Curriculum for

Textile Engineering

Bachelor of Engineering Program

2020

Pakistan Engineering Council
&
Higher Education Commission
Islamabad

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Contents

PREFACE

The curriculum, with varying definitions, is said to be a plan of teaching-learning process that students of an academic programs are required to undergo. It includes the objectives and learning outcomes, course outline, scheme of studies, teaching methodologies and methods of assessment of learning. Since knowledge in all fields and sectors is expanding at a faster pace and new disciplines are also emerging; it is imperative that curricula should be dynamic having regular review and updating.

The University Grants Commission (UGC) was the designated authority to develop, review and revise curricula beyond Class-XII vides Section 3, Sub-Section 2 (ii), Act of Parliament No. X of 1976 titled "Supervision of Curricula and Textbooks and Maintenance of Standard of Education". With the repeal of UGC Act, the same function was assigned to the Higher Education Commission (HEC) under its Ordinance of 2002, Section 10, Sub-Section 1 (v). In compliance with the above provisions, the HEC has been undertaking the development of curricula for new/emerging fields and revision of existing curricula after every three years through respective National Curriculum Revision Committees (NCRCs) until 2018.

As a policy change and expanding higher education base under HEC, the curriculum review and development task has been shifted to the respective regulators and HEIs. PEC also having mandate under its Act and especially after attaining the Washington Accord full signatory status and IPEA licensing authority, took up the challenge to review and develop the curricula for engineering programs based on Outcome-Based Education (OBE) System. PEC has therefore constituted an Engineering Curriculum Review and Development Committee (ECRDC) and also subject ECRDCs comprising the eminent engineers and professionals from academia and industry to take up the task of curricula review and updating. Nevertheless, the basic templates developed by HEC NCRCs have been followed as guidelines.

This curriculum document would serve as a guideline whereas allowing HEIs to tame/change within the framework by introducing courses in support of the local/required industrial demand as well as satisfying the 12 GAs (Graduate Attributes) covering core and elective courses, which are considered as beauty of OBE system in the international environment. At the same time, this curriculum framework would fulfill our national, social and economic needs leading towards attainment of Sustainable Development Goals (SDGs-2030). It would also provide the level of competency specified in Pakistan Qualification Framework to make it compatible with international educational standards.

1. Engineering Curriculum Review & Development Committee (ECRDC)

PEC in its efforts towards quality engineering education, took up the challenge of curriculum review and development for engineering programs after due consent of HEC. A high level Engineering Curriculum Review and Development Committee (ECRDC), led by Prof Engr Dr Fazal Ahmad Khalid, Chairman Punjab HEC/ Vice Chairman PEC, was constituted whereas other eminent members are from industry and academia to take up the task of curricula review and updation, besides developing curriculum for new/ emerging fields. The main responsibility of ECRDC is to oversee the entire curriculum review and development process while setting policies and guidelines for the subject ECRDCs working in their respective domains. The 1st meeting of main ECRDC was held on 29th June, 2018 at PEC HQ, Islamabad, wherein the Convener briefed the scope, objective and ToRs of the Committee and also formulated the subject ECRDCs comprising of eminent engineers and professionals from academia and industry.

1.	Engr Prof Dr Fazal Ahmed Khalid Convener, Metallurgy, Materials, Mining Engg & Allied Disciplines	Convener
2.	Engr Prof Dr Iftikhar Hussain Convener Mechanical Engg & Allied Disciplines	Member
3.	Engr Prof Dr M. Younus Javed Convener Electrical Engg & Allied Disciplines	Member
4.	Engr Malik Saleem Ullah Saeed Convener Chemical Engg & Allied Disciplines	Member
5.	Engr Dr Wasim Khaliq Convener, Civil Engg & Allied Discipline	Member
6.	Engr Dr Muhammad Ashraf Convener, Agricultural Engg & Allied Disciplines	Member

7.	Engr Prof Dr Jameel Ahmed Convener, Common to All (Non-Engg Component)	Member
8.	Engr Muhammad Raza Chohan Director General, HEC	Member
9.	Engr Dr Nasir Mahmood Khan Additional Registrar (Accreditation), PEC	Member
10.	Engr Dr Ashfaq Ahmed Sheikh, Additional Registrar, CPD	Secretary

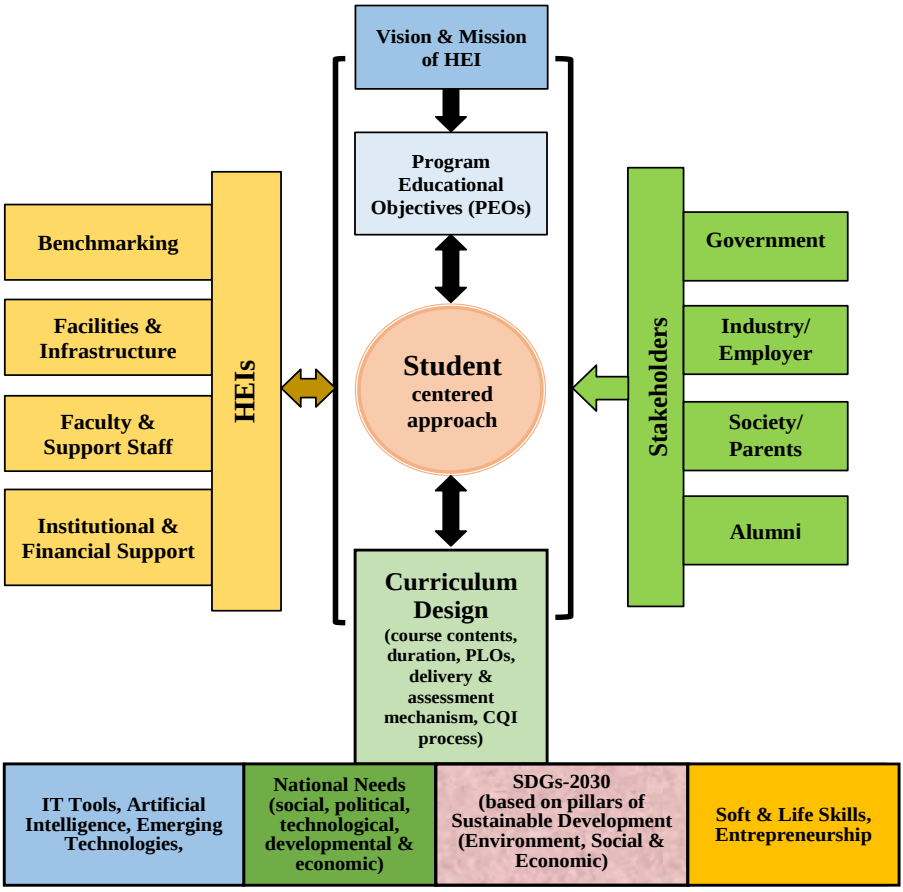
2. ECRDC Agenda

- The ECRDC is responsible to oversee the overall working of curriculum review and development for all engineering programs in terms of strategy, guidance and progress, and thereby submission to the relevant forum for adoption notification.
- Each member of ECRDC will also work in the capacity of a convener for the respective discipline as mentioned against his name and as per ToRs.

3. OBE-Based Curriculum Development Framework

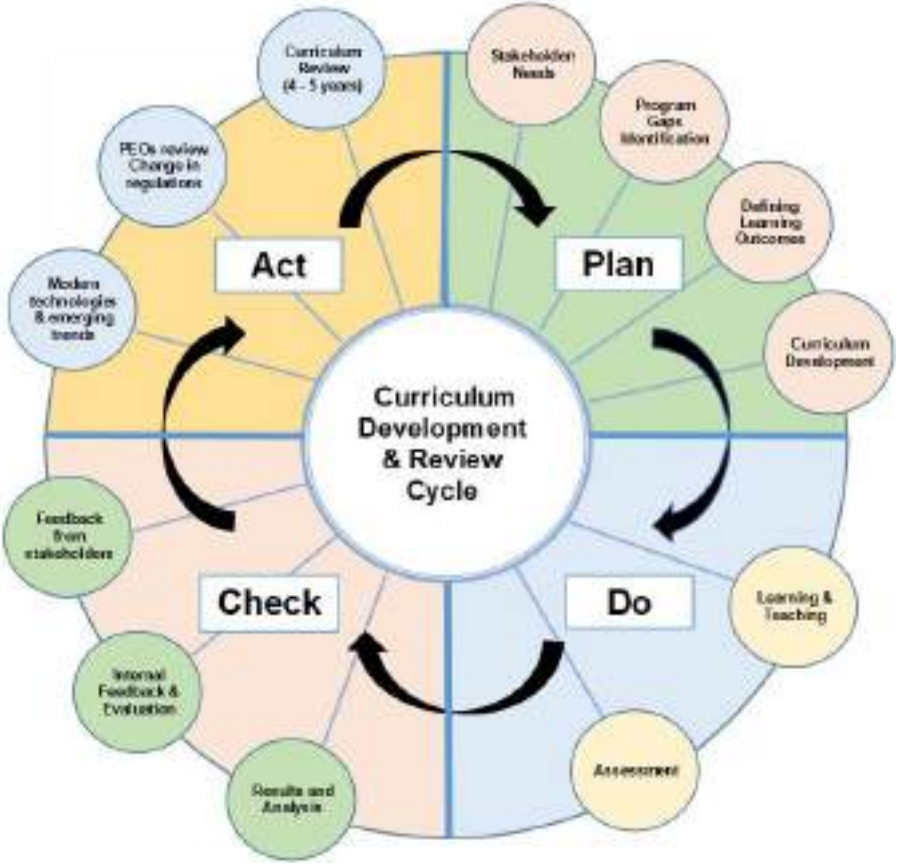
Outcome Based Education (OBE) is an approach of teaching and learning that focuses on what students should be able to attain at the end of the educational program. OBE is a student's centered system which concerns what the students will know and be able to do as learning outcomes. The curriculum development under OBE is therefore an integration of graduates attributes and stakeholders' feedback in cognizance with institution's Vision and Mission.

Outcome-Based Education (OBE) - Curriculum Development Framework



4. PDCA Approach to Curriculum Design and Development

The process of curriculum design and development constitutes various interconnected elements with the objective of achieving the intended purpose of the program. The Plan-Do-Check-Act approach (PDCA) as explained below has been followed in the curriculum development and review process.



Plan. This stage begins with an analysis of the stakeholders' needs of faculty, current and past students, employers and society in general. The stakeholders' needs are translated into human resource terminology i.e. graduate competencies which in turn translated into educational taxonomy and learning outcomes. Based on the learning outcomes, curriculum is designed backward to meet PLOs.

Do. The plan stage is implemented where curriculum is delivered and learning outcomes are assessed to gauge the achievement of PLOs.

Check. This stage involves the analysis of assessment results and feedback from students and faculty. Areas for improvement are identified.

Act. When the learning outcomes are achieved, the curriculum, learning and teaching strategies and assessment methods are standardized. Best practices are shared and improvement is made for the next cycle of PDCA.

5. ECRDC for Chemical, Polymer, Textile and Allied Engineering

The PEC Engineering Curriculum Review and Development Committee (ECRDC) of Chemical, Polymer, Textile and Allied Engineering disciplines took up the task to review and update the curriculum for Textile engineering degree program. The subject Committee had two meetings on 13-9-2019 and 24-1-2020 at Lahore besides two meetings of Sub-Group for Textile Engineering on 25-11-2019 and 10-12-2019 at PEC Regional Office, Lahore. The Committee consisted of following members:

1	Engr. Malik Saleem Ullah Saeed Chief Executive Officer Water Engineering & Management Services (WEMS), Lahore	Convener
2	Engr. Dr. Amjad Hussain Dilawari Professor (Rtd) UET, Lahore	Member
3	Engr. Dr. Syed Kamran Sami Dean Faculty of Engineering & Architecture Balochistan University of Information Technology, Engineering and Management Sciences (BUITEMS), Quetta	Member

4	Engr. Dr. Asif Ali Qaiser Professor/Chairman Department of Polymer & Process Engineering UET, Lahore	Member
5	Engr. Dr. Syed Farman Ali Shah Professor Department of Chemical Engineering Mehran University of Engineering and Technology (MUET) Jamshoro	Member
6	Engr. Dr. Mahmood Saleem Professor Institute of Chemical Engg. & Technology University of the Punjab, Quaid-e-Azam Campus, Lahore	Member
7	Engr. Dr. Aqeel Ahmad Taimoor Associate Professor Faculty of Materials & Chemical Engg Ghulam Ishaq Khan Institute of Engineering Sciences and Technology, District Swabi	Member
8	Engr. Dr. Naveed Ramzan Professor Department of Chemical Engineering UET, Lahore	Member
9	Engr. Dr. Rabia Nazar Assistant Professor Department of Polymer & Process Engineering UET, Lahore	Member
10	Engr. Dr. Arshad Hussain Professor Chemical Engineering Department SCME, National University of Sciences and Technology (NUST) Islamabad	Member

11	Engr Dr Muddasar Habib Chairman Department of Chemical Engineering University of Engineering and Technology, Peshawar	Member
12	Engr Muhammad Irshad Ramay Coordinator National Cleaner Production Centre Refinery Morgah, Rawalpindi	Member
13	Engr Asad Dawood Unit Manager HSE Fatima Fertilizer Ltd., Lahore	Member
14	Engr Nasir Zaman Khan Manager United Energy Pakistan, Karachi	Member
15	Engr Muhammad Akram Executive Director Operations Ibrahim Fibres Limited (Polyester Plant), Islamabad	Member
16	Engr Muhammad Ramzan Plant Manager Rafhan Maize Products, Jaranwala	Member
17	Engr Imran Ashraf Chief Executive Officer Brilliant Engineers, Lahore	Member
18	Engr. Dr Inayat Ali Memon Professor Department of Chemical Engineering NED-UET, Karachi	Member
19	Engr. Dr. Javaid Rabbani Khan Professor GIKI, Swabi	Member

20	Engr. Abdul Basit Field Manager Facilities Engineering Manager Orient Petroleum Ltd., Islamabad	Member
21	Engr. Dr. Suleman Tahir Professor/Chairman Chemical Engineering University of Gujrat, Gujrat	Member
22	Engr. Dr. Sadiq Hussain Professor/Chairman Chemical Engineering Department NFC-Institute of Engineering & Technology, Multan	Member
23	Engr. Mubasher Mahmood Butt Manager HSE&Q Fauji Fertilizer Company Sadiqabad, Rahimyar Khan	Member
24	Engr. Dr. Nadeem Feroze Professor/Chairman Department of Chemical Engineering UET, Lahore	Member
25	Engr. Liaquat Mahmood Professor (Rtd) ICET, University of Punjab, Lahore	Member
26	Engr. Amar Abbas Process Manager Pak Arab Refinery Company, Kot Addu	Member
28	Mr. Hidayatullah Kasi Deputy Director Higher Education Commission, Islamabad	Rep HEC
29	Engr. Dr. Ashfaq Ahmed Sheikh Additional Registrar-CPD Pakistan Engineering Council, Islamabad	Secretary

30	Engr. Muhammad Kashif Ali Assistant Registrar-CPD Pakistan Engineering Council, Islamabad	AR-CPD

5.1 Sub Group Textile Engineering

1.	Engr. Dr. Mumtaz Hasan Malik Professor/Dean School of Textile and Design University of Management & Technology, Lahore	Lead Sub-Group
2.	Engr. Dr Yasir Nawab Associate Professor Faculty of Engineering National Textile University, Faisalabad	Expert
3.	Engr. Dr M. Mohsin Associate Professor Department of Textile Engineering University of Engineering & Technology (Faisalabad Campus) Lahore	Expert
4.	Engr. Dr Sheraz Hussain Siddiqui Associate Professor Department of Textile Engineering NED-UET, Karachi	Expert
5.	Engr. Dr. Zameer ul Hassan Associate Professor Department of Textile Engineering BUITEMS, Quetta	Expert
6.	Engr. Dr Awais Khatri Associate Professor Department of Textile Engineering MUET, Jamshoro	Expert
7.	Mr. Hidayatullah Kasi Deputy Director Higher Education Commission HQ, Islamabad	Rep HEC

8. Engr. Dr. Ashfaq Ahmad Sheikh — Secretary
   Additional Registrar-CPD
   Pakistan Engineering Council, Islamabad

9. Engr. Muhammad Kashif Ali — AR-CPD
   Assistant Registrar-CPD
   Pakistan Engineering Council, Islamabad

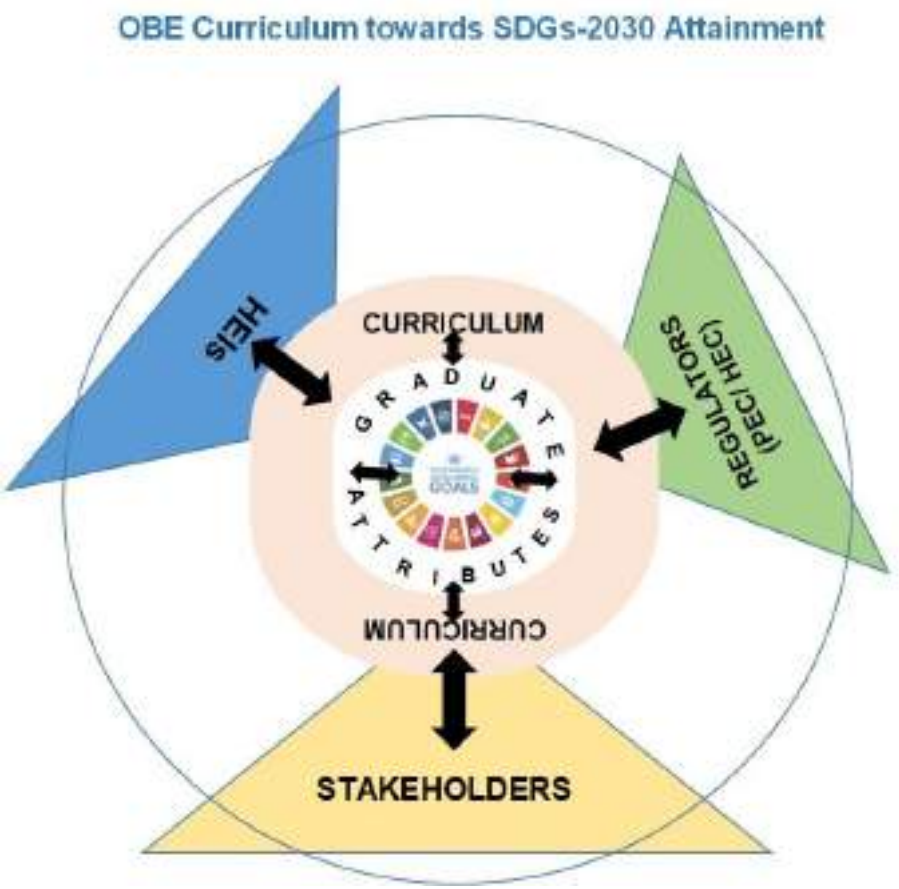
6. Agenda of ECRDC for Chemical, Polymer, Textile and Allied Engineering Disciplines

- The Subject ECRDC will work under the overall directions and supervision of main ECRDC comprising all Conveners.
- The key driving lines for the development of engineering curriculum for each discipline will be the overall policy of Pakistan Engineering Council in connection with international commitments (Washington Accord, IPEA etc.) and Government policies.
- Review of polices and stakeholders' feedback relating sector relevant to the respective discipline
- Comparative study of the curricula being offered at various engineering universities/institutions following the OBE-based system
- Development and finalization of complete scheme and curriculum for respective discipline including all aspects.

The Convener Eng. Mailk Saleemullah Saeed highlighted the important benchmarks and international best practices to be considered for the development/ revision of the curriculum while taking into account the Outcome Based Education (OBE) system. He also suggested that the Committee comprising professors and experts from academia, industry and R&D institutions has provided a useful input and suggestions covering new developments to be incorporated in the curriculum. He also highlighted the importance of the field of Textile Engineering for achieving sustainable developments while addressing socio-economic issues and challenges envisaged in Sustainable Development Goals-2030 as under and well-mapped within the curriculum;

- Goal-1: No Poverty
- Goal-2: Zero Hunger

- Goal-3: Good Health and Well-being
- Goal-4: Quality Education
- Goal-5: Gender Equality
- Goal-8: Decent Work and Economic Growth
- Goal-9: Industrial Innovation and Infrastructure
- Goal-12: Responsible Consumption and Production



The curriculum therefore has been designed based on above SDGs translating into program objectives and mapped with the scheme of study.

7. Program Educational Objectives (PEOs) and Learning Outcomes (PLOs)

As guidance, the sample Program Educational Objectives (PEOs) and Learning Outcomes (PLOs) are given below for a typical Textile Engineering Program. The HEIs should have their own program objectives, PLOs and CLOs in line with the institution's Vision and Mission, in cognizance with industrial needs as well as national and international trends.

7.1 Program Educational Objectives (PEOs)

The program aims at imparting quality education to Textile Engineering graduates for contributing to the society through modern technologies and practices in line with SDGs especially Goal-1, Goal-2, Goal-3, Goal-4, Goal-5, Goal-8, Goal-9 and Goal-12.

i. The graduates of the program will able to:
ii. Demonstrate sound engineering knowledge and skills.
iii. Execute and manage teamwork, interpersonal skills and professional growth.
iv. Conduct professional practice considering socio-economical, environmental, ethical, health and safety and cultural aspects.

7.2 Program Learning Outcomes (PLOs)

Program outcomes are the narrower statements that describe what students are expected to know and be able to do by the time of graduation. These relate to the knowledge, skills and attitude that the students acquire while progressing through the program. Specifically, it is to be demonstrated that the students have acquired the following graduate attributes (GAs):

PLO1 Engineering Knowledge: An ability to apply knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems.

PLO2 Problem Analysis: An ability to identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences.

PLO3 Design/Development of Solutions: An ability to design solutions for complex engineering problems and design systems, components or processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal, and environmental considerations.

PLO4 Investigation: An ability to investigate complex engineering problems in a methodical way including literature survey, design and conduct of experiments, analysis and interpretation of experimental data, and synthesis of information to derive valid conclusions.

PLO5 Modern Tool Usage: An ability to create, select and apply appropriate techniques, resources, and modern engineering and IT tools, including prediction and modeling, to complex engineering activities, with an understanding of the limitations.

PLO6 The Engineer and Society: An ability to apply reasoning informed by contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to professional engineering practice and solution to complex engineering problems.

PLO7 Environment and Sustainability: An ability to understand the impact of professional engineering solutions in societal and environmental contexts and demonstrate knowledge of, and need for, sustainable development.

PLO8 Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of engineering practice.

PLO9 Individual and Team Work: An ability to work effectively, as an individual or in a team, on multifaceted and/or multidisciplinary settings.

PLO10 Communication: An ability to communicate effectively, orally as well as in writing, on complex engineering activities with the engineering community and with society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PLO11 Project Management: An ability to demonstrate management skills and apply engineering principles to one's own work, as a member and/or leader in a team, to manage projects in a multidisciplinary environment.

PLO12 Lifelong Learning: An ability to recognize importance of, and pursue lifelong learning in the broader context of innovation and technological developments.

8. Program Salient Features

- **Duration:** 4 years
- **Number of Semesters:** 8
- **Total number of Credit Hours:** 130 - 136
  - Engineering Domain: minimum 85 Credit Hours
  - Non-Engineering Domain: minimum 30 Credit Hours

  (HEIs have flexibility of 15-21 Credit Hours to add courses either in Engineering, Non-Engineering or both Domains to fulfill the program objectives in line with the overall Vision/ Mission of the Institute concerned).
- **Additional Course or Credit Hours Requirements:** Any addition of course or credit hour requirements as per direction or policy of the Government (Provincial or Federal), HEIs have leverage to cater such needs over and above the prescribed requirements in this document.
- **Number of weeks per semester:** 15 - 18
- **Number of credit hours per semester:** 15 - 18
- **Curriculum:** The engineering curriculum is the most important instrument for grooming the students based on 12 Graduate Attributes (GAs) encompassed under the Program Learning Outcomes (PLOs). In order to inculcate different dimensions of thinking – mathematical, computational, design and creative – among students in Cognitive, Psychomotor and Affective domains, the curriculum is based on the following knowledge profiles:

  WK1 - Natural Sciences: A systematic theory-based understanding of natural sciences applicable to the discipline.

WK2 - Mathematics and Computing: The concept-based mathematical thinking, numerical analysis, statistics and formal aspects of computer and information science to support analysis and modeling applicable to the discipline.

WK3 - Engineering Fundamentals: A systematic, theory-based formulation of engineering fundamentals required in an engineering discipline.

WK4 - Engineering Specialization: The knowledge of engineering specialization that provides theoretical frameworks and bodies of knowledge for the accepted practice areas that are at the forefront in a discipline.

WK5 - Engineering Design: The Design Thinking Knowledge that supports engineering design in a practice area of an engineering discipline.

WK6 - Engineering Practice: The Knowledge of engineering practices (technology) in different practice areas of an engineering discipline.

WK7 - Engineering in Society: A systematic, comprehension-based knowledge of the role of engineers in a society and the professional issues related to practicing engineering profession in a discipline: ethics and the professional responsibility of an engineer to public safety including the impact of an engineering activity i.e. economic, social, cultural, and environmental and sustainability

WK8 - Research Literature: Engagement with selected knowledge in the research literature of the discipline.

The curriculum matrix covering above knowledge profiles should therefore be composed of non-engineering domain (humanities, math, management and natural sciences), and engineering domain with computer science, foundation, breadth, depth and multidisciplinary courses (including safety) so that different streams could be encouraged within each discipline, enabling students to undertake a range of Complex Problem Solving and Complex Engineering Activities. The students may select electives from any of the streams with guidelines from their respective advisors.

Knowledge Profile* (WK-1 to WK-8)	Knowledge Area	Sub-Area	Courses	Credit Hours
Non-Engineering Domain				
WK-2	Natural Science	Math	As per program requirements	12 - 15
WK-1		Physics	Applied Physics	6 - 9
		Chemistry	Applied Chemistry	
		Natural Science/ Math Elective	As per program requirements	
WK-7	Humanities	English	Written, communication and presentation skills	4 - 7
		Culture	Islamic Studies and Ethics	2
			Pakistan Studies and Global Perspective	2
		Social Science	Social and soft skills	2 - 6
	Management Sciences	Professional Practice	Professional and Project Management	2 - 6
Total (Non-Engineering Domain)				**Min 30**
Engineering Domain				
WK-2/ WK-4/ WK-5/ WK-6	Computer and Information Science	ICT/AI/ Data Science/ Cyber Security	Information and Communication Technologies (ICT) Artificial Intelligence	6 - 9
WK-3/ WK-2	Foundation Engg Courses		Specific to program objectives and outcomes	22 - 24
WK-4/ WK-2/ WK-1	Core Breadth of Engg discipline		Specific to program objectives and outcomes	23 - 24
WK-5/ WK-6	Core Depth of Engg Discipline		Specific to program objectives and outcome	22 - 24

WK-1/ WK-2/ WK-3/ WK-4	Multi-disciplinary Engg Courses		Specific to program objectives and outcome	6 - 12
			Occupational Health and Safety (Mandatory – 01 Cr Hr) (to be taught during first year of program)	
WK-6/ WK-7/ WK-8	Final Year Design Project (FYDP)/ Capstone	Integration of innovative, creative, technical, management and presentation skills of a graduate towards final year.		6
WK-6/ WK-7	Industrial Training	At least 6 - 8 weeks mandatory internship		Qualifying
WK-2/ WK-4/ WK-5/ WK-6/ WK-7/ WK-8	**Innovative and Critical Thinking (under relevant courses):** - Complex Problem Solving - Complex Engineering Activities - Semester Project - Case Studies - Open Ended Labs - Problem Based Learning (PBL)			
Total (Engineering Domain)				**Min 85**
Total Credit Hours				**130 - 136**

* As a specific or more than one knowledge profile to be covered.

