Agro Industrial Engineering Technology (Depth)	Grain Science for Industry	2+1=3	2+3=5	21	14	7	5
	Farm and Industrial Structures	2+1=3	2+3=5				
	Industrial Processes and Management	2+1=3	2+3=5				
	Farm Mechanization	2+1=3	2+3=5				
	High Efficiency Irrigation Systems	2+1=3	2+3=5				
	Depth Elective I	2+1=3	2+3=5				
	Depth Elective II	2+1=3	2+3=5				
Senior Design Project	Project Part-I	0+3=3	0+9=9	6	6	2	2
	Project Part-II	0+3=3	0+9=9				
Training	Supervised Industrial Training	0+16=16	0+16=16	16		0	
	Supervised Industrial Training	0+16=16	0+16=16	16		0	
Total Credit Hours and Courses (For Engineering Technology Domain Courses)		**108**		**26**			

Non-Engineering Technology Domain Courses in Recommended Schemes of Studies as per Framework								
Knowledge Area	**Sub Area**	**Name of Course**	**Credit Hours** (Th+Lab)	**Weekly Contact Hours** (Th+Lab)	**Total Credit Hours**		**Number of Courses**	
					As per Scheme of Studies	**As per Framework**	**As per Scheme of Studies**	**As per Framework**
Humanities and Social Sciences	English (Expository Writing)	Composition and Communication Skills	3+0=3	3+0=3	6	6	2	2
		Technical Report Writing	2+0=2	2+0=2				
	Culture	Islamic Studies / Ethics	2+0=2	2+0=2	6	6	2	2
		Pakistan Studies	2+0=2	2+0=2				
	Social Sciences Electives	Social Sciences Elective I (Professional Ethics)	2+0=2	2+0=2	2 / 4* Opt.	9	1 / 2* Opt.	3
		Social Sciences Elective II (Optional)	2+0=2	2+0=2				
Management Sciences	Management Sciences	Management Elective I (Project Management)	2+0=2	2+0=2	6	6	3	3
		Management Elective II (Entrepreneurship)	2+0=2	2+0=2				
		Management Elective III	2+0=2	2+0=2				
Natural Sciences	(Quantitative Reasoning)	Applied Mathematics-I	3+0=3	3+0=3	9	6	3	2
		Applied Mathematics-II	3+0=3	3+0=3				
		Applied Statistics	3+0=3	3+0=3				
	Physics	Applied Physics	2+1=3	2+3=5	3	4	1	1
Total Credit Hours and Courses (For Non-Engineering Technology Domain Courses) *Optional Courses			**38**		**14**			

4. Admission Criteria

Criteria for admission in Bachelor of Agro Industrial Engineering Technology program is defined in NTC's Program Accreditation Policy and Procedure Manual for Engineering & Other Technologies, Clause 3.2.4.1. The salient eligibility features for admission are:

(1) At least 50% marks in DAE/FSc (Pre-engineering)
or other equivalent qualifications such as A-level/ICS/B.Sc. (sports and Hafiz-e-Quran marks are not included) and

(2) Entrance Test

(3) Weightage:

- 70% for academics (DAE/FSc etc.)
- 30% for Entrance Test

5. Semester-wise Scheme of Studies

Semester-wise scheme of studies for Bachelor of Agro Industrial Engineering Technology program, spanning 4 years, spread over 8 semesters, and totaling 137 credit hours is presented below, along with weekly contact hours for each course.

SEMESTER-I				**Weekly Contact Hrs. (Th+Lab)**
Suggested Course Codes	**Course Title**	**Knowledge Area/Domain**	**Credit Hrs. (Th+Lab)**	
AIT-101	Technical Drawing and Graphics	Engineering Foundation	1+1	1+3
AIT-103	Workshop Technology	Major Based Depth	1+2	1+6
AIT-105	Introduction to Agro-Based Industry	Major Based Depth	2+1	2+3
CST-101	Information and Communication Technology	Computing	2+1	2+3
AIN-101	Applied Mathematics-I	Natural Science	3+0	3+0
AIS-101	Islamic Studies/Ethics	Art & Humanities	2+0	2+0
AIS -103	Pakistan Studies	Art & Humanities	2+0	2+0
AIN -103	General Mathematics for Pre-Medical Students	Natural Science	3+0	3+0
	Subtotal		**13+5 =18**	**13+15 =28**
SEMESTER-II				**Weekly Contact Hrs. (Th+Lab)**
Suggested Course Codes	**Course Title**	**Knowledge Area/Domain**	**Credit Hrs. (Th+Lab)**	
AIT-102	Computer Aided Drawing	Engineering Foundation	1+1	1+3
AIT-104	Fluid Mechanics	Engineering Foundation	2+1	2+3
AIT-106	Industrial Material	Major Based Depth	2+1	2+3
AIN-102	Applied Physics	Natural Science	2+1	2+3
AIN-104	Applied Mathematics-II	Natural Science	3+0	3+0
AIS-102	Composition and Communication Skills	Social Sciences	3+0	3+0

	Subtotal		**13+4 =17**	**13+12 =25**
SEMESTER-III				**Weekly Contact Hrs. (Th+Lab)**
Suggested Course Codes	**Course Title**	**Knowledge Area/Domain**	**Credit Hrs. (Th+Lab)**	
AIT-201	Applied Thermodynamics	Major Based Depth	2+1	2+3
AIT-203	Farm Mechanization	Major Based Depth	2+1	2+3
AIT-205	Environment, Health and Safety	Engineering Foundation	2+1	2+3
AIT-207	Industrial Material Handling and Processes	Major Based Depth	2+1	2+3
AIN-201	Industrial Chemistry	Natural Science	2+1	2+3
AIN-203	Applied Statistics	Natural Science	3+0	3+0
	Subtotal		**13+5 =18**	**13+15 =28**
SEMESTER-IV				**Weekly Contact Hrs. (Th+Lab)**
Suggested Course Codes	**Course Title**	**Knowledge Area/Domain**	**Credit Hrs. (Th+Lab)**	
AIT-202	Engine Operation and Maintenance	Major Based Depth	2+1	1+3
AIT-204	Manufacturing Processes	Major Based Depth	2+1	1+6
AIT-206	Post-Harvest Processes	Major Based Depth	2+1	2+3
AIT-208	Grain Science for Industry	Major Based Depth	2+1	2+3
AIM-202	Project Management	Management Sciences	2+0	3+0
AIM-204	Professional Ethics	Management Sciences	2+0	2+0
AIH -206	Technical Report Writing	Art & Humanities	2+0	2+0
	Subtotal		**14+4 =18**	**14+12 =26**

SEMESTER-V				Weekly Contact Hrs. (Th+Lab)
Suggested Course Codes	**Course Title**	**Knowledge Area/Domain**	**Credit Hrs. (Th+Lab)**	
AIT-301	Farm and Industrial Structures	Major Based Depth	2+1	2+3
AIT-303	Instrumentation and Control	Major Based Depth	2+1	2+3
AIT-305	Total Quality Management	Major Based Depth	2+1	2+3
AIT-307	Industrial Processes and Management	Major Based Depth	2+1	2+3
AIH-301	Entrepreneurship	Art & Humanities	2+0	2+0
Technology Elective I				
AIT-309	Feed Milling Technology	Major Based Depth	2+1	2+3
AIT-311	Cotton Ginning and Fiber Technology	Major Based Depth	2+1	2+3
AIT-313	Sugar Technology	Major Based Depth	2+1	2+3
	Subtotal		**12+5 =17**	**12+15 =27**
SEMESTER-VI				**Weekly Contact Hrs. (Th+Lab)**
Suggested Course Codes	**Course Title**	**Knowledge Area/Domain**	**Credit Hrs. (Th+Lab)**	
AIT-302	Automation and Robotics	Major Based Depth	2+1	2+3
AIT-304	Boiler operation and maintenance	Major Based Depth	2+1	2+3
AIT-306	Industrial software applications	Major Based Depth	2+1	2+3
AIT-308	High Efficiency Irrigation Systems	Major Based Depth	2+1	2+3
AIM-302	Management Elective	Art & Humanities	2+0	2+0
Technology Elective II				
AIT-310	Grain Milling Technology	Major Based Depth	2+1	2+3

AIT-312	Technology of Oils and Fats	Major Based Depth	2+1	2+3
AIT-314	Seed Science and Seed Processing Technology	Major Based Depth	2+1	2+3
	Subtotal		**12+5 =17**	**12+15 =27**
SEMESTER-VII				**Weekly Contact Hrs. (Th+Lab)**
Suggested Course Codes	**Course Title**	**Knowledge Area/Domain**	**Credit Hrs. (Th+Lab)**	
AIT-401	Supervised Industrial Training (Compulsory)	Technology Domain Industrial Training	**0+16**	**40 (Per Week)**
	Subtotal		**0+16=16**	**0+40 =40**
SEMESTER-VIII				**Weekly Contact Hrs. (Th+Lab)**
Suggested Course Codes	**Course Title**	**Knowledge Area/Domain**	**Credit Hrs. (Th+Lab)**	
AIT-402	Supervised Industrial Training (Compulsory)	Technology Domain Industrial Training	**0+16**	**40 (Per Week)**
	Subtotal		**0+16= 16**	**0+40= 40**
Total Credit Hours & Contact Hours in Four Years (When SIT conducted in both 7th and 8th Semesters)			**77+60=137**	**77+131 = 201**
Theory vs Practical's with respect to Contact Hours			Theory Practical	**77 (35%)** **124 (65%)**

6. Course Codes

Course Codes are defined below:

- Each course code has a unique three letter prefix, followed by three-digits.
- Letters are acronyms for course description, and numbers define the chronological position in the academic year and sequence number in the program.
- The program will span over 4 years, with 2 Semesters, Spring and Fall, per year (with a possible Summer Semester).

Letters in course-code prefix are defined below:

- First two letters pertain to the program (e.g., AI for Agro Industrial)
- The third letter pertains to specifics of the course (e.g., T for Technology, N for Natural Science etc.)

Digits in course-code are defined in table below:

1st Digit	2nd Digit	3rd Digit
Denotes Year (1,2,3,4)	Denotes Semester (1,2,3…)	Denotes Sequence (1, 2, 3…)

Course Code Examples		
Sr.	**Course Code Prefix**	**Description**
1	AI**T**	Agro Industrial Engineering Technology
2	AI**N**	Natural Sciences
3	AI**S**	Social Sciences
4	AI**M**	Management Sciences
5	AI**C**	Computing

7. Elective Courses

Lists of elective courses – grouped across depth and breadth categories – are presented below:

List of Elective Courses	
Social Sciences	**Management Sciences**
➢ Professional Ethics ➢ Sociology for Technologist ➢ Critical Thinking ➢ Organizational Behavior ➢ Economics for Technologist ➢ Human Resource Development ➢ Culture and Society ➢ Elective Courses by HEI*	➢ Entrepreneurship ➢ Project Management ➢ Principle of Management ➢ Quality Management Systems ➢ Total Quality Management ➢ Supply Chain Management ➢ Production Management ➢ Elective Courses by HEI*
Natural Sciences	**Depth Technology Electives**
➢ Applied Mathematics-I ➢ Multivariable Calculus ➢ Applied Physics ➢ Applied Mathematics-II ➢ Industrial Chemistry ➢ Applied Statistics ➢ Elective Courses by HEI*	➢ Feed Milling Technology ➢ Cotton Ginning and Fiber Technology ➢ Sugar Technology ➢ Grain Milling Technology ➢ Technology of Oils and Fats ➢ Seed Science and Seed Processing Technology ➢ Renewable and Alternative Energy Technologies ➢ Machine Repair and Maintenance ➢ Elective Courses by HEI*
*Any related course can be included with approval of the HEI's Statutory Bodies (maximum: 3 courses per elective knowledge area)	

8. Course Contents

The primary goal of this curriculum is to be substantially in compliance with international standards set by relevant agencies such as the International Engineering Alliance (IEA) and the Sydney Accord (SA).

Program Learning Objectives (PLO's), Course Learning Objectives (CLO's) and Bloom's Taxonomy levels are expected learning outcomes aligned to standards set by SA and the IEA.

Course Content

8.1 Technical Drawing and Graphics

CODE & TITLE (AIT-101) **Technical Drawing and Graphics**	**CREDIT & CONTACT HOURS** (1+1) **16 Theory + 48 Lab**	**KNOWLEDGE AREA/ DOMAIN** **Industry, Innovation, and Infrastructure**	
After completion of this course, students will be able to:		**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Understand** the fundamentals of technical drawing, importance of technical drawings, and types of drawings.	C-1	1
CLO-2	**Select** appropriate drawing tools for sketching and other engineering applications.	C-3	3
CLO-3	**Demonstrate** drawings in 2-D and 3-D views.	P-5	9

Course Outline for Theory

Introduction to Technical Drawing: Basic geometrical construction, various types of lines, dimensioning and lettering, usage of drawing instruments, Principles of technical Graphics and their significance.

Technical Drawing Standards: General principles of presentation, conventional representation of dimensioning and sectioning and threaded parts. Abbreviations and symbols used in technical drawings. Symbols and method of indication on the drawing for surface finish, welding and riveted joints.

Principles of Orthographic Projections-Conventions - Projections of Points, projection of straight lines and lines inclined to both planes; Projections of planes, inclined Planes - Auxiliary Planes.

Projections of Regular Solids: Isometric projections, projection of planes and solids in simple position, Solids inclined to both the Planes- Auxiliary Views.

Sections and Sectional Views of Right Angular Solids:

Development of surfaces of Right Regular Solids - Prism, Pyramid, Cylinder and Cone; Isometric Projections, Principles of Isometric projection – Isometric Scale, Isometric Views, Conventions; Isometric Views of lines, Planes, Simple and compound Solids; Conversion of Isometric Views to Orthographic Views and Vice-versa.

Limits, Fits and Tolerances Tolerance types and representation on the drawing – Fits types and selection for different applications – Basic hole systems - Basic shaft systems – Allowances. Geometric tolerances – Form and positional. Datum and datum.

Lab Outline
1. Setting up of drawing environment by setting drawing limits, drawing units, naming the drawing, naming layers, setting line types for different layers using various type of lines in engineering drawing, saving the file with .dwg extension. 2. Draw different types of bolts and nuts with internal and external threading in Acme and square threading standards. Save the bolts and nuts as blocks suitable for insertion. 3. Draw 3D models by extruding simple 2D objects, dimension and name the objects. 4. Draw a spiral by extruding a circle. 5. Construction of inscribes and circumscribes square, triangle and hexagon. 6. Construction of tangent of circle inside and outside. 7. Construction of hyperbola curve 8. Construction of involutes and cycloids. 9. Orthographic projection of 1st angle and 3rd angle of any Given Block. 10. Isometric and orthographic views of hexagonal nut and bolt. 11. Creating technical drawing of fasteners: Rivets, cotter joint and threads. 12. Draw sectioning symbols for different materials. 13. Development of Prism, Cylinder, Cone and Pyramid. 14. Development of the truncated Prism, Cylinder, Cone and Pyramid. 15. Open ended Project based on previous knowledge and skills
Recommended Books
1. Engineering Drawing. by French & Vierck. (Latest Edition) 2. Geometrical Drawing by N.D. Bhatt. (Latest Edition) 3. French, T.E. and C.J. Vierck. 2000. A Manual of Engineering Drawing. McGraw Hill Book Co., New York, NY, USA

Course Content

8.2 Workshop Technology

CODE & TITLE (AIT-103) **Workshop Technology**		**CREDIT & CONTACT HOURS** (1+2) **16 Theory + 96 Lab**	**KNOWLEDGE AREA/ DOMAIN** **Industry, Innovation, and Infrastructure**	
After completion of this course, students will be able to:			**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Comprehend** basic knowledge of materials, their properties, and heat treatments.		C-2	1
CLO-2	**Analyze** problems related to selection of materials and processing.		C-4	2
CLO-3	**Demonstrate** operations and processes used in workshops.		P-4	9

Course Outline for Theory

Workshop Safety: Definition and its classification. Introduction: metals, metalloids and non-metals; Production and properties of common engineering materials. Ferrous metals: iron ores, properties and uses of pig iron, cast iron, wrought iron, steel, standard processes of manufacturing of iron and steel, open hearth process, basic oxygen processes, production of ingots; Steel; effect of alloying elements; the AISI/SAE alloy steel and their identification; corrosion resistant steel: steel for high temperature services, alloy steel. Non-ferrous metals: Properties and uses of copper, aluminum, zinc, tin, nickel, and lead, non-ferrous alloys, copper alloys, aluminum alloys, zinc base alloys, nickel base alloys, lead-tin alloys, iron-carbon equilibrium diagram. Heat treatment: Heat treatment theory and process, heat treatment of steel, annealing, hardening, tempering, normalizing, surface hardening, quenching, and heat treatment equipment. Foundry: Definition, importance, advantages and disadvantages of foundry, casting, hand molding tools, characteristics of molding sand, foundry cores, properties of core and crucibles, handling and care, copula furnace, construction, zone of copula and its advantages .Introduction of basic tools of workshop: Measuring & layout tools, Fitting tools, Machining tools, Carpentry tools etc. Introduction to workshop machine tools: Lathe (conventional and CNC), milling, shaper and planner, drilling, grinding, bending; cutting etc. Welding: Definition, types of welding process, survey of welding equipment, types of joints and welding positions. Arc welding: Current rating, arc-welding processes, inspection and testing of welded joints. Gas welding: Welding flames and materials, cutting of metals, gas-welding processes. Motion transmission devices: Introduction and applications of Belts, ropes, pulleys, Sprockets & Composition, use and properties of Non-metals: plastics, rubber, fiberglass, ceramics, glasses, polymers, and refractory materials and composites. Metal testing: tension test, hardness test, torsion test.