- **Industrial Training:** Internship of at least 6 - 8 weeks is mandatory part of degree requirements towards 3rd to 4th year of program; must be supervised, monitored, evaluated, and reflected in the transcripts under a prescribed mechanism and with defined and mapped rubrics with program objectives;
  - Selection of internship in line with elective subjects/ specific streams
  - Qualifying weightage: 70%
    - At least 75% attendance is mandatory 10%
    - Assessment report from the employer 50%
    - Evaluation at relevant HEIs/ Deptt – presentation 40%

- **Final Year Design Project (FYDP)/ Capstone:** FYDP aims to challenge innovative, creative, technical, management and presentation skills of a graduate to bring together the learning over the degree program.
    - A final year design project (FYDP) is the confluence of an engineering program. Undertaking a final year design project is a compulsory requirement. It should mainly comprise literature search, individual analysis, modeling and simulation, AI (Artificial Intelligence) and computational data analytics, design and putting together various hardware, software, firmware and Algorithm Engineering / Informatics related to the program to demonstrate a functional concept including rapid prototyping, where applicable.
    - The FYDP shall include complex engineering problems and design systems, components or processes integrating core areas and meeting specific needs with appropriate consideration for public health and safety, cultural, societal, and environmental considerations.
    - A project of this nature should invariably lead to an integration of the knowledge and practical skills as mandated in the program outcomes. In this context, projects of multidisciplinary nature should be encouraged.
    - The FYDP should span over two consecutive semesters, i.e. semester 7 & 8, totaling 6-credit hours and should be fully supervised, assessed and reflected in the transcripts under a prescribed mechanism so as to prepare for joining industry after graduation.
- **Faculty:** The faculty must be trained for the Outcome-Based Education (OBE) system. Their familiarity with the program objectives and outcomes, understanding of the Outcome-Based Assessment (OBA) cycle, enthusiasm for developing an effective program, and the ability to become an active player in this regard are the keys to ensure the attainment of program objectives. The faculty is expected to have the ability to ensure proper implementation of the program, and to develop processes for evaluation, assessment and CQI. A formal training program to groom the faculty should be instituted to become effective instructors in applying pedagogical skills in all aspects of Teaching, Learning and Assessment covering all domains of Knowledge, Skills and Attitude.

- **Personal Grooming:** Personal Grooming of young faculty members and students is very important in order to develop and support their professional skills. Therefore, it is required that HEIs should conduct/arrange sessions or counseling hours on regular basis to provide guidance for personal grooming. Personal Grooming is important for positive self-image and increasing the confidence level of the individuals. It would help in enhancing students' self-esteem and would go a long way in developing an attractive personality by adopting habits like personal hygiene, clothing, appearance, interaction and expressive skills, etc. The students should be motivated and equipped to be entrepreneurs in their relevant field.
- **Presentation and Communication Skills:** Special focus should be given to inculcate communication and presentation skills amongst the graduates through individual and group presentations, technical writing and discussions, throughout the program as a regular feature.

This curriculum has been designed to guide and facilitate the universities and departments to formulate their own programs according to the industrial needs, emerging trends and recent developments in the field of textile Engineering. The HEIs have flexibility to incorporate changes in the proposed curriculum within given range of credit hours for engineering and non-engineering domain.

9. Framework for Bachelor of Textile Engineering Program

Knowledge Profile (WK-1 to WK-8)	Knowledge Area	Sub Area	Course Title	Theory	Lab	Total
				Credit Hours		
Non-Engineering Domain						
WK-7	Humanities	English	Functional English	2	0	2
			Communication Skills	2	0	2
			Technical Writing and Presentation Skills	3	0	3
		Culture	Islamic Studies and Ethics	2	0	2
			Pakistan studies and Global Perspectives	2	0	2
		Professional Ethics	Elective-I (Sociology for Engineers, Psychology, Professional Ethics, Organizational) Behavior/ Community Service)	2	0	2
			Social Science-II (Engineering Economics)	3	0	3
	Management Sciences	Professional Practice	Management Science-I (Project Management/ Eng. Management)	3	0	3
			Management Science-II (Entrepreneurship) and Marketing)	2	0	2
WK-2	Natural Science	Math	Calculus and Analytical Geometry	3	0	3
			Linear Algebra	3	0	3
			Differential Equations	3	0	3
			Probability and Statistics	3	0	3
WK-1		Physics	Applied Physics	3	1	4
		Chemistry	Applied Chemistry	3	1	4
Total (Non-Engineering Domain)				**39**	**2**	**41**

Engineering Domain						
WK-2/ WK-4/ WK-5/ WK-6	Computer and Information Science	ICT/AI/ Data Science/ Cyber Security	Information and Communication Technologies (ICT)	2	1	3
			Artificial Intelligence	2	1	3
WK-3/ WK-2	Engineering Foundation	---	Introduction to Textile Engineering	2	0	2
			Textile Raw Materials	3	0	3
			Engineering Drawing	0	1	1
			Fiber Science	2	1	3
			Manufactured and High-Performance Fibers	3	0	3
			Environmental, Health and Safety	3	0	3
			Textile Industry Utilities & Services	3	0	3
			Color Science	3	1	4
WK-4/ WK-2/ WK-1	Major-based core (Breadth)	---	Textiles Testing and Quality Control	2	1	3
			Yarn Manufacturing Fundamentals	3	1	4
			Fabric Manufacturing Fundamentals	3	1	4
			Textile Chemical Processing Fundamentals	3	1	4
			Garment Manufacturing Fundamentals	3	1	4
			Technical Textiles Fundamentals	2	1	3
WK-5/ WK-6	Major-based core (Depth)	---	Engineering Elective-I	3	1	4
			Engineering Elective-II	3	1	4
			Engineering Elective-III	2	1	3
			Engineering Elective-IV	2	1	3
			Engineering Elective-V	2	1	3
			Engineering Elective-VI	2	1	3

			Recent Trends in Textiles	2	0	2
			Denim Manufacturing and Processing	3	0	3
WK-3/ WK-4/ WK-2/ WK-1	Multi-disciplinary engineering	---	Mechanical Engineering Fundamentals	2	1	3
			Electrical & Electronics Engineering Fundamentals	2	1	3
			Instrumentation & Control	2	1	3
			Thermodynamics and Fluid Mechanics	2	1	3
			Occupational Health and Safety (mandatory)*	1	0	1
WK-6/ WK-7/ WK-8	Final Year Design Project (FYDP)/ Capstone	Industrial/ Innovative/ Creative Project	FYDP (Part-I)	0	3	6
			FYDP (Part-II)	0	3	
WK-6/ WK-7/	Industrial Training	At least 6 – 8 weeks internship		0	0	0
WK-2/ WK-4/ WK-5/ WK-6/ WK-7/ WK-8	**Innovative and Critical thinking (under Relevant Courses)** - Complex Problem Solving - Complex Engineering Activities - Semester Project - Case Studies - Open ended labs - Problem Based Learning					
Total (Engineering Domain)				**67**	**27**	**94**
Total Credit Hours				**106**	**29**	**135**

* to be taught during first year of program.

10. Scheme of Studies for Bachelor of Textile Engineering

Course Title	Theory	Lab	Total	Course Title	Theory	Lab	Total
First Year							
Semester 1				**Semester 2**			
Introduction to Textile Engineering	2	0	2	Textile Raw Materials	3	0	3
Functional English	2	0	2	Information and Communication Technologies (ICT)	2	1	3
Calculus and Analytical Geometry	3	0	3	Linear Algebra	3	0	3
Applied Chemistry	3	1	4	Pakistan Studies and Global Perspective	2	0	2
Applied Physics	3	1	4	Engineering Drawing	0	1	1
Islamic Studies	2	0	2	Communication Skills	2	0	2
Occupational Health and Safety	1	0	1	Thermodynamics and Fluid Mechanics	2	1	3
Total	**16**	**2**	**18**	**Total**	**14**	**3**	**17**
Second Year							
Semester 3				**Semester 4**			
Yarn Manufacturing Fundamentals	3	1	4	Textile Chemical Processing Fundamentals	3	1	4
Fabric Manufacturing Fundamentals	3	1	4	Garment Manufacturing Fundamentals	3	1	4
Mechanical Engineering Fundamentals	2	1	3	Electrical & Electronics Eng. Fundamentals	2	1	3
Computer Programming (C Language)	2	1	3	Manufactured and High-Performance Fibers	3	0	3
Fiber Science	2	1	3	Social Science Elective-II (Engineering Economics)	3	0	3
Total	**12**	**5**	**17**	**Total**	**14**	**3**	**17**

Third Year							
Semester 5				**Semester 6**			
Engineering Elective-I	3	1	4	Engineering Elective-II	3	1	4
Social Science Elective-I	2	0	2	Colour Science	3	1	4
Instrumentation & Control	2	1	3	Management Science Elective-I	3	0	3
Textile Industry Utilities & Services	3	0	3	Technical Textiles Fundamentals	2	1	3
Technical Writing and Presentation Skills	3	0	3	Probability and Statistics	3	0	3
Differential Equations	3	0	3		0	0	0
Total	**16**	**2**	**18**	**Total**	**14**	**3**	**17**
Fourth Year							
Semester 7				**Semester 8**			
Engineering Elective-III	2	1	3	Engineering Elective-V	2	1	3
Engineering Elective-IV	2	1	3	Engineering Elective-VI	2	1	3
Textile Testing and Quality Control	2	1	3	Recent Trends in Textiles	2	0	2
Environment, Health and Safety	3	0	3	Denim Manufacturing and Processing	3	0	3
Management Science Elective-II	2	0	2	FYDP-II	0	3	3
FYDP-I	0	3	3				
Total	**11**	**6**	**17**	**Total**	**9**	**5**	**14**
Compulsory industrial internship of at least 6 - 8 weeks towards 3rd or 4th year of programme					Qualify		
Total Credits Hours					**135**		

Proposed Specialized Streams and Courses for Textile Engineering

Yarn Manufacturing Specialization

- Pre-spinning Processes-I
- Pre-spinning Processes-II
- Yarn Production Engineering
- Advanced Spinning Techniques
- Spinning Calculations
- Specialty Yarns

Weaving Specialization

- Weaving Preparatory Processes
- Weaving Mechanisms
- Weaving Mechanism II
- Woven Fabric Design and Structure
- Weaving Calculations
- Specialty Weaving

Knitting Specialization

- Knitted Fabric Structure and Design
- Knitting Preparatory Process
- Specialty Knitting
- Knitting Mechanism-I
- Knitting Mechanism-II
- Knitting Calculations

Textile Processing Specialization

- Pre-treatment of Textiles
- Dyestuff Chemistry
- Textile Dyeing
- Textile Printing
- Textile Finishing
- Textile Coating

Garment Manufacturing Specialization

- Garment Sizing and Pattern Making
- Computer Aided Pattern Design and Product Development
- Clothing Production Processes
- Garment Production Machinery
- Sewn Product Engineering
- Apparel Merchandizing and Sourcing

Electives for Social Science

- Sociology for Engineers
- Professional Ethics
- Economics for Engineers
- Sociology
- Social Anthropology
- Understanding Psychology and Human
- Social Psychology
- Organizational Behavior
- Critical Thinking
- Philosophy
- Human Resource Development
- Culture and Society
- Engineering Law

Electives for Management Sciences

- Entrepreneurship
- Entrepreneurship and Marketing
- Engineering Project Management
- Principle of Management
- Engineering Management
- Quality Management Systems
- Textile Marketing
- Industrial Engineering and Management
- Total Quality Management
- Supply Chain Management
- Production Management

Courses for Computer Sciences

- Information and Communication Technologies (ICT)
- Artificial Intelligence
- Cyber Security
- Data Science
- Modeling and Simulation
- Computer Programming and Design

11. Program Specific Labs

The following laboratories specific to engineering discipline be ensured to cover relevant knowledge domains but not limited to:

- Yarn Manufacturing Lab
- Weaving Lab
- Knitting Lab
- Textile Chemical Processing Lab
- Colour Measuring and Microscopy Lab
- Garment Manufacturing Lab
- Textile Testing & Quality Control Lab
- Project & Research Lab

12. Course Details and Teaching-Assessment Approaches

In the following sections, course outlines and teaching-assessment approaches are given for guidance based on a typical semester system. The instructors may adopt or adapt accordingly defining CLOs, course delivery plan, innovative teaching approaches and assessment techniques.

12.1 Engineering Domains

Computer and Information System Courses

Information and Communication Technologies (ICT)

Course Outline:

Introducing Computer Systems: Basic Definitions

- Computer and Communication Technology
- The applications of ICT - particularly for Engineers

Basic Operations and Components of a Generic Computer System

- Basic operations: Input, Processing, Output, Storage Basic components: Hardware, Software, Data, Users
- Types of storage devices

Processing Data

- Transforming data into information
- How computers represent and process data
- Processing Devices
- CPU architectures

The Internet

- The Internet and the World Wide Web- browsers, HTML
- URLs/ How DNS works
- Email and other programs

Introduction to Embedded Systems

- What is an Embedded System
- Applications
- Components
- Programming Languages
- Popular Development Platforms

Networking Basics

- Uses of networks
- Common types of networks (LAN, WAN, MAN etc.)
- Introduction to OSI Model
- Future of Networks

Database Management

- Hierarchy of Data
- Maintaining Data
- Database Management Systems

Exposure to ICT Tools and Blogs (Student Assignment)

Protecting your privacy, your computer and your data

- Basic Security Concepts
- Threats to users
- Threats to hardware
- Threats to Data

ICT in Education

Future Trends in ICT

Final Presentations

Tools / Software Requirement

Microsoft Office, Windows, Virtual Box, Netbeans

Teaching Methodology (Proposed as applicable):

Lectures (audio/video aids), written assignments/quizzes, tutorials, case studies relevant to engineering disciplines, semester project, guest speaker, industrial/field visits, group discussion, report writing

Assessment:

Mid-semester exam, report writing/presentation, assignments, project report, quizzes, end- semester exam

Suggested Books:

- "Introduction to Computers", Peter Norton, 7th Edition, 2013, McGraw-Hill.
- "Computing Essentials", Timothy O'Leary and Linda O'Leary, 2010, McGraw-Hill.
- Using Information Technology: A Practical Introduction to Computers & Communications", Williams Sawyer, 6th Edition, 2005, McGraw-Hill.
- "Discovering Computers, Complete: Your Interactive Guide to the Digital World.

Computer Programming

Course Outline:

Module 1 Introduction to Computational Thinking

- Computational Thinking Concept
- Applications to Computer Science

Module 2 Introduction to Programming Concepts and Programming Languages

- Paradigms of Programming
- Main Programming Structures
- Steps to Develop a Program
- Categories of Programming Languages

Module 3 Introduction to C Language and Building Blocks

- Basic C Concepts
- Structure of a C Program
- Input and Output Operations
- Data Types in C
- Data Type Modifiers
- Constants and Variables in C
- Backslash Constants in C
- Working with Operators and Expressions

Module 4 Structured Programming: Decisions

- Decision Control Structures
- Flowcharts
- The if /else Decision Structure
- Indentation and Nesting
- Case Control Structure
- Compound Logical Expressions

Module 5 Structured Programming: Loops

- Repetition / Iteration Control Structures
- Decision Loops (while, do-while Loop)
- Counter-controlled Loops (for Loop)
- Nesting of Iteration and Decision Control Structures

Module 6 Data Structures: Arrays and Pointers

- Arrays Initialization
- Bounds Checking
- Multidimensional Arrays
- Processing Arrays
- Creating and manipulating Strings
- Standard Library String Functions
- Understanding Pointers
- Performing Operations on Pointers
- Pointers and Strings
- Sorting Algorithms (Quick Sort, Bubble Sort, Merge Sort)

Module 7: Functions

- Motivation and benefits of Functions
- Functions and Variables
- Parameter Passing Mechanisms
- Recursion and its Applications
- Passing Arrays to Functions
- Preprocessor Directives

Module 8: Structures and File Processing

- Declaring a Structure
- Accessing Structure Elements
- Array of Structures
- File Operations
- Reading and writing to a File
- Database Management

Module 9: Object Oriented Programming with C++

- Introduction to Classes, Objects
- Operator Overloading
- Inheritance and Polymorphism

Teaching Methodology (Proposed as applicable):

Lectures (audio/video aids), written assignments/quizzes, tutorials, case studies relevant to engineering disciplines, semester project, guest speaker, industrial/field visits, group discussion, report writing

Assessment:

Mid-semester exam, report writing/presentation, assignment, project report, quizzes, end-semester exam

Suggested Books:

- Paul J. Deitel, C How to Program, 2016
- Yashavant Kanetkar, Let Us C, 2017
- Simon Monk, Programming Arduino, 2016

Computer Aided Design

Course Outline:

- Introduction to AutoCAD
- Use basic drawing and text commands
- Use basic editing commands (move, copy, erase, etc.)
- Use advanced editing commands (mirror, fillet, etc.)
- Dimensioning capabilities of Auto CAD
- Create and use layers
- Print or plot a drawing
- Create and using blocks
- Be familiar with hatching capabilities of Auto CAD
- Curves
- 3D modeling
- Multiple Lines
- Geometric Shapes
- Isometric drawings
- Polar Arrays

Teaching Methodology (Proposed as applicable):

Lectures (audio/video aids), written assignments/quizzes, tutorials, case studies relevant to engineering disciplines, semester project, guest speaker, industrial/field visits, group discussion, report writing

Assessment:

Mid-semester exam, report writing/presentation, assignment, project report, quizzes, end-semester exam

Suggested Books:

- Mastering AutoCAD 2017 and AutoCAD LT 2017 by George Omura with Brian Benton, (latest edition), 2016.
- AutoCAD® 2015 And AutoCAD Lt® 2015 No Experience required by Donnie Gladfelter.

Introduction to Modeling and Simulation

Course Outline:

Simulation

- Prepare Model Inputs and Outputs
- Configure Simulation Conditions
- Run Simulations
- View and Analyze Simulation Results
- Test and Debug Simulations
- Optimize Performance
- Simulation Guidelines & Best Practices

Modeling

- Design Model Architecture
- Manage Design Data
- Design Model Behavior
- Configure Signals, States, and Parameters
- Configure Inputs and Visualizations
- Analyze and Remodel Design
- Test Model Components
- Modeling Guidelines & Best Practices

Tools/ Software Requirement

- Matlab

Teaching Methodology (Proposed as applicable):

Lectures (audio/video aids), written assignments/quizzes, tutorials, case studies relevant to engineering disciplines, semester project, guest speaker, industrial/field visits, group discussion, report writing

Assessment:

Mid-semester exam, report writing/presentation, assignment, project report, quizzes, end-semester exam

Suggested Books:

- Introduction to Matlab for Engineering Students by David Houcque, Northwestern University.
- https://www.mathworks.com/help/simulink/simulation.html
- https://www.mathworks.com/help/simulink/modeling.html

Artificial Intelligence

Course Outline

This course gives a broad overview of the fundamental theories and techniques of Artificial Intelligence.

- Overview of AI Problems;
- Intelligent Behavior: Turing Test, Rationale versus Non-rationale Reasoning;
- Problem Characteristics: Fully versus Partially Observable,
- Single versus Multi agent; Intelligent Agents: reactive, deliberative, goal-driven, utility-driven, and learning agents; Uninformed Search: Depth First, Breadth First, Depth First with Iterative Deepening;
- Informed Search: Hill climbing, A*- Search and their Time and Space Complexity, Local Search, Genetic Algorithm; Game Playing: Minimax, Evaluation functions, Alpha-beta pruning; Propositional and Predicate Logic; Resolution and Theorem Proving; Forward and Backward Chaining;
- Machine Learning: Introduction,
- Supervised learning: Instance based learning, Decision tree, artificial neural networks, Unsupervised Learning: K-means Clustering, Reinforcement Learning.

Teaching Methodology (Proposed as applicable):

Lectures (audio/video aids), Written assignments/Quizzes, Case Studies relevant to Engg. disciplines, Semester project, Guest speaker, Industrial/Field visits, Group discussion, Report Writing.

Assessment:

Mid-term, Report writing/Presentation, Assignment, Project report, Quizzes, Final exam.

Suggested Books:

- Stuart J. Russell and Peter Norvig, "Artificial Intelligence: A Modern Approach", latest Edition, Prentice Hall, ISBN-13: 978-0136042594.
- Elaine Rich and Kevin Knight, "Artificial Intelligence", latest Edition, McGraw-Hill, ISBN-13: 978-0070522633.
- R. J. Schalkoff, "Artificial Intelligence in Engineering Approach", latest edition, McGraw Hill, ISBN-13: 978-0070550841.
- Peter Jackson, "Introduction to Expert Systems", latest Edition, Addison Wesley, and ISBN-13: 978-0201876864.
- Ivan Bratko, "Prolog Programming for Artificial Intelligence", latest Edition, Addison Wesley, and ISBN-13: 978-0321417466.

Engineering Foundation Courses

Introduction to Textile Engineering

Course Outline:

Module 1 Introduction

- Textile manufacturing processes and textile machines. Introduction to various departments of textile industry, description of general terms used in textiles.

Module 2 History of Textiles

- History and scope of textile sector in Pakistan and around the globe, textile material manufacturing

Module 3 Textile Raw Material

- Textile fibers. General classification of textile fibers (natural /manmade) and their application.

Module 4 Cotton Ginning

- Process flow chart, types of ginning, preparation of cotton bales, terms used in ginning, factors that can affect the fiber quality.

Module 5 Yarn Manufacturing

- Process flow chart, introduction to yarn manufacturing processes & machines, terms used in spinning.
- Spun yarn production processes
- Ring spinning process and open end spinning process
- Synthetic fiber spinning techniques
- Classification of synthetic fibers on the basis of manufacturing methods

Module 6 Fabric Manufacturing

- Types of fabric manufacturing techniques, process flow chart of weaving, introduction to weaving machines, terms used in weaving, process flow chart of knitting, introduction to knitting machines, terms used in knitting.
- Yarn preparation steps for weaving
- Basic weaving operation and types of looms and their major components
- Knitting manufacturing methods

Module 7 Wet Processing

- Process flow chart of wet processing;
- Wet processing (pre-treatment, dyeing, printing, finishing), terms used in wet processing.
- Colorants for dyeing

Module 8 Garment Manufacturing

- Process flow chart of garment manufacturing, types of garments, operations of garments manufacturing; pattern making, cutting, sewing, terms used in garment manufacturing.
- Quality control in garments department

Teaching Methodology (Proposed as applicable):

Lectures (audio/video aids), written assignments/quizzes, tutorials, case studies relevant to engineering disciplines, semester project, guest speaker, industrial/field visits, group discussion, report writing

Assessment:

Mid-semester exam, report writing/presentation, assignment, project report, quizzes, end-semester exam

Suggested Books:

- Y. Nawab, Textile Engineering: An Introduction, 2016
- Butola, Advanced Textile Engineering Materials, 2018
- ACIMIT, Textile Reference book for Spinning, 2002
- ACIMIT, Textile Reference book for Weaving, 2000
- ACIMIT, Textile Reference book for Knitting, 2001
- ACIMIT, Textile Reference book for Finishing, 2002
- Jenny Udale, Textiles and fashion, 2008
- Y.E Mogahzy, Engineering Textiles, Woodhead Publishing, 2008

Textile Raw Materials

Course Outline:

Module 1 Textile Fibers

- Definition and classifications of textile fibers

Module 2 Plant Fibers

- Cotton: Introduction of cotton and its types, Cultivation, harvesting and picking of cotton, Structure and morphology of cotton fiber, Physical, chemical properties and end uses of cotton fiber, Varieties of Pakistani cotton, Cotton grading.
- Bast fibers: Fibers such as jute, flax, ramie etc., Production and processing of bast fibers, Fiber structure, morphology, physical and chemical properties and end uses.
- Leaf fibers: Fiber such as abaca and sisal etc., Production, processing, structure, morphology, physical and chemical properties and end uses.

Module 3 Animal Fibers

- Hair fibers: Introduction, classification, structure, production, properties and uses of wool fibers, Grading of wool, Introduction of fibers such as Camel, Mohair, Cashmere, Alpaca and Angora.
- Silk: Production, structure, properties and end uses of silk yarn.

Module 4 Regenerated Fibers

- Manufacturing methods of viscose, lyocel, bamboo and cellulose acetate and its derivatives like Tencel. Their structure, properties and end uses in textile industry.

Module 5 Synthetic Fibers

- Manufacturing methods of polyester, polyamide, polypropylene, polyethylene and acrylic fibers, their structure, properties and end use in textile industry.
- Manufacturing methods of various elastane fibers such as Lycra, their structure, properties and end uses in textile industry.
- Competition of natural and man-made fibers in textile industry.

Teaching Methodology (Proposed as applicable):

Lectures (audio/video aids), written assignments/quizzes, tutorials, case studies relevant to engineering disciplines, semester project, guest speaker, industrial/field visits, group discussion, report writing

Assessment:

Mid-semester exam, report writing/presentation, assignment, project report, quizzes, end-semester exam

Suggested Books:

- Ivana Markova, Textile Fiber Microscopy A Practical Approach, 2019
- J.W.S. Hearle, Fiber Structure 2013
- J.W.S Hearle, Handbook of Textile Fibres Structures (vol. 1 and 2), 2009
- S. Gordon and You-Lohsieh, Cotton Science and Technology, 2007
- C. Woodings, Regenerated Cellulosic Fibres, 2001
- Morton, W.E. and J.W.S. Hearle, Physical Properties of Textile Fibres, 2008

Engineering Drawing

Course Outline:

Module 1 Introduction

- Drawing equipment and the use of instruments, Basic drafting techniques and standards.

Module 2 Basic Engineering Drawing

- Projection of points, lines, planes and solids. Orthographic projections.

Module 3 Geometrical Curves

- Plane curves, cycloid, hypocycloid, and the Involutes. Intersections at various positions of geometrical bodies such as prisms, pyramids, cylinders and cones.

Module 4 Concept of Working Drawing

- Size, description, dimensions, and specifications, limit dimensioning, and geometric tolerance, limits fits and tolerances, conventional symbols.

Module 5 Drawing of Textile Machine Components

- Nuts and bolts, shafts, couplings, bearings, pulleys, connecting rods, locking arrangements. Sectioning of machine components. Assembly drawing.

Module 6 Isometric Views

- Isometric views with especial reference to piping and ducting.

Teaching Methodology (Proposed as applicable):

Lectures (audio/video aids), written assignments/quizzes, tutorials, case studies relevant to engineering disciplines, semester project, guest speaker, industrial/field visits, group discussion, report writing

Assessment:

Mid-semester exam, report writing/presentation, assignment, project report, quizzes, end-semester exam

Suggested Books:

- Ashleigh Fuller, Technical Drawing 101 with AutoCAD, 2019.
- David Allan Low, Practical Geometry and Graphics, 2016.
- T. E. French and C. J. Vierich, A Manual of Engineering Drawing (Fourth Edition), 2012.
- N. D. Butt, Elementary Engineering Drawing, 2004.
- B. Bielefeld, Basic Technical Drawings, 2002.
- C. Parkinson, A First-Year Engineering Drawing, 1998.

Fiber Science

Course Outline:

Module 1: Chemical and Physical Structure of Natural Polymer Fibers

- Natural Cellulose Fibers
- Regenerated Cellulosic Fibers
- Natural Protein Fibers

Module 2: Chemical and Physical Structure of Synthetic Polymer Fibers

- Repeating Units
- Molecular Weight
- Configurations
- Conformations
- Bonding
- Solid Phases
- Unit Cells
- Crystalline Models
- Morphology of Synthetic Fibers

Module 3: Mechanical Properties of Fibers

- Basic Definitions
- Tensile Properties
- Compressive Properties
- Bending Properties

Module 4: Viscoelastic Properties of Fibers

- Molecular Mechanisms of Viscoelastic Behavior
- Phenomenological Aspects of Viscoelastic Behavior
- Time-Temperature Equivalence
- Models of Viscoelastic Behavior

Module 5: Thermal Properties

- Heat Capacity and Specific Heat
- Thermal Conductivity
- Thermal Expansion and Contraction
- Glass Transition
- Melting
- Degradation and Decomposition

Module 6: Electrical Properties of Fibres

- Electrical Conductivity
- Static Electricity

Module 7: Frictional Properties of Fibres

- Basic Concepts
- Nature of Friction
- Fiber-on-Fiber Friction
- Fiber-on-Other-Material Friction
- Lubrication

Module 8: Optical Properties of Fibres

- Polarization and Light
- Refractive Index and Birefringence
- Reflection and Luster
- Absorption and Dichroism

Teaching Methodology (Proposed as applicable):

Lectures (audio/video aids), written assignments/quizzes, tutorials case studies relevant to engineering disciplines, semester project, guest speaker, industrial/field visits, group discussion and report writing.