Lab Outlines

1. Safety and first aid in the workshop related to electrical, mechanical and other accidents. Use of PPEs.
2. Safety in the use of hand tools; Identification of tools and machines in the workshop.
3. Identification of different metals by spark tests and advanced methods.
4. Demonstration of different heat treatment processes.
5. Practice of arc welding and gas welding.
6. To prepare specimens of steel, aluminum, copper, and brass using appropriate macro etching reagents and to reveal segregation and crystal structure.
7. Performing lab exercise on (tensile, hardness and torsion) testing of metals.
8. Visits to local foundries.
9. Pipe joint and its types: Socket or a Coupler Joint, Nipple Joint, Union Joint, Spigot and Socket Joint, Expansion Joint, Flanged Joint, Hydraulic Pipe Joint.
10. Applications of Motion transmission devices: Belts, ropes, pulleys, Sprockets & chains, gears, shafts and clutches.
11. Practice of Lathe machine operations
12. Practice of Shaper machine operations.
13. Practice of Milling machine operations.
14. Practice of Drilling and grinding machine operations.
15. Make an open-ended Project using previous knowledge and skills

Recommended Books

1. Chapman, W.A.J. 2004. Workshop Technology Part-I and II. Viva Books Private Ltd., New Delhi, India.
2. John, K.C. 2010. Mechanical Workshop Practice. Prentice-Hall of India Pvt.Ltd Prentice-Hall of India Pvt.Ltd Prentice-Hall of India Prentice-Hall of India Pvt. Ltd., New Delhi, India.
3. Rao, P.N. 2002. Manufacturing Technology: Metal Cutting and Machine Tools. Tata McGraw Hill Co. Ltd., New Delhi, India.
4. Sharma, S. and S.K. Sharma. 2009. Manufacturing Processes. I. K. International Publishing House Pvt. Ltd. New Delhi, India6

Course Content

8.3 Introduction to Agro-Based Industries

CODE & TITLE (AIT-105) **Introduction to Agro-Based Industries**	**CREDIT & CONTACT HOURS** (2+1) **32 Theory + 48 Lab**	**KNOWLEDGE AREA/ DOMAIN** **Industry, Innovation, and Infrastructure**	
After completion of this course, students will be able to:		**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Understand** basics agro-industrial processes.	C-1	1
CLO-2	**Identify** machinery used in agro-industrial processes.	C-2	2
CLO-3	**Demonstrate** different processes in agro based industries.	P-4	4

Course Outline for Theory

General Introduction of agro-based Industries; Prospects and potential of agro-based industry in Pakistan. Range of agro-industries operating in national and international scenario. Flow charts describing processes of the mills including cotton ginning industry, comparison of roller and saw ginning systems, oil mills, solvent plants, flour mills, rice mills, feed mills, pulses mills, seed industry, cold stores, pesticides refilling plants and other similar industries. Basic steps and machineries involved in sugar industry. Processing machines linked with animal and poultry slaughtering systems. Flour treatment and quality assessment; Rheology of doughs and batters. Types and varieties of grains. Industrial concern related to grain production technologies. Methods and types of fruit, vegetable and grain storage. Role of temperature, moisture, fumigation, aeration system relating to safe storage. Fruit and vegetable processes include dehydration systems, dehydration of fruits and vegetables by solar dryers and solar energy. Processing of mango comprises dehydration and mango hot water treatment plant. Types conveyors, elevators, and their application in the industry.

Lab Outlines

1. Identification of various grains and grading systems of grains.
2. Identification of various types of conveyers and belts.
3. Demonstration of multiple processes in agro-based industries.
4. Demonstration of Different types of Sifters and separators.
5. Visits of different agro-based industries and writing visit reports.
6. Term Projects by physically developing operational models related to agro-based industry.
7. Presentation and project report submission.

Recommended Books
1. Brooker, D.B., Bakker-Arkema, F.W. and Hall, C.W., 1992. Drying and storage of grains and oilseeds. Springer Science & Business Media. 2. Khan, S.R.R. 2001. Crop Management in Pakistan with Focus on Soil and Water. Directorate of Agri. Information, Punjab, Lahore, Pakistan. 3. Posner, E.S. and Hibbs, A.N., 2005. Wheat flour milling (No. Ed. 2). American Association of Cereal Chemists, Inc. 4. Rashid, A., E. Bashir and R. Bantel. 2005. Soil Science. National Book Foundation, Islamabad, Pakistan

Course Content

8.4 Information and Communication Technologies

CODE & TITLE	CREDIT & CONTACT HOURS	KNOWLEDGE AREA/ DOMAIN
(AIT-101) **Information and Communication Technologies**	(2+1) **32 Theory + 48 Lab**	**Quality Education** **Economic Growth**

	After completion of this course, students will be able to:	Bloom's Taxonomy Level	PLO
CLO-1	**Understand** web browsing and its applications.	C-2	1
CLO-2	**Understand** different software's and hardware's.	C-2	1
CLO-3	**Demonstrate** different commands of computer operating systems.	P-4	9

Course Outline for Theory

Brief History of Computer: Four Stages of History

Computer Elements: Processor, Memory, Hardware, Software

Application and System Software: Application Software its uses and Limitations, System Software its Importance and its Types

Types of Computers: Super, Mainframe, Mini and Micro Computer

Introduction to Computer Based Information System

Methods of Input and Processing

Organizing Computer Facility: Centralized Computing Facility, Distributed Computing Facility, Decentralized Computing Facility

Input Devices: Keyboard and its Types, Terminal (Dump, Smart, Intelligent), Dedicated Data Entry, SDA (Source Data Automation), Pointing Devices, Voice Input

Output Devices: Soft- Hard Copies, Monitors and its Types, Printers and its Types, Plotters, Computer Virus and its Forms, Storage Units, Primary and Secondary Memories, RAM and its Types, Cache, Hard Disks, Working of Hard Disk, Diskettes, RAID, Optical Disk Storages (DVD, CD ROM), Magnetic Types, Backup System,

Data Communications, Data Communication Model

Data Transmission: Digital and Analog Transmission, Modems, broadband, narrow band, bandwidth,

Medias (Cables, Wireless), Protocols, Network Topologies (Star, Bus, Ring), LAN, LAN, Internet, A Brief History, Birthplace of ARPA Net, Web Link, Browser, Internet Services provider and Online Services Providers, Function

Introduction to basics of C++: Introduction, variables, header files, loops, control structures.

Lab Outlines

1. Window operating system
2. Uses of MS Word procession
3. Create a word document, type a business letter format and save with specific name.
4. Add tables and word art of business requirement and save with another name.
5. Create a book format word document containing text, figures, tables, header & footer and page nos.
6. Create a document in newspaper format.
7. Create MS Excel (spreadsheets) as per format of marks sheet containing formula.
8. Make bar graph or pie chart
9. Power point exercises
10. Make a slide presentation for delivery of lecture.
11. Essential use of internet
12. E-mail and surfing
13. Introduction to basics of C++
14. Introduction to PLC

Recommended Books

1. Charles S. Parker, Understanding Computers: Today and Tomorrow, Course Technology, 25 Thomson Place, Boston, Massachusetts 02210, USA
2. Livesley, Robert Kenneth. An introduction to automatic digital computers. Cambridge University Press, 2017.
3. Zawacki-Richter, Olaf, and Colin Latchem. "Exploring four decades of research in Computers & Education." Computers & Education 122 (2018): 136-152.
4. Sinha, Pradeep K., and Priti Sinha. Computer fundamentals. BPB publications, 2010.
5. Goel, Anita. Computer fundamentals. Pearson Education India, 2010.

Course Content

8.5 Applied Mathematics-I

CODE & TITLE (AIN-101) **Applied Mathematics-I**	**CREDIT & CONTACT HOURS** (3+0) **48 Theory + 0 Lab**	**KNOWLEDGE AREA/ DOMAIN** **Quality Education** **Economic Growth**	
After completion of this course, students will be able to:		**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Use** mathematical knowledge to solve industrial problems.	C-1	1
CLO-2	**Apply** mathematical relationships to solve problems of agro industries.	C-3	3

Course Outline for Theory

Complex numbers, Argand diagram, De Moivre's theorem, hyperbolic and inverse hyperbolic functions. Algebra of vectors and matrices, systems of linear equations. Derivative as slope, as rate of change (graphical representation). Extreme values, tangents and normal, curvature and radius of curvature. Differentiation as approximation. Partial derivatives and their application to extreme values and approximation. Integration by substitution and by parts, integration and definite integration as area under curve (graphical representation). Reduction formulae. Double integration and its applications. Polar and Cartesian coordinates, polar curves, radius of curvature, cycloid, hypocycloid, epicycloids and involutes of a circle.

Recommended Books

1. David, C.L. 1998. Linear Algebra and Its Applications. 2nd Ed. Addison-Wesley Publication, Reno, NV, USA.
2. Davison, R. and A. Croft. 2008. Mathematics for Engineers: A Modern Interactive Approach. Prentice Hall, 3rd Ed. London UK.
3. Kreyszig, E. 1999. Advanced Engineering Mathematics. John Wiley and Sons, New York, NY, USA.
4. Smith, R.T. and R.B. Minton. 2002. Multivariate Calculus. 2nd Ed. McGraw-Hill, Richmond, TX, USA.
5. Yousaf, S.M. 1998. Mathematical Methods. Ilmi Kitab Khana, Kabir Street, Urdu Bazar, Lahore, Pakistan.

Course Content

8.6 Islamic Studies

CODE & TITLE (AIS-101) **Islamic Studies**	**CREDIT & CONTACT HOURS** (2+0) **32 Theory + 0 Lab**	**KNOWLEDGE AREA/ DOMAIN** **Quality Education** **Economic Growth**	
After completion of this course, students will be able to:		**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Comprehend** fundamentals of Islam and know Islamic history.	C-1	9
CLO-2	**Explain** concept of an Islamic civilization.	A-4	8
CLO-3	**Organize** and practice Islamic skills.	A-4	12

Course Outline for Theory

Fundamental of Islam: The five pillars – Declaration of faith (**Shahada**), Obligatory prayer (**Salah**), Compulsory-giving (**Zakat**), fasting (**Sawm**) and pilgrimage (**Hajj**) – constitute the basic norms of Islamic practice.

Introduction to Quranic Studies: Basic Concepts of Quran, History of Quran, Uloom-ul -Quran.

Study of Selected Text of Holy Quran:

1. Verses of Surah Al-Baqra (Verse No-284-286), Related to Faith.
2. Verses of Surah Al-Hujrat (Verse No-1-18), Related to Adab Al-Nabi.
3. Verses of Surah Al-Mumanoon (Verse No-1-11), Related to Characteristics of faithful.
4. Verses of Surah al-Furqan (Verse No.63-77), Related to Social Ethics.
5. Verses of Surah Al-Inam (Verse No-152-154), Related to Ihkam.

Study of Selected Text of Holly Quran:

1. Verses of Surah Al-Ihzab (Verse No.6, 21, 40, 56, 57, 58), Related to Adab al-Nabi
2. Verses of Surah Al-Hashar (18, 19, 20), Related to thinking, Day of Judgment,
3. Verses of Surah Al-Saf (Verse No-1,14), Related to Tafakar,Tadabar

Seerat of Holy Prophet (S.A.W) I:

- Life of Muhammad Bin Abdullah (Before Prophet Hood)
- Life of Holy Prophet (S.A.W) in Makkah
- Important Lessons derived from the life of Holy Prophet in Makkah.

Seerat of Holy Prophet (S.A.W) II:

- Life of Holy Prophet (S.A.W) in Madina,
- Important Events of Life of Holy Prophet in Madina,
- Important Lessons Derived from the life of Holy Prophet in Madina

Introduction to Sunnah:

- Basic Concepts of Hadith
- History of Hadith
- Kinds of Hadith
- Uloom –ul-Hadith,
- Sunnah & Hadith,
- Legal Position of Sunnah
- Selected Study from Text of Hadith

Introduction to Islamic Law & Jurisprudence: Basic Concepts of Islamic Law & Jurisprudence, History & Importance of Islamic Law & Jurisprudence, Sources of Islamic Law & Jurisprudence, Nature of Differences in Islamic Law, Islam and Sectarianism.

Islamic Culture & Civilization: Basic Concepts of Islamic Culture & Civilization, Historical Development of Islamic Culture & Civilization, Characteristics of Islamic Culture & Civilization, Islamic Culture & Civilization and Contemporary Issues.

Islam & Science: Basic Concepts of Islam & Science, Contributions of Muslims in the Development of Science, Quranic & Science; Islamic Economic System: Basic Concepts of Islamic Economic System, Means of Distribution of wealth in Islamic Economics, Islamic Concept of Riba, Islamic Ways of Trade & Commerce.

Political System of Islam: Basic Concepts of Islamic Political System, Islamic Concept of Sovereignty, Basic Institutions of Govt. in Islam; Islamic History: Period of Khlaft-E-Rashida, Period of Ummayyads, Period of Abbasids; Social System of Islam: Basic Concepts of Social System of Islam, Elements of Family, Ethical Values of Islam.

Recommended Books

1. Al-Quran
2. The Fundamentals of Islam by Muhammad bin Abdul Wahhab
3. Fundamentals of Islam by Syed Abul Ala Mawdudi
4. Bhatia, H.S. 1989. Studies in Islamic Law, Religion and Society. Deep and Deep Publications, New Delhi, India

Course Content

8.7 Pakistan Studies

CODE & TITLE (AIS-103) **Pakistan Studies**		CREDIT & CONTACT HOURS (2+0) **32 Theory + 0 Lab**	KNOWLEDGE AREA/ DOMAIN **Life on Land**
After completion of this course, students will be able to:		**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Understand** the historical efforts and dynamics in creation of Pakistan, and its present conditions.	C-1	9
CLO-2	**Acknowledge** efforts made by heroes in creation of Pakistan	A-1	12
CLO-3	**Comprehend** future challenges for Pakistan	A-4	12

Course Outline for Theory

Historical Perspective:
Ideological rationale with special reference to Sir Syed Ahmed Khan, Allama Muhammad Iqbal and Quaid-i-Azam Muhammad Ali Jinnah.

Factors leading to Muslim separatism:
People and Land, Indus Civilization, Muslim advent, location and geo-physical features.

Government and Politics in Pakistan:
Political and constitutional phases (1947-58, 1958-71, 1971-77, 1977-88, 1988-99, 1999 onward).

Contemporary Pakistan:
Economic institutions and issues, society and social structure, ethnicity, foreign policy of Pakistan and challenges, futuristic outlook of Pakistan.

Constitution and Legal System of Pakistan:
Nature and sources of law, Functions and purposes of law, Role of the legislature and the court system in Pakistan, Composition and functions of the assemblies, The judicial system of Pakistan, Constitutional law in Pakistan

Recommended Books

1. Burki and S. Javed. 1980. State and Society in Pakistan. The Macmillan Press Ltd. Basingstoke, UK.
2. Burke, S.M. and L. Ziring. 1993. Pakistan's Foreign Policy: An Historical Analysis. Oxford University Press, Karachi, Pakistan.
3. Mehmood and Safdar. 1994. Pakistan Political Roots and Development. Lahore, Pakistan

4. Wilcox and Wayne. 1972. The Emergence of Bangladesh. American Enterprise, Institute of Public Policy Research, Washington, WA, USA

Course Content

8.8 Computer Aided Drawing

CODE & TITLE (AIT-102) **Computer Aided Drawing**	**CREDIT & CONTACT HOURS** (1+1) **16 Theory + 48 Lab**	**KNOWLEDGE AREA/ DOMAIN** **Engineering Foundation**	
After completion of this course, students will be able to:		**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Use** AutoCAD as a tool for drawing of machine parts in 2D and 3D.	C-3	5
CLO-2	**Draw** machine components with computer software.	P-3	1
CLO-3	**Conceptualize** the exterior and interior parts of a component.	A-4	12

Course Outline for Theory

Introduction of AutoCAD, World Coordinate System (WCS) and User Coordinate Systems (UCS).
Creating basic drawings, Units, Layers, Properties, Modifying, blocks
Manipulating objects, drawing organization and inquiry commands, altering objects, working with layouts, annotating the drawing. Dimensioning, hatching objects, working with reusable content.
Creating additional drawing objects, plotting drawings, creating drawing templates.

Lab Outline

1. Making drawings of different machine elements on AutoCAD software.

Recommended Books

1. Anonymous. 2017. Learning AutoCAD 2017. Volume 3. Autodesk Inc. Mission, KS, USA.
2. Anonymous. AutoCAD 2004. Autocad Mechanical Power Pack, Autodesk New York, USA.
3. Anonymous. AutoCAD 2005; A problem –Solving Approach. Autodesk Press Sham Tickoo, New York, NY, USA.
4. French, T.E., C.J. Vierck and R.T. Foster. 2011. Engineering Drawing and Graphics Technology. McGraw-Hill Science/Engineering/Math, Richmond, TX, USA.
5. Rao, P.N. 2005. CAD/CAM – Principles and Applications. 2nd Ed. Tata McGraw Hill Co. Ltd. New Delhi, India.
6. AutoCAD Tutor for Engineering Graphics R14 by Alen J. Kalameja

Course Content

8.9 Fluid Mechanics

CODE & TITLE (AIT-104) **Fluid Mechanics**	**CREDIT & CONTACT HOURS** (2+1) **32 Theory + 48 Lab**	**KNOWLEDGE AREA/ DOMAIN** **Engineering Foundation**	
After completion of this course, students will be able to:		**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Explain** fundamental properties of fluids, including viscosity, Newtonian and non-Newtonian rheology, and viscoelasticity.	C-2	1
CLO-2	**Analyze** macroscopic fluid mechanics systems, using the integral form of conservation equations.	C-4	2
CLO-3	**Identify** relevant parameters that govern a fluid system and use dimensional analysis to identify fundamental variables that define flow.	C-3	2
CLO-4	**Evaluate** pressure distributions in a static fluid, taking account of hydrostatic pressure, buoyancy force, and interfacial tension (Laplace pressure and capillary action).	P-3	3

Course Outline for Theory

Introduction to Fluid mechanics: Hydrostatics, kinematics, hydrodynamics, hydraulics, units and dimensions. Physical properties of fluids; Specific weight, density, specific volume, surface tension, compressibility, viscosity, units of viscosity, measurement of viscosity, Newton's equation of viscosity.

Fluid Measurements: Fluid properties, Measurement of static pressure, Measurement of Velocity Pitot Tubes and other methods, orifices, Nozzles and Tubes, Jet contraction, Jet velocity and Pressure, Coefficient determination, Bourdon Tube, Venturi tube, Flow Nozzles, flow measurement of Compressible Fluids, Unsteady Flow of Incompressible Fluid in Pipes, Establishment of steady flow.

Fluid Statics: Pressure intensity and pressure head, pressure specific weight relationship, absolute and gauge pressure, measurement of pressure, Piezometer, Manometer, Pressure Transducers. Differential manometer and Bourdon gauge. Forces on submerged planes and curved surfaces and their applications. Buoyancy and floatation, Equilibrium of floating and submerged bodies.

Fluid Kinematics: Steady and unsteady flow, laminar and turbulent flow, uniform and non-uniform flow. Path line streamlines and stream tubes, Velocity and discharge, Equation of continuity for compressible and incompressible fluids.

Hydrodynamics: Different forms of energy in a flowing liquid, head, Bernoulli's equation and its application, E.L. & H.G.L., free and forced vortex.

Flow through Pipes: Losses in pipelines, minor and major losses, Darcy-Weisbach equation for major loss of head in pipes, Pipes in series and parallel, Transmission of energy through pipes.

Basics of oil hydraulic systems: General layout, applications, merits and limitations of oil hydraulic systems; Overview of essential properties of oils used in oil hydraulic circuits.

Pumps: construction, working principle, application and symbols of vane pump, gear pump, rotor pump, screw pump and piston pump.

Hydraulic valves, actuators and accessories: loading and unloading during oil hydraulic circuits, oil hydraulic circuit for milling machine and shaper machine.

Lab Outlines

1. Determination of viscosity of a given liquid using viscometer.
2. Determination of velocity through Pitot tube.
3. Determination of coefficient of discharge using venture meter.
4. Determination of coefficient of discharge of the orifices.
5. To investigate the validity of Bernoulli’s equation for steady flow of water.
6. Assemble meter in and meter out oil hydraulic circuits and compare their working with list of application.
7. Assemble quick return mechanism oil hydraulic circuit for shaper machine.
8. Study of trouble shooting procedure of various hydraulic circuits.
9. Selection of circuit components for simple oil hydraulic circuit such as circuit used for milling machine, shaper machine.

Recommended Books

1. Abbas, M.A. 2006. General Agriculture. Emporium Urdu Bazar, Lahore, Pakistan.
2. Khalil, I.A and A. Jan. 2002. Crop Technology, National Book Foundation, Islamabad, Pakistan.
3. Khan, S.R.R. 2001. Crop Management in Pakistan with Focus on Soil and Water. Directorate of Agri. Information, Punjab, Lahore, Pakistan.
4. Fannelop T.K. (1994). Fluid Mechanics for Industrial Safety and Environmental Protection, Volume 3, 1st Edition, eBook ISBN: 9780444597847, Elsevier Science.
5. Rashid, A., E. Bashir and R. Bantel. 2005. Soil Science. National Book Foundation, Islamabad, Pakistan
6. Fluid Mechanics: Fundamentals and Applications by John Cimbala and Yunus A Çengel

Course Content

8.10 Industrial Material

CODE & TITLE (AIT-106) **Industrial Material**		CREDIT & CONTACT HOURS (2+1) **32 Theory + 48 Lab**	KNOWLEDGE AREA/ DOMAIN **Depth**
After completion of this course, students will be able to:		**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Handle** materials, equipment, and know marketing principles.	C-1	1
CLO-2	**Describe** conveyer systems for materials in industrial processes.	C-2	2
CLO-3	**Design** equipment for material handling.	C-5	3
CL0-4	**Demonstrate** material handling equipment used in the industry.	P-4	7

Course Outline for Theory

Techniques for estimating nutritive value of feed stuffs and their validity: In vivo and laboratory techniques.
Factors affecting the nutritive value of feeds: measures of protein quality for monogastric; protein efficiency ratio, gross protein value; the essential amino acid index.
Protein evaluation systems for ruminants: natural toxicants of feeds and detoxification.
Feeding systems for Human, livestock, and poultry: Raw feed material handling and storage, mixing, processing and storage of finished feed.
Quality control in feed processing: forms of feeds and least cost ration formulation.
Feed stuff laws and regulations.

Lab Outline

1. Use of computers for least cost feed formulation for various classes of livestock and poultry.
2. Availability pattern of feed stuff in local market and their price structures.
3. Manufacturing of wholesome feed; Demonstration of feeding trials for estimating feed

Recommended Books

1. Cheeke, P.R. 2005. Applied Animal Nutrition. Feeds and feeding. 3rd Ed. Pearson, USA.
2. Ensminger, M.E., J. E. Oldfield, and W.W. Heinemann. 1990. Feeds and Nutrition Digest. The Ensminger

Publishing Co. Clovis, CA, USA.
3. Lesson, S. and J. D. Summers. 2001. Commercial Poultry Nutrition. University Book, Gulph, Ontario, Canada.
4. McDonals, P., R. A. Edwards, J.F.D. Greenhalgh, C.A. Morgan, L.A. Sinclair and R.G. Wilkinson. 2011. Animal Nutrition Benjamin Cummings Publisher, USA
5. Moughan, P. J. and W. H. Hendriks. 2018. Feed Evaluation Science. Wageningen Academic Publishers, Netherland.

Course Content

8.11 Applied Physics

CODE & TITLE (AIN-102 **Applied Physics**	**CREDIT & CONTACT HOURS** (2+1) **32 Theory + 48 Lab**	**KNOWLEDGE AREA/ DOMAIN** **Natural Science**	
After completion of this course, students will be able to:		**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Understand** electromagnetism and electronics.	C-1	1
CLO-2	**Develop** circuit diagrams.	C-3	3
CLO-3	**Understand** different conductor properties.	P-3	4

Course Outline for Theory

Waves & Oscillations: Periodic motion & Simple Harmonic Oscillation (SHO), Simple Pendulum, Transverse & Longitudinal Waves, Speed of a traveling Wave, Damped Harmonic Oscillator, EM waves.

Electricity: Basic terms & definitions; Electric Forces and Fields, Electric Flux, Coulomb's Law, Electric field due to the Point and Various Charges, Gauss's Law and its Applications, Conductors in Electric Fields, Parallel Metal Plates, Capacitance , Resistance, Electric Potential and Potential Energy, Ohms' Law, practice problems

Magnetism: Magnetic Field, Flux and Flux density (B), B-H loop, Hysteresis, Retentively, Magnetic Force on moving charges, Torque on Current Loop, Ampere's Law, Magnetic Dipole Moment. Earth's Magnetic Field, practice problems,

Electromagnetic Induction: Induced Current and EMF, Faraday's Law of Electromagnetic induction, Lenz's Law, Mutual and self-Inductance, Motional EMF, Inductor and Inductance, RL circuits

Electronics: Semiconductor materials, conduction in conductors, insulator, and semiconductors, doping, N-type and P-type semiconductors, energy band diagrams of conductors, insulators, intrinsic and extrinsic Semiconductors, PN junction, basic diode operation, forward and reverse operating modes, Diode applications.

Light and Optics: Oscillating Electric and Magnetic Fields, Light as EM Wave, Reflection, Refraction, Interference, Young's Double Slit Experiment, Equivalent Optical Path, Diffraction, Mechanics: Definitions of Work, Energy & Power, Work – Energy Theorem and its applications, Mechanical Energy of System, Conservation of Mechanical Energy, practice problems, Gravitational potential energy, Hook's Law & Restoring force. Review of Angular Variables, K.E. Energy of Rotation and moment of Inertia, Torque and Newton's Second Law of Rotation, Work and Rotational K.E: Angular momentum, Angular Momentum for System of Particles.

Lab Outlines

1. Measuring magnitude and direction of Earth's a) magnetic field. b) To measure Dip angle.
2. Examining Lenz's and Faraday's Law.
3. Studying the production of EMF using fix coil or fix magnet
4. Measurement of Current, Voltage drops and Power in a Resistance circuit
5. Diode; identification of Diode terminals using Ohm meter series circuits.
6. Diode series circuit, Diode Parallel circuits
7. Half Wave rectification and Full Wave rectification
8. Measurement of wavelength of sodium light using diffraction Grating and Spectrometer
9. Study of diffraction minima and maxima using single and multi-slits.
10. Verification of Law of Conservation of Energy by measuring potential and kinetic energies in various arrangements a) Determine relationship between force and spring deformation using Hook's law. b) Investigating both spring compression and extension.

Recommended Books

1. Babu, J.J.C and S.P.X. Eugene. 1999. Principles of Control System. 1st Ed. S. Chand and Company Ltd., New Dehli, India.
2. Gupta, B.R. 1999. Principles of Electrical Engg. S. Chand and Company Ltd., New Dehli, India.
3. Hughes. 2017. Electrical Technology. Longman Scientific &Technical New York, NY, USA.
4. Kalavathi, M.S., S.P. Ramana, S.R. Chudhary and G. Suresh. 2017. Basic Electrical and Electronics Engineering. S. Chand and Company Ltd., New Dehli, India.

Course Content

8.12 Applied Mathematics-II

CODE & TITLE (AIN-104) **Applied Mathematics-II**	**CREDIT & CONTACT HOURS** (2+0) **32 Theory + 0 Lab**	**KNOWLEDGE AREA/ DOMAIN** **Natural Science**	
After completion of this course, students will be able to:		**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Use** mathematical knowledge to solve industrial problems.	C-3	12
CLO-2	**Apply** mathematical relationships to solve agro-industrial problems.	A-3	3

Course Outline for Theory

Differential equation: basic concepts and ideas; geometrical interpretation of first and second order differential equations; separable equations, equations reducible to separable form, exact differential equations, integrated factors. Linear first order differential equations, Bernoulli's differential equation.

Families of curves: orthogonal trajectories and applications of differential equations of first order to relevant engineering systems. Homogeneous linear differential equations of second order, homogeneous equations with constant coefficients, the general solutions, initial and boundary value problems, D-operator: complementary functions and particular integrals.

Real, complex and repeated roots of characteristics equations: Cauchy equation, non-homogeneous linear equations. Applications of higher order linear differential equations. Ordinary and regular points and corresponding series solutions; Introduction to Laplace transformation.

Recommended Books

1. David, C.L. 1998. Linear Algebra and Its Applications. 2nd Ed. Addison-Wesley Publication, Reno, NV, USA.
2. Davison, R. and A. Croft. 2008. Mathematics for Engineers: A Modern Interactive Approach. Prentice Hall, 3rd Ed. London UK.
3. Kreyszig, E. 1999. Advanced Engineering Mathematics. John Wiley and Sons, New York, NY, USA.
4. Sharma, G.S., K.L. Auhuja and I.J.S. Sarna.1988. Advanced Mathematics for Engineers and Scientists. Tata McGraw Hill Co., New Dehli, India.
5. Yousaf, S.M. 1998. Mathematical Methods. Ilmi Kitab Khana Kabir Street, Urdu Bazar, Lahore, Pakistan.

Course Content

8.13 Composition and Communication Skills

CODE & TITLE (AIS-102) **Composition and Communication Skills**		CREDIT & CONTACT HOURS (3+0) **48 Theory + 0 Lab**	KNOWLEDGE AREA/ DOMAIN **Social Science**
After completion of this course, students will be able to:		**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Demonstrate** effective communication skills.	A-1	9
CLO-2	**Improve** their communication skills.	A-2	10
CLO-3	**Express** their knowledge and information confidently.	A-3	10

Course Outline for Theory

Reading skills: effective reading habits, comprehension, (i) Bromides and Sulphites (Gelett Burgess) (ii) TV Addiction (Marie Winn),

Writing skills: personal writing, CV, report writing, letter writing, descriptive writing; argumentative writing; narrative writing; expository writing; précis writing.

Grammatical tools: knowledge about parts of speech and their analysis, punctuation, dash, comma, semi colon, capitalization,

Presentation skills: Communication skills, types of communication, 7 Cs of communication, preparing effective presentations.

Recommended Books

1. Eastwood, J. 2009. Oxford Practice Grammar, Oxford University Press, Karachi.
2. Wren, P.C., Martin, H., (Revised by: Prasada Rao, N.D.V). 2009. English Grammar & Composition, S. Chand & Compay Ltd. New Delhi.
3. Shah, S.S.A., 2006. Exploring the world of English. Ilmi Kitab Khana, Urdu Bazar, Lahore.
4. Mandel, S. 2011. Effective Presentation Skills: A Practical Guide Better Speaking
5. Mark, P. 2013. Presenting in English. Language Teaching Publications.

Course Content

8.14 Applied Thermodynamics

CODE & TITLE (AIT-201) **Applied Thermodynamics**	**CREDIT & CONTACT HOURS** (2+1) **32 Theory + 48 Lab**	**KNOWLEDGE AREA/ DOMAIN** **Major Base Depth**	
After completion of this course, students will be able to:		**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Understand** the concepts of thermodynamic processes.	C-1	1
CLO-2	**Discuss** entropy and compression of gases.	C-2	4
CLO-3	**Explain** different co-efficient of fuels and refrigerators.	C-2	6
CLO-4	**Explain** the mechanism of thermodynamic systems and its laws.	P-4	7

Course Outline for Theory

Heating and expansion of gases: Units of heat, gases and vapors, constant volume and constant pressure, P-V diagram, specific heat of gases, internal energy of gas, law of conservation of energy, methods of heating and expanding gases and vapors, work done by gas in expanding; Laws of perfect gases: Laws of thermodynamics, heating of gases, equations for different types of heating methods; Air cycles: Cycles of operation, air standard efficiency of a cycle, reversible process, reversible cycles, reversibility and efficiency, Carnot cycle, Otto cycle, diesel cycle, mean effective pressure; Entropy of gases: Entropy and heat, T-S diagrams, Carnot, Otto, diesel and dual combustion cycles on T-S diagrams; Air compressors: functions, compressor types, reciprocating and rotary compressors, single and multistage compressors, cylinder clearance, work done, compressor efficiency; Compound expansion: advantages of compound expansion, tandem type of two-cylinder compound engine, receiver type compound engine: combined indicator diagram for compound engine, Calculations for cylinder uniflow engine; Fuels: Combustion of fuels, properties of fuels viscosity, pour point, flash point, calorific value, API gravity, conversion of volumetric analysis, analysis by weight, weight of carbon in burnt gases, weight of air required for complete combustion of fuel, weight of flue gases per pound of fuel burnt, weight of excess air supplied, method of analyzing flue gases, heat carried away by flue gases, volumetric analysis of a gas, air fuel ratio for I.C. Engine; Refrigeration: Coefficient of performance, units of refrigeration, air compression refrigeration, vapor compression refrigeration, refrigeration cycles, rating, and quality.

Lab Outlines

1. To analyze the thermodynamic systems and its properties
2. Study of working principle of external combustion engine

3. Study of working principle of internal combustion engine
4. Demonstration of Joule's law
5. Measurement of rotary and reciprocating air compressors efficiency and their characteristic curves
6. Analysis of engine flue gases for CO, CO2, NO2, etc
7. Determination of fuel energy content (heating value)
8. viscosity measurement; Pour point measurement
9. Flash point measurement
10. Thermodynamic analysis of refrigeration and air conditioning cycles
11. Psychrometric analysis

Recommended Books

1. "Thermodynamics: From Concepts to Applications", Shavit, A. and C. Gutfinger, CRC Press (Latest Edition)
2. "Principles of Engineering Thermodynamics" , John R. Reisel, SI Edition, (Latest Edition)
3. "Stochastic Thermodynamics: An Introduction" , Luca Peliti, Simone Pigolotti (Latest Edition)
4. "Thermodynamics, Gas Dynamics, and Combustion" , Henry Clyde Foust (Latest Edition)
5. "Principles of Thermodynamics" , Jean-Philippe Ansermet, Sylvain D. Brechet (Latest Edition)

Course Content

8.15 Farm Mechanization

CODE & TITLE (AIT-203) **Farm Mechanization**	CREDIT & CONTACT HOURS (2+1) **32 Theory + 48 Lab**	KNOWLEDGE AREA/ DOMAIN **Major Base Depth**

After completion of this course, students will be able to:		Bloom's Taxonomy Level	PLO
CLO-1	**Understand** concepts of farm power and identify machinery.	C-1	1
CLO-2	**Explain** the different technologies in farm mechanization as per cropping systems.	C-2	6
CLO-3	**Demonstrate** farm power, implements, and machinery.	P-4	7

Course Outline for Theory

Farm Mechanization: Introduction, Objectives, and scope of farm mechanization. Present status and future prospectus of mechanization in Pakistan. Tractor types, components and terminologies, Principle of operation, tractor systems, Tractor troubleshooting and maintenance, Tractor logbook. Farm Machinery: Tillage, objective and types of tillage, Types of tillage implements: Primary and secondary tillage implements. Sowing machinery: broadcaster, seed drill/planters, seed drill calibration. Fertilizer application techniques. Plant Protection Equipment: spraying machinery. Harvesting and threshing machinery: reapers, thresher, and combine harvester. Cost analysis: Parameters to calculate fixed and variable cost. Cost analysis of agricultural machinery.

Lab Outlines

1. Study of Different Parts of Tractor
2. Study of Tractors Cooling System, Lubrication System and Fuel System
3. Tractor Maintenance.
4. Hitching and de-hitching of farm implements
5. Practical Demonstration of Primary and Secondary Tillage Implements
6. Calibration and Operation of Sowing Machinery
7. Study of Plant Protection Equipment
8. Study of Harvesting Equipment

Recommended Books

1. Agricultural Machinery and Mechanization" , Iqbal, M., M.A. Khan and K.A. Hussain, UAF (Latest Edition)

2. “Advances in Agricultural Machinery and Technologies” , Guangnan Chen (Latest Edition)
3. “Robotics, Machinery and Engineering Technology for Precision Agriculture” , Mark Shamtsyan, Marco Pasetti, Alexey Beskopylny (Latest Edition)
4. “Farm Machinery” , Philip Hendriks (Latest Edition)

Course Content

8.16 Environment, Health, and Safety

CODE & TITLE (AIT-205) **Environment, Health, and Safety**	**CREDIT & CONTACT HOURS** (2+1) **32 Theory + 48 Lab**	**KNOWLEDGE AREA/ DOMAIN** **Engineering Foundation**	
After completion of this course, students will be able to:		**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Demonstrate** knowledge of Health Safety and Environment issues.	C-3	6
CLO-2	**Discuss** the techniques and importance of safety policy, and safety management.	C-2	6
CLO-3	**Analyze** types of hazards at work and in living places.	C-4	6

Course Outline for Theory

Introduction to Health and Safety: Industrial Safety: introduction objectives of Safety, Importance of Safety in an industry, Industrial accidents, Effects of accidents, Types of accidents, incidence of fire. Fire prevention and control. Techniques of Safety Management: Principles of accident prevention and hazard analysis. Legal, humanitarian, and economic reasons for action. Safety inspection procedures. Safety training, First aid and emergency procedures. Environment and Health: Introduction: importance of clean environment, Scale of Environmental Pollution. Environmental Act. Health and Safety Act. Atmospheric Pollution: Types of Atmospheric pollution, Their Causes and Effects on Human Health, Available Technologies for Controlling Pollution. Industrial Waste: Solid Waste, Industrial Effluents and Waste Gases, waste treatment plants. Noise Pollution: Measurement of Noise level, Effect of excessive noise on human health. Remedial Measures. ISO Standards: for Safety and Health and Environment.

Lab course outline

1. Survey different industry to determine the safety options adopted by relevant industry
2. Evaluate the ISO standard adopted by industrial sector
3. Determine the various factors to pollute the environment
4. Determine the options to control the Noise pollution
5. Determine the factor involved to increase the Air Pollution.

Recommended Books
1. “Health Safety Management Systems A Complete Guide”, Gerardus Blokdyk (Latest Edition) 2. “Health and Safety: Risk Management”, Tony Boyle (Latest Edition) 3. “Introduction to Health and Safety at Work”, Phillip W. Hughes (Latest Edition) 4. “Handbook of Occupational Safety and Health”, S. Z. Mansdorf (Latest Edition) 5. “Occupational Health & Safety: Theory, Strategy & Industry Practice”, Dianne E. G. Dyck (Latest Edition).