Assessment:

Mid-semester exam, report writing/presentation, assignment, project report, quizzes, end-semester exam

Suggested Books:

- Patricia. I. Dolez, Advanced Characterization and Testing of Textiles, 2017
- Xiangwu Zhang, Fundamentals of Fiber Science, 2014
- R. Bunsell, Handbook of Tensile Properties of Textile and Technical Fibers, 2009
- B P Saville, Physical Testing of Textiles, 2002
- J. E. Booth, Principles of Textile Testing, 1996
- J.W.S. Hearle and W.E Morton, Physical Properties of Textile Fibres, 2008
- AATCC, ASTM and ISO Test Methods related to the course

Manufactured and High-Performance Fibers

Course Outline:

Module 1 Man-made Fibers and their Processing Requirements

- Chemistry of fiber-forming polymers
- Polymerization processes
- Influence of chemical structure on the physical properties of chemicals and fibers
- Effects of molecular weight on fiber spin ability, structure and properties
- Flow properties of polymers
- Principles of solidification during fiber formation
- Fiber formation techniques
- Post-fiber formation treatments

Module 2 Understanding the Behavior of Synthetic Polymer Fibers during Spinning

- Polymer behavior during cooling and resulting fiber structure
- Polymer behavior during filament spinning
- The die swell phenomenon
- Drawing of polymers: changes in morphology and properties of filaments

Module 3 Technologies for the Manufacture of Synthetic Polymer Fibers

- Textile filament and bulk continuous fiber (BCF) spinning
- Staple fiber spinning
- Industrial fiber spinning equipment
- Monofilament fiber equipment
- Bicomponent fiber equipment
- Solvent spinning lines
- Hollow fiber membranes
- Gel spinning

Module 4 Gel Spinning

- Gel spinning of synthetic polymer fibers
- Gel spinning technologies
- Types of fibers produced using gel spinning
- Factors affecting gel spinning
- Gel spun textile products

Module 5 Wet Spinning

- Fundamentals of melt spinning
- Limitations of melt spinning
- Developments in melt spinning

Module 6 Dry Spinning of Synthetic Polymer Fibers

- The dry spinning processes
- Characteristics of dry spun fibers
- Variables in dry spinning
- Dry spinning of acrylic fibers
- Dry spinning of cellulose acetate and triacetate
- Dry spinning of other fibers: polybenzimidazole (PBI), spandex and polyvinyl chloride (PVC)

Module 7 Electro-spinning, Processing and Characterization of Polymer-Based Nano-Composite Fibers

- Principles of electrospinning
- Electrospinning technology

- Electrospinning of nanofibers
- Properties of electro spun nanofibers
- Wet spinning of synthetic polymer fibers
- Principles of wet spinning
- Types of fibers used
- Fiber properties
- Factors affecting wet spinning
- Applications

Module 8 High Performance Fibers

- Objectives, classification and distinguished properties of high performance fibers
- Trade names, types, structure, manufacturing processes, properties and applications of the following high-performance fibers:
- Para and Meta Aramid Fibers
- High Modulus Polyethylene Fibers
- Thermotropic Liquid Crystal Polymers
- Poly Phenylene Benzobisoxazole (PBO) Fibers
- Poly Benzimidazole (PBI) fibers
- Carbon Fibers
- Glass Fibers

Teaching Methodology (Proposed as applicable):

Lectures (audio/video aids), written assignments/quizzes, tutorials case studies relevant to engineering disciplines, semester project, guest speaker, industrial/field visits, group discussion and report writing.

Assessment:

Mid-semester exam, report writing/presentation, assignment, project report, quizzes, end-semester exam

Suggested Books:

- Gajanan Bhat, Structure and Properties of High Performance Fibres, 2016
- Dong Zhang, Advances in filament yarn spinning of textiles and polymers, 2014
- Robert R Mahr, The Chemistry of Textile Fibers, 2015

- Sco-Jin Park, Carbon Fibres, 2014
- R. J. Young, P. A. Lovell, Introduction to Polymers, 2011
- Tatsuya Hongu, Glyn O. Phillips and Machiko Takigami, New Millinium Fibres, 2005
- John W. S. Hearle, High-performance Fibers, 2001

Environment, Health and Safety

Course Outline:

- Safety concerns with respect to textile industry
- Impact protection, noise protection
- Chemical protection, thermal (heat & fire) protection, respiratory protection, worker safety regulations, fire safety, and personal protective equipment.
- Social compliances in textile industry, zero discharge of hazardous chemicals (ZDHC),
- Eleven toxic priority chemicals for textile industry, sustainable technologies, manufacturing restricted substance list (MRSL), brand restricted substance list (RSL).
- Wastewater quality, textile effluent treatment methods: physical; chemical; biological,
- Solid textile waste management, textile audit protocol and textile toxic free chemical research, data disclosure and training.
- Introduction to blue sign, OSHA, ISO 14000, OEKO-TEX- 100.

Teaching Methodology (Proposed as applicable):

Lectures (audio/video aids), written assignments/quizzes, tutorials case studies relevant to engineering disciplines, semester project, guest speaker, industrial/field visits, group discussion and report writing.

Assessment:

Mid-semester exam, report writing/presentation, assignment, project report, quizzes, end-semester exam

Suggested Books:

- M. I. T. Rohr, Handbook of Sustainable Textile Production, 2011
- K. Slatter, Environmental Impact of Textile: Production Processes and Protection, 2003
- Gerard Kiely, Environmental Engineering, 2007
- ZDHC Manuals, 2015, 2017

Textile Industry Utilities & Services

Course Outline:

Module 1: Compressors

- History of compressed air
- Compressed air applications
- Compressor types
- Compressed air dryers
- Support components
- Compressors maintenance

Module 2: Humidification and Air Conditioning

- Need for humidity
- Types of humidification
- Air humidity units
- Concept of total air control
- Maintenance of humidity
- Air conditioning units

Module 3: Industrial Lighting

- Benefits of good industrial lighting
- Lighting for good industrial tasks
- Lighting and color
- Installation design
- Maintenance of lighting installations
- Calculations for interior general lighting
- Economics of good industrial lighting

Module 4: Steam Generation Systems

- Introduction to steam
- Industrial steam systems
- Boiler room combustion and ventilation air
- Industrial steam system equipment
- Steam plant pipe sizing and design considerations

Module 5: Fire Protection Systems

- Basics of fire
- Fire classification
- Fire preventive systems
- Fire alarm and detection systems
- Water-based fire protection systems
- Fire suppression systems and agents

Teaching Methodology (Proposed as applicable):

Lectures (audio/video aids), written assignments/quizzes, tutorials, case studies relevant to engineering disciplines, semester project, guest speaker, industrial/field visits, group discussion, report writing

Assessment:

Mid-semester exam, report writing/presentation, assignments, project report, quizzes, end- semester exam.

Suggested Books:

- Mojtaba Sabet, Industrial steam systems, 2015.
- B. Purushothama, Humidification and ventilation management in textile industry, 2009.
- Brian S. Elliott, Compressed air operations manual, 2006.
- Maurice jones, Fire protection systems, 2009.
- Arthur E. Cote, Fundamentals of fire protection, 2004.

Colour Science

Course Outline:

Module 1: Introduction

- Appearance attributes
- Colour attributes
- Electromagnetic radiations/waves and spectrum
- Wavelength; visible spectrum; prism; diffraction grating.
- Application of colour science in textiles

Module 2: Light

- Daylight, sources and properties of artificial light
- Interaction of light with matter; reflectance, transmission and absorbance curves;
- Light interaction with atoms and molecules.
- Planckian/black body radiators and colour temperature
- Fluorescence and phosphorescence
- Colour matching booths and visual colour matching

Module 3: Colour Perception

- Structure, parts and functioning of the human eye
- Eye and brain
- Theories of colour vision
- Colour deficiency and colour vision tests
- Eye-brain effects and optical illusions

Module 4: Colorimetry and Colour Specification

- Basic principles and possible colour specification system
- Additive and subtractive mixing
- The CIE system, colour matching functions and tristimulus values
- Calculation of tristimulus values from R values.
- Colour constancy and chromatic adaptation, colour rendering of light sources.

Module 5: Measurement of Colour

- Tristimulus Colorimeter
- Spectrophotometer and its anatomy: light sources, instrument geometry, spectral analyzer (monochromation and photodetection)
- Classification of spectrophotometers: transmittance and reflectance, single beam and dual beam, desktop portable and in line monitoring
- Beer-Lambert law and its applications
- Application of transmission spectrophotometry to dyes
- Kubelka-Munk theory and its application
- Applications of reflectance spectrophotometry to textile surfaces

Module 6: Colour Matching and Colour Difference

- Colour match prediction
- Colour difference evaluation and metamersim
- Various colour difference formulae
- Colour difference tolerance
- Evaluation of whiteness and yellowness
- Evaluations of colour fastness test results

Module 7: Color Order and Sorting Systems

- Colour-order systems and colour spaces
- Evaluation of depth and relative depth
- Shade sorting
- How shade sorting differs from pass/fail colour difference evaluation?
- 555 shade sorting system

Teaching Methodology (Proposed as applicable):

Lectures (audio/video aids), written assignments/quizzes, tutorials case studies relevant to engineering disciplines, semester project, guest speaker, industrial/field visits, group discussion and report writing.

Assessment:

Mid-semester exam, report writing/presentation, assignment, project report, quizzes, end-semester exam

Suggested Books:

- A.W.G. Hunt, Measuring Color, 2011
- M. L. Gulrajani, Color Measurement: Principles, Advances and Industrial Applications, 2010
- Matthew Luckiesh, Colour and its Application, 2009
- R. S. Berns, Principles of Color Technology, 2000

Breadth Engineering Courses

Textile Testing & Quality Control

Course Outline:

Module 1: Introduction

- Reasons for textile testing, standardization of testing, sampling, measurement. Textiles and moisture: Effect of moisture on physical properties, atmospheric moisture, regain and moisture content, correct invoice weight, control of testing room atmosphere. Fiber dimensions: fiber fineness, fineness measurement, fiber length, high volume instruments.

Module 2: Structure, Mechanics and Testing of Yarns

- Yarn strength: Single strand method, skein method.
- Fiber strength, yarn bulk, friction.
- Breaking strength; tensile strength, stress, specific stress, tenacity, breaking length, elongation, strain, extension percentage, gauge length, force elongation curve, yield point, modulus, work of rupture, time dependence, elastic recovery, factor affecting tensile test, types of testing machines, specimen length, rate of loading and time to break, effect of humidity and temperature.
- Linear density, evenness, imperfections, diameter, hairiness, twist; and their measurements. USTER statistics; Interpretation of yarn evenness testing results; Relationship of fiber properties with yarn properties; Relationship of yarn structure and its mechanical properties (strength, elongation, elasticity, recovery, modulus).

Module 3: Structure, Mechanics and Testing of Fabrics

- Physical properties and construction of fabric; Relationship of yarn properties with fabric properties; Relationship of fabric structure and its mechanical properties; fabric tensile strength: strip strength, grab strength.
- Tensile, bending, shear, serviceability, tear, burst, pilling, abrasion and air permeability of fabrics. Stretch and recovery properties.

Module 4: Structure, Mechanics and Testing of Dyed and Finished Fabrics

- Shade depth, rubbing, light, washing and perspiration fastness,
- Crease recovery angle, Appearance of the fabric after laundering
- Water repellency, Oil repellency. Color, rubbing, Light and wash fastness testing. Flame retardancy testing. Comfort testing,
- Handle, Kawabata system, FAST

Module 5: Structure, Mechanics and Testing of Garments

- Effect of garment construction on its properties (drape, fit and appearance);
- Effect of joining methods such as sewing/stitching and types of seam on fabric bending and drape properties.
- Seam strength

Module 6: Quality Control and its Application in Textile Industry

- Quality, types of quality, control of raw materials, preparatory processes and their effects on final product quality, quality control on finishing processes, Quality assurance. Quality audit, textile product labelling, classification and detection of processing faults.

Teaching Methodology (Proposed as applicable):

Lectures (audio/video aids), written assignments/quizzes, tutorials case studies relevant to engineering disciplines, semester project, guest speaker, industrial/field visits, group discussion and report writing.

Assessment:

Mid-semester exam, report writing/presentation, assignment, project report, quizzes, end-semester exam

Suggested Books:

- Sheraz Ahmad, Advanced Textile Testing Techniques, 2017
- Xiangwu Zhang, Fundamentals of Fiber Science, 2014
- B P Saville, Physical Testing of Textiles, 2002
- John W S Hearle and W E Morton, Physical Properties of Textile Fibres, 2008
- AATCC, ASTM and ISO Test Methods related to the course

Yarn Manufacturing Fundamentals

Course Outline:

Module 1: Spinning Processes

- Flow charts of spinning processes for filament and staple-spun yarns, carded and combed yarns, cotton blended yarns, jute, flax and spun silk yarn.
- Input and output of each process.
- Intermittent spinning and continuous spinning.

Module 2: Blow Room

- Objectives of blow room.
- Working principles in blow room.
- Working of bale breaker, porcupine opener, various beaters, cage condenser, scutcher and removal of wastes.

Module 3: Carding

- Objectives of carding
- Carding actions
- Working of card
- Role of different parts and their speeds.

Module 4: Draw Frame

- Objectives of draw frame
- Working of draw frame.
- Concept of drafting
- Drafting and doubling

- Breaker, inter and finisher draw frame.

Module 5: Combing

- Objectives of combing
- Noil %age
- Combing preparatory processes
- Working of comber.

Module 6: Roving

- Objectives of roving frame
- Principle and mechanism of twist insertion
- Working of roving frame

Module 7: Spinning

- Objectives of ring spinning
- Principle and mechanism of twist insertion
- Working of ring frame

Module 8: Winding, Conditioning and Yarn Packing

- Objectives of winding and packing
- Yarn clearing, knotting and splicing
- Working of auto-winder
- Objective of conditioning

Module 9: New Spinning Systems

- Open-End Rotor spinning
- Air-jet spinning
- Friction spinning
- Wrap spinning
- Compact spinning

Module 10: Woolen Industry

- Wool and its classification
- Woolen and worsted yarn
- Flow charts for woolen and worsted spinning processes
- Wool classification and sorting

- Impurities in wool
- Raw material for woolen industry
- Wool scouring, carbonizing, drying and blending
- Woolen carding and woolen spinning.

Module 11: Worsted Industry

- Worsted carding, backwashing and gilling
- Combing, drawing and spinning.

Teaching Methodology (Proposed as applicable):

Lectures (audio/video aids), written assignments/quizzes, tutorials case studies relevant to engineering disciplines, semester project, guest speaker, industrial/field visits, group discussion and report writing.

Assessment:

Mid-semester exam, report writing/presentation, assignment, project report, quizzes, end-semester exam

Suggested Books:

- W. Klein, The Reiter Manual of Spinning, vol. 1 to 7, 2018
- Ephruim Lipson, The History of Woolen & Worsted Industry, 2015
- R. Sunthil Kumar, Process Management in Spinning, 2014
- E. Oxtoby, Spun Yarn Technology, 2013
- C. A. Lawrence, Advances in Yarn Spinning Technology, 2010
- S. Kershaw Dumville, The Worsted Industry 2010

Fabric Manufacturing Fundamentals

Course Outline:

Module 1: Basics of Weaving

- History and scope of weaving
- Weaving preparatory processes: winding, warping and sizing and their objectives,
- Primary, secondary and auxiliary motions of weaving
- Different shedding systems: tappet, dobby, jacquard

- Different weft insertion systems: shuttle, shuttle less (air-jet, water-jet, rapier, projectile)
- Types of take-up motions & let-off motions
- Let-off and take-up motions
- Weave presentation, repeat, draft, peg plan and reed plan,
- Weave designs: plain weave and its derivatives, twill weave and its derivatives, satin and sateen weaves.
- Woven fabric faults and inspection

Module 2: Basics of Knitting

- History and scope of knitting
- Introduction to knitting, Classification of knitting machines, Types of Warp and Weft knitting machines, knitting machine elements, beard latch and compound needles.
- Introduction weft knitting, Course and Wale, knit tuck and loop formation, usage of different knit loops, End use of weft knitted structures.
- Introduction to warp knitting, mechanism of loop formation in warp knitting, classification of warp knitting machines, basic warp knitted structures, stitch notation of warp weft knitted structure, End usage of warp knitted structures
- Properties of plain and rib fabrics, properties of purl and interlock fabrics
- Knitted fabric faults and inspection.

Teaching Methodology (Proposed as applicable):

Lectures (audio/video aids), written assignments/quizzes, tutorials case studies relevant to engineering disciplines, semester project, guest speaker, industrial/field visits, group discussion and report writing.

Assessment:

Mid-semester exam, report writing/presentation, assignment, project report, quizzes, end-semester exam

Suggested Books:

- Sabit Adanur, Handbook of Weaving, 2019.
- Kyosev and Yordan, Braiding Technology for Textiles: Principles, Design and Processes, Elsevier, 2016.

- J. David, Knitting Technology: by Spencer, 2014.

Textile Chemical Processing Fundamentals

Course Outline

Module 1: Introduction

- Introduction to textile chemical processing
- Chemical processing flow chart

Module 2: Pre-treatment

- Singeing and Shearing
- Desizing
- Scouring
- Bleaching
- Mercerizing
- Heat Setting

Module 3: Dyeing

- Introduction to textile dyes and pigments
- Dyeing of cellulose fibers, polyester, polyamide, acrylic, wool and silk
- Fastness testing and improvement of the dyed fabrics
- Important characteristics of dyed fabrics

Module 4: Printing

- Introduction, different methods and styles of printing
- Printing pastes and inks
- Digital printing

Module 5: Finishing

- Objectives, Classification of finishes and finishing methods: chemical and mechanical
- Performance finishes

Teaching Methodology (Proposed as applicable):

Lectures (audio/video aids), written assignments/quizzes, tutorials case studies relevant to engineering disciplines, semester project, guest speaker, industrial/field visits, group discussion and report writing.

Assessment:

Mid-semester exam, report writing/presentation, assignment, project report, quizzes, end-semester exam

Suggested Books:

- Handbook of Textile Processing Chemicals by Michael and Arene Ash, latest Edition.
- Handbook of Technical Textiles, 2nd edition, 1st February, 2016, ISBN: 9781782424659
- Textile Processing and Properties by T.L. Vigo, latest edition, ISBN: 9780080933986
- Basics of Textile Chemical Processing by D Gopalkrishan and T. Karthik, 1st January, 2016, ISBN: 9789351308782

Garment Manufacturing Fundamentals

Course Outline:

Module 1: Overview of Apparel Industry and Types of Articles

- Structure of the apparel manufacturing industry in Pakistan as well as around the world
- Supply chain of the apparel industry
- Various clothing articles and differences in them.

Module 2: Apparel Product Development Process

- Product development concept including pre-adoption phase, line adoption phase and post adoption phase.
- Design development in apparel including concept board, groups, items, design elements and design principles.
- Developing a sample garment.

- Various types of samples being prepared in the apparel manufacturing (from customer approvals to bulk orders confirmation

Module 3: Garment Preparatory Process

- Process flow of cutting department
- Procedures of fabric receiving from folding/finishing and issuance to the cutting section
- Presentation of fabric like open width, doubled, tubular, rolled, wound, plaited, etc.
- Marker making, dimensions of a marker, marker efficiency, marker quality, and methods of marker making.
- Procedures for making a lay plan manual, pantograph or computerized systems.
- Different types of lay plan like half garment lay, whole garment lay, single size lay, multi-size lays including sectional lays, interlocking lays, and mixed multisize lays.

Module 4: Fabric Spreading and Cutting

- Spread or lay, different types of lay/spread like single ply, multiply, and stepped lay.
- Spread/lay height limitations, various methods of spreading being used in the industry, manual method, spreading carriage method, and automatic spreading machine method.
- Spreading modes, face-to-face, face-one-way, etc.
- Spreading quality, setup for spreading, spreading equipment, spreading time and cost.
- Cutting accuracy, cutting quality and cutting equipment.
- Steps involved in preparation for sewing including position marking, shading, bundling, numbering, etc.

Module 5: Sewing Process

- Stitch formation of lock stitch, chain stitch, over lock stitch, and cover stitch.
- Stitching classes edge finishing and ornamental stitching.
- Special stitch types used in apparel and home textiles with their application.
- Different types of seams (superimposed seams, lapped seams, bound seams, flat seam).

- Types and applications of sewing thread.
- Sewing thread selection criteria
- Alternatives to thread.

Module 6: Sewing Machine Fundamentals

- Machine casting and types of sewing machines.
- Sewing machine lubrication system.
- Stitch forming mechanism of the sewing machine.
- Needle parts and types of needles.
- Needle points classification and their application in apparel.
- Needle and sewing thread relationship.
- Material feeding system to sewing machine.
- Causes of general sewing defects and their solution

Module 7: Garment Washing, Finishing and Packing

- Garment Dry Process operations & their application.
- Garment Wet Process operations & their application
- Basic principles used for stain removing.
- Basic purpose of pressing in garments.
- Basic elements of pressing
- Pressing techniques being used in apparel
- Technological advancement in the pressing equipment.
- Identify Packing types, packing material and Garment Presentation
- Different care symbols, their application and use.

Module 8: Apparel Accessories & Work Aids

- General types of apparel support materials in apparel manufacturing.
- Interlinings properties and applications.
- Linings, types of linings, properties and functions of linings.
- Other support materials adhesives, collar stays, and shoulder pads, etc.
- Types of trims being used in apparel.
- Function and application of trims
- Different types of closure and their applications.
- Buttons & Buttonholes.
- Work aids and attachments in apparel

- Module 9: Material Handling Techniques
- Various types of apparel production systems.
- Progressive bundle system (PBS).
- Unit production system (UPS).
- Modular production system (MPS).

Teaching Methodology (Proposed as applicable):

Lectures (audio/video aids), written assignments/quizzes, tutorials case studies relevant to engineering disciplines, semester project, guest speaker, industrial/field visits, group discussion and report writing.

Assessment:

Mid-semester exam, report writing/presentation, assignment, project report, quizzes, end-semester exam

Suggested Books:

- Jelka Geršak, Design of clothing manufacturing processes, 2013
- Gerry Cooklin, Introduction to Clothing Manufacture, 2006
- Gerry Cooklin, Clothing Technology for Fashion Designers, 2011
- Jeanette Weber, Clothing, 2006
- Ruth E. Glock, Grace I. Kunz, Apparel Manufacturing: (Sewn Product Analysis), 2004
- H. Eberle, L. Verlag Europa, Clothing Technology, 2002

Technical Textiles Fundamentals

Course Outline:

Module 1: Overview of Technical Textiles

- Definition of technical textile & classification
- Processes and materials used
- The future of technical textiles

Module 2: Fibers for Technical Textile

- Types of fibers for technical textiles
- Characteristics of fibers for technical textiles

Module 3: Technical Yarns and Fabrics

- Nature and properties of technical yarns
- Nature and properties of technical fabric

Module 4: Coating & Lamination of Technical Textiles

- Chemistry of coated textiles
- Coating Techniques
- Fusible Interlinings
- Laminating

Module 5: Dyeing of Technical Textile

- Important parameters for dyeing technical textile
- Uniformity and fastness of the dyed technical textile

Module 6: Non-Woven Technology

- Fibre and polymer selection
- Web formation processes
- Web bonding processes
- Finishing and functionalization of nonwoven fabrics
- Characterization and testing
- Applications of non-woven

Module 7: Composites Technology

- History of composite materials,
- Classification of composite materials,
- Manufacturing Techniques
- Characterization of composites &comparison with other materials
- Applications of composites

Module 8: Braiding & Narrow Width Fabrics

- Introduction
- Classification of Braiding & Narrow Width Fabrics
- Manufacturing Techniques
- Applications

Teaching Methodology (Proposed as applicable):

Lectures (audio/video aids), written assignments/quizzes, tutorials case studies relevant to engineering disciplines, semester project, guest speaker, industrial/field visits, group discussion and report writing.

Assessment:

Mid-semester exam, report writing/presentation, assignment, project report, quizzes, end-semester exam

Suggested Books:

- A Richard Horrocks, Subhash C. Anand, Handbook of Technical Textiles; Technical Textile Application, 2016.
- Yimin Qin, Medical Textile Materials, 2015.
- Xiaoming Tao, Handbook of Smart Textiles, 2015.
- Daniel Gay, Composite Materials: Design and Application, 2014.
- Yordan Kyosev, Braiding Technology, 2014.
- Brian J. McCarthy, Smithers Rapra, Polymeric Protective Technical Textiles, 2013.
- R. A. Chapman, Applications of Nonwovens in Technical Textiles, 2010.
- A. R. Bunsell, Handbook of Tensile Properties of Textile and Technical fibers, 2009.

Elective Courses for Yarn Manufacturing Specialization

Pre-spinning Processes-1

Course Outline:

Module 1: Raw Material as a Factor Influencing Spinning

- Characteristics of raw material such as fiber fineness, length, strength, maturity, impurities, neps, fiber finish and contamination, Bale management system

Module 2: Blow Room

- Theories of opening, cleaning, blending/mixing and dust removal

- Basic operations in blow room. Blow room installations/sequence of machines (conventional as well as modern). The components of blow room machine, feeding apparatus, opening devices, grid and their interaction.
- General factors influencing opening and cleaning.
- Bale opening, Pre-cleaning, blending and fine-cleaning machines of conventional and modern blow rooms.
- Machines for card feeding
- Transport of material, mechanical transport, Pneumatic transport, control of material flow.
- Machine damage prevention and fire protection, metal detection.
- Foreign Contamination detection and removal system;
- Waste management and filtration systems;
- Evaluation of blow room output material.
- Running and cleaning efficiency.
- Optimum process atmospheric conditions.

Module 3: Carding

- Theory of carding machine viz Opening, carding disposition and doffing disposition, fibers hook formation, classical carding theory
- Material feeding systems viz Lap and chute feed
- Feeding devices for taker-in viz conventional and modern
- Taker-in zone, auxiliary carding devices, carding zone and post-carding zones;
- Detaching, crushing and coiling;
- Machine drive. Conventional and E-drives, Auto-leveling equipment, Principles of short-term, medium-term and long-term auto-leveling, machine settings and auxiliary equipment, running and cleaning efficiency; Evaluation of card sliver. Optimum process atmospheric conditions.

Module 4: Card Clothing

- Card clothing, metallic card clothing and its geometry
- Maintenance of card clothing, stripping, brushing and grinding, Integrated grinding system (IGS).

Teaching Methodology (Proposed as applicable):

Lectures (audio/video aids), written assignments/quizzes, tutorials case studies relevant to engineering disciplines, semester project, guest speaker, industrial/field visits, group discussion and report writing.

Assessment:

Mid-semester exam, report writing/presentation, assignment, project report, quizzes, end-semester exam

Suggested Books:

- The Reiter Manual of Spinning, vol. 1 and 2 by W. Klein, (2016)
- Fundamentals of Spun Yarn Technology by C. A. Lawrence, (2003)
- Spun Yarn Technology by E. Oxtoby, (2013).
- Advances in Yarn Spinning Technology by C. A. Lawrence, (2010)
- Hand book of Yarn Production by Peter R. Lord, (2003)
- Short staple yarn manufacturing by Dan J. McCright, (1997)
- Process Management in Spinning by R. Sunthil Kumar, (2014)

Pre-spinning Processes-II

Course Outline:

Module 1: Draw Frame

- Task of the draw frame; equalizing, parallelizing, blending, dust removal. Sliver Doubling and averaging effect, sliver blending at draw frame.
- Theory of roller drafting: Draft and attenuation, drafting force, drafting wave, Stick-slip motion, Behavior of fibers in the drafting zone, Fiber guidance, Floating fibers, fiber friction field, Influencing factors, distribution of draft.
- Creel (sliver feed), the drafting arrangement, coiling, the delivery arrangement, condensing, sliver coiling, can changers.
- Auto-leveling at draw frame. Open-loop control, Closed-loop control, Mechanical scanning of slivers, leveling process, adjustment of the draft, correction length, leveling action point and leveling intensity.

- Evaluation of draw frame sliver. Optimum Process atmospheric conditions. Latest trends in draw frames

Module 2: Lap Forming Process

- Lap former, preparation of stock for combing, conventional and modern preparation system with latest trends. Evaluation of sliver lap. Optimum process atmospheric conditions.

Module 3: Comber

- Influence of feed stock on combing: parallelization of fiber in batt, batt thickness, evenness of batt sheet' disposition of hooks
- Theory of combing: combing cycle, backward feed, forward feed, amount of feed per cycle, detachment setting, numbers of points on combs, top comb penetration depth, piecing
- Sequence of operations in a rectilinear comber. Comber feeding, nipper assembly, combs, detaching rollers, piecing, sliver take-off, the drafting arrangement, coiling the sliver, waste removal.
- Automation in the combing section. Comparison of carded and combed slivers. Optimum process atmospheric conditions. Latest trends in combing.