Course Content

8.17 Industrial Material Handling and Processes

CODE & TITLE (AIT-207) **Industrial Material Handling and Processes**		**CREDIT & CONTACT HOURS** (2+1) **32 Theory + 48 Lab**	**KNOWLEDGE AREA/ DOMAIN** **Major Base Depth**
After completion of this course, students will be able to:		**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Understand** basic concepts of material handling and industrial processes.	C-2	1
CLO-2	**Identify** different material handling equipment.	C-4	5
CLO-3	**Explain** organizational behavior and safety measures.	C-2	6

Course Outline for Theory

Introduction to materials handling: Definition and scope of materials handling, importance of materials handling, systems concept, characteristics and classification of materials; Principles of materials handling: planning principle, systems principle, material flow principle, simplification principle, gravity principle, space utilization principle, unit size principle, safety principle, mechanization principle, equipment selection principle, standardization principle, flexibility principle, dead-weight principle, motion principle, idle time principle, maintenance principle, obsolescence principle, control principle capacity principle, performance principle; Unit load concept: Definition of unit load, advantages and disadvantages, load unitization process and handling methods, pallets, skids and containers, alternative methods of handling, packaging for materials handling; Classification of materials handling equipment: Basic equipment types, classification of handling equipment, industrial vehicles/trucks, hand trucks, power trucks, forklift trucks, tractors, conveyors, bulk handling equipment and systems, hoisting equipment, Robotic handling: Robots and their classification, robotic handling applications, gates, feeders, chutes, positioners, ball table, pallet loader and unloader; Engineering materials: Ferrous metals including cast iron, steel, etc. nonferrous metals; Manufacturing processes: Basic metal forming processes, forging, foundry, casting, heat treatment; Machine tools: Basic parts and processes on lath machine, milling machine, shaper etc., organization, maintenance, safety in materials handling.

Lab course outline

1. Study the different industrials materials handling equipment, Characteristics of different forms of industrial materials for selection of equipment,
2. Safety measures during the industrials materials handling equipment, tools used for materials handling

equipment maintenance, understand the process of materials handling of industrials trucks.

3. Determine the capacity of forklifting truck, understand the mechanism of the belt conveyers system, chain convey system, roller conveyers system, screw conveyers, bucket conveyers,
4. Visit of different industries regarding the materials handling equipment.

Recommended Books

1. Materials Handling Handbook" , David E. Mulcahy (Latest Edition)
2. "Material-handling equipment The Ultimate Step-By-Step Guide" , Gerardus Blokdyk (Latest Edition)
3. "Material Handling Systems: Designing for Safety and Health" , Charles Reese (Latest Edition)
4. "Manufacturing Facilities Design & Material Handling" , Matthew P. Stephens (Latest Edition)

Course Content

8.18 Industrial Chemistry

CODE & TITLE (AIN-201) **Industrial Chemistry**		**CREDIT & CONTACT HOURS** (2+1) **32 Theory + 48 Lab**	**KNOWLEDGE AREA/ DOMAIN** **Breadth**
After completion of this course, students will be able to:		**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Understand** basic industrial processes.	C-2	1
CLO-2	**Analyse** products of different industrial processes.	C-4	5
CLO-3	**Analyse** environment related issues.	C-3	7

Course Outline for Theory

An overview of Chemical Industry and Large-Scale Manufacturing: Background factors in large scale processes; Impurities in natural water: hard water, water softening, boiler scales and deposits, industrial and municipal water, metallic corrosion and its inhibition, paints and varnishes, fats and oils, extraction, refining and hydrogenation of oils; Inorganic Processes in Industry: Wet process Phosphoric Acid and Superphosphates, thermal process for Phosphoric acid, Ammonia, Sulfuric acid, Nitric acid, Sodium hydroxide and Chlorine; Products of Fermentation Processes: Background for fermentation processes for industrial chemicals and sewage treatment, industrial fermentations using aerobic and anaerobic methods, water-an important raw material for the chemical industry; Organic Chemical Processes: Conversion for petroleum into purified chemical substances, industrial processes using Ethylene and Propylene chemistry, Butene fraction of refinery streams, industrial chemicals from Benzene, Toluene, Xylenes, Methane; The environmental impact of industrial processes causing atmospheric and soil pollution.

Lab Outlines

1. Determination of carbonates and bicarbonates in industrial water
2. Determination of chlorides and sulphates in industrial water
3. Determination of pH and TSS in water
4. Estimation of nitrogen, phosphorus, and potassium in fertilizers
5. Analysis of oil for acid, saponification, and iodine value.

Recommended Books

1. "Organometallic Chemistry in Industry: A Practical Approach" , Thomas J. Colacot and Carin C.C (Latest

Edition)
2. “Biotechnology in the Chemical Industry: Towards a Green and Sustainable” , Pratima Bajpai (Latest Edition)
3. “Industrial Green Chemistry” , Serge Kaliaguine, Jean-Luc Dubois (Latest Edition)
4. “Chemistry and Industrial Techniques for Chemical Engineers” , Lionello Pogliani, Suresh C. Ameta, A. K. (Latest Edition)

Course Content

8.19 Applied Statistics

CODE & TITLE (AIN-201) **Industrial Chemistry**		**CREDIT & CONTACT HOURS** (2+1) **32 Theory + 48 Lab**	**KNOWLEDGE AREA/ DOMAIN** **Natural Science**
After completion of this course, students will be able to:		**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Understand** basic terminologies of statistics.	C-2	1
CLO-2	**Analyze** data using different statistical techniques.	C-4	4
CLO-3	**Evaluate** experiments using practical design applications.	C-6	5

Course Outline for Theory

Introduction to statistics: Describing, exploring, and comparing data. sample and population; Definition of sample and population, types of sampling, sampling techniques. Probability: introduction to Probability, Probability Distributions, Normal Probability Distributions, Estimates and Sample Sizes; Hypothesis Testing: Hypothesis testing for mean, difference of mean, standard deviation etc. Z-test and t-test: z-test and t-test for probability normal distribution, sample distribution, population distribution. Inferences from Two Samples; Correlation and Regression; Multinomial Experiments and Contingency Tables; Analysis of Variance; One way and two-way ANOVA, LSD test, Tuckey Test etc; Experimental Designs: Introduction to CRD and RCBD Designs, Factorial Design with practical examples.

Lab Outlines

1. Determination of field data using statistical application
2. Determination of regression analysis, ANOVA using software option
3. Determination of quantitative data and qualitative data using different statistical analysis
4. Project task to determine the comparative evaluation of experimental data

Recommended Books

1. "Introduction to Statistics and Data Analysis" , Roxy Peck (Latest Edition)
2. "Principles of Statistics" , MG Bulmer (Latest Edition)
3. "Statistical Inference" , George Casella, Roger L. Berger (Latest Edition)
4. "Design and Analysis of Experiments" , Douglas C. Montgomery (Latest Edition).

Course Content

8.20 Engine Operation and Maintenance

CODE & TITLE (AIT-202) **Engine Operation and Maintenance**	**CREDIT & CONTACT HOURS** (2+1) **32 Theory + 48 Lab**	**KNOWLEDGE AREA/ DOMAIN** **Major Base Depth**	
After completion of this course, students will be able to:		**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Apply** concepts of thermodynamic processes to engines.	C-3	1
CLO-2	**Analyze** problems related to engine systems and their performance.	C-3	3
CLO-3	**Demonstrate** engine performance and suggest maintenance solutions.	P-4	4

Course Outline for Theory

Introduction: History of engine development, engine cycles, principles of operation, types of engines; Principal parts of engine: Functions, construction, cylinder, cylinder heads, liner, crankcase, piston, connecting rod, crank shaft, clutch, flywheel, valves and their operation, valve mechanism; Fuels and combustion: Types of engine fuels, fuel tests and their significance, gasoline tests, antiknock test, octane number, volatility, Reid vapour pressure, Sulphur content, gun content, heat values, gasoline additives. Engine emissions and their analysis; Fuel System: Major components of fuel systems (petrol/diesel), theory and mechanism carburettor, fuel injection pump, injector/nozzles, electronic fuel injection, governing system, trouble shooting, calibration of fuel injection pump, fuel classification and storage.

Ignition system: Types of ignition, spark, magneto and compression ignition system, induction coils, distributor, spark plug, contact-breaker points, condenser and troubleshooting; Cooling system: Types, principle of operation, parts of air/water cooling system, line diagram, radiator, thermostat, water pump, fan, engine heating, repair and maintenance, types of coolants; Lubrication system: Types of lubrication systems e.g. splash and forced lubrication etc., principle of operation, components of lubrication systems, line diagram, types of lubricants, trouble shootings and maintenance; Electrical System: A.C. and D.C. voltage, alternator/dynamo, battery, battery charging and maintenance, self-starter, electrical gauges and controls, line diagram, repair and maintenance of electrical system; Intake and exhaust system: Air intake system, valve timing diagram, air cleaner, super charger, turbo charger, inter-cooling, and construction of intake and exhaust manifolds, mufflers; Power Transmission System: Clutch and Brakes, Transmission, Differentials, Power take-off, Pulley drives, Power lift and hydraulic controls.

Lab Outlines
1. Demonstration of main components of engine and engine types 2. Demonstration of valve system and its adjustments 3. Demonstration of fuel system, cooling system and electrical system of tractor 4. Measurement of air pressure/air fuel ratio in each cylinder of engine 5. Fuel injector, pump adjustment and calibration 6. Demonstration of engine lubrication system; Servicing of a single cylinder diesel engine 7. Removal of air lock of a diesel engine; Battery testing for charging/discharging; Measurement of tractor PTO/Draft power.
Recommended Books
1. Ganeshan V. Internal Combustion Engines. McGraw-Hill Education (Latest Edition) 2. Paul, W.G., J.H. Smith and E.J. Ziruys Fundamentals of Internal Combustion Engines (Latest Edition) 3. N. E. Chell Operation and Maintenance of Machinery in Motorships (Latest Edition) 4. Tim Gilles, Automotive Service: Inspection, Maintenance, Repair (Latest Edition)

Course Content

8.21 Manufacturing Processes

CODE & TITLE (AIT-204) **Manufacturing Processes**		**CREDIT & CONTACT HOURS** (2+1) **32 Theory + 48 Lab**	**KNOWLEDGE AREA/ DOMAIN** **Major Base Depth**	
After completion of this course, students will be able to:			**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Differentiate** between different manufacturing processes.		C-4	1
CLO-2	**Select** appropriate manufacturing processes to manufacture a component.		C-5	3
CLO-3	**Demonstrate** casting and machining processes.		P-4	3

Course Outline for Theory

Introduction**:** Introduction to Manufacturing Processes and their Classification.

Casting Process**:** Introduction to Casting Processes, Basic Steps in Casting Process, Pattern, Types of Patterns, Pattern Allowances, Gating system and its components, Cores and its types, core binders, core making and setting. Mould and moulding materials, classification of moulding sands, Requirement of moulding sand, types of moulds, and moulding methods, melting (Cupola) and Pouring, Cleaning and Finishing, Casting Defects and Remedies, Die and centrifuge casting.

Machining Process: Introduction to basic machining processes, machines and tools: Turning, Boring, Milling, Broaching and unconventional and non-traditional machining processes. Metal Cutting: Orthogonal and Oblique cutting, cutting tools and their types, Geometry and nomenclature of single point cutting tool, tool signature, Mechanics of chips formation, Type of Chips, Chips breaker, Factors influencing cutting processes, Use of Coolants in machining. Turning parameters: Feed, feed rate, cutting speed, spindle speed, cutting time and material removal rate.

Metal Forming Processes: Introduction to Hot and Cold Working, Principles of Hot and Cold Working Processes: Forging, Rolling, Extrusion, Wire Drawing and Bending.

Surface Finishing Processes**:** surface finishing processes, Lapping, Honing, Super finishing, Polishing, Buffing, Electroplating, Galvanizing

Metal properties changing process: Annealing, Normalizing, Hardening, Tempering

Additive manufacturing:

Lab Outlines
1. Study of lathe machine: its components and operations 2. Fabrication of various machine parts by using lathe 3. Making a slot on a shaft for a cotter pin using shaper and milling machines 4. Cutting threads using milling and lathe machines 5. Making holes in machine parts using drilling machines 6. Making bends on metal sheet using sheet rolling machines 7. Making of molds for casting different objects; Study tour
Recommended Books
1. Groover, M. P Fundamentals of modern manufacturing. John Wiley & Sons. (Latest Edition) 2. Black, J. T., & Kohser, R. A. Degarmo's Materials and Processes in Manufacturing (Latest Edition) 3. Wift, K.G. and J.D. Booker. Manufacturing Process Selection Handbook (Latest Edition) 4. Muammer Koç, Tugrul Özel · 2019. Modern Manufacturing Processes (Latest Edition) 5. LamNgeun Virasak · 2020. Manufacturing Processes (Latest Edition)

Course Content

8.22 Post-Harvest Processes

CODE & TITLE (AIT-206) **Post-Harvest Processes**	**CREDIT & CONTACT HOURS** (2+1) **32 Theory + 48 Lab**	**KNOWLEDGE AREA/ DOMAIN** **Breadth**	
After completion of this course, students will be able to:		**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Explain** basics post-harvest techniques for better utilization of farm produce.	C-2	1
CLO-2	**Analyze** problems related to post-harvest technologies and their solutions.	C-4	2
CLO-3	**Analyze** performance of various post-harvest technologies used in local and international industries and markets.	P-1	4

Course Outline for Theory

Postharvest technology: introduction, production, losses, causes, trade. Fruit ripening: changes during ripening, recommended conditions, commercial practices, water loss, respiration activity. Harvesting and handling methods. Maturity assessment of different fruits and vegetables. Ripening process: respiration, climacteric and non-climacteric patterns, pectic substances, ripening conditions. Postharvest physiology of fruits and vegetables. Postharvest pests of fruits, vegetables, and cereal grains: identification, biology, and management. Postharvest treatments: coatings, curing, vapor heat treatment, hot water treatment, degreasing. Storage: refrigerated, CA, hypobaric, MAS. Packaging: types, design, modified atmospheric packaging, recycling. Cold chain: packing house operations, transportation. Safety and quality of fruits and vegetables. Postharvest technology of cereals: harvesting, threshing, drying, storage, and handling. New developments in postharvest technology

Lab Outlines

1. Determining harvest maturity of different fruits and vegetables
2. Applications of different postharvest techniques
3. Changes in physical and chemical quality parameters of fruits during storage - weight loss, acidity, TSS, vitamin C degradation, firmness, color changes
4. Effect of packaging materials on stored fruits and vegetables
5. Effect of different chemicals - anti-sprouting, anti-ripening

6. Measurement of moisture content of grain, fibre, and other food products; Study of storage structures and their specifications
7. Visits to public / private storage structures.

Recommended Books

1. Hosahalli S. Ramaswamy Post-harvest Technologies of Fruits & Vegetables (Latest edition)
2. Elhadi M Yahia Postharvest Technology of Perishable Horticultural Commodities (Latest edition)
3. Mohammed Wasim Siddiqui . Eco-Friendly Technology for Postharvest Produce Quality (Latest edition)
4. Bijendra Singh, Sudhir Singh. Advances in Postharvest Technologies of Vegetable Crops (Latest edition).
5. Charis Michel Galanakis. Food Losses, Sustainable Postharvest and Food Technologies (Latest edition)

Course Content

8.23 Grain Science for Industry

CODE & TITLE (AIT-208) **Grain Science for Industry**	**CREDIT & CONTACT HOURS** (2+1) **32 Theory + 48 Lab**	**KNOWLEDGE AREA/ DOMAIN** **Major Base Depth**	
After completion of this course, students will be able to:		**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Describe** basic agricultural processing engineering.	C-2	1
CLO-2	**Analyze** problems related to agricultural processing industry.	C-4	2
CLO-3	**Solve** design problems relating to processing supply chain industries and markets.	C-4	3
CLO-4	**Investigate** the performance of different agricultural processes.	P-5	4

Course Outline for Theory

Grains: definition and importance, types (cereals, legumes, oilseeds other); cereal grains: morphology, components of cereal grains, physical properties, processing and diversity of uses for cereal grains; harvesting and treatment: grading, milling and its principles; chemistry and stability of cereal products; chemistry and stability of fats and oils; Wheat grain: development, terminology, microstructure, grading factors affect milling yield and end-use quality; chemical characteristics; ash, flour color, fiber content, protein content; intrinsic characteristics: protein quality, starch quality; processing quality: milling quality, bread-making quality, noodles, and Asian product quality; structure and functional properties of gluten; processing of wheat to optimize product quality; Rice grain: terminologies, properties and composition of rice, and quality traits; Improvement in nutritional properties: Rice bran: its oil, processing and uses; Environmental effects on rice quality; future trends; By-products of rice milling; Corn grain: structure and chemical composition of corn, characteristics and quality requirements, utilization of corn, Milling technologies of corn, Future trends; Barley grain: morphological and biochemical characteristics, uses, quality requirements, maintaining barley quality, future trends; Legumes: grain composition, physiological role of carbohydrates, effects of processing on composition, legume grains and animal nutrition. Legumes as raw material; Grain analysis techniques; principles and instrumentation available for testing cereal and other grains and their food and feed products. Utilization of grains in food and non-food products.

Lab Outlines

1. Grain quality testing and physical purity analysis

2. Microscopic analysis of different grains
3. Lab exercise on chemical characteristics of wheat (moisture content, ash, fiber content, etc.)
4. Determination of corn quality
5. Visit to grain processing industries.