Module 4: Roving Formation

- Roving frame as a production necessity, tasks of the roving.
- Operating zones of the roving frame: Creel, drafting arrangement, aprons, pressure arm, condensers, and spacers.
- Spindle and Flyer: Imparting twist, winding system. Package formation.
- Machine drive system: Mechanical drive systems, viz. Bobbin drive, Cone drive transmission, Shifting the belt, Correction rail, Lifter motion, Builder motion, Shifting the cone belt, Reversal of the bobbin rail movement, Shortening the lift, electronic drive systems.
- Automation at Roving Frame: Manual and automatic doffing. Accessories and automation, transport of bobbins to ring spinning machine. Roving tension monitoring, Evaluation of roving. Optimum process atmospheric conditions.

Teaching Methodology (Proposed as applicable):

Lectures (audio/video aids), written assignments/quizzes, tutorials case studies relevant to engineering disciplines, semester project, guest speaker, industrial/field visits, group discussion and report writing.

Assessment:

Mid-semester exam, report writing/presentation, assignment, project report, quizzes, end-semester exam

Suggested Books:

- The Rieter Manual of Spinning Vol. 1 and 3 by W. Klein, (2016)
- Fundamentals of Spun Yarn Technology by C. A. Lawrence, (2003)
- Advances in Yarn Spinning Technology by C. A. Lawrence, (2010)
- Spun Yarn Technology by E. Oxtoby, (2013)
- Hand book of Yarn Production by Peter R. Lord, (2003)
- Short staple yarn manufacturing by Dan J. McCright, (1997)
- Process Management in Spinning by R. Sunthil Kumar, (2014)

Yarn Production Engineering

Course Outline:

Module 1: Ring Spinning

- Functions and mode of operation, spinning geometry, balloon geometry, limitations of ring spinning. Latest trends in ring spinning.
- Structure of the machine, bobbin creel, drafting system, top rollers, roller covers, rollers pressure loading, fiber guidance devices. Spindle, thread guide devices, balloon control ring, separators. Ring structure and its functions. Traveler types, shape, mass and traveler clearer. Machine drive and cop buildup.
- Automation, the potential for automation. Monitoring systems and auxiliary equipment. Automatic doffing, Automatic transport to the winding machine.
- Compact spinning: principle and advantages of compacting. Different compacting systems. Optimum process atmospheric conditions.

Module 2: Winding

- Objectives, working principle of yarn winding, Yarn package types and their building; types of winding machines, uniform buildup of cones, waxing of yarn, splicing of yarn, splicing methods and difference, yarn length counter, automatic electronic yarn clearer and its settings, difference between optical and capacitive yarn clearer,
- Yarn tensioners, patterning, reasons and their remedies.
- Yarn fault classifying systems. Basic features of various auto-winders. Latest developments in winding machinery. Optimum process atmospheric conditions.

Module 3: Yarn Conditioning and Packaging

- Conventional and modern yarn conditioning systems; Merits of conditioning by autoclaves; Impact of yarn conditioning on yarn quality and productivity. Methods of packing of yarn.

Teaching Methodology (Proposed as applicable):

Lectures (audio/video aids), written assignments/quizzes, tutorials case studies relevant to engineering disciplines, semester project, guest speaker, industrial/field visits, group discussion and report writing.

Assessment:

Mid-semester exam, report writing/presentation, assignment, project report, quizzes, end-semester exam

Suggested Books:

- Fundamentals of Spun Yarn Technology by C. A. Lawrence, (2003)
- The Rieter Manual of Spinning by W. Klein, (2016)
- Advances in Yarn Spinning Technology by C. A. Lawrence, (2010)
- Spun Yarn Technology by Eric Oxtoby,(1987).Engineering Fundamentals of Ring Spinning/ Twisting, Over-end Unwinding and Two-for-one Twisting in Textile Processes by Subhash Batra (2015)

Advanced Spinning Techniques

Course Outline:

Module 1: Introduction

- Fiber characteristics requirements for different leading spinning technologies, possibilities and limitations of different spinning technologies.

Module 2: Rotor Spinning

- The principle of rotor spinning, structure and operation of the rotor spinning machine, spinning box, package formation, yarn waxing device, operating and monitoring, quality control systems. Machine and transport automation, automatic piecing, automatic package change. Selection and influence of draft and yarn twist. Economics of rotor spinning. New developments in rotor spinning. Optimum process atmospheric conditions. Advancements in rotor spinning systems.

Module 3: Air-jet Spinning

- Principle of operation, raw material requirements, drafting unit, spinning nozzle, winding, automation, yarn structure and properties. False twist and its structure, downstream processing and end products; Economics. Comparison of air-jet and vortex spinning systems. Optimum process atmospheric conditions. Advancements in air-jet spinning systems.

Module 4: Friction Spinning

- Principle and raw material preparation, process and machine parameters affecting product quality. Assessment of DREF-II and DREF-III yarn structures and properties. Optimum process atmospheric conditions. Advancements in friction spinning systems.

Module 5: Other Spinning Techniques

- Wrap spinning, Siro spinning, solo spinning, hollow spindle spinning, and self-twist spinning.

Teaching Methodology (Proposed as applicable):

Lectures (audio/video aids), written assignments/quizzes, tutorials case studies relevant to engineering disciplines, semester project, guest speaker, industrial/field visits, group discussion and report writing.

Assessment:

Mid-semester exam, report writing/presentation, assignment, project report, quizzes, end-semester exam

Suggested Books:

- Fundamentals of Spun Yarn Technology by C. A. Lawrence, (2003)
- The Rieter Manual of Spinning by W. Klein, (2016)
- Advances in Yarn Spinning Technology by C. A. Lawrence, (2010)

Spinning Calculations

Course Outline:

Module1: Moisture Determination

- Calculations related to raw material requirements, and moisture in raw materials

Module 2: Calculations on Blow-room and Carding Machine

- Piping calculations in blow room and card.
- Blow room production, draft in blow room, bale stacking, cleaning efficiency, fiber growth, actual and mechanical draft at scutcher, running efficiency, Waste percentage, Lap CV%, Lap weight per yard, and Lap rejection percentage.
- Calculations related to Card production, total draft, and tension draft.

Module 3: Calculations on Draw-frame

- Calculations related to production calculations, total draft, break draft, main draft, and efficiency.

Module 4: Calculations on Lap Former and Comber

- Calculations related to Lap former production, draft, efficiency.
- Calculations related to comber production, noil percentage, draft

Module 5: Calculations on Simplex/Roving Frame

- Calculations related to simplex production and efficiency, draft calculations, twist, winding rate, delivery rate, coil per inch.

Module 6: Calculations on Ring Frame

- Calculations related to Ring production and efficiency (OPS, pounds, bags), draft calculations, twist calculations.
- Average count, CV, doubling and twisting calculations

Module 7: Calculations on Winding Machine

- Calculations related to production and efficiency on winding machine

Module 8: Calculation on Rotor Machine

- Calculations related to rotor production, draft calculations, twist calculations.

Module 9: Spin Plans

- Designing of spin plans for different counts of yarns (Cotton carded Yarn, Cotton combed Yarn, Blended Yarn), Average count calculation.

Module 10: Air Conditioning/Compressed Air Calculations and Costing of Mill

- Calculations of air changes per hour for different departments
- Calculations of compressed air requirements
- Calculations of costing of a spinning mill

Teaching Methodology (Proposed as applicable):

Lectures (audio/video aids), written assignments/quizzes, tutorials case studies relevant to engineering disciplines, semester project, guest speaker, industrial/field visits, group discussion and report writing.

Assessment:

Mid-semester exam, report writing/presentation, assignment, project report, quizzes, end-semester exam

Suggested Books:

- Cotton Spinning Calculations and Yarn Costs by James Winterbottom (2016)
- Textile Mathematics, Vol. I, II, III by J. E. Booth (1977)
- Cotton Spinners Handbook by R. Jagannathan (1976)
- Manual of Cotton Spinning by Textile Institute (1965)

Specialty Yarns

Course Outline:

Module 1: Introduction

- Introduction and background, Historical development, market for fancy yarns, Manufacturing attitudes and the applications of fancy yarns for weaving and knitting

Module 2: Manufacturing of Melange Yarns

- Introduction, preparation of fibers for melange yarns, mixing of different colour fibers, blending of different colour fibers on draw frame, spinning melange yarn on ring and rotor spinning.

Module 3: Fancy Yarn Structures

- Fancy yarn structures, and analysis of fancy yarns, Types of fancy yarns (Marl yarn, Spiral yarn, Gimp yarn, Diamond yarn, Eccentric yarn, Bouclé yarn, Loop yarn, Snarl yarn, Mock chenille yarn, Knop yarn, Slub yarn, Neppy yarn and fleck yarn, Tape yarn, Chainette yarn, Chenille yarn, Cover yarn, Metallic yarn)

Module 4: Manufacturing Techniques

- Ring spindle system, hollow spindle system, combined systems, doubling system, condenser system, two for one twister, wrapping of yarn, core spun yarn, dual core yarn, slub yarn, multicount yarn, injection slub yarn,

composite yarn, open-end spinning system, friction spinning system, Air texturing. Chenille yarn production, flocking.

Module 5: Design and Applications

- The design of fancy yarns using computers, designing fabrics using fancy yarns and fancy doubled yarns, uses for fancy yarns, potential of fancy yarns (apparel fabrics, furnishing fabrics)

Teaching Methodology (Proposed as applicable):

Lectures (audio/video aids), written assignments/quizzes, tutorials case studies relevant to engineering disciplines, semester project, guest speaker, industrial/field visits, group discussion and report writing.

Assessment:

Mid-semester exam, report writing/presentation, assignment, project report, quizzes, end-semester exam

Suggested Books:

- Fancy Yarns: Their Manufacture and Application by R. H. Gong and R.M. Wright, 2002
- Hand Spinners' Workbook: Fancy Yarns by Mabel Ross, 1989
- The Spinner's Book of Yarn Designs: Techniques for Creating 80 Yarns
- by Sarah Anderson, 2013

Elective Courses for Weaving Specialization

Weaving Preparatory Processes

Course Outline:

Module 1: Yarn Storage/Conditioning and Winding

- Yarn storage methods, Yarn conditioning systems, Impact of yarn conditioning on yarn. Technical requirements of the winding process, Factors effecting production of winding machine. Density & stability of package Different types of winders: Non-automatic and Automatic winding machines, Weft winding process, types of packages used in fabric

manufacturing. Calculation for speed transmission of winding machines, production and efficiency.

Module 2: Warping

- Direct, sectional and ball warping. – Detailed process of warping and Quality control. Latest development in warping machines, Creels and their types (V and parallel). Mechanism of direct, sectional and ball warping. Functions of major parts involved in warping machines. Identification and examination of faults/defects in warping process & quality control, Expression of warp quality in terms of length & weight. Production possibility of any fabric on a specific warping machine. Costs of Beam warping, Tension control in warping, production, yarn breakage rate, efficiency and speed of warping machines.

Module 3: Sizing

- Introduction to sizing machines, study of machine parts & their functions, types of sizing machines. Beam creel & types of beam creel, Drive of sizing machine, PIV mechanism. Describe the warp tension zones. Determination of warp tension of each zone for a given fabric construction. Occupancy of squeezing roller. Capacity of drying rollers. Factors governing speed of sizing Calculation for yarn breakage rate in sizing process, production and efficiency of sizing machines.
- Properties of different sizing materials (sizing ingredients, aqueous sizes, solvent sizes, dye sizing and indigo dye sizing) and their use for different types of yarns; Sizing recipe and mixing procedure, Size additives; Size liquor pick up & factors governing it; Sizing of terry towels & open-end yarn. Selection of size materials. Formulation of size recipe for a given construction. Wastages & losses in sizing process, use of after waxing system, viscosity measurement of sizing liquor. Calculation of recipe for different types of cookies. Calculate the sizing cost of a certain recipe. Calculation for the count of sized yarn.
- Sizing and beaming of filament warps & open-end yarn

Module 4: Sizing

- Advancements in sizing, refracto-meter for viscosity measurements, sequence of leasing rods. Brake operation of warp beams. Settings of

different tension zones w.r.t., different yarns types. Effect of tension setting in one zone w.r.t., other zones. Sizing Vs doubling. Recycling of sizing agents. Film making for different sizing chemicals. Rubber roller grinding and rubberization. Calibration of different sizing machine parts. How to design sizing recipe for different fabric constructions.

Module 5: Drawing-in and Knotting

- Drawing-in systems. Drawing-in accessories: draw hooks, reed knife; Knotting process. Complete article changes of weaving machine. Automatic and manual drawing-in.

Teaching Methodology (Proposed as applicable):

Lectures (audio/video aids), written assignments/quizzes, tutorials case studies relevant to engineering disciplines, semester project, guest speaker, industrial/field visits, group discussion and report writing.

Assessment:

Mid-semester exam, report writing/presentation, assignment, project report, quizzes, end-semester exam

Suggested Books:

- Weaving: Conversion of Yarn to Fabric by P. R. Lord and M. H. Mohamed, (1982)
- Handbook of Weaving by Sabit Adanur, (2000)
- Weaving Technology and Operations by Allan Ormsrod (1995)
- Industrial Practices in Weaving Preparatory, by Mukesh K. Singh, (2014)

Weaving Mechanisms I

Course Outline

Module 1: Shedding Systems

- Introduction to shedding mechanism and types of shedding mechanism, Tappet shedding mechanism, Types of tappets, Design of tappet, Dobby shedding mechanism, Types of Dobby. Jacquard shedding mechanism, Working of different parts of jacquard mechanism, Types of jacquards.

Tappet shedding: mechanism; merits and demerits; positive and negative cams.

Module 2: Weft Insertion Systems

- Weft insertion system, Conventional shuttle weft insertion system; automatic weft insertion system; bobbin change mechanism; pirn winding mechanism, projectile weaving machine.
- Speed and weight of the projectile, projectiles for different types of yarns, torsion rod mechanism, projectile opener, lifter, gripper. Picking and receiving units. Picking force of the projectile. Guide teeth and their settings. Conveyor chain. Projectile lubrication system. Weft mixer system

Module 3: Let off Mechanism

- Explain let off motion. Types & objective of let off motion. Discuss effect of warp tension in let of motion. Sketch construction of positive let off motion. Discuss working of positive let off motion. Draw construction of electronic let off motion & explain its working. Formulate relationship b/w beam diameter & RPM of weavers beam.

Module 4: Take-up Mechanism

- Discuss types & objective of take up motion. Demonstrate construction & working of take up motion on shuttle and shuttle-less loom. Sketch construction & working of take up motion on projectile loom. Formulate relation for weft density on shuttle & projectile loom. Discuss periodicity due to eccentricity in take up motion.

Module 5: Beat-up Mechanism

- Beat-up mechanism of conventional looms; principle and working of crank beat-up; 4-bar linkage mechanism; Determine throw of crank in crank beat up motion. Demonstrate principle, working and construction of Cam beat up motion. Comparison b/w crank & cam beat up motion and Sley eccentricity

Module 6: Stop Motions

- Explain the types and objectives of warp stop motions. Demonstrate construction & working of electrical warp stop motion. Explain weft stop

motion. Discuss electrical weft stop motion. Explain warp protector motion. Discuss types of weft stop & warp protector motion.

Teaching Methodology (Proposed as applicable):

Lectures (audio/video aids), written assignments/quizzes, tutorials case studies relevant to engineering disciplines, semester project, guest speaker, industrial/field visits, group discussion and report writing.

Assessment:

Mid-semester exam, report writing/presentation, assignment, project report, quizzes, end-semester exam

Suggested Books:

- Weaving: Conversion of Yarn to Fabric by P. R. Lord and M. H. Mohamed, (1982)
- Handbook of Weaving by Sabit Adanur, (2000)
- Weaving Technology and Operations by Allan Ormsrod (1995)
- Mechanisms Of Flat Weaving Technology, by Choogin, Valeriy V., Palitha Bandara, and Elena V. Chepelyuk.. Elsevier, (2013)

Weaving Mechanism II

Course Outline:

Module 1: Shed Settings for Different Fabric Constructions

- Staggered shed: shed staggered in timing, staggered in degree, staggered in both timing and degree, asymmetric shed, shed setting for heavier fabrics, back shed settings, front shed settings, shed height and depth settings.

Module 2: Dobby and Jacquard Shedding System

- Dobby Systems, Conventional Dobbies, Double Lift Dobbies, Cam Dobbies, Paper Dobbies, Knowel's Dobbies, Terry Dobbies, Rotary Dobbies, Electronic Dobbies
- Jacquard Systems, Conventional Jacquards, Jacquard System Basics, Single Lift Jacquard,

- Double Lifts Jacquard, Electronic Jacquard Basic, Jacquard Harness Types and its parts

Module 3: Detailed Weaving Mechanism of Rapier Weaving Machine

- Versatility of rapier weft insertion mechanism for all types of conventional and high performance yarns. Types of rapier weaving mechanisms. Rigid and flexible rapiers. Single and double rapiers. Use of rapier weaving for technical fabrics. Machine settings for carbon, kevlar, glass, dyneema and other higher performance yarns.

Module 4: Detailed Weaving Mechanism of Air-jet Weaving Machine

- Air-jet nozzles, insertion and auxiliary nozzles. Ultrasonic cleaning of nozzles. Machine operating pressure. Air consumption/pick. Pneumatic tuck-in system and its limitations. Rotary leno in air-jet weaving. Machine with onboard air compressor, sevo motor let off and take up.

Module 5: Detailed Weaving Mechanism of Water-jet Weaving Machine

- Air-jet nozzles, insertion

Module 6: Selvedge Formation for Shuttleless Weaving Machine

- Tuck-in selvedge: tuck-in selvedge in projectile and pneumatic tuck-in airjet weaving. Limitation of tuck-in selvedge against machine speed and warp threads density at the selvedge etc. Leno selvedge: half and full leno selvedge formation. Necessity of dummy selvedge for leno. Rotary leno selvedge. Leno waste. Tension setting for dummy and leno yarns.

Module 7: Automation in Weaving

- Automatic Drawing-In, Automatic Knotting, Quick Style Change, Automatic Warp Creel filling, Automatic Leasing

Teaching Methodology (Proposed as applicable):

Lectures (audio/video aids), written assignments/quizzes, tutorials case studies relevant to engineering disciplines, semester project, guest speaker, industrial/field visits, group discussion and report writing.

Assessment:

Mid-semester exam, report writing/presentation, assignment, project report, quizzes, end-semester exam

Suggested Books:

- Handbook of Weaving by Sabit Adanur, (2000)
- Weaving Technology and Operations by Allan Ormsrod (1995)
- Mechanisms of Flat Weaving Technology, by Choogin, Valeriy V., Palitha Bandara, and Elena V. Chepelyuk.. Elsevier, (2013)
- Principles of Fabric Formation by Banerjee, Prabir Kumar. CRC Press, (2014)

Woven Fabric Design and Structure

Course Outline:

Module 1: Basic Weaves

- Introduction to common weaves: Plain, Twill weaves and its derivatives, satin & sateen weaves and others, use of design paper for weave design, drafting and lifting plan construction.

Module 2: Dobby Design

- Bedford cords, high-low cords, herringbone and Brighton honey comb.

Module 3: Jacquard Designs

- Limitations of dobby designs, flower designs, design of large repeats. Single thread jacquard designs.

Module 4: Crepe Weaves

- Introduction to crepe weaves and different types of crepe weaves

Module 5: Design of Compound Weaves

- Pile fabrics and their weaves, Warp pile structure. Weft pile weaves. Velvets, Plush and velveteen, Terry fabrics and their weaves. Calculation for towels. Double cloth and their weaves. Multilayer fabric, Tri-axial weave, Carpet.

Module 6: Color and Weave Effect

- Hairline effect, single double and multi hairline effects, step effect, allover effect, hound's tooth effect. Combined color and weave effects.

Module 7: Cloth Geometry and Digital Weaving

- Cloth geometry models, cloth cover and its relation to its properties. Use of software to weave Dobby and Jacquard Design

Module 8: Multilayer Fabrics:

- Types of multilayer fabrics: open width, tubular, single double triple and four-layer fabrics. Weave presentation of multilayer designs. Stitching techniques of multilayer fabrics. Extra stitch, raiser and sinker stitch.

Teaching Methodology (Proposed as applicable):

Lectures (audio/video aids), written assignments/quizzes, tutorials, case studies relevant to engineering disciplines, semester project, guest speaker, industrial/field visits, group discussion and report writing.

Assessment:

Mid-semester exam, report writing/presentation, assignment, project report, quizzes, end-semester exam

Suggested Books:

- Tensile Fabric Structures: Design, Analysis, and Construction by Craig G. Huntington, (2013)
- Fabric Structure and Design by N. Gokarneshan, (2005)
- Designing Woven Fbrics by Janet Phillips (2008)

Weaving Calculations

Course Outline:

Module 1: Yarn count & Physical Conversion

- Derivation of formulae for direct & indirect count system.
- Different hank length in indirect & direct systems
- Conversion of physical & textile units

- Determination of count in indirect system

Module 2: Count Conversions

- Calculation of count in direct system
- Count conversion with in indirect system.
- Count conversion with in direct system
- Conversion of count from indirect to direct system
- Average, conditioned & folded count

Module 3: Yarn costing & Winding Production

- Calculation of the production of winding machine
- Determination of no. of machines & spindles required for winding particular yarn

Module 4: Warping Production

- Calculation of the time required to wind the given amount of yarn
- Determination of warping production
- Determination of the efficiency of machine
- Find out the time required to prepare a set.

Module 5: Warp Calculations

- Determination of warp weight, beam count & no. of ends in warp
- Find out the beam capacity
- Determination of breaks /10 MM & pound / break
- Determination of proportion of warping to sizing

Module 6: Sizing Production & Liquor Calculations

- Determination of production & efficiency of sizing
- Evaluation of sized count, size % age & weight of size on yarn
- Determination of conc. of liquor, water volume & condensation allowance
- Determination of size pick up % age.

Module 7: Size Liquor Calculations

- Determination of degree of size in % age & kgs.
- Determination of size liquor requirement
- Evaluation of maximum speed of sizing machine

- Determine the roll capacity of sizing machine

Module 8: Beam Space & Loom Production

- Determination of relation for weaves beam space
- Determination of weaver beam space for different loom size & qualities
- Determination of loom production & efficiency
- Determination of average r.p.m, density, reed space & count.
- Stitch length of knitted fabric

Module 9: Fabric Contraction & Weight

- Calculation of warp & weft contractions
- Determination of GSM of fabric
- Determination of warp weight per linear meter, GSM of Knitted fabric

Module 10: Cover Factor

- Derivation of a relation for cover factor
- Cover factor for square constructions
- Determination of fractional cover factor, relation b/w fractional cover factor & cover factor.

Module 11: Fabric Parameters Relationship

- Determination of approximate construction
- Determination of relationship b/w count & density
- Derivation relation for intersection in fabric Production of Knitted fabric

Module 12: Reed Calculations

- Determination of reed space & count for fabric
- Determination of total ends for fabric qualities, Total ends in weavers' beam, Yarn consumption in knitted fabric

Module 13: Yarn Requirement & Cost

- Determination of requirement of warp & weft for particular quality.
- Determination of conversion cost per meter & per pick
- Determination of material cost of warp & weft per meter.

Module 14: Weave Ability of Fabric

- Determination of relation b/w fiber & yarn density
- Explain packing coefficient of yarn
- Determination of max. picks per inch by formula & by table..

Module 15: Pile Fabric

- Production of towel cloth.
- Pile height calculations
- Total ends per width of towel & for weavers' beams.

Module 16: Utility Costing

- Air and Energy costing

Teaching Methodology (Proposed as applicable):

Lectures (audio/video aids), written assignments/quizzes, tutorials case studies relevant to engineering disciplines, semester project, guest speaker, industrial/field visits, group discussion and report writing.

Assessment:

Mid-semester exam, report writing/presentation, assignment, project report, quizzes, end-semester exam

Suggested Books:

- Fabric Manufacturing Calculations: Process and Product by Yasir Nawab, (2017)
- Weaving Technology and Operations by Allan Ormsrod, (1995)
- Shuttle-less weaving machines by Idrich Talavasek (1981)
- Weaving Calculations: A Guide to Calculations Relating to Cotton Yarn and Cloth and All Processes of Cotton Weaving, by C. P. Brooks, (2010)
- Weaving: Machines, Mechanisms, Management. by Talukdar, Marinal Kanti, P. K. Sriramulu, and Dinkar Bapurao Ajgaonkar. Mahajan Publishers, (1998)

Specialty Weaving

Course Outline:

Module 1: 2D-3D Preforms:

- Textile preforms (2D and 3D) used in composites, multilayer fabrics, history of multilayer fabrics, the 2D and 3D weaving concepts.
- Modifications in conventional weaving machines to weave 3d fabric, modification in shed height, depth.
- Different possible axes in a 3D fabric.
- Fukuta's 3D-3axes weaving machine and fabric.
- M. H Mohammad's 3D-5-axes model and fabric.
- Circular and non-circular 3D fabrics,
- Concept of spacer fabrics, H, T and J beam sections.
- 2D and 3D braids

Module 2: Terry-towel Weaving and Weft Pile Fabrics Weaving

- 3-pick and 5-pick terry fabrics, terry towel designs different machine settings for terry towels, calculation for contraction of pile warp threads, pile warp beam settings. Heald frame priority for low and high crimp wart threads.

Module 3: Sear-suckers

- Explanations of machine settings for sear-sucker fabrics. Calculation for contraction of crimpy warp threads, warp beam settings. Heald frame priority for low and high crimp warp threads.

Module 4: Sample and Circular Weaving

- What is sample weaving and what is circular weaving, working of circular weaving and uses circular woven fabrics.

Teaching Methodology (Proposed as applicable):

Lectures (audio/video aids), written assignments/quizzes, tutorials, case studies relevant to engineering disciplines, semester project, guest speaker, industrial/field visits, group discussion and report writing.

Assessment:

Mid-semester exam, report writing/presentation, assignment, project report, quizzes, end-semester exam

Suggested Books:

- Weaving of 3D Fabrics: A Critical Appreciation of the Developments by Gokarneshan, N., and R. Alagirusamy. Textile Progress 41.1 (2009)
- Hand Book of Weaving by Sabit Adanur, 1st CRC Press (2000)
- 3D-Weaving: Theory and Practice. by Khokar, N. Journal of the Textile Institute 92.2 (2001)
- Woven Textile Structures by B.K. Behra and Hari, 1st Wood head publishing (2010)
- Textile - Reference Book for Weaving Fondazione ACIMIT Pub, (2000)

Elective Courses for Knitting Specialization

Knitted Fabric Structure and Design

Course Outline:

Module 1: Introduction to Knitting Techniques

- Understand Knitted Loop Structures
- Understand stitch types in weft knitting
- Compare Woven & Knitted Fabrics and its process.

Module 2: Knitting Terminologies, Designs & Its Elements

- Grip over General Terms and Principle used in Knitting
- Understand the design repeat
- Understand the use of Design Elements & Pattern devices
- Understand the Knitting Loop structures & Needle Action

Module 3 & 4: Basic Structure, Plain Jersey

- Draw the Knitting Notations of different fabrics
- Draw the Plain Single Jersey graph
- Design the Float Single Jersey (Vertical Stripe)

- Draw Single Jersey Lycra
- Construct R/L Tuck- Float (Diagonal)
- Make graph of Plaited Single Jersey
- Draw Plaited Single Jersey Lycra

Module 5: Pique (POLO) and its Derivatives

- Draw the Single Tuck Pique
- Construct the Double Tuck Pique
- Design the Micromesh
- Construct the Pineapple Pique
- Draw the Single Honeycomb Pique/ Cross Tuck
- Design graph of Double Honeycomb PQ
- Develop the Single Jersey Tubular (Pique)
- Construct technical graph of Popcorn Pique

Module 6: Fleece & Terry Knit

- Prepare mesh diagram of 2-End Fleece (Straight)
- Design the yarn notation 2-End Fleece (Cross)
- Draw diagram of 3-End Fleece (Straight)
- Construct 3-End Fleece (Cross)
- Arrange the cams and needles for 3-End 4 track Cross Fleece

Module 7: Rib Structures

- Select the best yarn notation diagram of Rib 1x1
- Arrange the needles w.r.t design of Rib 2x1
- Draw the technical notation of Rib 2x2
- Design the needle arrangement of Rib 3x2
- Draw the cam arrangements for Milano Rib (Its derivatives)

Module 8: Rib Structures

- Arrange the cams and needles for Cardigan (Its derivatives)
- Produce the Rib Lycra
- Construct the 2 Tone Rib with help of yarn and design.
- Compare Plated Rib with other Ribs

Module 9: Interlock & its Derivatives

- Construct with cams and gaiting of Interlock Fabrics.
- Arrange the needles and cams for Interlock Cross-Tubular
- Draw the Interlock Cross-Miss
- Design the graph of Interlock Half Milano

Module 10: Interlock & Purl

- Draw the Interlock Double Tuck
- Arrange the needles and cams to develop Interlock Pique
- Draw yarn notation of Pin Interlock
- Design the cam arrangement of Interlock Half Cardigan
- Draw the needle arrangement for Purl Fabrics

Module 11: Thermal/Waffle

- Draw the design of 6 Feed Tuck Thermal
- Arrange the cams arrangement for 8 Feed Tuck Thermal
- Construct the technical diagram of 6 Feed Miss Waffle
- Develop the structure of 8 Feed Miss Waffle
- Draw the yarn notation of Feed Stripe Thermal
- Design the Thermal Spandex
- Construct the design of Mini Thermal/Waffle

Module 12: Flat Back Rib

- Draw the 3 feed Repeat Flat-back Rib
- Propose the design for 4 feed Repeat Flat-back Rib
- Make the 6 feed Repeat Flat-back Rib
- Develop the structure of 2-Tone Flat Back Rib

Module 13: Flat Knit Fabric

- Compare the Collars & Cuffs structures
- Develop the design layout of Tipping Collars & Cuffs
- Construct the Flat Knit Sleeve & waist Rib
- Draw the design of Bird-Eye Collars
- Know the techniques for Jacquard Collars

Module 14: Socks Knit Designs

- Understand common designs in socks
- Types of sock w.r.t to design.
- Understand Design pattern at different steps of socks

Module 15: Warp Knitting Terminologies, Structure and Characteristics

- Comparison of Warp and Weft Knitted fabrics and structure
- Understand the Warp Knitting Design & Terminologies
- Comparison of Raschel Knitted Fabric
- Tricot Knitted Fabrics

Module 16: Warp Knitting Terminologies, Structure and Characteristics

- Develop the Half Tricot
- Draw the notation of Full Tricot
- Draw the yarn notation of Lock-nit
- Develop the Reverse Lock-nit
- Construct the yarn path of Sharkskin
- Compare the yarn notation with Satin
- Design the Loop Raised structure
- Construct the Queens cord

Teaching Methodology (Proposed as applicable):

Lectures (audio/video aids), written assignments/quizzes, tutorials, case studies relevant to engineering disciplines, semester project, guest speaker, industrial/field visits, group discussion, report writing.