Recommended Books

1. Farooq Shah, Zafar Khan, Amjad Iqbal . Recent Advances in Grain Crops Research (Latest edition)
2. Sergio O. Serna-Saldivar · Cereal Grains: Properties, Processing, and Nutritional Attributes (Latest edition)
3. KeShun Liu, Kurt A. Rosentrater Distillers Grains: Production, Properties, and Utilization (Latest edition)
4. Wrigly, C., I. Batey, and D. Miskelly. Cereal Grains; Assessing and Managing Quality (Latest edition)

Course Content

8.24 Project Management

CODE & TITLE (AIM-202) **Project Management**	**CREDIT & CONTACT HOURS** (2+0) **32 Theory + 0 Lab**	**KNOWLEDGE AREA/ DOMAIN** **Management Science**	
After completion of this course, students will be able to:		**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Define** basic concepts and scope of Project Management.	C-1	11
CLO-2	**Understand** the nature and role of Project Management.	C-2	11
CLO-3	**Analyze** product life cycle and its risks.	C-4	11
CLO-4	**Design** and develop the WBS (Work Breakdown Structure) of projects for budgeting and schedule estimation.	C-6	11
CLO-5	**Utilize** modern software packages to evaluate budget and schedule estimation.	C-3	5

Course Outline for Theory

1. Fundamental principles
2. Project proposals and feasibilities
3. Project life cycle
4. Project organization and human resource management
5. PM planning
6. Work breakdown structure
7. Estimating time and cost
8. Network Diagrams and CPM Method
9. Precedence relationships
10. Project scheduling and control techniques
11. Project risk analysis
12. Time compression and resource levelling
13. Computerized project management
14. Special software packages:

Recommended Books
1. Project Management: A Systems Approach to Planning, Scheduling, and Controlling by Harold Kerzner, John Wiley (Latest Edition) 2. Case studies in project management, 2nd Edition, by Harold Kerzner, John Wiley (Latest Edition) 3. Project Management Body of Knowledge (PMBOK) 4th Edition, by P. M.I (Latest Edition) 4. Kerzner, Harold, Case studies in project management, 2nd Edition, John Wiley (Latest Edition) 5. P. M.I., Project Management Body of Knowledge,4th Edition(Latest Edition)

Course Content

8.25 Professional Ethics

CODE & TITLE (AIS-202) **Professional Ethics**	**CREDIT & CONTACT HOURS** (2+0) **32 Theory + 0 Lab**	**KNOWLEDGE AREA/ DOMAIN** **Social Science**	
After completion of this course, students will be able to:		**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Apply** concepts of ethics to develop morality in their actions.	C-3	1
CLO-2	**Analyze** organizational influences in ethical decision making.	C-4	3
CLO-3	**Comprehend** the role of opportunity and conflict in ethics.	C-2	7

Course Outline for Theory

An Overview of Business Ethics: Business Ethics Defined, Social Responsibility, and Business Ethics, The Development of Business Ethics, Why study Business Ethics? Framework for Studying Business Ethics. Ethical issues in Business: Foundation of Ethical Conflict, Classifications of Ethical, Issues, Ethical Issues Related to Participants and Functional Areas of Business, Recognizing an Ethical Issue. Applying Moral Philosophies to Business Ethics Moral Philosophy Defined, Moral Philosophy Perspectives. Social Responsibility: The Economic Dimension, The legal Dimension, The Ethical Dimension, the Philanthropic Dimension. An Ethical Decision-Making Framework Ethical Issue Intensity, Individual Factors: Stages of Cognitive Moral Development, Corporate Culture, Significant others, Opportunity, Business Ethics Evaluations and Intentions, Using the Ethical Decision-Making Framework to Improve Ethical Decisions. How the Organization Influences Ethical Decision-Making Organizational Structure and Business Ethics, the role of Corporate Culture in Ethical Decision Making, Group Dimensions of Organizational Structure and Culture, Implications of Organizational Relationships for Ethical Decisions. The Role of Opportunity and Conflict Opportunity, Conflict. Development of an Effective Ethics Program an Effective Ethical Compliance, Program, Codes of Ethics and Compliance Standards, High-Level Manager's Responsibility for Ethical Compliance Program and the Delegation of Authority, Effective Communication of Ethical Standards, Establishing Systems to Monitor, Audit, and Enforce Ethical Standards, Continuous Improvement of the Ethical Compliance Program, The Influence of Personal Values in Business Ethics Program, The Ethical Compliance Audit. International Business Ethics Ethical Perceptions and International Business, Culture as a Factor in Business, Adapting Ethical Systems to a Global Framework: Cultural Relativism, the Multinational Corporation, A universal Set of Ethics, Ethical Issues Around the Globe.

Recommended Books
1. Ferrell, O. C., and Fraedrich, John, Ethical Decision Making and Cases, New York: Houghton Mifflin (Latest edition) 2. “Ethics in Engineering” by Mike Martin and Roland Schinzinger (Latest edition) 3. “Engineering Ethics – Concepts and Cases” by Michael S Pritchard and Michael J Rabins 4. “Ethics and the Conduct of Business” by John R Boatright (Latest edition) 5. “Fundamentals of Ethics for Scientists and Engineers” by Edmund G Seebauer and Robert L Barry (Latest edition) 6. “Professional Ethics and Human Values” by Govindarajan M 7. “Human Values and Professional Ethics” by Suresh Jayshree and Raghavan B S (Latest edition)

Course Content

8.26 Technical Report Writing

CODE & TITLE (AIS-202) **Technical Report Writing**		CREDIT & CONTACT HOURS (2+0) **32 Theory + 0 Lab**	KNOWLEDGE AREA/ DOMAIN **Social Science**
After completion of this course, students will be able to:		**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Discuss** basic concepts of technical writing, and use of standard word processing software, along with referencing tools for report writing.	C-2	1
CLO-2	**Initiate** technically correct statements, assignments, final year project report, project proposals, short reports, research papers, business and professional correspondence.	C-3	10

Course Outline for Theory

Introduction to technical writing, technical communication process, proposal write-up and improvement strategies, introduction to research and research types, choosing research problems and research advisors, how to carry out research, different parts of technical writing, formulation – problem statement, literature review, design – methodology, analysis - data analysis and interpretation good writing style techniques, uses of correct words, presenting and publishing research, write business/professional correspondence, cover letter and CV, writing meeting minutes, introduction to informal writing, uses of informal reports.

Recommended Books

1. Technical Report Writing Today, by Daniel Riordan, 10th Edition (or Latest Edition) Technical Writing and Professional Communication, Leslie Olsen and Thomas Huckin, 2nd Latest Edition)
2. Communication for Engineering Students by J. W. Davies, (or Latest Edition)
3. Science Research Writing for Non-Native Speakers of English by Hilary Glassman-Deal, Imperial College
4. Press. (Latest Edition)

Course Content

8.27 Farm and Industrial Structures

CODE & TITLE (AIT-301) **Farm and Industrial Structures**		**CREDIT & CONTACT HOURS** (2+1) **32 Theory + 48 Lab**	**KNOWLEDGE AREA/ DOMAIN** **Technology Foundation-I**	
After completion of this course, students will be able to:			**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Identify** industrial structures.		C-1	1
CLO-2	**Apply** architectural knowledge to the industry.		C-3	3
CLO-3	**Evaluate** the operation and maintenance of machines at farms and industrial structures.		P-6	4
Course Outline for Theory				
Introduction to farm/industrial structures: Benefits of structures, Planning, design and erection of farm/industrial buildings, Design considerations of farm structures, Building Plans and Specifications. Building materials: Factors considered in material selection, Wood as a construction material, Manufactured boards, Natural building materials, Earth as a building material, Soil Stabilization – binders, Cement, sand and stones, Concrete and reinforced concrete, Metals, glass, plastics and paints, Fasteners and fastening techniques. Structural designs and elements of construction: Structural design, Structural elements, and loading, Elements of construction, building production, Methods of construction, building life, Building repairs and maintenance. Climate and environmental control: Insulating materials, Plumbing, heating and ventilation, Rate of heat transmission through building materials, Air distribution, Cooling, Sound insulation - noise control, Lightning conductors. Animal housing, sundry farm buildings, and farm dwellings: Animal behavior and building design, Farm buildings for various animals, Machinery shops and storage, Greenhouses, Farm dwellings.				
Lab Outlines				
Lab-01 To draw the layout plan of the university farm. Lab-02 Identification of different material used in farm structures, their properties, and requirement. Lab-03 To draw the layout plan of the dairy farm and its requirement. Lab-04 To draw the layout plan of a poultry farm and its requirement. Lab-05 Designing warehouses. Lab-06 Grain storage structures. Lab-07 To draw the layout plan of a wheat flour mill and its requirement. Lab-08 To draw the layout plan of cotton ginning and its requirement.				

Lab-09 Safety measures in farm and industrial structures.
Lab-10 Study visits.

Recommended Books

1. French, T. E. 2010. Agricultural Drawing and design of farm structures. Nabu Publisher, USA
2. Baker, C. G. J. 2013. Handbook of Food Factory Design. Springer-Verlag, New York.
3. Nelson, G., Manbeck, H.B., Meador, N.F. 1988. Light Agricultural and Industrial Structures. Springer US
4. Barre, H. J., and Sommet, L.L. 2001. Farm Structure. John Wiley and Sons, Inc. New York, USA.
5. Barnes, A.M. and M. Clive. 2000. Farm Building Construction. Farming Press, London, UK
6. Kruegher, W.C. 2011. Farm Structures and Equipment with Information on Farmhouse, Wells, Water Piping, Heating System and Livestock Houses. Kent Press, Canada.

Course Content

8.28 Instrumentation and Control

CODE & TITLE (AIT-303) **Instrumentation and Control**	**CREDIT & CONTACT HOURS** (2+1) **32 Theory + 48 Lab**	**KNOWLEDGE AREA/ DOMAIN** **Technology Foundation-I**	
After completion of this course, students will be able to:		**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Explain** the fundamentals of instrumentation and measurement systems.	C-2	1
CLO-2	**Illustrate** working principles of instruments and apply them in practical scenarios.	C-2	1
CLO-3	**Apply** working principles of instruments for industrial applications.	C-3	2
CLO-4	**Investigate** instrumentation and measurement systems.	P-4	4

Course Outline for Theory

Orientation of the course and the myth of Instruments with industrial applications and controls; Temperature measuring instruments; Feature specifications of instrumentation / Transducer; Force / Load Measuring instruments. Review and Instrument types; Static Characteristics of Instruments; Dynamic Characteristics of Instruments; Measurement Uncertainty (Errors); Instrument Calibration/error analysis.

Pressure measuring instruments; Flow measuring instruments; Acceleration; vibration; density measurements; Viscosity and humidity/moisture measurements; Level and flow measuring instruments.

Display devices and Systems; Typical applications for the sensors, signal conditioning and transmission.

Lab Outlines

1. Measurement of Displacement by LVDT and Potentiometer.
2. Measurement of wind velocity.
3. Measurement of Force by Strain Gauges.
4. Calibration of pressure gauges with dead weight tester.
5. Measurement of Temperature by thermocouples.
6. Computer inter-facing for the depth and draft controls of tractors.
7. Study of depth sensors

Recommended Books
1. Bartelt, Terry L.M. 2010. Industrial Automated Systems: Instrumentation and Motion Control. 1st Ed. Delmar Cengage Learning, New York City, NY, USA. 2. K Krishnaswamy, 2018, Industrial Instrumentation 2nd Edition New International Publisher New Delhi India 3. Mikell P. Groover 2016 Automation production systems and computer-integrated Manufacturing 3rd Edition Pearson Publisher UK. 4. National Joint Apprenticeship and Training Committee. 2008. Building Automation: Control Devices and Applications. 1st Ed. Amer Technical Publishers, Orland Park, IL, USA. 5. Richard, C., Dorf. Bishop, and H. Robert. 2010. Modern Control Systems. 12th Ed. Pearson Publisher, Cambridge, UK

Course Content

8.29 Total Quality Management

CODE & TITLE (AIT-305) **Total Quality Management**		CREDIT & CONTACT HOURS (2+1) **32 Theory + 48 Lab**	KNOWLEDGE AREA/ DOMAIN **Technology Foundation-I**	
After completion of this course, students will be able to:			**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Explain** the meanings of the quality concept and its influence.		C-2	11
CLO-2	**Describe** and use techniques and quality management tools.		C-2	5
CLO-3	**Identify** the elements that are part of the quality measuring process in the industry.		C-1	7
CLO-4	**Detect** the errors in the measuring process, distinguishing its nature and the root causes.		P-1	4

Course Outline for Theory

Definition: quality, deming, miller, Crosby theories, Service and Product quality, Customer orientation; Evaluation of Total quality Management.

Inspection Quality Control: TQM System Human component, Introduction to Six Sigma concepts, Lean Manufacturing concepts (What is Lean? / Goal of Lean, Concept of Value & Waste, Lean Concepts & Guideline to Map Future State, Creating & Implementing Continuous Flow, Managing Human element in industries).

Unit II Quality Planning: Planning SMART Goal setting, designing for quality manufacturing for Quality, Process control CPK, Process capability; Scientific Approach to TQM Data based approach Quantification: Statistical tools, Quality control tools, New 7 tools, Sampling and Control Charts: ISO 9000 Systems, Support (Augmentation Standards) [Customer Satisfaction (ISO 10001,2,3,4,8), Complaints Handling (ISO 10002), Audit Fundamentals (Concepts, Principles and Standards).

Unit III TQM Techniques Benchmarking: Definition, Types, Steps, Metrics case studies, quality function deployment, Definition steps, Case studies; Corrective techniques: Preventive techniques failure mode and effect analysis 5S, Continuous improvement techniques, Different techniques such as POKA YOKE etc; Deming wheel case studies; Unit IV Reliability Definition: Control charts theory of control charts, measurement range.

Lab Outlines
1. Construction and analysis of R charts; process capability study. 2. Use of control charts; Attributes of Control Charts Defects; construction and analysis off-chart, improvement by control chart; variable sample size. 3. Construction and analysis of C-chart. 4. Defects Diagnosis and Prevention Defect study; identification and analysis of defects; corrective measure, factors affecting reliability, MTTF. 5. Calculation of reliability; Building reliability in the product; evaluation of reliability; interpretation of test results; reliability control, maintainability, zero defects, quality circle.
Recommended Books
1. Dale H Besterfield, (2008), Total Quality Management, Pearson Education 2. L.S. Srinath, (2005) Reliability Engineering, Affiliated East West Press, New Delhi. 3. Lean Production Simplified, by Pascal Dennis 4. Value stream management by Don Tapping 5. Evans, J.R., Lindsay, W.M. (2011), Management for Quality and Performance Excellence, South-Western Cengage Learning, Mason, Ohio, 8th edition

Course Content

8.30 Industrial Processes and Management

CODE & TITLE (AIT-307) **Industrial Processes and Management**		CREDIT & CONTACT HOURS (2+1) **32 Theory + 48 Lab**	KNOWLEDGE AREA/ DOMAIN **Technology Foundation-I**	
After completion of this course, students will be able to:			**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Comprehend** fundamentals of programming.		C-2	1
CLO-2	**Analyze** production and demand.		C-4	2
CLO-3	**Synthesize** production and scheduling.		C-5	3
CLO-4	**Develop** plans and their layouts.		P-1	1

Course Outline for Theory

Fundamentals of Optimization: Linear programming models, simplex algorithm, mixed-integer programming models, branch-and-bound algorithm, duality and sensitivity analysis, minimum cost network flow problems and shortest path problems, Dijkstra's algorithm, short introduction to non-linear programming.

Operation Research: Optimization (linear, integer, and non-linear programming), network models, inventory models, markov processes, queuing theory, game theory, decision theory, simulation, Scheduling techniques.

Purchasing and procurement. Inventory control; EOQ/EPQ models, Time and motion study, Organizational structure. Production Planning and Scheduling: Introduction to planning and scheduling, capacity management and control, forecasting using time series (forecasting stationary demand, demand with trend, and seasonal demand), Aggregate production planning (common strategies and Linear Programming (LP) approach), scheduling production and workforce in manufacturing systems, variability and production and inventory systems, Deterministic inventory models (EOQ, discount models, EPQ, models with constraints on budget and space), Stochastic inventory models (Newsboy problem, continuous review models, (R, Q) policy, periodic review systems (policy), Lean Operations (JIT, CONWIP, Kanban, TQM, TPM etc), risk pooling strategies.

Lab Outlines

Lab-01 Study of organizational structures of selected industries.
Lab-02 Study of plant/factory layout principles.
Lab-03 Estimation of air, water and soil pollutants of selected industries.

Lab-04 Study of different types of cleaners and conveyors.
Lab-05 Evaluation of different storage techniques.
Lab-04 Visit to local vendor Industries.
Lab-05 Student projects.

Recommended Books

1. Goldratt, Eliyahu M., and J. Cox. 2004. The Goal: A Process of Ongoing Improvement. 3rd Ed. Highbridge Recorded Books LLC, Washington D.C., WA, USA.
2. Kumar, P. 2017. Industrial Engineering and Management. 1st Ed. Pearson Education, Delhi, India.
3. Nahmias, S. 2008. Production and Operations Analysis. 6th Ed. Irwin/McGraw-Hill, New York City, NY, USA.
4. Rardin, Ronald L. 2016. Optimization in Operations Research. 2nd Ed. Pearson Education, Delhi, India.
5. Ravi, V. 2015. Industrial Engineering and Management. 1st Ed. PHI Learning, Delhi, India.

Course Content

8.31 Entrepreneurship

CODE & TITLE (AIM-301) **Entrepreneurship**	CREDIT & CONTACT HOURS (2+0) **32 Theory + 0 Lab**	KNOWLEDGE AREA/ DOMAIN **Management Science**	
After completion of this course, students will be able to:		**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Exhibit** entrepreneurial ideas and understand corresponding challenges.	C-5	3
CLO-2	**Analyze** financial requirements for new business ideas and develop financial strategies.	C-4	3
CLO-3	**Evaluate** entrepreneurial plans, challenges of new ventures, and sustainability concerns.	C-6	2

Course Outline for Theory

Entrepreneurship: an evolving concept: Entrepreneurship – A perspective, Emerging Trends: The Internet and E-Commerce, entrepreneurial opportunities, The evolution of Entrepreneurship, The myths & approaches to entrepreneurship; Understanding Strategic Issues in Business Plan Development: Comparative analysis entrepreneurship in other countries, Strategic Objectives, Competitor Analysis; Understanding the Entrepreneurial Perspective in Individuals: The Entrepreneurial Perspective, The Dark side of Entrepreneurship, Entrepreneurial Motivation, entrepreneurial perspective in organization, corporate entrepreneurship. social entrepreneurship and the ethical challenges of entrepreneurship; Legal Challenges for Entrepreneurial Ventures: Legal Challenges for the Entrepreneurial Venture, Intellectual Property Protection: Patents, Copyrights, and Trademarks, Identifying Legal Structures for Entrepreneurial Ventures, Sole Proprietorships, Partnerships, Corporations, Specific Forms of Partnerships and Corporations, Understanding Bankruptcy

Assessment of Entrepreneurial Plan: The Challenge of New- Venture Start-Ups, Pitfalls in Selecting New Ventures, Critical Factors for New-Venture Development, Why New Ventures Fail, The Evaluation Process; Strategic Entrepreneurial Growth: The Nature of Strategic Planning in Emerging Firms, Strategic Planning, The Lack of Strategic Planning, The Value of Strategic Planning, Managing Entrepreneurial Growth, Venture Development Stages, The Entrepreneurial Company in the Twenty-First Century, Building the Adaptive Firm, The Transition from an Entrepreneurial Style to a Managerial Approach, Understanding the Growth Stage, Unique Managerial Concerns of Growing Ventures, The International Environment: Global Opportunities, Achieving Entrepreneurial Leadership in the New Millennium.

Recommended Books

1. Bill, G. 2017. All In: 101 Real Life Business Lessons for Emerging Entrepreneurs. Koehler Books, Virginia Beach, VI, USA.
2. Donald, F. K. Entrepreneurship: Theory Process Practice. 9th Ed. Cengage Learning, Boston, MA, USA.
3. Ferris, T. 2016. Tools of Titans: The Tactics, Routines, and Habits of Billionaires, Icons, and World-Class Performers. Houghton Mifflin Harcourt, Boston, MA, USA.
4. Lyons D. 2016. Disrupted: My Misadventure in The Start-Up Bubble.1st Ed. Hachette Books, New York City, NY, USA.
5. Meisel, A., and N. Sonnenberg. 2016. Idea to Execution: How to Optimize, Automate, and Outsource Everything in Your Business. Lioncrest Publishing, Austin, TX.

Course Content

8.32 Feed Milling Technology

CODE & TITLE (AIT-309) **Feed Milling Technology**	**CREDIT & CONTACT HOURS** (2+1) **32 Theory + 48 Lab**	**KNOWLEDGE AREA/ DOMAIN** **Major Based Depth**	
After completion of this course, students will be able to:		**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Understand** functioning of feed mills.	C-1	1
CLO-2	**Develop** flow diagrams for feed mills.	C-3	3
CLO-3	**Plan** feed production operations.	C-5	3
CLO-4	**Design** mechanism for working of feed mills.	P-4	4

Course Outline for Theory

Present status of feed industry in Pakistan, Problems of feed industry in Pakistan. Introduction to different forms of feed mills; Criterion for selection of raw material (grain, meal, vitamins, minerals and liquids), Grain Storage and treatment technologies, Estimation of grain storage life, Feed Mill Operation: Interpretation of feed mill codes, flow diagram, feed mill lay-out and technical drawings; outline of feed mill operations in a poultry, dairy and fish feed mill, capacity calculation, flow diagram, reception, handling, cleaning, drying, receiving and storage of raw materials, blending/dosing, grinding, material weighing and batching, mixing conditioning, /pelleting, cooling, sizing, sieving and packaging, Maintenance of equipment, Plant safety (dust explosion); Management and Economics: cost calculation, cost control of feed processing; Nutrition and feed formulation of poultry: Feed composition and nutrient requirements for broiler, layer ad breeder.

Nutrition and Feed Formulation of dairy: Types of cattle, Feed composition and nutrition requirements for different types of cattle, buffalo and milking cattle; nutrient requirements of different cattle types, safe maximum requirement of ingredients; Fish and shellfish: overview, importance, handling, transportation. Reception, testing and storage of fish. Quality indicators: biochemical, microbiological. Fish preparation: heading, filleting, skinning. Standards for freshness of fish. Fish preservation: Types of fishes, Feed composition for different types of fishes; nutrient requirements of different fish types, safe maximum requirement of ingredients.

Lab Outlines

Lab-01 Preparation of feasibility report to establish a feed mill for poultry feed.
Lab-02 Preparation of feasibility report to establish a feed mill for ruminants.

Lab-03 Construction techniques of feed mill for poultry feed.
Lab-04 Construction techniques of feed mill for ruminants.
Lab-05 Exercise to search for local and international market of grains and meals.
Lab-06 Sampling techniques at feed mill.
Lab-07 Feed marketing techniques.
Lab-08 Demonstration of different types of grinders.
Lab-09 Demonstration of different types of mixers.
Lab-10 Demonstration of different types of conveyers and elevators.
Lab-11 Demonstration of different types of Silos for feed ingredient storages.
Lab-12 Pallet machine use in feed mills.
Lab-13 Visit of feed mills (Poultry).
Lab-14 Visit of dairy feed mill.

Recommended Books

1. Bebb, D.L. 1990. Mechanized Livestock Feeding. BSP Professional Books, Oxford, U.K.
2. Eileen, K. and R.R. Schofield. 2005. Feed Manufacturing Technology IV. American Feed Industry Association, Inc. Arlington, TX, USA.
3. Ensminger, M.E. J.E. Oldfield and W.W. Heinemann. 1990. Feeds and Nutrition Digest. 2nd Ed. The Ensminger Publishing Co. Clovis, CA. USA.
4. Mcellihiney, R.R.1994. Feed Manufacturing Technology IV. American Feed Industry Association, Inc. Arlington, TX, USA.
5. Orskov, E.R. 1988. Feed Science, World Science Series-B, Disciplinary Approach. Elsevier, Amsterdam, Netherlands.

Course Content

8.33 Cotton Ginning and Fiber Technology

CODE & TITLE (AIT-311) **Cotton Ginning and Fiber Technology**	**CREDIT & CONTACT HOURS** (2+1) **32 Theory + 48 Lab**	**KNOWLEDGE AREA/ DOMAIN** **Major Based Breadth**	
After completion of this course, students will be able to:		**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Understand** cotton ginning.	C-1	1
CLO-2	**Comprehend** steps in the ginning process.	C-2	2
CLO-3	**Perform** post-production analysis.	C-4	4
CLO-4	**Conduct** tests in the cotton industry.	P-2	1

Course Outline for Theory

Introduction to ginning and ginning processes: their requirements & essentials. Modernization in ginning processes, induction of special equipment to improve their working efficiencies. Common standard types of ginning processes used in Pakistan i.e., roller ginning, saw ginning etc; Ginning Machinery Model layout & its operational maintenance requirements: Definition of bearing, functions of bearing & their common types. Numbering system of ball & roller bearings. Definition & function of lubricants. Types of lubricants i.e., oils and grease etc.

Suction & Delivery Module: Introduction of suction module & delivery modules. Detailed description of parts of duct lines. Cleaning Module: Define contamination, Types of contamination in seed cotton i.e., leaves, trash, sticks, bowls, (sangli), balls (tenda), dust, stones & other solid / foreign materials etc. Requirements of cleaning seed cotton. Stages of cleaning seed cotton i.e., pre ginning, post ginning. Machinery / equipment used for cleaning seed cotton Spreading machine / platform. Description of different cleaners.

Separator Module: Explain the working of separator. Description of cleaning rollers & guides of the separator, adjustments & assembling – disassembling etc. Description of stick machine. Functions of the Feeder Extractor Collector (FEC). Study of general feeder; Humidification in cotton ginning: Requirement of humidification of cotton and its effects. Control of moisture contents in cotton lint. Methods of humidity test; Bailing and Packing Unit: Define the baling unit and hydraulic press. Cotton cloth warping, wire packing of bales – its effects. Function of lint slide – common problems. Description of pusher. Working of tramper – It's timing with the pusher. Study of weighing units / machines, its types. Standard weight of the bales; Processing of By-Products: Cotton Seed expelling, study of expeller etc. Cotton Seed cake. Cotton Seed Oil. Cotton Bowl (Sangli), Waste cotton dust etc; Fiber & Quality of Fiber / Lint:

Basic & brief study of qualities of cotton lint / fiber. Various tests of cotton staple / fiber, Common defects induced in cotton lint during the ginning process to the required standards.

Lab Outlines

Lab-01 Various tests of cotton staple / fiber.
Lab-02 Common defects induced in cotton lint during the ginning process.
Lab-03 Study of expeller.
Lab-04 Describe the function of the discs in saw ginning.
Lab-05 Description of ribs, their sizes, angles, adjustments of side clearances between saws & ribs.
Lab-06 Study of working of hot air cleaner.
Lab-07 Dust collection systems i.e., cyclones, chutes.
Lab-08 Study of the function and working of a dragon machine.

Recommended Books

1. A. L. Vandergriff. 1996. Ginning Cotton: An Entrepreneur's Story. Texas Tech University Press, Lubbock, TX, USA.
2. Anthony, W.S. Mayfield, and D. William. 1994. Cotton Ginner's Handbook. US Government Publishing Office, Washington D.C., WA, USA.
3. Doraiswamy, I. Chellamani, P., and A. Pavendhan. 1993. Cotton Ginning (Textile Progress). The Textile Institute. India.
4. Gordon, Cook J. 1984. Handbook of Textile Fibers. 190507th Ed. Elsevier, Amsterdam, Netherlands.
5. Robinson Masters, N. 2006. The Cotton Ginning (Inventions That Shaped the World). Franklin Watts Publisher, London, UK.

Course Content

8.34 Sugar Technology

CODE & TITLE (AIT-313) **Sugar Technology**	**CREDIT & CONTACT HOURS** (2+1) **32 Theory + 48 Lab**	**KNOWLEDGE AREA/ DOMAIN** **Major Based Breadth**	
After completion of this course, students will be able to:		**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Comprehend** the sugar industry and its production system.	C-1	1
CLO-2	**Understand** the technology used in production of sugar.	C-2	2
CLO-3	**Evaluate** the sugar quality.	C-6	4
CLO-4	**Identify** mechanism for quality control.	C-4	3

Course Outline for Theory

Sugar industry in Pakistan. Sugarcane and sugar beet: production, quality. Indigenous technology for small scale sugar production: gur, khund, shakar. Raw sugar manufacturing: unit operations - juice extraction, purification, heating, evaporation, crystallization, crystallization in motion. Refining: affination, clarification, decolorization, crystallization, centrifugation, drying. Bagging, storage. Factors affecting sugar processing. Quality criteria: raw and refined sugar. Specialty sugar products: brown or soft sugar, liquid sugar. Sugar industry byproducts and their uses.

Lab Outline

Lab-01 Analysis of sugar cane, sugar beet for TSS, pH, fibre, ash and polarization.
Lab-02 Extraction and clarifications of raw juice.
Lab-03 Analysis of sugar and its intermediate products.
Lab-04 Inversion of sugar.
Lab-05 Visit to sugar industries.

Recommended Books

1. Asadi, M. 2007. Beet Sugar Handbook. John Wiley & Sons, Inc. New York City, NY, USA.
2. Chen, C.C. 2000. Handbook of Sugar Refining: A Manual for the Design and Refining Facilities. John Wiley & Sons, Inc. New York City, NY, USA.

3. Chen, J.C.P. 2007. Meade-Chen Cane Sugar Handbook. John Wiley & Sons, Inc. New York City, NY, USA.
4. Lionnet, G.R.E. 1999. Sugar Technology for Students. Lang Fred, Durban, South Africa.
5. Mathur, R.B.L. 1984. Handbook of Cane Sugar Technology. 2nd Revised Ed. Imprint Unknown, London, UK.

Course Content

8.35 Automation and Robotics

CODE & TITLE (AIT-302) **Automation and Robotics**	**CREDIT & CONTACT HOURS** (2+1) **32 Theory + 48 Lab**	**KNOWLEDGE AREA/ DOMAIN** **Major Based Breadth**	
After completion of this course, students will be able to:		**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Understand** working principles of robotics.	C-1	1
CLO-2	**Apply** robotics in the industry.	C-3	3
CLO-3	**Evaluate r**obotics.	P-3	4
CLO-4	**Utilize** robotics effectively.	P-3	5

Course Outline for Theory

Process control fundamentals, Relay logic and various control devices, Architecture of programmable logic control units, Introduction to distributed control system (DCS) and SCADA Sensors for industrial processes, D/A and A/D converters, Industrial processes interfacing with micro-processors, practical applications, Introduction to Robotics, Robot anatomy, Robot configuration, accuracy & Repeatability, Robot specifications, end effectors, Kinematics and Dynamics, Characteristics of Robot applications, Robot Cell Design, types of Robot Applications.

Lab Outlines

1. Practicals on various control devices.
2. PLC introduction and Programming (Ladder Diagram).
3. Simulation and Interfacing with Programmable Logic Controller (PLC).
4. SCADA System (Automation Applications).
5. Study and use of Robot for various applications.
6. Any other lab on discretion of the instructor.

Recommended Books

1. Bartelt, Terry L.M. 2010. Industrial Automated Systems: Instrumentation and Motion Control. 1st Ed. Delmar Cengage Learning. New York City, NY, USA.

2. Boucher, Thomas O. 1996. Computer Automation in Manufacturing: An Introduction. Springer Publisher, Berlin, Germany.
3. Distofanoelef, J.J. Automatic Control. Imprint Unknown. (Latest Ed.)
4. Groover, Mikell P. 2014. Automation, Production Systems & Computer Integrated Manufacturing. 4th Ed. Pearson, Delhi, India.
5. In Partnership with NJATC. 2008. Building Automation: Control Devices and Applications. 1st Ed. Amer Technical Publishers, Orland Park, IL, USA.

Course Content

8.36 Boiler Operation and Maintenance

CODE & TITLE (AIT-304) **Boiler Operation and Maintenance**	**CREDIT & CONTACT HOURS** (2+1) **32 Theory + 48 Lab**	**KNOWLEDGE AREA/ DOMAIN** **Major Based Breadth**

After completion of this course, students will be able to:		**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Understand** basics of boiler engineering.	C-1	1
CLO-2	**Analyze** steam cycles and their respective use.	C-4	2
CLO-3	**Understand** power plants, and layouts of modern steam plants.	C-2	1
CLO-4	**Demonstrate** performance of boilers and measurement of impulse forces.	P-4	4

Course Outline for Theory

Biotechnology- definition and history; foundations of biotechnology and interdisciplinary pursuit; branches and/or applications of biotechnology in medicine, agriculture (food, livestock, fisheries, algae, fungi, etc.); protection of biotechnological products; safety in biotechnology; public perception of biotechnology; biotechnology and ethics; biotechnology and the developing world

Course Outline for Lab

Boiler Engineering: Introduction, types, construction, mounting, accessories steam cycle, steam nozzles, supersaturated expansion in nozzles, heat drop in saturated and supersaturated expansion, steam injector, steam turbine, work done, velocity diagram, work done in blading, velocity compounding, pressure compounding, impulse turbine, heat account for boiler and turbine, amount of fuel burnt, acceptance tests, analysis and calorific value of fuel, analysis of flue gases, amount of steam produced, pressure and quality of steam, design of boiler and pressure control system devices. Properties of steam, enthalpy of water, dryness fraction, enthalpy of wet steam, use of steam tables, super-heated steam, internal energy of steam.

Power Plants: Steam Plants: Introduction, general layout of modern steam plants, steam generators, engines and auxiliary components, back pressure and pass out turbines, deviation of actual cycle from ideal, turbine pump and condenser. Steam Turbine and Power Plants: Introduction, the steam turbine cycle, modification in basic cycle, isentropic efficiency of compressors and turbines, inter cooling and reheating, explosion type steam turbine with

solar heating, development and improvement in gas turbine. Jet propulsion plant, comparison of steam and gas power plants, efficiency, cost analysis.

Lab Outlines

1. Demonstration and inspection of different types of boilers.
2. Determination of calorific value of fuel.
3. Analysis of flue gases using gas analyzer.
4. Quality analysis of steam; Measurement of impulse force on vane of turbine.
5. Assessment of power generation at output shaft.
6. Visit to different power plants.
7. Visit to textile industries to study boilers and steam power.
8. Visit to nuclear and steam power plants

Recommended Books

1. Cengel, Y.A. and R.H. Turner. 2005. Fundamentals of Thermal Fluid Sciences. 2nd Ed. McGraw Hill International, New York City, NY, USA.
2. Chattopadhyay, P. 2000. Boiler Operation Engineering. 2nd Ed. TATA McGraw Hill Pub. Co. Ltd, New Delhi. India.
3. Granet, I. and M. Bluestein. 2001. Thermodynamics and Heat Power. 6th Ed. Pearson Education Asia, New Delhi. India.
4. Mallick, Amiya R. 2015 Practical Boiler Operation Engineering and Power Plant. 4th Ed. PHI Learning, New Delhi, Delhi, India.

Course Content

8.37 Industrial Software Applications

CODE & TITLE (AIT-306) **Industrial Software Applications**	**CREDIT & CONTACT HOURS** (2+1) **32 Theory + 48 Lab**	**KNOWLEDGE AREA/ DOMAIN** **Major Based Breadth**	
After completion of this course, students will be able to:		**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Understand** integer and nonlinear programming.	C-1	1
CLO-2	**Apply** linear algebra concepts to solve industrial problems.	C-3	3
CLO-3	**Demonstrate** and use computer programs on CNC machines and industrial robots.	P-4	5

Course Outline for Theory

Application of Linear Algebra to Industrial Problems, Introduction to Linear Programming, Graphical method of solving L.P. problems, Simplex method, Duality and Sensitivity, solving large scale problems using computer, Transportation and Assignment Problems, Network problems, shortest path, minimum spanning tree, maximum flow problems, Queuing theory. transportation problem. Minimum cost network flow algorithms; out-of-kilter method; primal dual methods. Integer programming; Interior point optimization methods; affine scaling method. Karush-Kuhn-Tucker conditions for constrained nonlinear programming problems; necessary and sufficient conditions; quadratic programming; applications. Heuristic optimization methods: genetic algorithms; ecological engineering application.

Lab Outlines

1. Part programming on CNC machines
2. Part storage/retrieval programs and applications
3. Automated part identification
4. Part handling by robots and AGV
5. Use of CMM
6. Simulation of CIM
7. IDEF model's development
8. Study of a decision support system.

Recommended Books

1. Kalavathy, S. 2004. Operations Research. 2nd Ed. Vikas Publishing House, Chennai, India.
2. Lee, J. K. and L. P. Ritzman. 2001. Operation Management: Strategy and Analysis. 6th Ed. Prentice Hall, Upper Saddle River, NJ, USA.
3. Rardin, Ronald L. 2016. Optimization in Operations Research. 2nd Ed. Pearson Education, Delhi, India.
4. Taha, A. H. 2007. Operations Research: An Introduction. 8th Ed. Prentice Hall. Upper Saddle River, NJ, USA.
5. Winston, Wayne L. 2003. Operations Research: Applications and Algorithms. Duxbury Press, Pacific Grove, CA, USA.

Course Content

8.38 High Efficiency Irrigation Systems

CODE & TITLE	CREDIT & CONTACT HOURS	KNOWLEDGE AREA/ DOMAIN
(AIT-308) **High Efficiency Irrigation Systems**	(2+1) **32 Theory + 48 Lab**	**Major Based Depth**

After completion of this course, students will be able to:		Bloom's Taxonomy Level	PLO
CLO-1	**Understand** irrigation techniques, design fundamentals, and types of farm irrigation systems.	C-2	1
CLO-2	**Identify** methods to determine crop water requirement using different techniques.	C-4	4
CLO-3	**Analyze** relevant parameters to understand plant-water-soil relationship.	C-4	2
CLO-4	**Evaluate** various surface irrigation techniques.	P-5	3

Course Outline for Theory

Irrigation methods. Introduction and Scope of Pressurized irrigation system. Crop Water needs different crops. Measurement of irrigation water. Introduction to irrigation efficiencies. Introduction of Water Lifts and Pumps. Variable Displacement Pumps. Pipe hydraulics and head losses.

Drip Irrigation: Introduction and Types. Different types i.e., drip, subsurface, bubbler, and spray irrigation system, components of drip irrigation system, emitter selection, design of tickle/drip system; Adaptability, limitations and standards and quality assurance. Installation, Operation and maintenance, Control of trickle irrigation system clogging, filtration, settling basin, media filter, screen filter, chemical treatments, and evaluation of drip irrigation system.