Assessment:

Mid-semester exam, report writing/presentation, assignment, project report, quizzes, end-semester exam

Suggested Books:

- Knitting Technology Third Edition by David J. Spencer
- Circular Knitting 2nd Edition by. Lyer/Mammel/Schach
- Understanding Textiles by Billie J. Collier
- Knitting Reference Book of Textile Technology. By. Carmine Mazza

- Mayer & Cie Knitting Machine Manual
- Thermal Comfort Properties of Some Knitted Structures, Fibres and Textiles in Eastern Europe, January - December 2007, Vol. 15
- Lonati Sock Machine Manual
- Paper: 3D Simulation of Warp Knitted Structures by Wilfried Renkens & Yordan Kyosev
- Textile Journal: Analysis of warp knitted fabric structure, Hadi Dabiryan & Ali A.A. Jeddia

Knitting Preparatory Process

Course Outline:

Module 1: Introduction to Subject

- Understand the Knitting History
- Understand basic knitting preparatory processes
- Differentiate between warp & weft knitting
- Distinguish Knitting Machine elements

Module 2: Knitting Yarns used more frequently

- Discuss Types of knitting yarns
- Discuss Types of cotton used
- Understand the Cotton yarns used frequently in knitting.

Module 3: Properties of Cotton Yarn

- Understand requirements for cotton knitting yarn
- Differentiate knitting yarns of different spinning techniques.
- Explain Supporting yarns

Module 4: Properties of Synthetic Yarns

- Understand properties of synthetic yarns used in knitting.
- Understand Elastomeric yarns
- Differentiate Staple & Filaments yarns

Module 5: Composites & Fancy Threads

- Understand the use of fancy threads in knitting
- Determine Use of composites and blends in yarn and fabrics.

Module 6: Knitting Yarn Strength & Twist

- Understand the frictional properties of yarn
- Understand TM twist multiplier
- Analyze Strength & recovery of yarn

Module 7: Relation of Yarn with the Loop Structure

- Identify the effect of yarn on loop structure and appearances,
- Illustrate Aesthetic properties of fabric
- Define Yarn rigidity

Module 8: Yarn Testing Techniques

- Understand about the Process flow of Yarn testing
- Report Testing of Acru, Dyed & Heather Yarn.
- Understand Grading systems of Yarn

Module 9: Yarn Faults & Packaging Faults

- Differentiate between Types of Packages
- Analyze different yarn faults
- Judge Fabric faults due to yarn
- Judge Package & winding faults

Module 10: Creels of Knitting Machines

- Manage the storage of yarn
- Differentiate type of creels and their importance
- State Creel parameters, capacity of creels & Requirement of creels for different type of fabrics

Module 11: Fabric Analysis

- Identify different fabrics.
- Analyze fabric parameters & Effect of these parameters on G.S.M

Module 12: Creels Required for Stripe Fabrics

- Identify the difference in creels for
- Auto-stripper machines
- Feed stripe fabrics
- Socks & Flat knitting machines

Module 13: Yarn, Fabric and Machine Parameters Compatibility

- Understand about Yarn & fabric Compatibility.
- Understand Fabric & machines compatibility.
- Identify the settings & adjustments for structured fabrics

Module 14: Knitting Preparatory Process for Warp Knitting

- Demonstrate warp preparatory processes.
- Calculate #. of ends required for warping

Module 15: Warping for Warp Knitting

- Understand Warping for plain fabrics
- Determine Warping for complex structured fabrics,
- Understand Sectional warping

Module 16: Socks & Gloves Knitting

- Classify the Socks.
- Plan Socks Processes
- Understand preparatory process required for Socks knitting
- Discuss preparatory process required for gloves

Teaching Methodology (Proposed as applicable):

Lectures (audio/video aids), written assignments/quizzes, tutorials, case studies relevant to engineering disciplines, semester project, guest speaker, industrial/field visits, group discussion, report writing.

Assessment:

Mid-semester exam, report writing/presentation, assignment, project report, quizzes, end-semester exam

Suggested Books:

- Knitting fundamentals, machines structures & developments by Anbumani.
- Advances in knitting technology by K.F.Au
- Circular knitting, by Lyer/ Mammel/ Schach

Specialty Knitting

Course Outline:

Module 1: Plated Knitted Fabrics

- Explain the plating techniques
- Understand the objectives of plating
- Modify a knitting machine for plating
- Discuss the properties of plated knitted fabrics
- Specify the application areas of plated fabrics

Module 2: Weft-knitted Structures for Moisture Management

- Identify the basic mechanism of wetting
- Discuss the effect of different materials and contact angle on wetting properties
- Differentiate between wicking and absorption
- Improve the wick ability of knitted fabrics

Module 3: Laying-in and Inlaid Knitted Fabrics

- Differentiate between laying-in and inlaid structures
- Differentiate between properties laying-in and inlaid structures
- Specify the applications of laying -in and inlaid fabrics

Module 4: Plush Knitted Fabrics

- Identify the types of plush fabrics
- Explain different manufacturing techniques of plush fabrics
- Discuss the properties of plush fabrics
- Specify the application areas of plush fabrics

Module 5: Quilted Knitted Fabrics

- Discuss quilted knitted fabrics
- Explain the manufacturing techniques of quilted fabric
- Properties and applications of quilted fabrics

Module 6: Seer Sucker Fabrics

- Define seer sucker fabrics
- Discuss manufacturing methods of seer sucker fabrics
- Differentiate between woven and knitted seer sucker fabrics
- Functional properties of seer sucker fabrics

Module 7: Spatial A Jour Knitted Structures

- Understand what spatial structures are
- Differentiate a jour and spatial structures
- Explain importance of a jour knitted structures
- Identify applications of a jour fabrics

Module 8: Special Knitting Techniques

- Develop double face knitted fabrics
- Design elastane knitted fabrics
- Discuss fleece knitted fabrics
- Construct high pile and sliver knitted fabrics

Module 9: 3D Knitting

- Differentiate between 2d and 3d knitted fabric
- Explain 3D knitted structures and manufacturing
- Know about applications of 3D knitted structures
- Discuss Advantages of 3D knitting

Module 10: Weft-knitted Structures for Industrial Applications

- Introduce different knitted structures used in industry
- Identify the problems and limitations in industrial applications
- Differentiate between DOS and combined DOS structures
- Simulate the mechanical properties of weft knitted structures
- Discuss applications and future requirements

Module 11: Knitted Structures for Sound Absorption

- Analyze acoustic textiles in vehicles
- Examine the sound absorption of plain knitted structures
- Engineer advanced knitted fabrics for sound absorption
- Integrate thick & dense spacer structures

Module 12: Compression Sportswear

- Understand the compression sportswear
- Identify different types of compression sportswear
- Discuss the specifications requirements
- Examine different classes of compression
- Discuss gradient compression stocking

Module 13: Spacer Fabrics

- Define spacer fabric
- To classify knitted spacer fabrics
- Produce weft knitted spacer fabric
- Produce spacer fabric on dial and cylinder machine
- Produce spacer fabric on V-bed machine

Module 14: Spacer Fabrics

- Produce spacer fabric on warp knitting machine
- Understand the Properties & advantage of spacer fabric
- Identify the application area of spacer fabric
- Type of testing performed for spacer fabric

Module 15: Knitted Fabric Composites

- Types of fiber and yarn used in knitted fabric composites
- Composite preforms
- Knit structures for fabric composites
- Types of matrix materials
- Developments in manufacturing methods for knitted fabric composites
- Mechanical properties & applications

Module 16: Knitted Fabrics for Medical Applications

- Underline Functions of Med Textiles
- Explain Wound Care Management
- Express Trends in Med Textiles
- Study the application area in Meditech
- Properties required in Meditech
- Development of knitted structure for Meditech

Teaching Methodology (Proposed as applicable):

Lectures (audio/video aids), written assignments/quizzes, tutorials, case studies relevant to engineering disciplines, semester project, guest speaker, industrial/field visits, group discussion, report writing.

Assessment:

Mid-semester exam, report writing/presentation, assignment, project report, quizzes, end-semester exam

Suggested Books:

- Advances in Knitting Technology Edited by KF Au published by woodhead
- Fundamentals and advances in knitting technology Sadhan Chandra Ray published by woodhead
- Circular Knitting Lyer, Mammel published by Meisenbach Bamberg
- Knitting Technology by David J Spencer
- Knitting Technology by Kin-Fan_Au (CH-12)
- Research articles
- Advances in Knitting Technology by Kin-Fan_Au (CH-6)

Knitting Mechanism-I

Course Outline:

Module 1: Overview of the Subject

- Classify types of knitting
- Define Criteria of Knitting Machine
- Identify method of weft knitting machines classifications

- Classify warp knitting machines
- Understand M/c descriptions and their parts

Module 2: Parts of Circular Knitting Machine

- Understand Circular Knitting Machine descriptions, parts and their functions
- Justify different Creel usages and its parts
- Understand why yarn feeding devices are used
- Analyze problems with irregular yarn feeding

Module 3: Parts of Circular Knitting Machine

- Differentiate Yarn feeder working of different type of devices
- Importance of Yarn feeder position
- Define working of Tooth delivery device
- Define working of Tape delivery device
- Define working of Storage feeding devices
- Define working of Combined storage and Positive feeding devices
- Analyze different type of yarn tensioner

Module 4: Parts of Circular Knitting Machine

- Quiz
- Determine Yarn tension in knitting and problem associated with it
- Understand function of Guides
- Determine functioning of Feed plate or feeders
- Analyze importance of Feeder density
- Understand working of Stop Motions

Module 5: Parts of Circular Knitting Machine

- Classify Fabric spreader
- Rationalize working of Pulley belt and brush
- Segregate Cams and its system
- Understand functioning of different Parts of cams
- Analyze Needles and working of its parts

Module 6: Loop Formation Sequence of Needles

- Understand Loop forming sequence of latch needles
- Understand Loop forming sequence of compound needle
- Understand Loop forming sequence of spring bleared needle

Module 7: Sinker and Needle Mechanism

- Classify sinkers and its function
- Summarize Relative technology with latch needle
- Implement Needle and sinkers dynamics and its importance in machine
- Quiz

Module 8: Robbing Back effect, Cam Dynamics

- State Robbing back effect
- Differentiate Theoretical and Actual Stitch length
- Understand Cam dynamics
- Differentiate different type of Cam systems

Module 9: Knitted Loop Geometry

- Understand Relationship between properties and geometry of loop
- Determine Geometry of weft knitted loop
- Analyze Knitted fabric properties

Module 10: Circular Knitting Machine Needle Selection

- Understand Needle selection technique in circular knitting
- Discuss operation of Pattern wheel
- Understand functioning of Pegged drum and pattern drum

Module 11: Circular Knitting Machine Needle Selection

- Understand functioning of Needle with different length of butt/split cams
- Explain Multi cam track
- Explain Jacquard system (Mechanical and electrical)

Module 12: Advancement in Needles

- Describe Needles advancements
- Differentiate G00 and G0 needles

- Explain Lite speed needles
- Explain E-needle by Fukuhara
- Describe Steel Composite Needles

Module 13: Advancement in Needles and Circular Knitting Mechanisms

- Explain Steel Composite needles
- Differentiate different Needles manufacturing techniques
- Explain Oiling system
- Differentiate between Pulsonic Lubrication and Uniwave lubrication

Module 14: Circular Knitting Different Mechanism Fabric Faults Related to Machine

- Explain Air Circulation system
- Explain working of V.D.Q pulley
- Understand Control and monitoring system
- Analyze Mechanics of double knit machines
- Differentiate Knitted fabric defects related to mechanism
- Differentiate Knitted fabric defects related to elements

Module 15: Take Down Mechanism of Circular Knitting Machine

- Understand function of Circular Knitting machine drive
- Understand importance of Take down mechanism and its functioning
- Determine working of Dead weight mechanism
- Understand working of Eccentric Take down principal
- Analyze working of Fabric cloth winding principal

Module 16: Flat Knitting Machine Parts and Working Mechanism

- Different parts of flat knitting machine
- Samples that can be prepared on flat bed machine
- Working mechanism of different parts of flat-bed machine

Teaching Methodology (Proposed as applicable):

Lectures (audio/video aids), written assignments/quizzes, tutorials, case studies relevant to engineering disciplines, semester project, guest speaker, industrial/field visits, group discussion, report writing.

Assessment:

Mid-semester exam, report writing/presentation, assignment, project report, quizzes, end-semester exam

Suggested Books:

- Knitting by Carmine Mazza
- Fundamentals and Advances in Knitting by Sadhan Chandra Ray
- Knitting Technology by David J. spencer
- Circular Knitting by Lyer/Mammel/Schach

Knitting Mechanism-II

Course Outline:

Module 1: Flat Knitting Machines Parts

- Know Types of Flatbed knitting machines
- Understand Range of machines gauge and width
- Understand functioning of different parts of flat knitting machine
- Understand functioning of cams system and auxiliary cam system
- Understand loop formation cycle of flat knitting machine

Module 2: Flat Knitting Machine Parts and Operations

- Know what locks is and how it works
- Understand why low/ high butt needles are used
- Differentiate split and multiple cam system
- Understand fabric formation process from feeding to take down and problems associated with it

Module 3: Power Flat Knitting Machine Parts and Operations

- Differentiate between Electronics and manual flat knitting machine
- Differentiate and explain working of different parts of power flat knitting machine
- Understand Importance and working of yarn tensioning assembly
- Working of Digital stitch control system

- Working of different parts of carriage
- Understand how loop transferring techniques works and step involved
- Understand take down mechanism and needle bed racking system

Module 4: Power Flat Knitting Machine Parts and Operations

- Differentiate parts of cams/ carriage and their functioning
- Understand working of needle selection mechanism
- Understand working of pressor cams and their role in needle selection
- Understand how loose 2nd stich and tuck 2nd stich is formed using different pressor
- Know about multi gauging technique
- Know about different manufacturer of flat knitting machines and CMS technology

Module 5: Types of Hosieries, Differentiation of Hosiery Machines and Different Parts of Socks

- Know compatibility of machine gauge w.r.t yarn count ranges
- Explain reason for the specific fault and could suggest possible remedies
- Explain how different type of hosieries garments are differentiated
- Why different types of yarns are used in socks manufacturing and added functionality in socks

Module 6: Working of Different Parts of Socks Knitting Machine

- Express what is gloves, construction and design of glove, types of gloves.
- Explore major industries dealing with gloves.
- Understand gloves manufacturing cycles
- Understand Working of different parts of gloves knitting machine
- Working of cams of gloves knitting machine function of different solenoid magnet
- Modern gloves knitting machine and added functionality

Module 7: Gloves Manufacturing System and Functioning of Different Parts of Gloves Knitting Machine

- Express what is gloves, construction and design of glove, types of gloves.
- Explore Major industries dealing with gloves.
- Understand Gloves manufacturing cycles

- Understand Working of different parts of gloves knitting machine
- Working of cams of gloves knitting machine
- Function of different solenoid magnet
- Modern gloves knitting machine and added functionality

Module 8: Advancement in Delivery System

- Explore advancements in yarn delivery system
- Know about Positive Yarn delivery system
- Know about Elastane roller
- Explain working of Belt feeder
- Explain Negative storage feeder
- Advancement in creels

Module 9: Advancement in Circular Knitting

- Explore Advances in circular knitting
- Explain Current problems and limitations of circular knitted structure
- Elaborate Limitation of pattern in jacquard and seamless knitting machines
- Know about recent advancement in circular knitting
- Explain Santoni seamless knitting technology
- Elaborate Ultra fine knitting machines
- Know in detail Loop transfer technology in circular knitting machines

Module 10: Warp Knitting m/c's and Knitting Elements

- Warp Knitted fabrics
- Knitting elements of warp knitting m/c
- Warp beam Fabric take-down
- Comparison of warp and weft knit structures
- Types of warp knitting
- Comparison of Tricot and Raschel Knitting machine

Module 11: Basic Warp Knitting Principles and Types of Warp Knitting Machines

- Parts of warp knitting machine
- The warp beams
- Needle and needle bar

- The guides and guide bar
- Pressor bar and latch wire/guard
- Sinker and sinker bar
- Trick plate

Module 12: Warp Knitting m/c Elements and Loop Formation Cycle

- Needle bar and Guide bar movement
- Lapping and swinging motion of guide bar
- Elements of warp knit structures
- Guide bar shog/overlap/underlap
- Run-in and rack /technical face and back of warp knit structures
- Effect of overlap and underlaps on fabric properties
- Pattering mechanism of warp knitting machine
- Pattern wheel
- Pattern chain
- Electronic Jacquard

Module 13: Warp Knitting m/c Elements and Loop Formation Cycle

- Displacement of various knitting elements relative to each other
- Warp knit structure representation
- Lapping movement
- Numerical notation
- Tricot machine loop formation cycle with beard needle
- Raschel machine knitting cycle with latch needle
- Loop formation of double needle bar Raschel
- Loop formation cycle of compound needle
- Single guide bar structures
- Double guide bar structures and rules of its formation

Module 14: Warp Knitting m/c Pattering and Different Developments in Fabric Formation

- Tricot structures
- Locknit structures
- Reverse locknit
- Sharkskin

- Queenscord
- Double Atlas
- Satin
- Loop Raised fabrics

Module 15: Warp Knitting m/c Pattering and Different Developments in Fabric Formation

- Differentiate double needle bar structures and their applications
- Know open work and laid in structures
- Know about weft insertion system and its working
- Know Multi axial warp knitting technique and its mechanism
- To know about special stitches used in warp knitting

Module 16: Sensors and Electromechanical Parts in Knitting – Energy Efficiency Green Knitting

- Types of sensors
- Functioning of knitting sensors
- Electromechanical parts on knitting machine
- Concept of energy efficiency in knitting
- Green knitting technique
- Application of electronics in knitting

Teaching Methodology (Proposed as applicable):

Lectures (audio/video aids), Written assignments/quizzes, tutorials, case studies relevant to engineering disciplines, semester project, guest speaker, industrial/field visits, group discussion, report writing.

Assessment:

Mid-semester exam, report writing/presentation, assignment, project report, quizzes, end-semester exam

Suggested Books:

- Flat Knitting by Samuel Raz
- Knitting technology by David J Spencer
- Fundamentals and Advances in Knitting Technology by Sadhan
- Advances in knitting technology by Kin Fan Au

- Circular Knitting by Lyer/Mammel/Schach
- Knitting by Carmine Mazza, ACIMIT

Knitting Calculations

Course Outline:

Module 1: Yarn Count & Physical Conversion

- Drive the formulae for direct & indirect count system.
- Different hank length in indirect & direct systems
- Understand physical & textile units.
- Understand count in indirect system

Module 2: Count Conversions

- Understand count in direct system
- Understand conversion with in-indirect system.
- Understand of count from indirect to direct system

Module 3: Average, Conditioned & Folded Count

- Understand count from direct to indirect system
- Differentiate condition count, Average count
- Determine the count of folded yarns

Module 4: Yarn Costing & Winding Production

- Calculate the production of winding machine
- Determine the no. of machines & spindles required for winding yarn.

Module 5: Preparatory Calculations

- Analyze Yarn and fabric calculations
- Estimate GSM of the knitted fabric
- Determine Elastane %, composition and Stitch density

Module 6: Yarn Requirement Calculations

- Calculate Yarn requirement of different knitted structure like Single knit, Striper, Terry, and Fleece fabric

Module 7: Yarn Requirement Calculations

- Calculate Yarn requirement of different knitted structure like Double knit (Rib, Interlock, and its derivatives)

Module 8: Production Calculations

- Calculate composition of different knitted structure like Single knit, Striper, Terry and Fleece fabric, double knit Structures

Module 9: Optimum knitting Calculations

- Understand the optimum knitting parameters like Tightness Factors, Run-in ratio, knitting Width

Module 10: On Machine Calculations

- Understand knitting machine calculation for different quality of fabric
- Understand Quality calculation
- Calculate Run-in-Ratio
- Calculate Course Length

Module 11: Prediction of Areal Density of Different Knitting Structure

- Predict the formula for areal density of Single knit, Double knit ad its derivatives structures

Module 12: Knitted Fabric Dimensional Characteristics

- Calculate Dimensional Characteristics
- Estimate Fabric Width
- Calculate Fabric cover factor

Module 13: Warp Knitting Calculations

- Understand Warping calculations
- Estimate Set calculations

Module 14: Warp Knitting Calculations/term

- Calculate Production Calculations
- Calculate Areal density
- Estimate Tightness factors

Module 15: Warp Knitting Calculations/Testing Calculations

- Analyze Dimensional characteristics of warp knit fabrics
- Calculate Run-in Ratio and Stitch length
- Calculate Stretch and recovery related Calculation
- Estimate Shrinkage and Skew ness testing Calculation

Module 16: Case study (knit to pack)

- Estimate the materials (Knit to pack) and calculation involved.
- Manage the production process PPC

Teaching Methodology (Proposed as applicable):

Lectures (audio/video aids), written assignments/quizzes, tutorials, case studies relevant to engineering disciplines, semester project, guest speaker, industrial/field visits, group discussion, report writing.

Assessment:

Mid-semester exam, report writing/presentation, assignment, project report, quizzes, end-semester exam

Suggested Books:

- Knitting fundamentals, machine structure and development by N. Anbumani.
- Knitting technology, third edition by David J. Spencer
- Circular knitting 2nd edition by Lyer/Mammel/Schach

Elective Courses for Textile Processing Specialization

Pre-Treatment of Textiles

Course Outline:

Module 1: Greige Inspection & QC

- Greige receiving and Recording
- Greige faults and their grading systems
- 2-point and 10-point System

- Fabric inspection machinery and its description
- Fabric packing & storage

Module 2: Shearing & Singeing

- Principle, method and machinery for shearing
- Principle, method and machinery for singeing
- Common shearing & singeing faults and their countermeasures
- Testing & Q.C. of singed & sheared fabric
- Faults and remedies

Module 3: Desizing

- Principle, method and machinery
- Chemical composition of Sizes and their identification
- Desizing mechanisms and methods
- Desizing Recipes & Process Design
- Testing & Q.C. of Desized fabrics
- Faults and remedies

Module 4: Scouring

- Principle, method and machinery
- Mechanism of scouring
- Chemical and bio-scouring of cotton, flax, jute, wool, manmade fibers and their blends
- Scouring Recipes & Process Design
- Testing & Q.C. of scoured textiles
- Faults and remedies

Module 5: Heat-setting

- Principle and machinery
- Mechanism of heat-setting
- Dimensional stability of synthetic fiber
- Structural changes taking place in fiber during heat treatment
- Methods of heat setting
- Heat-setting Process Design
- Testing & Q.C. of heat set fabrics

- Faults and remedies

Module 6: Bleaching

- Principle, method and machinery
- Mechanism of Bleaching
- Chemistry and mechanism of different bleaching agents: Hydrogen peroxide; Sodium hypochlorite; Sodium Chlorite; bio
- Bleaching of cotton, flax, jute, wool, manmade fibers and their blends
- Bleaching Recipes & Process Design
- Testing & Q. C. of bleached textiles
- Faults and remedies

Module 7: Mercerization & Causticization

- Principle and methods
- Mechanism and effects of Mercerization
- Yarn and Fabric Mercerization
- Slack & Tension Mercerization both in the cold and hot conditions
- Mercerization machines and their description
- Caustic Weight reduction of Polyester
- Mercerization & Causticization Process Design
- Testing & Q. C. of Mercerized textiles
- Faults and remedies

Module 8: Liquid Ammonia Treatment

- Cotton treated with Liquid Ammonia
- Physical and chemical modification taking place during the process
- Liquid Ammonia treatment machinery and its description
- Testing & Q. C. of Ammonia treated fabrics
- Faults and remedies

Teaching Methodology (Proposed as applicable):

Lectures (audio/video aids), written assignments/quizzes, tutorials, case studies relevant to engineering disciplines, semester project, guest speaker, industrial/field visits, group discussion, report writing.

Assessment:

Mid-semester exam, report writing/presentation, assignment, project report, quizzes, end-semester exam

Suggested Books:

- Chemical Technology in the Pretreatment Processes of Textiles by S. R. Karmakar, (1999)
- Cellulosic Dyeing by John Shore (1995)
- Chemistry and Technology of Fabric Preparation & Finishing by Charles Tomasino, (1992)
- Scouring and Bleaching by E. R. Trotman

Dyestuff Chemistry

Course Outline:

Module 1: Introduction

- Introduction and history of dyes; Natural dyes
- Structure and properties of dyes. Colorfastness characteristics

Module 2: Color and Chemical Constitution

- Early attempts to classify dyes and pigments, introduction to color index classification, color and its relation to dye chemical structure, resonance and orbital theory of color. Development of first synthetic dye mauveine, era of synthetic manufacturing.

Module 3: Dye Manufacturing Process

- Sulphonation, nitration, amination, alkylation, hydroxylation, diazotization and coupling mechanism of various compounds and use of coupling components. Machinery involved in dyestuff manufacturing including autoclave, filter press, reactor and chillers.

Module 4: Dyestuff Classification

- Ionic Class: Anionic, Cationic, Non-ionic
- Chemical Class: Various Chromophores and Auxochromes

- Application Class: Direct dyes, Reactive dyes, Sulphur dyes, Vat dyes, Solubilized vat dyes, disperse dyes, Acid and Basic dyes. Chemistry, properties and classification and these dyes.

Module 5: Pigments

- Classification and properties of pigments viz. inorganic and organic pigments.

Module 6: Fluorescent Brightening Agents

- Introduction of FBAs, Mode of action, chemistry and application of FBA.

Teaching Methodology (Proposed as applicable):

Lectures (audio/video aids), written assignments/quizzes, tutorials, case studies relevant to engineering disciplines, semester project, guest speaker, industrial/field visits, group discussion, report writing.

Assessment:

Mid-semester exam, report writing/presentation, assignment, project report, quizzes, end-semester exam

Suggested Books:

- Industrial Dyes (Chemistry, Properties, Applications) by K. Hunger, Wiley (2003)
- Colorants and Auxiliaries by John Shore, Vols. I & II, (2002)
- Color Chemistry by R M Christie (2001)
- Reactive Dyes for Textile Fibres by A. Hunter M. Renfrew (1999)

Textile Dyeing

Course Outline:

Module 1: Introduction

- Introduction and history of dyeing; Dyeing with natural dyes
- Essential definitions and terms used in dyeing and their explanation
- Processing flow chart for yarn, woven, denim and knitwear textiles.