Sprinkler irrigation system: Introduction and Types of sprinkler system. Layout and components of Sprinkler irrigation system. Adaptability, limitations and standards and quality assurance. Types and Selection of Emission Devices. Installation, operation, and maintenance of sprinkler irrigation unit. Fertigation application methods through pressurized irrigation methods. Filtration system of pressurized irrigation system. Power requirement for pressurized irrigation systems. Performance Evaluation of pressurized Irrigation Systems. Automation of Micro Irrigation System. Post construction issues upgrading and development.

Lab Outlines
1. Demonstration of Drip Irrigation Components 2. Visit of students to Drip Irrigation System on the Farm 3. Visit of students to Sprinkler Irrigation System on the Farm 4. Visit of students to bubbler Irrigation System on the Farm 5. Visit to factory or material manufacturing for pressurized irrigation
Recommended Books
1. Tiwari K. N. and T. B. S. Rajput. Micro irrigation system design. 2. Phocaides. FAO Consultant. 2017. Handbook on Pressurized Irrigation techniques 2nd Edition. 3. Keller, J. and R.D. Bliesner, 1990. Sprinkler and Trickle Irrigation. The Black Burn Press, Chapman Y. Hall. 4. Keller, J. 1984. Sprinkler Irrigation. SCS National Engineering Handbook. Section 15/ Chapetr 11. Agriculture and Irrigation Deptt- Utah State University, U.S.A. 5. Richard. B. Choate. Turf Irrigation Manual. 5th Edition whether-matic Division & Telsco Industries. 6. Landscape Irrigation Design Manual by Keith Sheperskly Rain Bird Irrigation Company. 7. Drip Irrigation Design Manual by Keith Sheperskly Rain Bird Company

Course Content

8.39 Grain Milling Technology

CODE & TITLE (AIET-310) **Grain Milling Technology**	CREDIT & CONTACT HOURS (2+1) **32 Theory + 48 Lab**	KNOWLEDGE AREA/ DOMAIN **Major Based Depth**

After completion of this course, students will be able to:		Bloom's Taxonomy Level	PLO
CLO-1	**Identify** different varieties of paddy and wheat, and their specifications.	C-1	1
CLO-2	**Analyze** different industrial process in rice and flour mills**.**	C-4	2
CLO-3	**Apply** industrial managerial skills in rice and flour mills.	C-3	5
CLO-4	**Work** in rice and flour mill laboratories testing their various parameters.	P-3	5

Course Outline for Theory

Paddy Rice Varieties: Basmati rice varieties, non-basmati varieties, other varieties; Rice Milling: sun drying of paddy, mechanical drying of paddy, cleaning, drying & storage of paddy; Pakistan standard specification for rice; rice fumigation; Rice Parboiling: introduction, technique of soaking in water, steam treatment (gelatinization), husking and bran removing, abrasive polishing/ whitening, resultant amber colour rice; Overview of the Pakistan flour milling industry; Wheat sampling, grading factors, international grading system; Quality parameters: wheat moisture, wheat ash, falling number value, hectolator weight, Protein content; The flour Mill laboratory; facilitates environmental conditions; communications; procedures Experimental & milling laboratory; Methods of separating wheat impurities: theory of condition and tempering wheat before milling, cleaning preconditioned wheat, future trends; Wheat Grinding Process: Grinding machines, breaking system, middling system, refraction; The sieving system: Principles of sieving, machines, understanding to granulation; The purification process: Principles of purification, Mill Management porting methods in operating mills Flour mill machineries, Wheat and the Screen room: The Wheat Plant, Wheat Varieties, Wheat Production, Wheat Intake, Wheat Storage, Wheat Cleaning, The Screen room, Treatment and Disposal of Screenings, Adjustment and Maintenance of Plant, Wheat Damping, Conditioning and Drying Wheat. Grain selection for flour mills, grain washing and drying technique, Automation in flour mills.

Lab Outlines
1. Paddy Testing and Lab Analysis: 2. determination of moisture, trash, dirt, and damaged rice. 3. Identification of Varieties of Basmati & Non-Basmati Rice; Processing, Husking & Milling of Paddy. 4. Visit to rice mill; Identification of different Types of Flour; Identification of different Flour Grades; Quality Assurance tests on wheat and flour. 5. Visit to flour mill, Calculation of Fineness modulus of wheat flour. 6. Demonstration of sieves used for cleaning/grading. 7. Carrying out screen analysis of milling/grinding equipment.
Recommended Books
1. Gariboldi, F.1973. Rice Testing Methods and Equipment. Food and Agricultural Organization of the United Nations, Rome, Italy. 2. Kassan, H. Manual for Identification of Rice Varieties. Rice Exporters Association of Pakistan, Lahore, Pakistan. 3. Kozmin, P.A., M. Falkner and T. Fjelstrup. 1994. Flour Milling; A Theoretical and Practical Handbook. D. Van Nostrand Co. New York City, NY, USA. 4. Mushtaq, A.C. Handbook on Rice Varieties in Pakistan. Zaib Khan Publisher, Urdu Bazar, Lahore, Pakistan.

Course Content

8.40 Technology of Oils and Fats

CODE & TITLE (AIT-312) **Technology of Oils and Fats**		**CREDIT & CONTACT HOURS** (2+1) **32 Theory + 48 Lab**	**KNOWLEDGE AREA/ DOMAIN** **Major Based Depth**	
After completion of this course, students will be able to:			**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Understand** oils and fats.		C-1	1
CLO-2	**Analyze** different industrial processes in oil mills.		C-4	2
CLO-3	**Apply** industrial managerial skills to oil mills		C-3	5
CLO-4	**Demonstrate** oil extraction and packing processes.		P-3	5

Course Outline for Theory

Oils and fats: importance, sources, production, uses. Characteristics of oils and fats: physical, chemical. Oil bearing materials: pre-treatment, storage. Extraction methods: rendering, expression, solvent extraction. Processing: degumming, refining, bleaching, deodorization, fractionation, winterization, hydrogenation inter esterification, esterification, emulsification, stabilization. Spoilage: oxidative and hydrolytic rancidity – chemistry, prevention - use of antioxidants. Manufacture of frying oils, margarine, and mayonnaise. By products of fats and oils industry and their uses. Important hydrocarbon properties and terminology Typical sales/disposal specifications Flow lines, piping and gathering systems Production Separation Oil Processing Water injection systems (including pumps) Gas handling - compression Gas handling - dehydration Measurement, packaging and storage.

Lab Outlines

1. Demonstration of Extrusion process of Oil mill.
2. Demonstration of software to handle Oil mill operations.
3. Manufacturing of wholesome Oil Packing and Storage process; Quality evaluation of processed flower, corn, and Fish Oil.
4. Preservation of Oil by Packing and Canning; Preparation of Oil selection in terms of products; Extraction of oils and fats.
5. Determination of physical and chemical constants: color, cold test, melting point, smoke point, specific gravity, solid fat index, refractive index, acid value, peroxide value, iodine value, saponification value.
6. Visit to oil and fat industries

Recommended Books

1. Akoh, C.C. and D.B. Min. 2008. Food Lipids: Chemistry, Nutrition and Biotechnology, 3rd Ed. CRC Press, Taylor & Francis Group, Boca Raton, FL, USA.
2. AOCS. 2009. Official Methods and Recommended Practices of AOCS. Am. Oil Chem. Soc. Champaign, IL, USA.
3. Board, NIIR. 2013. Modern Technology of Oils, Fats and its Derivatives. 2nd Revised Ed. Asia Pacific Business Press Inc. Kamla Nagar, Delhi, India.
4. Fereidoon S. 2005. Bailey's Industrial Oil and Fat Products Edible Oil and Fat Products. 6th Ed. John Wiley & Sons Inc. New York City, NY, USA.
5. Raie, M.Y. 2008. Oils, Fats and Waxes. 1st Ed. National Book Foundation, Islamabad, Pakistan.

Course Content

8.41 Seed Science and Seed Processing Technology

CODE & TITLE (AIT-314) **Seed Science and Seed Processing Technology**		**CREDIT & CONTACT HOURS** (2+1) **32 Theory + 48 Lab**	**KNOWLEDGE AREA/ DOMAIN** **Major Based Depth**
After completion of this course, students will be able to:		**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Understand** seed development stages.	C-1	1
CLO-2	**Analyze** processing of seeds**.**	C-4	2
CLO-3	**Demonstrate** seed processing in the industry.	P-1	2

Course Outline for Theory

Seed: definition, types and significance; Development and maturation; Dormancy and germination; Seed quality: concept, significance and standards; Seed multiplication; Certification and legislation; Seed testing; Storage and longevity; Seed enhancements.

Seed processing Pre-processing seed storage, Seed dryers, Pre cleaners and Fine cleaners: Air cleaners and gravity separators, indented cylinders, spiral separators magnetic separators, Electronic color separators; Seed graders; Vibratory feeders; seed coaters; Seed polishers; Seed conveyers and elevators; Seed treater; bagging, weighing and storage equipment; General Seed processing plant and Modern (Computerized) seed processing plant-Features, selection, Operation and maintenance; Mobile seed cleaners. Various size reduction machineries and energy requirement, Material handling equipment, separating equipment based on size, shape and surface characteristics of seed materials, mode of heat transfer, different type of heat exchangers, Principles of drying and drying equipment. Storage of seed grains. Sensory test methods and procedures used to evaluate the seed cleaning quality and seed grades for storage.

Lab Outlines

1. Visit to local seed industry in Pakistan.
2. Study of Different Conveyors in Industries.
3. Survey of and preparation of report on different seed processing plants.
4. Visit to local seed storage facilities available at seed processing plants.
5. Seed moisture tests.

Recommended Books

1. Basra, A.S. 2006. Handbook of Seed Science and Technology. Food Products Press, New York City, NY, USA.
2. Benech-Arnold, R.L., and R. A. Sanchez. 2004. Handbook of Seed Physiology: Applications to Agriculture. Food Products Press, New York City, NY, USA.
3. Copeland, L.O. and M.B. McDonald. 2001. Principles of Seed Science and Technology. 4th Ed. Kluwer Academic Publishers, Norwell, MA, USA.
4. Henderson, S.M., and R. L. Perry. 1976. Agricultural Process Engineering. The AVI Publishing Company, Inc. Westport, CT, USA.
5. Multor, J.L. A.M. Rainbest, and D. Marsh, A.J. Eydt. 1989. Preservation and Storage of Grain, Seeds and Their Bye-Product: Cereals, Oilseeds, Pulses and Animal Feed. CBS Publishers and Distributors, New Delhi, India.

9. Supervised Industrial Training

9.1 Background

Supervised Industrial Training (SIT) refers to students supervised hands-on experience in an environment where engineering technology is practiced, familiarizing them with professional engineering work prior to graduation. The training curriculum consists of a minimum of 16 weeks of continuous industrial training, comprised of 8 hours per day, 5 working days per week. A Bachelor of Engineering Technology student must undergo mandatory SIT during the 8th Semester (16 weeks), or 7th and 8th Semesters (16 weeks mandatory, and 16 weeks optional in the 7th Semester), after he/ she has passed all subjects up to the 6th Semester.

SIT covers a range of activities, such as design implementation, production processes, laboratory experiments, on-site field works and maintenance operations. It also serves as a mechanism to integrate engineering practices and the curriculum to achieve Program Learning Outcomes that cover Engineering Technologists Graduate Attributes in line with the Sydney Accord. While SIT provides practical exposure to engineering processes and helps developing professional skills required for an Engineering Technologist, it also offers an opportunity to the prospective employers to assess potential skills of a future employee.

9.2 Objectives

Through the SIT, students will:

a. Learn to apply engineering technology knowledge learned in classroom environment in real industrial situations.
b. Be provided exposure to professional practices in the industries.
c. Understand the role and responsibilities and code of ethics that Engineering Technologists should uphold.
d. Develop awareness about general workplace behavior and build interpersonal skills.
e. Maintain professional work records and reports.
f. Learn to write reports and network with probable future employers to increase employability.

9.3 Responsibility of HEI: Placement in SIT Program

During the 7th (optional) and 8th semester, Bachelor of Agro Industrial Engineering Technology students will undergo Mandatory continuous SIT of 16 (or 32) weeks. This training shall be arranged by HEIs in leading industries, and preferably should sign an MoU for the SIT. A designated Administrator/Coordinator of HEI shall complete all necessary documentation, preferably 12 weeks prior to the commencement of the training, and issue Training Schedule for 16 (or 32) weeks so that all stakeholders and the students are aware and assured of undergoing SIT training in 7th (optional) and 8th (mandatory) semester according to a scheduled timeline.

9.4 Responsibilities of Students

a. Bachelor of Agro Industrial Engineering Technology students shall get enrolled for SIT during the 6th semester and before commencement of the 7th semester.
b. Students shall have to undergo continuous training of 16 (or 32) credit hours. One week's training of 8 hours daily for 5 days (40 contact hours) will be counted as 1 credit hour. Accordingly, 16 weeks (one semester) will help earn students 16 credit hours.

c. Total contact hours per semester are: 16 weeks per semester x 5 working days per week x 8 hours per day = 640. If an HEI opts SIT in 2 semesters (7^{th} and 8^{th}), these credit hours and contact hours will be doubled.
d. Students will maintain a daily Logbook, signed by the SIT supervisor at site, Training Administrator appointed by HEI and the student.
e. Students must observe safety and security rules of the Organization where they receive Training.
f. Students must wear specified working dress during training.
g. Students must obey all rules and regulations of the organization.
h. Students must observe working timings of the training Organization. Students may be allowed 10 days leave during the Training period of 16 (or 32) for genuine reasons. The leave shall only be used to cater for emergencies, with prior sanction from the training Administrator/Coordinator.
i. Leave will be deducted from training hours and required to be made up later.
j. Unsanctioned leaves shall be treated as "absent", and liable to disciplinary action.
k. Public holidays and leave should not be counted as working hours.

9.5 Training Progress Assessment and Review by HEI

Every HEI should appoint a focal person as SIT Administrator for each program who will monitor progress randomly through site visits, phone calls or emails to the industrial organization's counterpart focal person. Progress reports will be maintained after coordination with training supervisor(s) as well as the students.

The purpose of monitoring of SIT by the Administrator are:

a. To ensure the training organization is providing suitable and appropriate training to students.
b. To obtain feedback on students' performance and training progress through discussion with training supervisor(s).
c. To make courtesy visits and establish industrial relations between the HEI and the industries where students will receive their SIT.
d. To discuss the possibility of students' job placement with the training organization.
e. To survey new industries as potential training placement locations in the future.

9.6 Changing Student Placement During SIT

Students are discouraged to change placement during the training period from one organization to another.

a. However, written permission may be granted by the SIT Administrator, if a new placement of the student is available and confirmed in another organization, provided the student does not suffer loss of training hours due to this changeover.
b. After getting written permission from the SIT Administrator, a fresh approval is needed for the new placement.

9.7 Daily Training Logbook

All training activities must be recorded daily in the Training Logbook [See Appendix F]. Students must get it signed, daily, by on-the-job Trainer.

The Training logbook must reflect:

a. The student's learning experience during the industrial training
b. Training records and evidence of supervised training, with evidence of participation of student, on- the-job Trainer and HEI's training Administrator/Coordinator.
c. Part of professional practice in engineering profession where incidence and evidence are properly documented.
d. Information that becomes a source of reference in preparing the Industrial Training Report.
e. The Logbook must be submitted along with the Industrial Training Report.

9.8 Industrial Training Report

An Industrial Training Report will be submitted upon completion of SIT. The Report must describe a student's learning and development in technical knowledge, engineering practices and professional skills acquired through practical experience. The Industrial Training Report should also reflect a student's ability in communication skills and understanding of engineering practices. Students should seek advice from their on-the-job Trainer on site, to ensure that no confidential materials are included in the report. The report shall be submitted to the Training Administrator. The student may present a copy of the report to the prospective employer. Any references made in preparation of the report should be recognized using standard referencing formats. Students should refer to the Industrial Training Report Template as provided [See Appendix G] and guidelines given below in preparing the Report. The Daily Training Logbook should be submitted together with the Report.

9.9 Guidelines for Preparation of Industrial Training Report

Under the guidance of supervisors, students need to properly document their experience and learning during the SIT in the form of an Industrial Training Report. A properly prepared Report can portray their practical experience precisely in an orderly manner. The Report must be prepared according to the format and the guidelines below:

9.9.1 Contents of Industrial Training Report

(a) Table of Contents

This section of the report shall consist of:

i. Headings
ii. Sub-headings
iii. Page numbers

Every appendix requires a title, and each page needs to be numbered accordingly.

(b) Background & Profile of the Training Organization

Brief and concise description of the organization in which the student is undertaking the SIT. The main items are:

i. Backgrounds/profile of the organization

ii. Vision and Mission
iii. Organogram.
iv. Title and position of the supervisor in charge
v. Other necessary information only (not more than three pages)

(c) Schedule of Duties Performed as Trainee

This section briefly describes the time, duration and types of duties performed during the training. The description must follow the schedule of the training, i.e., in chronological order (for 16/32 weeks). The days when the student was not on duty must be properly recorded with cogent reasons.

(d) Experience During SIT

In this section, the student must fully describe the industrial training experience gained. Some suggested areas include:

i. Project (s) carried out
ii. Supervisory works
iii. Problems encountered
iv. Problems solving process or approach
v. Hands-on skills acquired
vi. How productivity can be further enhanced
vii. Quality Management system in place
viii. Safety at work

(e) Conclusion

Students provide an overall assessment in this section and arrive at a conclusion with regards to the SIT undergone. Contents may include:

i. Types of major work performed during SIT
ii. Different modules of SIT
iii. Comments whether SIT met the training objectives
iv. Suggestions and recommendations for improvement of the SIT

(f) References

A complete list of the references used in the report must be included according to standard referencing format.

(g) Appendixes

Appendixes are additional information appended to support the main text of the Report. A copy of the letter of permission from the Training Organization must be attached as an appendix. Other suggested appendixes are:

i. Investigation and project report during SIT
ii. Technical drawings, so far these are not secret documents or proprietary etc.
iii. Any other document that adds to the Report

(h) Figures and Tables

All figures, tables and similar content must be captioned, labeled, and mentioned in the main text of the Report.

(i) Notations, Symbols & Acronyms

If the report contains notations, symbols, and acronyms, these must be defined before they first appear in the main text. It is good practice to put a list of notations, symbols, and acronyms on a separate page, appropriately titled, and placed after 'Tables of Contents' page.

Every appendix must have a title and be mentioned in the main text of the Report. All page numbers for appendixes must be in continuation of page numbers of the main Report.

9.9.2 Format of the Report

(a) General

i. Students are advised to start writing the SIT Report as soon as training commences to ensure timely completion and submission.
ii. Do not include irrelevant materials, e.g., brochures from the organizations, or any publicity materials in the report.
iii. The Report must be typewritten on plain white A4 size paper, with 12-point Times New Roman font type and line spacing of 1.5.