Module 2: Theory of Coloration of Textiles

- Characteristics of fibers, dye molecules and water pertinent to dyeing; Relationship between fiber structure and dyes during the dyeing process.
- Dyeing equilibrium and kinetics: adsorption isotherms, affinities, electrolytic effects, heat and dyeing entropy
- Essential dyeing characteristics and evaluation: color yield, dye exhaustion, dye diffusion, dye migration, dye fixation and colorfastness
- Dyeing stages, efficiency and control: Role of water, electrolyte, temperature and dyebath pH; dyeing auxiliaries; Washing off.

Module 3: Dyeing Machinery and Methods

- Fundamentals of functional design of coloration machines
- Exhaust dyeing (Fiber dyeing, Yarn dyeing, Fabric dyeing and Garment dyeing)
- Pad dyeing's
- Others: Solvent dyeing. Special dyeing effects: cross-dyeing, union dyeing, tone-to-tone effects, top dyeing, tie dyeing

Module 4: Dyeing with Direct Dyes

- Principles and methods of dyeing cellulose with direct dyes
- After-treatment of textiles dyed with direct dyes
- Design of recipe and process for dyeing cellulose with direct dyes
- Dyeing control and corrections for the key faults

Module 5: Dyeing with Reactive Dyes

- Principles of dyeing cellulose with reactive dyes
- Reactive dyeing mechanisms
- Methods and processes
- Washing-off
- Colorfastness
- Design of recipe and process for dyeing cellulose with direct dyes
- Dyeing control and corrections for the key faults

Module 6: Dyeing with Vat and Indigo Dyes

- Principles of dyeing cellulose with vat dyes
- Dyeing methods and processes
- Dyeing of denim yarn with indigo dyes
- After-treatment of textiles dyed with vat dyes
- Design of recipe and process for dyeing cellulosics with vat dyes
- Dyeing control and corrections for the key faults

Module 7: Dyeing with Sulphur Dyes

- Principles and methods of dyeing cellulose with Sulphur dyes
- After-treatment of textiles dyed with Sulphur dyes
- Design of recipe and process for dyeing cellulose with Sulphur dyes
- Dyeing control and corrections for the key faults

Module 8: Selection of Dyes for Cellulose

- Customer requirements: Color, color yield and colorfastness
- Cost Factor
- Structure and properties of dyes for cellulose; Behavior of dyes in various dyeing processes; Application method

Module 9: Dyeing of Polyester and Cellulose Acetate Materials

- Principles of dyeing with disperse dyes
- Methods for dyeing polyester and dyeing cellulose acetate
- Carrier dyeing; High temperature/pressure dyeing
- Design of recipe and process for dyeing with disperse dyes
- Dyeing control and corrections for the key faults

Module 10: Dyeing of Acrylic Textiles

- Principles and methods of dyeing acrylic with cationic dyes
- Design of recipe and process for dyeing acrylic with cationic dyes
- Dyeing control and corrections for the key faults

Module 11: Dyeing of Protein and Polyamide Fibres

- Principles of dyeing protein fiber with acid dyes
- Methods of dyeing of wool
- Methods of dyeing of silk
- Design of recipe and process for dyeing protein fibers
- Principles and methods of dyeing of polyamide with acid dyes
- Dyeing of polyamide carpets
- Dyeing control and corrections for the key faults.

Module 12 Blend Dyeing

- Objective and need of blending
- Commercially important blends
- Dyeing of polyester/cotton blend with different dye combinations by various methods/processes
- Dyeing of other important blends such as polyester/viscose, polyester/acrylic, wool/acrylic…etc.
- Design of recipes and processes for dyeing different blends
- Dyeing control and corrections for the key faults

Module 13 Pigment Dyeing

- Introduction
- Pigment dyeing
- Difference between pigment dyeing and conventional dyeing
- Binders and cross-linking agents used in pigment dyeing
- Colorfastness pigment dyed substrate

Teaching Methodology (Proposed as applicable):

Lectures (audio/video aids), written assignments/quizzes, tutorials, case studies relevant to engineering disciplines, semester project, guest speaker, industrial/field visits, group discussion, report writing.

Assessment:

Mid-semester exam, report writing/presentation, assignment, project report, quizzes, end-semester exam

Suggested Books:

- Advances in Reactive Dyeing of Cotton by Awais Khatri (2015)
- Sustainable Dyeing Technologies, Awais Khatri and M. White, in Sustainable Apparel by Richard Blackburn (2015)
- Fundamentals and Practices in Coloration of Textiles by Chakraborty (2009)
- Basic principles of Textile Coloration by A. D. Broadbent (2005)
- Critical Solutions in Dyeing of Cotton Textile Materials by R. Shamey and T. Hussain (2005)
- Cellulosic Dyeing by John Shore (1995)
- Chemical Principles of Synthetic Fibre Dyeing by S. M. Burkinshaw (1995)
- Blends Dyeing by John Shore (1995)
- Wool Dyeing by D. M. Lewis (1992)
- Dyeing and Finishing of Polyester Fibers and its Blends, BASF 1990
- Wool Dyeing, Society of Dyers and Colorists, 1992
- Theory of Coloration of Textiles, Society of Dyers and Colorists
- Engineering in Textile Coloration, Society of Dyers and Colorists

Textile Printing

Course Outline:

Module 1: Introduction

- Introduction, history, terminologies and theory of Textile Printing
- Process flow of printing (fabric preparation, print paste preparation, printing, drying, fixation, washing-off).

Module 2: Textile Printing Methods

- Block printing, Roller printing, Hand screen printing, and Semi-automatic flat screen printing, fully automatic flat screen printing, Rotary screen printing, and Digital printing.

Module 3: Print Design Studio & Engraving

- Introduction to print design studio, CAD/CAM, Rotary screen engraving

Module 4: Screen Printing Machines

- Mechanical aspects, design registration, blanket & screen synchronization & related concepts of rotary and flatbed screen printing machines.

Module 5: Production & Properties of Printing Pastes

- Stock printing paste preparation, IPS (Integrated paste preparation & dispensing systems), dispensing & manual dispensing techniques
- Properties and types of ideal thickeners
- Print Paste Rheology

Module 6: Printing with Different Colorants

- Pigment printing, Reactive printing of cotton, Vat printing of cotton, Disperse Printing of Polyester

Module 7: Textile Printing Styles

- Direct printing, resist printing, Discharge printing, Burn out printing, Transfer printing

Module 8: Print Fixation & After-treatment Processes

- Print paste fixation mechanisms & equipment
- Curing, Ageing, Flash Ageing, Steaming
- Washing off process & washing off equipment.

Module 9: Digital Textile Printing

- Image capture & display
- Screen making using digital pattern data
- Digital control systems
- Ink-jet printing
- Variables affecting reproducibility

Module 10: Printing Faults & their Countermeasures

- A study of the faults that may occur during and/or after printing and their countermeasures

Teaching Methodology (Proposed as applicable):

Lectures (audio/video aids), written assignments/quizzes, tutorials, case studies relevant to engineering disciplines, semester project, guest speaker, industrial/field visits, group discussion, report writing.

Assessment:

Mid-semester exam, report writing/presentation, assignment, project report, quizzes, end-semester exam

Suggested Books:

- Novel processing in special finishing and printing of textile by F. Uddin and M. Lomas (2010)
- Digital Printing of Textiles by H. Ujiie (2006)
- Textile Printing by W. C. Miles (2003)

Textile Finishing

Course Outline:

Module 1: Introduction to Finishing

- Textile finishing both in narrow and broad sense, Objectives of textile finishing, Important factors affecting textile finishing, Classification of textile finishing, Synergistic and antagonistic effects of finishes, Flow charts of different routes adopted in the finishing of woven and knitted fabrics.

Module 2: Introduction to Mechanical Finishing

- Objectives and classification of mechanical finishing.
- Function, method and mechanism of different mechanical finishes; Fabric drying, Heat setting, Calendaring, Raising, Emerizing/Sueding/Peaching, Shearing, Sanforizing, Compaction.

Module 3: Application Methods of Chemical Finishes

- Different methods to apply a chemical finish on fabric, Basic calculations for batch and continuous application, Wet pickup, percentage add-on, Critical application value, continues routs and low wet pick, Factors

affecting the wet pick up, Low wet pick up methods, Types of saturation removal methods, Types of topical application methods

Module 4: Chemical Softening

- Objective, mechanism, classification, chemistries, properties and evaluation methods.

Module 5: Hand Building Finishes

- Objective, mechanism, classification, chemistries, properties and evaluation methods.

Module 6: Easy Care and Durable Press Finishes

- Objective, mechanism, classification, chemistries, properties and evaluation methods.

Module 7: Oil and Water Repellent Finishes

- Objective, mechanism, classification, chemistries, properties and evaluation methods.

Module 8: Soil Release Finishes

- Objective, mechanism, classification, chemistries, properties and evaluation methods.

Module 9: Antimicrobial Finishes

- Objective, mechanism, classification, chemistries, properties and evaluation methods.

Module 10: Flame Retardant Finishes

- Objective, mechanism, classification, chemistries, properties and evaluation methods.

Module 11: Antistatic Finishes

- Objective, mechanism, classification, chemistries, properties and evaluation methods.

Module 12: Anti-pilling Finishes

- Objective, mechanism, classification, chemistries, properties and evaluation methods.

Module 13: Non-slip Finishes

- Objective, mechanism, classification, chemistries, properties and evaluation methods.

Module 14: UV Protection Finishes and Bio Finishes

- Objective, mechanism, classification, chemistries, properties and evaluation methods of UV protection and Bio finishes

Module 15: Insect resist and mite protection Finishes

- Objective, mechanism, classification, chemistries, properties and evaluation methods.

Module 16: Bio Polishing and other Noval Finishes

- Objective, mechanism, classification, chemistries, properties and evaluation methods of bio polishing.
- Nanomaterials, plasma treatment, microencapsulation, aroma finishes, PCM, cool finish, thermochromic dyes, photochromic dyes, hydrochromic.

Teaching Methodology (Proposed as applicable):

Lectures (audio/video aids), written assignments/quizzes, tutorials, case studies relevant to engineering disciplines, project's report, guest speaker, industrial/field visits, group discussion, report writing.

Assessment:

Mid-semester exam, report writing/presentation, assignment, project report, quizzes, end-semester exam

Suggested Books:

- Chemical Finishing of Textiles by W. D. Schindler and P. J. Hauser (2004)
- Textile Finishing by Derek Heywood (2003)
- Reference Book of Textile Finishing Technology by ACIMIT (2002)

- Chemistry and Technology of Fabric Preparation and Finishing by Charles Tomasino (1992)

Textile Coating

Course Outline:

Module 1: Introduction

- Introduction and Applications of Textile Coating, Breathable water-proof fabrics, artificial leather, Architectural textiles, automotive textiles

Module 2: Coating with Polymeric Materials

- Objectives, Natural and synthetic rubbers, Polyvinyl chloride, Polyurethane, Acrylic

Module 3: Coating with Functional Materials

- Objectives, Phase change materials, Flame retardants, chemical protection, and microcapsules containing fragrance, anti-microbials, conductive materials, smart polymers and nano materials

Module 4: Coating Rheology

- Rheological behavior of fluids and plastisols

Module 5: Coating Methods

- Knife coating, Roller coating, Dip coating, Transfer coating, Coating with screens, Foam coating, Spray coating

Module 6: Properties of Coated Fabrics

- Tensile strength and elongation, Adhesion, Tear strength, Weathering behavior, Yellowing, Microbiological degradation

Teaching Methodology (Proposed as applicable):

Lectures (audio/video aids), written assignments/quizzes, tutorials, case studies relevant to engineering disciplines, semester project, guest speaker, industrial/field visits, group discussion, report writing.

Assessment:

Mid-semester exam, report writing/presentation, assignment, project report, quizzes, end-semester exam

Suggested Books:

- Smart Textile Coatings and Laminates by William C Smith (2010)
- Coated Textiles – Principles and Applications by Asish Kumar Sen (2008)
- Coatings Technology Handbook by D.Satas, (2001)

Elective Courses for Garment Manufacturing Specialization

Garment Sizing and Pattern Making

Course Outline:

Module 1: Anthropometry and Human figure

- Anthropometry and new trends
- Human anatomy
- Figure types, ideal standard figure and body landmarks

Module 2: Sizing System

- Sizing systems and development
- Methods to decide Size intervals
- Sizing system for Pakistani population

Module 3: Imaginary Lines in Fabric and Collars

- Grain line, length and crosswise grain, bias grain, true bias and selvedge.
- Collar terms, types & Collar classification
- Basic shirt collar foundation

Module 4: Basic Block Pattern, Panelled Bodice and Contouring

- Measurements to construct a basic block
- Basic block Pattern & its Different Types.
- Development of paneled, princess style and wing seamed bodice
- Principles of contouring and contour guide pattern

- Surplice/wrap and off shoulder designs

Module 5: Dart Manipulation, Gather, Pleats, Sleeves, Cuffs Plackets and Pockets

- Dart, objectives of dart, types of dart and its manipulation techniques
- Pleats, Gathers & flares
- Types of pleats and development of pleat cluster
- Types of sleeves & cuffs
- Types of plackets & Pockets

Module 6: Skirts

- Types of skirts with respect to design and length
- Measurements to construct a skirt's pattern
- Basics of Skirt patterns
- Skirt lengths and silhouettes

Module 7: Measurement Chart and Grading

- Development of chart for a sewn product measurement
- Developing before-wash measurements for a denim trouser
- Grading and manual pattern grading process

Module 8: Impact of Fabric/Lining Properties on Patterns

- Manipulating fabric stretch and shrinkage in pattern making
- Dart-less stretch fabric foundations
- Types of lining/interlining
- Cut-out necklines and armholes

Module 9: Draping

- Introduction to 2D and 3D pattern making
- Comparison of draping and drafting
- Sketch understanding
- Identification of different elements
- Pattern design using draping
- Development of basic dress (ladies) pattern by draping

Teaching Methodology (Proposed as applicable):

Lectures (audio/video aids), written assignments/quizzes, tutorials, case Studies relevant to engineering disciplines, semester project, guest speaker, industrial/field visits, group discussion, report writing.

Assessment:

Mid-semester exam, report writing, presentation, assignment, project report, quizzes, end-semester exam

Suggested Books:

- Sizing in Clothing: Developing Effective Sizing Systems for Ready-to-Wear Clothing by S. P. Ashdown (2007)
- Fashion Patternmaking Techniques (volume 1) by Antonio, Donnanno (2017)
- Fashion Patternmaking Techniques (volume 2) by Antonio,Donnanno (2016)
- Patternmaking for Fashion Design by Helen Joseph Armstrong (2013)
- Fabric and Pattern Cutting: Fabric, Form and Flat Pattern Cutting by Winifred Aldrich (2013)
- Pattern Cutting and Making Up: The Professional Approach by Shoben and Matin (1987)
- Guide to Basic Garment Assembly by Jayne Smith (2013)

Computer Aided Pattern Design and Product Development

Course Outline:

Module 1: Fashion Forecasting

- Fashion, fashion trends and fashion forecasting
- Objective of fashion forecasting
- The process of fashion forecasting
- Target market

Module 2: Conceptualization

- Theme
- Mood board
- Inspiration/story board
- Color board
- Sketches

Module 3: Material and Color Selection

- Aesthetic requirements of a product
- Functional requirements of a product
- Selection of main fabrics, trims and accessories
- Color wheel and colors on color wheel
- Effect of different colors on clothing design
- Selecting appropriate colors for a new product

Module 4: Style Selection and Feasibility

- Style selection
- Silhouette selection
- Intended performance of the product
- Cost effectiveness of the product

Module 5: Mass Customization in Apparel Industry

- Introduction to mass customization and conceptual development
- Current and future changes in consumer buying behaviour
- Mass production & mass customization concepts
- Mass customization and manufacturing process in fashion industry
- Virtual prototyping
- Consumers, manufacturers, wholesalers and retailers

Module 6: Improving Apparel Size and Fit

- Key issues affecting apparel sizing and fit
- Applications of technological advancements
- 3D body scanning and technologies of body scanning
- Applications of 3D scanning in apparel industry

Module 7: Computerized Pattern Grading

- Pattern grading
- Objective of grading
- Grade points
- Grading rules
- Rule table

Module 8: Digitizing

- Working principle of a digitizing table
- Parts of digitizing table
- Placing a shape on digitizing table
- Process of digitizing a shape

Module 9: Computerized Pattern Making in Garment Production

- Introduction and principles of computerized pattern making
- Garment balance
- Computerized made to measure systems
- The pattern design screen
- Managing pieces on screen
- Piece drop menu
- Customizing pattern design screen layout
- Preferences option

Module 10: Model and Order Making

- Parts of an apparel product, denim trouser, woven (casual & formal) trouser, woven (casual and formal) shirt, knitted shirt (t-shirt, polo shirt, hoodie)
- Model making
- Applying a rule table on a pattern piece
- Base size
- Selection of different sizes
- Order making keeping in view the lay plan

Module 11: Marker Making

- Marker, objective of marker making and types of marker
- Marker space

- Manipulating placement of pattern pieces
- Material utilization

Teaching Methodology (Proposed as applicable):

Lectures (audio/video aids), written assignments/quizzes, tutorials, case studies relevant to engineering disciplines, semester project, guest speaker, industrial/field visits, group discussion, report writing.

Assessment:

Mid-semester exam, report writing/presentation, assignment, project report, quizzes, end- semester exam

Suggested Books:

- Textiles and Fashion: Materials, Design and Technology by Rose Sinclair (2014)
- Advancement in Apparel Production by Catherine Fairhurst (2008)
- Computer Aided Fashion Design using Gerber Technology by Jane D. Espinoza Alvonoda (2007)
- Computer Aided Pattern Design and Product Development by Beazley and Bond (2003)
- Patternmaking for Fashion Design by Helen Joseph Armstrong (2013)
- Concept of pattern grading Techniques for manual and computer grading, K Mullet (2009)
- Clothing Appearance and fit; science and Technology by J Fan (2004)
- Cooklin's Garment Technology for fashion designers by Steven Hayes, John McLoughlin and Dorothy Fairclough (2012)

Clothing Production Processes

Course Outline:

Module 1: Cutting Room Operations

- Initial preparation and quality control of textile materials in cutting room
- Storage, registration and inspection of materials
- Sorting fabrics by shade, shrinkage and size
- Lay planning

Module 2: Textile Spreading

- Cutting room fabric losses, their types, contribution and wastage reduction
- General characteristics of the spreading process
- Fabric spreading modes and their application
- Dealing with different kinds of spread, Fabric quality issues
- Manual Vs. automatic Spreading Process, advantages and disadvantages
- Effect of fabric width on fabric consumption of garments

Module 3: Textile Cutting Processes

- General characteristics of the cutting process flow
- Advantages and disadvantages of manual and automatic cutting
- Notches and cloth marking

Module 4: Handling Cutting Room Equipment, Fusing Cut and Quality Control

- Placement of manual spreading and cutting equipment/workstations
- Placement of automated spreading and cutting equipment/workstations
- Lay storage systems for automated cutting processes
- Fusing/Interlinings cutting, Fusing presses and their main parts
- Accuracy problems in cutting process and in cut components
- Re-cutting faulty components, Numbering, sorting and bundling of cut parts

Module 5: Cutting of Patterned Fabrics

- Spreading and cutting of striped fabrics
- Spreading and cutting materials with check patterns
- Marker making, spreading and cutting fabrics with motif and border patterns

Module 6: Cutting of Pile, Narrow Lace and Intricate Fabrics

- Spreading and cutting fabrics with pile
- Marker making, spreading and cutting of narrow lace
- Marker making styles directly on Intricate fabrics
- Problems in spreading and cutting intricate fabrics

Module 7: Sewing Room Operations

- Introduction to sewing room operations and process flow
- Receiving of goods from cutting room with feeding reports and material storage
- Handling cut parts, feeding process to sewing line and work in progress
- Role of management on the sewing floor

Module 8: Stitches and Seams, Sewing Thread

- Stitch and seam classification, numerical expressions and applications
- Sewing threads, Sewing Thread Size, Ticket Numbering, Stitch Per Inch,
- Sewing Thread Consumption and applications
- Compatibility of fabric, sewing thread and needle size
- Needle heating, its causes and remedies

Module 9: Sewing Mechanics

- Construction of different stitches: lock stitch, chain stitch, over-lock stitch, safety stitch
- Principle of sewing, Concept of sewing equilibrium
- Extensibility of sewing threads, relaxation and seam fault manifestation
- Sew-ability of fabric and thread

Module 10: Adhesive Bonding and Heat-sealing

- Adhesive bonding of textiles: principles, types of adhesive and methods
- Bonding requirements in coating and laminating of textiles
- Coating and laminating process
- Use of heat sealing, hot air and hot wedge to join textile materials
- Ultrasonic and dielectric welding of textiles
- Laser seaming of fabrics
- Techniques for joining nonwoven materials

Module 11: Seam Performance

- Quality and performance of sewn seams
- Seam strength, Seam extensibility, recovery, drape and bending
- Seaming quality problems causes and prevention

- Seam slippage, Seam grinning/gaping, Seam failure, Seam pucker, Degradation etc.

Module 12: Stitching Faults and Sewing Supported Departments

- Problems in stitch formation, Thread breakage, needle breakage,
- Slipped/missed stitching etc.
- Efficiency of sewing room
- Role of supporting departments on sewing productivity
- Types of sewing floor reports: absenteeism, hourly production, critical operation, daily production and monthly production reports etc.

Module 13: Garment Dry Process

- Garment Dry Process (GDP) workflow, operations and their applications
- Mechanical fading methods: Whiskers, Scraping, Grinding, Brushing, Distress/Destroy, Sand blasting, Tagging and tying, Laser beam, Resin applications, 3D crush effects

Module 14: Garment Washing

- Garment Wet Process (GWP) operations and their applications
- Washing Process Flow and requirements, Factors affecting washing effect
- De-sizing, Bleaching, stone washing, Tinting/Dying, Neutralization,
- Bio-techniques: Enzymes for denim washing
- Washing Process recipes
- Spray Processes, KMnO4 application
- Types of Garment washes: Single/Double Stone Wash, Acid wash
- Garment washing and finishing chemicals and auxiliaries: dyes, Enzymes, Fixer & Softeners
- Washing quality control issues, Back-staining
- Reduced water washing of denim garments: ozone fading

Module 15: Garment Pressing Technology

- Garment Pressing operations and their applications
- Pressing Elements: heat, steam, pressure, and time.
- Pressing equipment and types
- Under pressing and top pressing
- Technological advancement in the pressing equipment.

Module 16: Finishing and Packing

- Printing and embroidery of garment cut panels before stitching
- Laser engraving of denim
- Embossing and other finishing effects
- Trimming, Buttoning and Riveting
- Kinds of stains and their removal
- Packing types, packing material

Teaching Methodology (Proposed as applicable):

Lectures (audio/video aids), written assignments/quizzes, tutorials, case studies relevant to engineering disciplines, semester project, guest speaker, industrial/field visits, group discussion, report writing.

Assessment:

Mid-semester exam, report writing/presentation, assignment, project report, quizzes, end-semester exam

Suggested Books:

- Industrial Cutting of Textile Materials by I V Nemes (2012)
- Joining Textiles: Principles and Applications by I Jones, TWI and G. Stylios (2013)
- Apparel Manufacturing Technology by T. Karthik, P. Ganesan & D. Gopalakrishnan (2016)
- Denim Manufacture, Finishing and Applications by Roshan Paul (2015)
- Transforming Clothing Production into a Demand driven, Knowledge based, High-tech Idustry by Lutz Wakter, George Alexander Kartsounis and Stefano Carosio (2009)
- Basic Processes and Clothing Construction by Raushni Deshpandi (1988)
- The Complete Photo Guide to Clothing Construction by Christine Haynes (2014)

Garment Production Machinery

Course Outline:

Module 1: Introduction to Garment Production Machinery:

- Defining basic terms and concepts of garment production machinery,
- Classification of machines
- Introduction of latest automatic machines

Module 2: Garment Preparatory Machines:

- Fabric inspection tables
- Digitizing, marker making and marker printing equipment
- Spreading equipment, spreading tables and spreading fabric control devices
- Fabric cutters, types, components, applications and their working principles.

Module 3: Industrial Sewing Machine:

- Lock stitch, chain stitch, and flat lock, over lock and inter lock machines.
- Special purpose machines; button attach, button hole, tape attach, zip attach machines etc.
- Blind stitch machines, their parts, working principle and application.

Module 4: Fundamentals of Industrial Sewing Machine:

- Casting, lubrication systems, stitch formation system and feeding system
- Sewing machine components; gears, lower drive shafts, upper drive shafts, cams and cranks, belts and electric motor.
- Working and synchronization of all these parts.

Module 5: Stitch Formation Devices and Systems:

- Stitch forming devices
- Stitch forming systems; presser foot, throat plate and feed dogs
- Stitch formation mechanism
- Feed dogs and their types, feed mechanisms
- Stitching defects and their reasons and remedies

Module 6: Ancillary Mechanisms for Industrial Sewing Machine:

- Auxiliaries and additional attachments as work aids for special functions
- The importance and need of machine attachments, their role in efficiency and productivity.

Module 7: Automation in Sewing Machines:

- Technology advancements: Mechanization, Automation and Robotics in apparel machines.
- General purpose machines and special purpose machines.
- Need for technology advancement and few examples of automatic equipment like CAD/CAM etc.
- Introduction of software used in garment development and production processes.

Module 8: Garment Washing, Pressing, Finishing and Packing Machinery:

- Garment pressing equipment: Types, uses and functions
- Machines for garment pressing: Iron kinds and their functioning.
- Garment finishing machines as washers, sand blasting guns, laser machines etc.
- Packing equipment: tag attach gun, carton packing and pallet wrapping machines, stretch wrapping machines etc.

Module 9: Maintenance of Garment Production Machinery:

- Importance of maintenance, types of maintenance, tools and equipment used in mechanical workshops,
- Problem solving techniques and preventive maintenance procedures.

Teaching Methodology (Proposed as applicable):

Lectures (audio/video aids), written assignments/quizzes, tutorials, case studies relevant to engineering disciplines, semester project, guest speaker, industrial/field visits, group discussion, report writing.

Assessment:

Mid-semester exam, report writing/presentation, assignment, project report, quizzes, end-semester exam

Suggested Books:

- Apparel Machinery and Equipment by R. Rathinamoorthy and R. Surjit (2015)
- Industrial Cutting of Textile Materials by I V Nemes (2012)
- The Art of Modelling with Spread Sheet by Stephen. Powel, Kenneth R. Baker (2013)
- Garment Machinery and Equipment Repair and Maintenance Manual by Wang Wen Bo.
- Manuals and User Guides related to Machines.
- Fundamental of Industrial Sewing Machine Stitch Formation and Adjustment by Singer Sewing Machine Company (1953)
- Advances in Apparel Production by Catherine Fairhurst (2008)

Sewn Product Engineering

Course Outline:

Module 1: Concepts of Production and Productivity:

- Production and productivity
- Efficiency, effectiveness and controlling variables

Module 2: Role of Industrial Engineer in Apparel Production:

- Industrial engineering,
- Role of industrial engineering in manufacturing industry
- History of industrial engineering and importance of industrial engineering
- Basic terminologies of industrial engineering

Module 3: Work and Method Study:

- Work study and importance of work study
- Work study as direct means of raising productivity
- Method study and factors involved in method study
- Recording techniques of method study

Module 4: Work Measurement and Time Study:

- Work measurement
- Advantages and purpose of work measurement
- Techniques of work measurements
- Time study, basic time study equipment, steps in making time study,
- Standardization of measured operation time.

Module 5: Motion Economy and PDTMS:

- Motion Study, Motion economy in apparel unit
- PDTMS for work measurements
- Importance of PDTMS
- Advantages of PDTMS
- Recording techniques of PDTMS

Module 6: Job Design and Learning Curves:

- Learning curves and history of learning curves
- Different approaches of calculating time
- Producing learning curves and setting standards
- Time required to do a job
- Learning rates of an organization
- Process or individual using learning curves

Module 7: Apparel Layout Planning:

- Layout planning
- Layout types and flexibility at work
- Designing process and product layouts

Module 8: Material Handling and Apparel Production Systems:

- Material handling
- Principles of material handling
- Selecting material handling methods
- Progressive bundle system
- Unit Production system
- Modular production system.

Module 9: Dexterity and Ergonomics:

- Dexterity, benefits and implementation of dexterity
- Dexterity tests for evaluation of worker/operator
- Ergonomics and human factor
- Importance of ergonomic method assigned for identification of ergonomic hazards
- Problems faced due to work place ergonomic design in sewing and cutting
- Introduction of 5S its importance use and applications in apparels

Module 10: Line Balancing:

- Line balancing
- Line balancing using operator skill history
- Reduce line setting time for assembly line

Module 11: Operation Breakdown:

- Operation breakdown,
- Considerations for making operation bulletin and machine selection
- Techniques and tools used for operation breakdown
- Operation breakdown making of different top garment products: T-Shirt, polo-shirt, dress-Shirt.
- Exercise of making operation breakdown of different Bottom garment products: Slacks, Boxer Short, Denim Trousers.