(b) Abstract or Preface

The Report should start with an abstract of maximum 2 pages, and should briefly describe:

i. Description of Organization providing SIT
ii. Summary of the Report
iii. Acknowledgements

9.10 SIT Assessment

Assessment of the SIT should be based on the following parameter:

i.	On-the-Job Trainer Report	(20% marks)
ii.	HEI's Training /Advisor Report through visits or survey	(10% marks)
iii.	Industrial Training Report	(50% marks)
iv.	Viva voce	(20% marks)

It is also be noted that:

i. A minimum of 50% marks are required to pass the SIT.
ii. Students are advised to be diligent in writing their Report.
iii. The Report must be of good quality and portray in full the industrial experience and knowledge gained.
iv. The Report should not be in the form of short notes and figurative form.
v. If the Report is not satisfactory, students shall rewrite the Report until it is deemed satisfactory.

9.11 Completion of Industrial Training

i. Upon completion of a 16- or 32-week continuous SIT, a Confirmation Letter to this effect must be obtained from the training organization and/or probable employer.
ii. The Confirmation Letter must be submitted to the Industrial Training Administrator/Coordinator, together with the (1) On-the-Job Trainer's Report, (2) Student Feedback Form, and (3) Industrial Training Report for grading.

APPENDIX A: Sydney Accord Knowledge and Attitude Profile

(Retrieved from www.ieagreements.org)

A Sydney Accord program provides:
SK1: A systematic, theory-based understanding of the natural sciences applicable to the sub-discipline and awareness of relevant social sciences.
SK2: Conceptually based mathematics, numerical analysis, data analysis, statistics and formal aspects of computer and information science to support detailed consideration and use of models applicable to the sub-discipline.
SK3: A systematic, theory-based formulation of engineering fundamentals required in an accepted sub-discipline.
SK4: Engineering specialist knowledge that provides theoretical frameworks and bodies of knowledge for an accepted sub-discipline.
SK5: Knowledge, including efficient resource use, environmental impacts, whole-life cost, re-use of resources, net zero carbon, and similar concepts, that supports engineering design and operations using the technologies of a practice area.
SK6: Knowledge of engineering technologies applicable in the sub-discipline.
SK7: Knowledge of the role of technology in society and identified issues in applying engineering technology, such as public safety and sustainable development (represented by the 17 UN-SDGs).
SK8: Engagement with the current technological literature of the discipline and awareness of the power of critical thinking.
SK9: Ethics, inclusive behavior, and conduct. Knowledge of professional ethics, responsibilities, and norms of engineering practice. Awareness of the need for diversity by reason of ethnicity, gender, age, physical ability etc. with mutual understanding and respect, and of inclusive attitudes.

APPENDIX B: Engineering Technologist Graduate Attribute Profile

(Retrieved from www.ieagreements.org)

As per Sydney Accord, Engineering Technologist Graduate is expected to have the following attributes:
Engineering Technology Knowledge: **SA1:** An ability to apply knowledge of mathematics, natural science, Engineering Technology fundamentals and Engineering Technology specialization to defined and applied Engineering Technology procedures, processes, systems, or methodologies.
Problem Analysis **SA2:** An ability to Identify, formulate, research literature and analyze Broadly Defined Engineering Technology problems reaching substantiated conclusions using analytical tools appropriate to the discipline or area of specialization.
Design/Development of Solutions **SA3:** An ability to design solutions for broadly- defined Engineering Technology problems and contribute to the design of systems, components, or processes to meet specified needs with appropriate consideration for public health and safety, cultural, societal, and environmental considerations.
Investigation **SA4:** An ability to conduct investigations of broadly defined problems; locate, search and select relevant data from codes, data bases and literature, design and conduct experiments to provide valid conclusions.
Modern Tool Usage **SA5:** An ability to Select and apply appropriate techniques, resources, and modern technology and IT tools, including prediction and modelling, to Broadly Defined Engineering Technology problems, with an understanding of the limitations.
The Engineering Technologist and Society **SA6:** An ability to demonstrate understanding of the societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to Engineering Technology practice and solutions to broadly defined Engineering Technology problems.
Environment and Sustainability **SA7:** An ability to understand and evaluate the sustainability and impact of Engineering Technology work in the solution of broadly defined Engineering Technology problems in societal and environmental contexts.
Ethics: **SA8:** Understand and commit to professional ethics and responsibilities and norms of Engineering Technology practice.
Individual and Teamwork **SA9:** An ability to Function effectively as an individual, and as a member or leader in diverse teams.

Communication **SA10:** An ability to communicate effectively on broadly defined Engineering Technology activities with the Engineering Technologist community and with society at large, by being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
Project Management **SA11:** An ability to demonstrate knowledge and understanding of Engineering Technology management principles and apply these to one's own work, as a member or leader in a team and to manage projects in multidisciplinary environments.
Lifelong Learning: **SA12:** An ability to recognize the need for and have the ability to engage in independent and life-long learning in specialist Engineering Technologies.

APPENDIX C: Engineering Technologist Professional Competence Profile

(Retrieved from www.ieagreements.org)

As per Sydney Accord, Engineering Technologist Graduate is expected to demonstrate the following competencies:
Comprehend and apply universal knowledge: **TC1:** Comprehend and apply the knowledge embodied in widely accepted and applied procedures, processes, systems, or methodologies.
Comprehend and apply local knowledge: **TC2:** Comprehend and apply the knowledge embodied procedures, processes, systems, or methodologies that is specific to the jurisdiction of practice.
Problem analysis: **TC3:** Identify, clarify, and analyze broadly defined problems using the support of computing and information technologies where applicable.
Design and development of solutions: **TC4:** Design or develop solutions to broadly defined problems considering a variety of perspectives.
Evaluation: **TC5:** Evaluate the outcomes and impacts of broadly defined activities.
Protection of society: **TC6:** Recognize the foreseeable economic, social, and environmental effects of broadly defined activities and seek to achieve sustainable outcomes (represented by the 17 UN-SDGs).
Legal, regulatory, and cultural: **TC7:** Meet all legal, regulatory, and cultural requirements and protect public health and safety during all activities.
Ethics: **TC8:** Conduct activities ethically
Manage engineering activities: **TC9:** Manage part or all of one or more broadly defined activities.
Communication and Collaboration: **TC10:** Communicate and collaborate using multiple media clearly and inclusively with a broad range of stakeholders during all activities.

Continuing Professional Development (CPD) and Lifelong learning: **TC11:** Undertake CPD activities to maintain and extend competences and enhance the ability to adapt to emerging technologies and the ever-changing nature of work.
Judgement: **TC12:** Choose appropriate technologies to deal with broadly defined problems. Exercise sound judgement in the course of all broadly defined activities.
Responsibility for decisions: **TC13:** Be responsible for making decisions on part or all of one or more broadly defined activities.

APPENDIX D: Minutes of Preliminary Meeting of NCRC

The preliminary Meeting of National Curriculum Review Committee (NCRC) was held on 23-02-2022 to 25-02-2022 at the MNS University of Agriculture, Multan. Welcome session started with recitation of Holy Quran, and it was chaired by Prof. Dr. Asif Ali, Vice Chancellor. Honorable Engr. Imtiaz Hussain Gilani, Chairman NTC, attended the meeting online. The Chairman NTC elaborated the importance of curriculum development for engineering technology programs with sharper focus on practical work, and keeping a futuristic outlook, market demand, and societal needs. The curriculum must follow NTC guidelines, aligned with HEC Undergraduate Policy framework, and be substantially compliant with the Sydney Accord protocols.

Hafiz Ghulam Muhammad represented NTC.

In the second session, the house nominated a Convener, Co-Convener and Secretary of the NCRC. After discussion among members, Prof. Dr. Allah Bakhsh was nominated as Convenor, Dr Taj Ali Khan, as Co-Convener and Dr. Sarfraz Hashim was nominated as Secretary, respectively.

The following nominated members from various HEI's were part of the NCRC for Bachelor of Agro Industrial Engineering Technology program.

Sr.	NCRC Members	Role
1	Prof. Dr. Allah Bakhsh Ex-Dean Pir Mehr Ali Shah Arid Agriculture University (PMAS AAU), Rawalpindi	Convener
2	Dr. Taj Ali Khan Chairman University of Engineering Technology (UET), Peshawar	Co-Convener
3	Dr. Sarfraz Hashim HOD/Assistant Professor MNS University of Agriculture, Multan	Secretary
4	Dr. Alamgir Akhtar Khan Ex-Chairman MNS University of Agriculture, Multan	Member
5	Dr. Umair Sultan Assistant Professor MNS University of Agriculture, Multan	Member
6	Dr. Zia ul Haq Professor UET, Peshawar	Member
7	Dr. Aftab Ahmed Soomro Associate Professor Benazir Bhutto Shaheed University of Technology & Skill Development (BBSUTSD), Khairpur	Member
8	Dr. Munir Ahmed Mangrio Professor Sindh Agriculture University (SAU), Tandojam	Member
9	Dr. Daulat Khan Professor Swedish College of Technology, Wah Cantt	Member

Sr.	NCRC Members	Role
10	Dr. Azmatullah Khan Professor BUITEMS, Quetta	Member
11	Dr. Yasir Niaz HOD/Assistant Professor Khwaja Fareed Univ. of Engg & IT, (KFUEIT), Rahim Yar Khan	Member
12	Dr. Muhammad Mohsin Waqas Assistant Professor Khwaja Fareed Univ. of Engg & IT, (KFUEIT), Rahim Yar Khan	Member
13	Engr. Abdul Aleem Ex-Director Agricultural Mechanization Research Institute, Multan	Opt-Member
14	Dr. Muhammad Kamran Bhatti Associate Professor NFC Institute of Engineering and Technology Multan	Opt-Member

After the introductory session, deliberations on the agenda of the Preliminary Meeting formally commenced. It was headed by the Convener Engr. Prof. Dr. Allah Bakhsh, Co-Convener Engr. Prof. Dr. Taj Ali Khan, and Secretary Engr. Dr. Sarfraz Hashim. The NCRC Members were informed that valuable feedback was received from the following industry experts.

Sr	Name	Affiliation
1	Mr. Zulqarnain Haider	GM, Asia Feed Mills
2	Dr. Muhammad Faisal	CEO, Faisal Group of Industries
3	Engr. Mumtaz Shujra	Director, Shujra Group of Industries
4	Mr. Rashid Mahmood	Consultants Famsun /CEO, Classic Industries

The Industrialist appreciated the efforts made by NCRC to compose a balanced and standardized curriculum for Agro-industrial Engineering Technology. Their proposed suggestions will be incorporated in the curriculum.

The objectives of NCRC were discussed by the Convener, and the following three sub-committees were constituted for a thorough review to improve the Curriculum:

Sub-committee-1: For first-year courses	
Dr. Aftab Ahmed Soomro	Convener
Dr. Munir Ahmed Mangrio	Member
Dr. Muhammad Mohsin Waqas	Member
Sub-committee-2: For second-year courses	

Dr. Azmatullah Khan	Convener
Dr. Yasir Niaz	Member
Engr. Abdul Aleem	Member
Dr. Umair Sultan	Secretary
Sub-committee 3: For third-year courses	
Dr. Allah Bakhsh	Convener
Dr. Taj Ali Khan	Member
Dr. Alamgir Akhtar Khan	Member
Dr. Zia ul Haq	Member
Dr. Daulat Khan	Member
Dr. Sarfraz Hashim	Secretary

The Members acknowledged the efforts of Dr. Alamgir Akhtar Khan and Dr. Sarfraz Hashim to liaise with Southern Punjab Agro-Industries and got input from industrialists in the curriculum.

The Members deliberated and discussed the curriculum considering the current and future prospectus of the degree program and recommended the following:

- They finalized the curriculum preface, mission, vision, preamble, rationale, scope, course scheme etc. (Annexure-I).
- The Admission Criteria finalized to induct new students batch is:
    - Eligibility Criteria: F.Sc. (Engineering, Medical, Agriculture)/ICS/A-Level/ICS/DAE (Three Years) with minimum 50 % marks
    - Merit Criteria: Intermediate 30%
    - Matric 20%
    - Entry Test 50%
- Approved Semester-wise break-up of courses, credit hour allocation, and breadth and depth courses for Bachelor of Agro-Industrial Engineering Technology.
- Finalized bench marking of Recommended Scheme of Studies, Engineering Technology Domain and Non-Engineering Technology Domain courses in consonance with NTC framework of 70:30 ratio of contact hours of technical and non-technical courses.
- The list of Electives courses are shown in Annexure-II-a (Elective Management Courses) and Annexure-II-b (Elective Technology Courses).
- Recommended the sample course profiles and contents of Bachelor of Agro-Industrial Engineering Technology.

- Recommended sample week wise lecture plan and laboratory work for foundation and breath courses in the curriculum.
- Industry liaison needs to be strengthened by establishing a mandatory Industrial Advisory Board, along with a schedule for periodic meetings.
- Mandatory Supervised Industrial Internships require a proper mechanism for smooth functioning, assessment, and implementation.
- Emphasis was laid on teachings of IT, Industrial software, and computer programming (PLC), programmable logical control.
- Emphasis was laid on imparting entrepreneurial skills so that Technologists may become Jobs creators rather than job seekers.
- Industrial visits may be conducted according to the nature of the courses.
- A proper mechanism must be established for receiving feedback from the stakeholders, employers, and alumni.

The final draft was compiled by Secretary Engr. Dr. Sarfraz Hashim. After review by Members, and with the approval of Convener Engr. Prof. Dr. Allah BAkhsh Jafri and Co-Convener Engr. Prof. Dr. Taj Ali Khan, it was submitted to NTC.

APPENDIX E: Minutes of the Final Meeting of NCRC

The final meeting of the NCRC was held on 15-06-2022 to 17-06-2022 at the MNS University of Agriculture, Multan. The inauguration session was started with the recitation of Holy Quran, and it was chaired by Honorable Prof. Dr. Asif Ali, Vice Chancellor MNS University of Agriculture, Multan, he appreciated the efforts made by all members and highlighted their valuable contribution for the national cause to setting standards for quality of education in Agro-Industrial engineering technology degree program. The Chair also extended his gratitude to the entire team and briefed the objectives and arrangements for the final NCRC meeting. Mr. Hafiz Ghulam Muhammad represented the NTC as focal person.

The following members attended the meeting:

Sr.	NCRC Members	Role
1	Prof. Dr. Allah Bakhsh Ex-Dean Pir Mehr Ali Shah Arid Agriculture University (PMAS AAU), Rawalpindi	Convener
2	Dr. Taj Ali Khan Chairman University of Engineering Technology (UET), Peshawar	Co-Convener
3	Dr. Sarfraz Hashim HOD/Assistant Professor MNS University of Agriculture, Multan	Secretary
4	Dr. Alamgir Akhtar Khan Ex-Chairman MNS University of Agriculture, Multan	Member
5	Dr. Umair Sultan Assistant Professor MNS University of Agriculture, Multan	Member
6	Dr. Aftab Ahmed Soomro Associate Professor Benazir Bhutto Shaheed University of Technology & Skill Development (BBSUTSD), Khairpur	Member
7	Dr. Aftab Ahmed Soomro Associate Professor Benazir Bhutto Shaheed University of Technology & Skill Development (BBSUTSD), Khairpur	Member
8	Dr. Muhammad Mohsin Waqas Assistant Professor Khwaja Fareed Univ. of Engg & IT, (KFUEIT), Rahim Yar Khan	Member
9	Engr. Abdul Aleem Ex-Director Agricultural Mechanization Research Institute, Multan	Opt- Member

After the introductory session, the deliberation on the agenda of the final meeting formally commenced which was headed by Convener Engr. Prof. Dr. Allah Bakhsh, Co-Convener Engr. Prof. Dr. Taj Ali Khan and Secretary Engr. Dr. Sarfraz Hashim. It was informed to honorable members that valuable feedback received from the following Industrial Experts.

Sr.	Industrialist Name	Affiliation
1	Mr. Zulqarnain Haider	GM, Asia Feed Mills
2	Dr. Muhammad Faisal	CEO, Faisal Group of Industries
3	Mr. Rashid Mahmood	Consultants Famsun /CEO, Classic Industries

The Industrialist appreciated the efforts made by NCRC to compose a balanced and standardized curriculum for Agro-industrial Engineering Technology. However, their proposed suggestions are noted to incorporate in the revised curriculum.

All objectives of the meeting were presented by the convener to honorable members of NCRC and appreciated the efforts as constituted three sub-committees for thoroughly review and improve the contents of the courses. The house acknowledged the efforts of Dr. Alamgir Akhtar Khan, Dr. Sarfraz Hashim and MNSUAN team to make a liaison with south Punjab Agro-Industries and prepared a curriculum with the consent of Industrialists. . House deliberated and discussed the existing curriculum as prepared after preliminary meeting in the light of future prospectus of the degree program and recommended the following points.

- The vision and mission revised with consent of respect NCRC member.
- The contents of courses with respect to deciding format were improved by the sub-groups and compiled a single draft.
- Recommended the sample course profiles and contents of Bachelor of Agro-Industrial Engineering Technology.
- Industry liaison / linkages need to be strengthened by establishing Industrial Advisory Board mandatory along with schedule for its periodic meetings.
- Supervised Industrial Trainings require a proper mechanism for its smooth functioning, assessment and implementation.
- Emphasis was laid on teachings of IT, Industrial software and computer programming (PLC), programmable logical control.
- Emphasis was laid on imparting entrepreneurial skills so that Technologists may become Jobs Creators rather than Job Seekers.
- Industrial visits may be conducted to the nature of the courses.
- Proper mechanisms shall be established for receiving feedback from the stakeholders, employers, and alumni.

The final draft was compiled by Secretary Engr. Dr. Sarfraz Hashim. After review by the members and with the approval of Convener Engr. Prof. Dr. Allah BAkhsh Jafri and Co-Convener Engr. Prof. Dr. Taj Ali Khan is submitted to NTC.

APPENDIX F: Supervised Industrial Training Logbook Sample Format

Student Details:
Name:
Roll Number:
Address:
Email:

Course of Study:
Year/Semester of Study:

Training Start Date:
Training End Date:

Training Organization Details:

Name of Organization:
Address:

Contact Person:
Contact Number:

On-the-job Trainer Name:
On-the-job Trainer Contact Number:

Daily Training Log

Please specify training information by descriptive statements, tables, sketches, figures, photographs, and so forth. Feel free to incorporate attachments wherever necessary.

Training Week: _____

Date	Time	Training Log

Declaration:

I, _____ Roll Number_____, do hereby declare that all information provided above is true and correct to the best of my knowledge.

_____
Student signature with date

_____ _____
Organization Supervisor signature with date HEI Coordinator signature & date

APPENDIX G: Supervised Industrial Training Report Sample Format

A Sample format for Supervised Industrial Training (SIT) Report is provided so that students can develop an understanding of what is expected of them when making the submission. Students are encouraged to expand upon the content presented below. A declaration page validating the originality of work, duly signed by the student and the supervisor, is also to be attached at the beginning of the submitted report.