Module 12: Calculations of IE and Garment Costing:

- Capacity calculation: production target calculation
- Productivity, performance and efficiency calculation
- WIP calculation in cutting, sewing and finishing
- Manpower and machine calculation
- Process costing and pricing strategies
- Computation of cost of different finishing processes: dying Process, printing process, embellishments
- Cutting and sewing operations cost, computation of cutting and sewing costs
- Analyzing the difference between different sewing operation costs
- Trims and accessories cost calculations
- Packaging and shipment of cargo cost

Module 13: Measurement and Control of Wastages in Apparel Production:

- Causes of wastages their measurements and preventive measures
- Wastage shrinkage role in efficiency and productivity

Teaching Methodology (Proposed as applicable):

Lectures (audio/video aids), written assignments/quizzes, tutorials, case studies relevant to engineering disciplines, semester project, guest speaker, industrial/field visits, group discussion, report writing.

Assessment:

Mid-semester exam, report writing/presentation, assignment, project report, quizzes, end-semester exam

Suggested Books:

- Industrial Engineering in Apparel Production by V. R. Babu (2011)
- Introduction to Clothing Production Management by A. J. Chutter (2001)
- Sewn Product Analysis by Ruth. E. Glock (2007)
- Production Control Tools for Garment Industry, Sewing Research Institute Juki (2004)
- Sewn Product Quality: A Management Perspective by Doris H. Kincade (2007)
- The Entrepreneur's Guide to Sewn Product Manufacturing by Kathleen Fasanella (1998)
- Apparel Manufacturing: Sewn Product Analysis by Ruth E. Glock and Grace I. Kunz (2005)

Apparel Merchandizing and Sourcing

Course Outline:

Module 1: Global Apparel Industry:

- History of Apparel Industry
- Sourcing Functions
- Structures of apparel industry and types
- Apparel industry supply chain system and global trade

- Garment production business models such as Retailer, Manufacturers, Private Labels, Brands, Vendors, Subcontractors and Buying agents.

Module 2: Introduction to Marketing, Merchandising and Sourcing:

- Evolution of apparel merchandising
- Merchandising, marketing, sourcing and buying functions
- Retail, fashion and export Merchandising,
- Global and internal sourcing,
- Market knowledge: P's and C's of marketing.

Module 3: Fashion Merchandising:

- Market survey and data collection
- Markets segmentation and stratification
- Niche market and branding
- Line and product development
- Range planning
- Sourcing and costing
- Forecasting and sales monitoring,
- Directional shopping: Fashion shows, trade fairs and exhibitions etc.,
- Comparative shopping.

Module 4: Apparel Export Merchandizing:

- Profile of a successful merchandiser
- Responsibilities and traits of a merchandiser
- Apparel product lifecycle management
- General Merchandising Process
- Planning and control function in apparel industry
- Performance Measurement Tools for Merchandising: Response time, order conversion rate etc.

Module 5: Style Specifications:

- Apparel product standards and specifications Package (tech Pack)
- Elements of Tech Pack: General Style Information, Order size, Assortment Plan and Design
- Product and Performance Specifications
- Bill of Materials.

Module 6: Product Development and Sampling:

- Process from order inquiry to file development
- Production planning and control work order sheet
- Different types of samples and sampling stages
- Style, proto and size set samples
- Advertising/photo shoot samples
- Pre-production, production and shipment samples.
- Lab dips, knitting, weaving, dyeing and printing.

Module 7: Fabric Sourcing:

- Fabric Sourcing strategy
- Fabric sampling and testing
- Third party accreditation
- Fabric Inspection and grading systems: Four point and ten point etc.

Module 8: Trims and Accessories:

- Requirements of Trims and accessories development
- Basic accessories: Buttons, Zippers, Linings, Interlinings, Ribbons, Toggles, Velcro, Elastic, Rivets, Labels, Motifs, Pocketing fabrics, Thread
- Decorative accessories: Tape types, Cords, Braids, Embroidery, Lace, Piping, ribbons, Ruffles etc.
- Finishing accessories: Hang tag, Price tag, Poly bag, Paper, Carton, Tape
- Linings and Interlinings
- Zippers and its types
- Buttons and its types
- Hooks, Velcro and loop fasteners
- Inspection and testing of trims.

Module 9: Clothing Quality Management:

- Sampling plan, statistical process control, acceptable quality level and rejection
- Rework and risks of Air-shipments
- Internal and third-party Audits
- Regulations and certifications: ISO, WRAP etc., Environmental and social compliance, Hazardous chemical/dyes regulations.

Module 10: Garment Costing:

- Pricing formulas
- Export order costing
- Costing elements: Direct cost and overheads. Product development cost, Fabric cost, Trims and accessories cost, Production/Processing cost, Finishing cost, Freight cost, Administrative cost.
- Costing for Men's Shirts (Long Sleeve) and T-Shirts (Polo).

Module 11: Supply Chain Management:

- Evolution of supply chain management
- Enterprise resource planning solutions in apparel Industry
- Material procurement
- Capacity, Production planning and management
- Vendor and buyer order management

Module 12: Sourcing Strategies:

- Souring at global and domestic level
- Development of sourcing strategies
- Factors involved in the sourcing decisions
- Designated and Non-designated suppliers
- Minimum order and limitations
- Internal manufacturing
- Offshore and domestic sourcing options.

Module 13: International Trade and Shipping Processes:

- Global sourcing process
- Trade and Shipping terms
- Financial instruments used in sourcing
- Bank Guarantees: Letter of Credit and its types

Teaching Methodology (Proposed as applicable):

Lectures (audio/video aids), written assignments/quizzes, tutorials, case studies relevant to engineering disciplines, semester project, guest speaker, industrial/field visits, group discussion, report writing.

Assessment:

Mid-semester exam, report writing/presentation, assignment, project report, quizzes, end-semester exam

Suggested Books:

- Apparel Merchandising: The Line Starts Here by Jeremy A. Rosenau and David L. Wilson (2010)
- Fashion Merchandising by Virginia Grose (2011).
- Textiles and Fashion Materials, Design and Technology by Rose Sinclair (2014)
- Apparel Manufacturing Technology by T. Karthik, P. Ganesan & D. Gopalakrishnan (2016).
- Sourcing Practices in the Apparel Industry by Marlon Lezama, Brian Webber and Charles Dagher (2004).
- Rules for Sourcing and Manufacturing in China by Rosemary Coates (2013)

Engineering Depth Courses

Recent Trends in Textiles

Course Outline:

Module 1: Conventional Textile Products and Markets:

- Local and global production in garments, home textiles, denim products, towels and other conventional textile items. Exports of textile products from Pakistan. Global and local market trends.

Module 2: Non-conventional Textile Products and Markets:

- Local and global production of technical textile products, nonwovens, textile composites, high performance fibers and non-conventional textile items. Exports of textile products from Pakistan. Global and local market trends. Potential of Pakistan Textile Industry for producing non-conventional textiles

Module 3: Challenges faced by Textile Industry:

- Current challenges of cutting the cost of production, energy conservation, productivity, environmental protection. Challenges faced by the industry at global level.

Module 4: Innovations in Textile Industry:

- Innovations in the fields of conventional textiles i.e. denim, towel, home textiles and garment industry. Innovations in the field of non-conventional textiles i.e. technical textiles, nonwovens, composites and raw materials

Module 5: Nano Technology:

- History of nano materials, classification of nano materials, synthesis &characterization of nano materials, applications of nano materials

Module 6: Plasma Technology:

- Introduction, chemistry of plasma processing, biomedical applications

Teaching Methodology (Proposed as applicable):

Lectures (audio/video aids), written assignments/quizzes, tutorials, case studies relevant to engineering disciplines, semester project, guest speaker, industrial/field visits, group discussion, report writing.

Assessment:

Mid-semester exam, report writing/presentation, assignment, project report, quizzes, end-semester exam

Suggested Books:

- Roshan Paul, High Performance Technical Textiles, 2019.
- K.L. Mithel, Textile Finishing Recent Development and Future Trends, 2017.
- V. S. Gajveile, Recent Trends in Sustainability and Management Strategy, 2017.
- Recent research papers and material published in the above fields

Denim Manufacturing and Processing

Course Outline:

- Cotton yarn manufacturing for denim, Indigo dye and reduction techniques,
- Indigo dyeing technology for denim yarns, dyeing of denim yarns with non-indigo dyes,
- Weaving technologies for denim manufacturing, finishing of denim fabric, stitching of denim fabric.
- Washing techniques for denim jeans, dyeing technologies for denim garments,
- Bio washing of denim jeans, reduction of water in washing of denim garments,
- Finishing of jeans and quality control, role of denim and jeans in the fashion industry,
- Novel varieties of denim fabrics, recovery and recycling of denim waste,
- Effluent treatment in denim and jeans manufacturing, environmental impacts of denim manufacturing.

Teaching Methodology (Proposed as applicable):

Lectures (audio/video aids), written assignments/quizzes, tutorials, case studies relevant to engineering disciplines, semester project, guest speaker, industrial/field visits, group discussion, report writing.

Assessment:

Mid-semester exam, report writing/presentation, assignment, project report, quizzes, end-semester exam

Suggested Books:

- R. Paul, Denim: manufacture, finishing and applications, 2015
- S.S. Muthu, Sustainability in Denim, 2017
- Piero Turk, A Life With Denim Vol.2, 2017

Multi-disciplinary Engineering Courses

Mechanical Engineering Fundamentals

Course Outline:

Module 1: Introduction

- Basics of mechanical engineering
- Mechanical engineering codes and standards

Module 2: Engineering Materials

- Ferrous and non-ferrous metals their properties and uses
- Alloy metals their properties and uses

Module 3: Simple Machine Component

- Design of shafts
- Torsion of circular shafts
- Horse power transmitted by shafts
- Flange, coupling, bearings, connecting rods
- Belts, chains, gears, pulleys, sprocket devices flexible shafts

Module 4: Workshop Practice

- Hand tools, their types and uses
- Mechanical workshop safety rules and practices
- Introduction to lath, principal parts of lath i.e. bed, head stock, tail stock, carriage or saddle, compound rest, tool post, lead screw, centres, work holding devices.
- Lath operations i.e. turning, boring, facing, tapering, taper turning, drilling, knurling, chamfering, threading.
- Introduction to shaper and its operations
- Introduction to milling and its operations
- Pattern making, sand molding and casting
- Fitting
- Welding
- Forging

Teaching Methodology (Proposed as applicable):

Lectures (audio/video aids), written assignments/quizzes, tutorials, case studies relevant to engineering disciplines, semester project, guest speaker, industrial/field visits, group discussion, report writing.

Assessment:

Mid-semester exam, report writing/presentation, assignment, project report, quizzes, end-semester exam

Suggested Books:

- K. C. John, Mechanical Workshop Practice, PHI Learning Pvt. Ltd, 2010
- P. K. Nag, K. Tripathi, and C. B. Pawar, Mechanical Engineering, McGraw-Hill Education, 2011
- R. G. Budynas and J. E. Shigley. Shigley's Mechanical Engineering Design, 8th Ed. McGraw-Hill Education. 2008

Electrical & Electronics Engineering Fundamentals

Course Outline:

Module 1: Electrical Engineering

- Fundamentals of AC, production of AC, measurement of ram's values, phase difference, vector diagram, wave diagrams circuit containing resistance and inductance, triangle power in an AC circuit containing resistance and inductance
- Layout of power generation and distribution, concepts of current, voltage, energy, and power.
- Types of sources (dependent & independent), passive sign convention, charge and current waveforms, energy and power waveforms, graphical questions related to differentiation and integration of electrical quantities.
- Ohm's Law, concept of conductance, power dissipation, concepts of node, loop and branch.
- Behavior of circuit containing capacitor only, power and power factor of circuit containing capacitor only circuit containing resistance, inductance and capacitance in series, impedances in series and their related problems.

- Series or voltage resonance, parallel circuits, current resonance and their related problems
- Interconnection of phases, symmetrical system, balanced system, and two phase three wire system. Three phase system, star connection. Three phase four-wire system mesh connection, power in balanced three-phase system, measurement of power in three-phase system
- Loop analysis of DC circuits (Independent sources, application to single and multiple source circuits, super-mesh technique)
- Back EMF, torque, armature torque, shaft torque, losses and efficiency, power stages, series motors, shunt motors, and compound motors
- Speed control of series motors, speed control of shunt motors

Module 2: Electronic Engineering

- Semiconductor, types of materials
- Diodes, rectifiers, types of filters
- Bipolar junction transistor
- Diode limiting and clamping circuits
- Transistors as an amplifier
- Field effect transistors
- Metal oxide semiconductor FET, Depletion MOSFET, enhancement MOSFET, Characteristics and parameters, MOSFET biasing, system application

Teaching Methodology (Proposed as applicable):

Lectures (audio/video aids), written assignments/quizzes, tutorials, case studies relevant to engineering disciplines, semester project, guest speaker, industrial/field visits, group discussion, report writing.

Assessment:

Mid-semester exam, report writing/presentation, assignment, project report, quizzes, end-semester exam

Suggested Books:

- Valery Vodovozov, Introduction to Electronic Engineering, 2010
- Alexander Sadiku, Admirality Sharma, Fundamentals of Electrical Circuits, 2007

- J. David Irwin, R. Mark Nelms, Basic Engineering Circuits Analysis, 8th edition, 2004
- T. F. Bogart, Electronic Devices and Circuits, 6th edition
- S.K. Bhattacharya, Basic Electrical and Electronics Engineering, Pearson Education India, 2011.

Instrumentation and Control

Course Outline:

Module 1: Introduction

- Introduction to automation, types of automation, reasons for automation. Production operation and automation strategies.

Module 2: Measurement Devices and Gauges Used in Textile Mills

- Fundamental principles of instrumentation system, instrument performance errors, measurement classification and methods, strain measurement, linear and angular displacement measurement, force, pressure, fluid flow, time, frequency and speed measurement, vibration measurement and temperature measurement, signal processing, displays and recording instruments.

Module 3: Sensors/Transducers used in Textile Machines

- General principles of sensors/transducers, active and passive transducers, resistive, capacitive, inductive, thermo-electric, piezoelectric, optical, elastic, pneumatic, differential pressure and rotating discs sensors/transducers.

Module 4: Control System

- General introduction, open-loop and close-loop systems, basic elements of a close loop system, close and open loop transfer function, feedback, effect of disturbance, dynamic characteristics. Transfer function and transfer operator, derivation of control, analysis of multi loop-system.

Module 5: Actuating and Controlling System

- Introduction, single conversion, electric, pneumatic, hydraulic and thermal actuators control elements. Two step control, proportional, integral and

differential controls. Linear feedback control systems, optimal control system, and computer assisted optimal control.

Module 6: Electronics Platform

- Arduino applications with digital and analogue input sensors and actuators
- Arduino programming with MATLAB and other software.

Teaching Methodology (Proposed as applicable):

Lectures (audio/video aids), written assignments/quizzes, tutorials, case studies relevant to engineering disciplines, semester project, guest speaker, industrial/field visits, group discussion, report writing.

Assessment:

Mid-semester exam, report writing/presentation, assignment, project report, quizzes, end-semester exam

Suggested Books:

- William Dunn, Fundamentals of industrial instrumentation and process control, 2018.
- Chowdhary, Textile Testing and Instruments Hardcover, 2012.
- Clarence, Vibration Monitoring, Testing, and Instrumentation, 2007.

Thermodynamics and Fluid Mechanics

Course Outline:

Module 1: Ideal Gas:

- Thermodynamic processes; Gas laws; Specific heats of an ideal gas; Dalton's Law of Partial Pressure; Third Law of Thermodynamics; Entropy of an ideal gas

Module 2: Energy and its Conservation:

- Relation of mass and energy; Different forms of energy; Different types of Open and Closed systems; Energy equation, devices and systems for steady flow; Perpetual motion of the first kind and second kind; Thermodynamics equilibrium; Reversibility; specific heats and their relationship; entropy;

First Law of Thermodynamics; Second Law of Thermodynamics; Property relation from energy equation; Frictional energy; Calusius's inequality; Availability and irreversibility

Module 3: Thermodynamic Cycles:

- Cycle work; Thermal efficiency and heat rate; Carnot cycle; Sterling cycle; Reversed and reversible cycles; most efficient engine; gas and steam power cycles

Module 4: Fluid Properties:

- Pressure, Vapour pressure, Density, Specific weight, Specific gravity, Viscosity, Bulk modulus of elasticity, Surface tension, capillary action, Ideal, Newtonian and non-Newtonian fluids, Relevance of fluid properties to textiles and textile processes

Module 5: Fluid Statics:

- Pressure variation in a static fluid; Pascal's law; hydrostatic force on a plane surface, Pressure prism method; hydrostatic force on a curved submerged surface; buoyant force, Archimedes' principle; the stability of floating and submerged objects,

Module 6: Fluid Dynamics:

- Flow characteristics; Equation of continuity; Application of Newton's second law to fluid flows; development, uses, and limitations of the Bernoulli equation; static, dynamic and stagnation pressures; Laminar and turbulent pipe flow; losses in pipe flows; velocity and flow rate measurement devices; pipe flow; pumps and turbines

Module 7: Fluid Flow Applications in Textile Processing:

- Air jet spinning, Nozzle design and performance in air jet spinning, Spun bonding process of non-woven, Textile wet processing, Air-jet and water jet weft insertion mechanisms

Teaching Methodology (Proposed as applicable):

Lectures (audio/video aids), written assignments/quizzes, tutorials, case studies relevant to engineering disciplines, semester project, guest speaker, industrial/field visits, group discussion, report writing.

Assessment:

Mid-semester exam, report writing/presentation, assignment, project report, quizzes, end-semester exam

Suggested Books:

- J.B. Franzini and E.J. Finnemore, Fluid Mechanics with Engineering Application. McGraw Hill Education. 2003.
- Y. A. Cengel and M. A. Boles. Thermodynamics: An engineering Approach. McGraw-Hill Education. 2014.
- T. D. Eastop, and A. McConkey, Applied Thermodynamics for Engineering and Technologists. 5th Ed. Pearson Education ltd. 2009.
- B. R. Munson, A. P. Rothmayer and T. H. Okiishi. Fundamentals of Fluid Mechanics, 7th Non-Engineering Domain

Occupational Health and Safety

Course Description:

This course introduces the student to the study of workplace occupational health and safety. The student will learn safe work practices in offices, industry and construction as well as how to identify and prevent or correct problems associated with occupational safety and health in these locations as well as in the home.

Learning Outcomes:

Upon successful completion of this course, the student will be able to:

i. Identify hazards in the home, laboratory and workplace that pose a danger or threat to their safety or health, or that of others.
ii. Control unsafe or unhealthy hazards and propose methods to eliminate the hazard.
iii. Present a coherent analysis of a potential safety or health hazard both verbally and in writing, citing the Ontario Occupational Health and Safety Regulations as well as supported legislation.
iv. Demonstrate a comprehension of the changes created by WHMIS and OSHA legislation in everyday life.

Course Outline:

Health and Safety Foundations

- Nature and scope of health and safety
- Reasons/benefits and barriers for good practices of health and safety
- Legal frame work and OHS Management System

Fostering a Safety Culture

- Four principles of safety- RAMP (Recognize, Assess, Minimize, Prepare)
- Re-thinking safety-learning from incidents
- Safety ethics and rules
- Roles and responsibilities towards safety
- Building positive attitude towards safety
- Safety cultures in academic institutions

Recognizing and Communicating Hazards

- Hazards and Risk
- Types of hazards: Physical (mechanical and non-mechanical), Chemical (Toxic and biological agents), electrical, fire, construction, heat and temperature, noise and vibration, falling and lifting etc.
- Learning the language of safety: Signs, symbols and labels

Finding Hazard Information

- Material safety data sheets
- Safety data sheets and the GHS (Globally Harmonized Systems)

Accidents & Their Effect on Industry

- Costs of accidents
- Time lost
- Work injuries, parts of the body injured on the job
- Chemical burn injuries
- Construction injuries
- Fire injuries

Assessing and Minimizing the Risks from Hazards

- Risk Concept and Terminology
- Risk assessment procedure
- Risk Metric's
- Risk Estimation and Acceptability Criteria
- Principles of risk prevention
- Selection and implementation of appropriate Risk controls
- Hierarchy of controls

Preparing for Emergency Response Procedures

- Fire
- Chemical Spill
- First Aid
- Safety Drills / Trainings:
- Firefighting
- Evacuation in case of emergency

Stress and Safety at Work Environment

- Workplace stress and sources
- Human reaction to workplace stress
- Measurement of workplace stress
- Shift work, stress and safety
- Improving safety by reducing stress
- Stress in safety managers
- Stress and workers compensation

Incident Investigation

- Importance of investigation
- Recording and reporting
- Techniques of investigation
- Monitoring
- Review
- Auditing Health and Safety

Teaching Methodology (Proposed as applicable):

Lectures (audio/video aids), written assignments/quizzes, tutorials, case studies relevant to engineering disciplines, semester project, guest speaker, industrial/field visits, group discussion, report writing

Assessment:

Mid-semester exam, report writing/presentation, assignment, project report, quizzes, end-semester exam

Suggested Books:

- The A-Z of health and safety by Jeremy Stranks, 2006.
- The Manager's Guide to Health & Safety at Work by Jeremy Stranks, 8th edition, 2006.
- Occupational safety and health law handbook by Ogletree, Deakins, Nash, Smoak and Stewarts, second edition, 2008.

12.2 Non-Engineering Domain

English Courses

Functional English

Area Scope:

The knowledge units in this area collectively encompass the following:

- Follow English vocabulary and skills to use it in professional life.
- Identify common errors usually made by the Learners of English as second language
- Practice English correctly in speaking and writing

Course Outlines:

- Public Speaking
- The Art of Creating a Power Point Presentation.
- Interacting with the Opposite Gender
- Classroom Etiquettes and Teachers' Expectations
- Articles
- Prepositions
- Homophones
- Punctuation
- Tenses in English Grammar
- Formal Letter Writing
- Summary writing
- Organizing and planning your writing
- Sensory Perception in writing
- Critical thinking
- Final Term Project

Teaching Methodology (Proposed as applicable):

Lectures (audio/video aids), written assignments/quizzes, tutorials, case studies relevant to engineering disciplines, semester project, guest speaker, industrial/field visits, group discussion, report writing

Assessment:

Mid-semester exam, report writing/presentation, assignments, project report, quizzes, end-semester exam

Suggested Books:

- P. C. Wren & H. Martin "High School English Grammar & Composition".
- Colin W. Davis & Andrew J. Watts New Expressway for English 1 (New Edition)
- Herta A. Murphy & Herbert William Hildebrandt. Effective Business Communications
- Diana Hacker. A Writer's Reference
- Sadat Ali Shah. Exploring the World of English
- A. J. Thomson and A. V. Martinet. Practical English Grammar, University Physics, 13th Edition

Communication Skills

Area Scope:

The knowledge units in this area collectively encompass the following:

- Communicate effectively using intermediate- to-advanced level English while developing the understanding of essentials of communication skills.
- Participate in group discussions by attentive listening, questioning to clarify ideas, eliciting responses, or disagreeing in a constructive way.

Course Outlines:

By the end of the semester students will have skills including:

Writing Skills

- Vocabulary Building
- Writing Skills: Essays and Letters
- Common Writing Errors
- Purposeful Writing

Reading Skills

- Skimming and Scanning
- Critical Reading
- Reading for Understanding
- Techniques and strategies to develop sound vocabulary.

Listening Skills

- Introduction to Communication Process
- Seven Cs of Communication
- Types of Listening
- Listening for Comprehension

Speaking Skills

- Verbal and Non-Verbal Communication
- Basics of Presentation Skills
- Presentation Strategies and public speaking skills.
- Use of Audio-Visual Aids
- Basics of Group Communication
- Listening Skills
- Communicate effectively in job interviews.

Teaching Methodology (Proposed as applicable):

Lectures (audio/video aids), written assignments/quizzes, tutorials, case studies relevant to engineering disciplines, semester project, guest speaker, industrial/field visits, group discussion, report writing

Assessment:

Mid-semester exam, report writing/presentation, assignments, project report, quizzes, end-semester exam

Suggested Books:

- Anchor in English-II (Lessons 1-5), A SPELT Publication
- Christopher Fry, “Summary Writing (Book-I)”, Oxford University Press
- College Essays by John Langland
- Barron’s TOFFL iBT Edition

- Communication Skills for Engineers by Sunita Marshal and C. Muralikrishna

Technical Writing and Presentation Skills

Area Scope:

The knowledge units in this area collectively encompass the following:

- The students will be able to write technically correct statements, assignments, final year project report, project proposal, short report and research paper
- The students would be able to their write CV, cover letter and business/ professional Correspondence meeting all criteria
- The students would be able to present their work/ research at a technical forum.

Course Outlines:

- Introduction to Technical writing
- Proposal write-up and improvement strategies Introduction to research and research types choosing research problems and research advisors How to carry out research
- 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

Teaching Methodology (Proposed as applicable):

Lectures (audio/video aids), written assignments/quizzes, tutorials, case studies relevant to engineering disciplines, semester project, guest speaker, industrial/field visits, group discussion, report writing

Assessment:

Mid-semester exam, report writing/presentation, assignments, project report, quizzes, end-semester exam

Suggested Books:

- Writing for computer science by Justin Zobel Research Methodologies – A step by step guide for beginners, Ranjit Kumar.

Mathematics Courses

Linear Algebra

Area Scope:

The knowledge units in this area collectively encompass the following:

- To comprehend basic concepts of Linear Algebra and optimization
- To apply techniques of Linear Algebra and optimization for solution of engineering problems

Course Outline:

System of Linear Equations and Applications

- Overview of linear system of equations, Cases of unique solution, No solution and infinite solutions,
- Echelon form, Gauss elimination method, Inversion of matrix in the context of solution of system of equations, LU factorization, Row space and column space
- Relevant engineering case studies such as Network analysis, Traffic Flows, balancing chemical reaction, Leontief Input-output model, Finding max stress in compound cylinder, Applications of linear systems in force balancing of structures, Markov process

Vector Spaces and Transformations

- Vector Spaces: Real vector spaces, Subspaces, Basis and dimension, Rank, Nullity
- Gram-Schmidt process for finding orthonormal basis

- Linear Transformation, Kernel of Transformation, Range of Transformation, Matrix of Transformation,
- Applications: Cryptography, Coding and decoding, Breaking of codes, Robotic Applications of linear transformations

Eigenvalues and Eigen Vectors

- Eigenvalues, Eigenvectors, Similar matrices, Diagonalization,
- Quadratic forms, Positive definite Matrices, Singular Value Decomposition, Inner product Spaces
- Applications of linear Algebra: Constructing curves and surfaces, Computer graphics, Genetics

Linear Programming

- Solution Introduction to linear programming, Optimization, Graphical method, Simplex method, Optimization problems in engineering and economics
- Dual simplex methods, Duality theory, Primal and dual problems, transportation models, north-west corner, least-cost and Vogel's approximations methods,
- Assignment model, the transshipment model and other relevant engineering case studies

Application of Linear Algebra in Dynamical Systems

- Numerical System of linear ODEs, Eigenvalue problems, Homogeneous and nonhomogeneous system of ODE.
- Dynamical systems, Population dynamics, Prey-Predator models, Stability analysis

Teaching Methodology (Proposed as applicable):

Lectures (audio/video aids), written assignments/quizzes, tutorials, case studies relevant to engineering disciplines, semester project, guest speaker, industrial/field visits, group discussion, report writing

Assessment:

Mid-semester exam, report writing/presentation, assignments, project report, quizzes, end-semester exam

Suggested Book:

- Introductory Linear Algebra: By Bernard Kolman and David R. Hill, Latest Edition.
- Elementary Linear Algebra: By Howard Anton and Chris Rorrers, Latest Edition.

Calculus and Analytical Geometry

Area Scope:

- To develop a clear understanding of fundamental concepts of single variable calculus
- To apply concepts of differentiation and integration to solve complex engineering problems

Course Outline:

Analytical Geometry:

- Review of vectors, scalars and vector products.
- Three-dimensional coordinate system and equation of straight line and plane

Functions Limit and Continuity:

- Review of functions and graphs,
- Limits & Continuity,
- Techniques of Finding Limits,
- Discontinuity,
- Limits of Sine and Cosine and Exponential Functions

Differentiation:

- Introduction to Derivatives
- Examples of Derivatives
- Derivative as Rate of Change
- Derivative's Rules
- Implicit Differentiation
- Higher order derivatives
- Leibnitz Theorem

Applications of Derivatives:

- Applications of Derivatives
- Monotonic functions
- Optimization problems
- Relative and Absolute extrema
- First and second derivative tests
- Point of inflection
- Concavity
- Curvature
- Indeterminate Forms and L' Hospital rule
- Differentials

Integration:

- Integrals and Properties of Integrals
- Techniques of Integration
- Integration by Parts
- Definite Integrals
- Integration of Trigonometric
- Exponential and Inverse Functions
- Integration by Partial Fractions
- Reduction Rules

Applications of Integration:

- Applications of Integration
- Area under the curve
- Area between curves
- Solids of Revolution
- Volume of Solids of revolution by disk
- washer, Cylindrical shell & Cross Section Methods
- Center of Pressure and Depth of Center of Pressure
- Center of mass
- Arc length

Improper Integrals:

- Improper Integrall
- Integrals and Singularities
- Convergence of improper integrals

Infinite Sequence and Series:

- Sequence and Infinite Series
- Convergence and Divergence of sequences and series
- Positive Term Series
- Integral Test
- Basic Comparison Test
- Limit Comparison Test
- Ratio and Root tests
- Alternating series
- Absolute and Conditional Convergence

Power and Taylor Series:

- Power series
- Maclaurin and Taylor Series and its Applications

Teaching Methodology (Proposed as applicable):

Lectures (audio/video aids), written assignments/quizzes, tutorials, case studies relevant to engineering disciplines, semester project, guest speaker, industrial/field visits, group discussion, report writing

Assessment:

Mid-semester exam, report writing/presentation, assignments, project report, quizzes, end-semester exam

Suggested Books:

- Thomas' Calculus by George B. Thomas, Jr., Maurice D. Weir, Joel R. Hass, Pearson, USA.
- Swokowski, Onlinick & Pence: Calculus
- Robert T. Smith & Roland B. Minton: Calculus
- Calculus: Early Transcendentals by James Stewart. Brooks/Cole USA.

Differential Equations

Area Scope:

The knowledge units in this area collectively encompass the following:

- To define basic mathematical concepts related to differential equations
- To describe different types of analytical methods for solution of differential equations
- To formulate different engineering problems in the form of differential equations

Course Outline:

Basic Concepts and Modeling

- Linear Differential equations, Non-Linear, Differential equations, Solutions of differential equations, General solutions, Particular solutions, Initial and boundary value problems, Degree and order of ODEs
- Formulation of first-order ODEs: Case studies related to finding age of fossils, mixing problems and free fall motion, finding temperature of a building, RL, RC circuits, Airplane take-off problem, Population dynamics and logistic equations etc.

Analytical Methods of Solution for First-order ODEs

- Variable separable method, Reduction to variable separable form, Homogeneous equations, Differential equations reducible to homogeneous form, Solution of the related ODE models by these methods
- Exact equations, Integrating factors, Linear equations and related examples, Bernoulli's equations, Orthogonal trajectories and solution of the related ODE models by these methods

Mathematical Models Based on Second-order ODEs

- Formulation of a single RLC circuit, Spring mass systems, Earthquake model of a single-story building
- Bungee Jumper model, Bridge collapse problem etc.

Analytical Methods of Solution for Second-order ODEs

- Homogeneous linear ODEs, Method of reduction order, Wronskain determinant to check independence of the solution, and related examples

- Cauchy-Euler equations and related examples, Non-homogeneous linear ODEs, Method of undetermined coefficients
- Method of variation of parameters and related example
- Analytical solution of the related ODE models by these methods

Series Solution for Second-order ODEs

- Series solution of ODEs and convergence tests
- Series solution of Legendre equation, Frobenious method of solution for Bessel equation and related applications

Laplace Transform

- Laplace Transform, Derivation of Basic formulae, Inverse Laplace Transform, First shift theorem
- Laplace transform of integrals and derivative, Solution of second order ODEs by Laplace Transform, Unit step function and its Laplace transform, Second shift theorem, Convolution
- Application of Laplace transform to a system of ODEs and related applications

Partial Differential Equations

- Partial Differential Equations and their types, Applications of partial differential equations in Engineering
- Method of Separation of Variables Method (MSVM) and solution of wave equation by the MSVM
- Method of Separation of Variables Method (MSVM) and solution of heat equation by the MSVM

Teaching Methodology (Proposed as applicable):

Lectures (audio/video aids), written assignments/quizzes, tutorials, case studies relevant to engineering disciplines, semester project, guest speaker, industrial/field visits, group discussion, report writing

Assessment:

Mid-semester exam, report writing/presentation, assignments, project report, quizzes, end-semester exam

Suggested Books:

- Advanced Engineering Mathematics by Erwin Kreyzig, John Wiley & Sons Inc. Latest Edition.
- Differential Equation with Boundary Value problems by D. G. Zill, M. R Cullen Latest Edition, Brooks/Cole Publishers.
- A First Course on Differential Equations with Modelling Applications by D. G. Zill, Latest Edition, Brooks/Cole Publishers.
- An Introduction to Mathematical Modelling by Bender, E.A., Latest Edition, Wiley, New York.

Numerical Analysis

Area Scope:

The knowledge units in this area collectively encompass the following:

- To comprehend different numerical techniques such as: error propagation, interpolation, differentiation, integration, eigenvalues and solution of algebraic and differential equations
- To apply the numerical techniques to different linear and nonlinear engineering problems

Course Outline

Error Analysis and Interpolation

- Error analysis, Types of error, Sources of error, Norms of vectors and matrices, Computer arithmetic, Condition number of a matrix, Significant digits and loss of significant digits, Floating point arithmetic, Binary and decimal representation, Single and double precision
- Interpolation: Newton forward and backward difference formula for interpolation, Central difference interpolation formulae, Lagrange's interpolation, Error in interpolation, Linear least square approximation, Interpolation versus least square approximation, Relevant engineering case studies

Numerical Differentiation and Integration

- Derivation of numerical differentiation of first order and second order derivatives using two points, three points, and five point's formulas along with its application in engineering, Relevant case studies
- Numerical integration: Trapezoidal rule, Simpson's rules, Composite Trapezoidal Simpson Rules and Romberg integration, Applications of numerical in engineering, Relevant case studies

Methods of Solution a System of Linear Equations

- Solution of system of linear algebraic equations, Gauss elimination method
- LU factorization, Tridiagonal solver
- Applications of these methods in engineering disciplines, Relevant case studies

Iterative Methods for Linear and Nonlinear Equations

- Numerical Solution of nonlinear equations: Bisection method, Newton's method, Secant method, Convergence analysis of these methods
- Newton's method for system of nonlinear equations
- Solution of system of linear equations by Jacobi, Gauss Seidel and SOR methods, Applications of these methods in engineering disciplines, Relevant case studies

Numerical Methods for IVPs and BVPs

- Euler's method and its variations, Taylor's higher order methods, Error analysis, Consistency, stability and convergence
- Runge-Kutta methods of order 2, 3, and 4, Stiff ODEs, Consistency, stability and convergence
- Linear multistep methods, Numerical solution of system of ODEs
- Numerical solution of BVPs by Finite Difference Method
- Applications in engineering: Some relevant case studies

Numerical Methods for Computing Eigenvalues

- Eigenvalues and Eigenvectors of matrix: power method,
- Inverse power method, Shifted inverse power method.
- Applications of eigenvalues in engineering disciplines.

Numerical Optimization

- Unconstrained Optimization,
- Golden search ratio, Lagrange Multipliers,
- Method of steepest descent
- Applications of optimization in engineering disciplines

Teaching Methodology (Proposed as applicable):

Lectures (audio/video aids), written assignments/quizzes, tutorials, case studies relevant to engineering disciplines, semester project, guest speaker, industrial/field visits, group discussion, report writing

Assessment:

Mid-semester exam, report writing/presentation, assignments, project report, quizzes, end-semester exam

Suggested Books:

- Numerical Analysis: By Richard L. Burden, J. Douglas Faires, Latest Edition
- Numerical methods for scientist and engineers by R.W. Hamming (Latest Edition)
- Numerical methods for Engineers by Steven C. Chapra and R. P. Canale (Latest Edition.

Probability & Statistics

Area Scope:

The knowledge units in this area collectively encompass the following:

- To understand the basic concept of Statistics and Probability and their need in engineering.
- To Describe properties and classifications of probability density functions, regression analysis and interval estimation
- To Apply different probability and statistics techniques in engineering problems

Course Outline

Basic Statistics

- Statistics, Branches of Statistics, Importance of statistics, population, sample, observation, variables, measurement of variable, Data, primary data, secondary data

Data Presentation

- Frequency distribution (grouped, ungrouped), stem and leaf display, histogram, frequency polygon, cumulative frequency polygon, Simple & Multiple Bar diagrams

Measure of Central Tendency

- Arithmetic Mean (A.M), Geometric Mean (G.M), Harmonic Mean (H.M), Quantiles (Median, Quartiles, Deciles, Percentiles), Mode, Applications of Averages

Measure of Dispersion

- Background, Range, Quartile deviation, Mean deviation, Variance, Standard deviation, Coefficient of variation, Moments, Moments ratios, Skewness, Kurtosis
- Applications in different Engineering Disciplines

Simple Regression, Correlation and Curve Fitting

- Introduction to regression theory, Simple linear regression line, Line fitting by least square methods, Coefficient of determination,
- Simple correlation, coefficient of correlation, fitting of a first and second degree curve, fitting of exponential and logarithmic Curves, related problems.
- Principle of least squares.

Probability and Random Variables

- Probability review, Laws of probability, Conditional probability, Bayesian theorem, independent, dependent events.
- Random variables, Discrete and Continuous random variables, Probability mass and density functions, Distribution functions, Mathematical expectation,

- Variance of random variable, Bivariate distribution, Joint probability distribution, Moment generating function

Probability Distributions

- Discrete distributions:
- Bernoulli distribution, Binomial, Geometric, Negative binomial, Hyper-geometric, Poisson distribution, Properties and application of these distributions.
- Continuous Distributions: Uniform Distribution, Exponential distribution, Normal distribution, Applications

Sampling and Sampling Distributions

- Introduction, Population, Parameter & Statistic, Objects of sampling, Sampling distribution of Mean, Standard errors, Sampling & Non-Sampling Errors,
- Random Sampling, Sampling with & without replacement, Sequential Sampling, Central limit theorem.
- Applications in relevant engineering discipline

Statistical Inference and Testing of Hypothesis

- Introduction to inferential statistics, Estimation, hypothesis testing of population means, proportion,
- Variance, Applications in Engineering

Teaching Methodology (Proposed as applicable):

Lectures (audio/video aids), written assignments/quizzes, tutorials, case studies relevant to engineering disciplines, semester project, guest speaker, industrial/field visits, group discussion, report writing

Assessment:

Mid-semester exam, report writing/presentation, assignments, project report, quizzes, end-semester exam

Suggested Books:

- Introduction to Statistical theory part 1, by Sher Muhammad Chuadary (Latest Edition)

- Advanced Engineering Mathematics, by Erwin Kreyszig (Latest Edition)
- Probability and Statistics for Engineers and Scientists, by Antony Hayter.
- Elementary Statistics, by Bluman.

Complex Variables & Transforms

Area Scope:

The knowledge units in this area collectively encompass the following:

- Explain the concept of complex number system, complex function, limit, continuity, differentiability and integral of complex valued functions
- Utilize the theory of complex integration and power series (Taylor series. Laurent series) to solve problems from the area of residue calculus
- Apply various transforms to solve complex integration.

Course Outline

Introduction:

- Review of complex numbers, Complex valued functions, Elementary functions (exponential and logarithmic functions, Trigonometric and hyperbolic functions and theirs inverses),
- Limits and continuity,
- Applications in Engineering

Complex Differentiation and Integration:

- Derivatives of complex valued functions, Differentiability,
- Analyticity, Cauchy Riemann Equations, Harmonic Functions,
- Complex integrals, Cauchy-Goursat Theorem, Independence of Path, Cauchy's Integral Formulas and Their Consequences, Applications

Power Series:

- Taylor Series, Laurent Series, Singularities, Zeros and poles, Residue integration method, Residue theorem,
- Conformal mapping

Laplace Transformation:

- Linearity, Scaling, First shifting theorem, Heaviside's Shifting theorem,
- Inverse Laplace transformation, Properties of inverse Laplace,
- Convolution theorem, Applications in relevant engineering discipline

Special functions and Fourier Transforms:

- (Gamma, Beta functions, Periodic functions, Error function),
- Fourier Series, Fourier Sine and Cosine series,
- Fourier transform, Fourier cosine and sine transform, properties.
- Applications in relevant engineering discipline

Z-Transformation:

- Z-transform, Properties of Z-transform, linearity and scaling, Standard Z-transform, Inverse Z-transform,
- Inverse Z- transform by using residue, convolution theorem of Z-transform,
- Formation of difference equation and its solution using Z-transform.

Teaching Methodology (Proposed as applicable):

Lectures (audio/video aids), written assignments/quizzes, tutorials, case studies relevant to engineering disciplines, semester project, guest speaker, industrial/field visits, group discussion, report writing

Assessment:

Mid-semester exam, report writing/presentation, assignments, project report, quizzes, end-semester exam

Suggested Books:

- Advanced Engineering Mathematics, by Erwin Kreyszing, Latest Edition
- Complex Variables and Applications by Churchill, Latest Edition
- R. J. Beerends, Fourier and Laplace Transform, Cambridge University Press, Latest Edition.
- Jeffry A, Advanced Engineering Mathematics, Elsevier, Latest Edition

Multivariate Calculus

Area Scope:

The knowledge units in this area collectively encompass the following:

- To develop a clear understanding of fundamental concepts of multivariable variable calculus
- To describe of the concept of gradient, multiple integrals in rectangular, polar, cylindrical and spherical coordinates, directional derivatives, and optimization problems
- To apply the concepts line integrals, surface integrals, volume integrals, Green's, Stokes', Gauss theorems to different engineering problems

Course Outline:

Geometry of Space:

- Analytical Space Geometry, Cylindrical and Spherical coordinates, Lines in space, Intersection of Line and a Plane

Vector-Valued Functions and Motion in Space:

- Functions of several variables, their limits and continuity, Quadratic Surfaces, Parametric representation of curves, Velocity and Acceleration, Arc length, Tangent, Normal, Bi-normal, Curvature & Torsion

Partial Differentiation:

- Partial derivatives, Total Differentials, Chain Rule with More Variables, Directional derivatives

Applications of Partial Derivatives:

- Optimization Problems, Extrema of functions of several variables, Conditional extrema, Lagrange Multipliers and Example

Multiple Integrals

- Double Integration, Order of Integration, Double Integrals in Polar Coordinates, Applications: Mass and Average Value, Moment of Inertia, Triple Integrals, Rectangular and Cylindrical Coordinates, Applications and Examples, Triple Integrals in Spherical Coordinates

Vectors in 3 Space:

- Introduction to vectors, Scalar and vector product, Volume of parallelepiped and tetrahedron, Gradient of a Scalar Field, Divergence of a Vector Field, Curl of a Vector Field

Integration in Vector Fields:

- Line Integral, Integration around Closed Curves. Work Done, Potential and Related Examples, Conservative and non-Conservative Fields, Green's Theorem, Divergence Theorem, Stoke's Theorem, Applications of Double and Triple integrals

Teaching Methodology (Proposed as applicable):

Lectures (audio/video aids), written assignments/quizzes, tutorials, case studies relevant to engineering disciplines, semester project, guest speaker, industrial/field visits, group discussion, report writing

Assessment:

Mid-semester exam, report writing/presentation, assignments, project report, quizzes, end-semester exam

Suggested Books:

- Thomas' Calculus by George B. Thomas, Jr., Maurice D. Weir, Joel R. Hass. Pearson, USA.
- George B. Thomas, Jr. and Ross L. Finney, Calculus and Analytic Geometry
- Swokowski, Onlinick & Pence: Calculus
- Robert T. Smith & Roland B. Minton: Calculus
- Calculus: Early Transcendental by James Stewart, Brooks/Cole USA.

Applied Physics

Course Outline:

Vectors:

Review of vectors, Ordinary Differentiation of Vector, Gradient of Scalar field, Divergence and Curl of Vector Field, Line, surface and volume integrals with their applications.

Electricity & Magnetism:

Electric field due to Discrete and Continuous Charge Distributions, Electrostatic Potential of discrete and Continuous charges, Gauss's Law and its Applications, Lorentz Force and Hall Effect, Ampere's Law, Maxwell's Equations, Magnetic Field due to current element (Circular Current Loop and Solenoid), Faraday's Law.

Waves & Oscillations:

Types of Waves and Superposition Principle, Wave Speed on a stretched string, Wave equation, Energy & Power of a Wave, Principle of Superposition and Standing Waves. Simple Harmonic oscillations. Forced & damped oscillations.

Optics and Lasers:

Huygens Principle, Two-slit interference, Single-Slit Diffraction, resolving power of Optical Instruments, Lasers and laser light, Working principle of lasers

Atomic and Nuclear Physics:

Atomic Nucleus and Properties of Nucleus, Radioactive Decay and Radioactive Dating. Nuclear Reactions, Nuclear Reactor, Thermonuclear Process, Controlled Thermonuclear Fusion, Radioactive Decay and Radioactive Dating, Radiation Detection Instruments,.

Thermodynamics:

Laws of thermodynamics and Heat Transfer Mechanisms, Heat and Work, Kinetic Theory of gases, Ideal gases, Mean Free path, distribution of molecular speeds, Change in Entropy and Irreversible processes.

Teaching Methodology (Proposed as applicable):

Lectures (audio/video aids), written assignments/quizzes, tutorials, case studies relevant to engineering disciplines, semester project, guest speaker, industrial/field visits, group discussion, report writing

Assessment:

Mid-semester exam, report writing/presentation, assignments, project report, quizzes, end-semester exam

Suggested Books:

- Halliday, Resnick and Walker, "Fundamentals of Physics" 10th Edition Extended
- Hugh D. Young and R.A. Freedman, University Physics. 12th Edition
- Raymond A Serway and John W. Jawett, Jr. Physics for Scientists and Engineers with modern Physics, 09th Edition.

Applied Chemistry

Area Scope:

The knowledge units in this area collectively encompass the following:

- To know Reaction mechanism and industrial applications of organic compounds and their reactions
- To understand chemical process industry, Industrial Chemical Analysis and primary raw materials used in various industries
- To infer the knowledge of synthesis and basic reactions of polymers
- To learn Synthesis characterization and applications of Paints, pigments, dyes and coating

Course Outline:

- Industrial Aspects of Inorganic Chemistry, study of selected inorganic industries, Sulfur industry, Industry dealing with nitrogen, phosphorus, chloralkaline and titanium oxide.
- Reaction mechanism and industrial applications of organic reactions such as sulfonation, Nitration, Hydrogenation, Amination, Halogenation, oxidation, polymerization.
- An overview of chemical process industry and primary raw material, Industrial Pollution Prevention, Industrial Chemical Analysis, Chemical Explosives and propellants, Synthetic polymers, Polymeric materials, Corrosion, chemical analyses of materials, Improved Paints pigments and industrial coatings, Dye: Chemistry and Applications, Chemical manufacturing processes and production methods

Teaching Methodology (Proposed as applicable):

Lectures (audio/video aids), written assignments/quizzes, tutorials, case studies relevant to engineering disciplines, semester project, guest speaker, industrial/field visits, group discussion, report writing

Assessment:

Mid-semester exam, report writing/presentation, assignments, project report, quizzes, end-semester exam

Suggested Books:

- Applied Chemistry and Chemical Engineering" A. K. Haghi, Devrim Balkose, Omari V.
- Mukbaniani, Andrew G. Mercader, Apple Academic Press, 2018
- Comprehensive Analytical Chemistry; Molecular Characterization and Analysis of
- Polymer, John M. Chalmers, Robert J. Meier, Elsevier (2008)
- Green Chemistry in industry by Mark Anthony Benvenuto, Heinz Plaumann, De Gruyter,
- Volume 3, 2018
- Polymers, Polymer Blends, Polymer Composites and Filled Polymers, G. E. Zaikov,
- Nova (2006)
- Biodegradable Polymer Blends and Composites from Renewable Resources, Long Yu, Wiley (2008)
- Sustainable Industrial Chemistry: Principles, Tools and Industrial Examples.
- Fabrizio cavani, Gabriele Centi, Siglinda Perathoner , Wiley Publishshers, 2009
- Pavia, Lampman, Introduction to Spectroscopy, 4th edition, Brooks/Cole, 2009
- H. Kuhn, Principles of Physical Chemistry, 2nd edition, Wiley, 2009
- G.D. Christian, Analytical Chemistry, 7th edition, 2014, Wiley
- D. W. H. Rankin, Norbert Mitzel, Carole Morrison, Structural Methods in Molecular Inorganic chemistry, Wiley, (2013)

- Gary Wulfsberg, Foundations of Inorganic Chemistry, University Science Books, 2017 David Klein, Organic Chemistry, Wiley, 2017

Social Sciences Courses

Sociology for Engineers

Area Scope:

This course is meant to provide engineering students, with an opportunity to view the discipline of sociology from the engineering perspective and will highlight its application to engineering profession. This will also enable the engineers to fit their technical ideas into a socially acceptable product /project in a more successful manner. The knowledge units in this area collectively encompass the following:

- To introduce to the methods and philosophy of the social science to help their understanding of the socio-cultural dimension of human existence as a fundamental reality in engineering projects etc.
- To provide opportunity for students to begin the process of considering social problems/ issues while designing engineering products.
- To allow engineers to play a pro-active role in critical discussions of social issues specifically.
- To demonstrate comprehension of roles and functions of various social institutions, state organizations, Professional bodies and relationships for analyzing their social impact Assessment.

Course Outline:

Fundamental Concepts and Importance of Sociology for Engineers

What is sociology? Nature, Scope, and Importance of Sociology, Sociological Perspectives and Theories, Social Interactions, Social Groups/ Social Institutions & heir interface with Engineering Project/services, Sociology & Impact of Technology & Engineering Products/Projects on Society.

Cultural Impacts of Engineering Projects on Society

Definition of Culture, Types of Culture & Elements of Culture, Culture & Power, Authority, Dominance Socialization and Personality, Role of Engineering Projects

on Culture, social norms and values of Society, Cultural Infusion of Engineers in Society

Theoretical Perspective of Sociology: Diffusion and Innovation; Adoption and Adaptation; Social development; Community Development

Community Development & Social consequences of Industrialization, Development Processes of Societal Development, Cooperation and Conflict in Community Development in Engineering Context.

Understanding of Societal & Ethical Norms and Values for Engineers

Engineering Ethics, Engineering product/services for less privileged, Role of Engg & Technology in addressing Social inequality, Core Social Values/Norms affecting Engg Performance

Organizational Social Responsibility (OSR) of Engineers

- Extenttowhichdevelopmentintendstosensitizesocietalandunder-privileged needs
- Gender inclusiveness and balance
- Special and Disadvantaged Community of the Area
- Planning for community inclusiveness
- Societal Obligation of Engineers

Engineers, Society and Sustainability

Social System and Concept of Sustainable Development Technology and Development, Population Dynamics in Pakistan, Causes and Consequences of Unplanned Urbanization, Community Development, Programs in Pakistan, Community Organization & Engineering Projects, Population, Technological & Industrial expansion and Development with focus on social/human/ethical dimensions.

Industrial & Organizational Psychology

Interpersonal Relations, Interpersonal Behavior, Formation of Personal Attitudes, Language and Communication, Motivations and Emotions, Impact of Technology on human feelings and level of Sensitivity

Climate Change and Ecological Friendliness from Engineering Perspective

Ecological Processes, Ecosystem and Energy, Impact of Engineering Projects on Eco System & Human Ecology, Industrial & Environmental impact on Population & General Masses, Technological Intervention, Ecosystem and Physical Environment, Social Impact of Technology & Engineering Products & Services (Solid Waste Disposal, Pollution control etc.)

Social Approaches and Methodologies for Development Administration & Stakeholders Analysis:

All Phases of the Project (pre, post and execution) Structured, Focused Group, Stakeholder Consultative Dialogues etc. Dynamics of Social Change, Sociology of Change and Industrial Development, Social Change due to Technology Driven Economic Growth.

SIA (Social Impact Assessment):

Base line and need-assessment, evaluation and impact assessment surveys of the development projects. Role of Engg & Technology for Creating Social Cohesiveness & Societal Integration. Technology Based change in Collective Behavior, Social Audit of Engineering Projects.

Engineering Intervention for Social Stratification:

Factors of Social Stratification, Engineering Interventions for addressing Social Stratification, Social Mobilization through Technological Innovation.

Case Studies of Different Development Projects in Social Context

Teaching Methodology (Proposed as applicable):

Lectures (audio/video aids), written assignments/quizzes, tutorials, case studies relevant to engineering disciplines, semester project, guest speaker, industrial/field visits, group discussion, report writing

Assessment:

Mid-semester exam, report writing/presentation, assignments, project report, quizzes, end-semester exam

Suggested Books:

- Godhade, J. B., and S.T. Hunderkari. 2018. Social Responsibility of Engineers. International Journal of Academic Research and Development. Vol. 03; Special Issue. March, 2018.
- Nichols, S.P. and Weldon, W.F. 2017. Professional Responsibility: The Role of Engineering in Society Center for Electro-mechanics, The University of Texas at Austin, USA.
- Aslaksen, E.W.2016. The Relationship between Engineers and Society: is it currently fulfilling its potential? Journal and Proceedings of the Royal Society of New South Wales, Vol.148. Nos.455-456. Gumbooya Pty Lte, Allambie Heights, Australia.
- Bell, S. Engineers, Society and Sustainability. Synthesis Lectures on Engineers, Technology, and Society. Edited by Caroline Baillie, University of Western Australia. Morgan and Claypool Publishers
- Jamison A., Christensen, S.H. and Lars, B. 2011.A Hybrid Imagination: Science and Technology in Cultural Perspective.
- Vermaas, P., Kroes, P., Poet, l., and Houkes, W. 2011. A Philosophy of Technology: From Technical Artefacts to Socio technical systems.
- Mitcham, C., and Munoz, D. 2010. Humanitarian Engineering. Morgan and Clay pool Publishers. Riley, D.2008. Engineering and Social Justice. Morgan and Claypool Publishers.
- Bugliarello, G.1991. The Social Functions of Engineering: A Current Assessment, a Chapter in "Engineering as a Social Enterprise.

Sociology

Area Scope:

The knowledge units in this area collectively encompass the following:

- To introduce the necessary subject knowledge and understanding required for the successful study of Sociology and related Social Science disciplines at undergraduate.
- To develop skills of application, analysis and evaluation in the context of the study of Social Science.

- To develop a knowledge and understanding of sociology both at a global and national level.
- To introduce the planning and organization skills necessary to develop as independent, autonomous learners.
- To develop the confidence and competence of the students as learners and to assist them in taking some responsibility for their own learning through directed study and reading.

Course Outline:

- Introduction: Sociological Perspective,
- The Development of Sociology,
- The Role of Values in Sociology, Prejudice In Early Sociology,
- Theoretical Perspective in Sociology. Culture: Components of Symbolic Culture, Subcultures and Counter Cultures, Cultural Universals, Animals and Culture,
- Technology and Global Village, Sociology and New Technology.
- Socialization: Social Development of Self, Mind, and Emotions,
- Socialization into Gender Social Structure and Interaction,
- Social Institutions. Research in Sociology: Research Model, Research Methods. Experiments, Ethics,
- Bureaucracy and Formal Organizations, Rationalization of Society, Formal Organizations and Bureaucracy,
- Voluntary Associations Social Classes, Economy, Politics, Power and Authority, Family, Medicine, Health and Illness, Population and Urbanization, Social Movements
- Social Psychology with special reference to attitudes, attributions and behavior, Emotions, Cognition and Thinking, Reasoning, Problem- Solving and Creativity, Personality, Intelligence, and Abnormal Behavior, etc.
- Introduction to the Field of Organizational Behaviour
- Conflict and Negotiation in the Workplace
- Leadership in Organizational Settings and Organizational Culture
- Ethics: In General an introduction and the development of ethical theory.
- Ethics in Islam, a comprehensive view with different ethics approaches and Ethics Theories
- Research Methods for Society and Sociology

Teaching Methodology (Proposed as applicable):

Lectures (audio/video aids), written assignments/quizzes, tutorials, case studies relevant to engineering disciplines, semester project, guest speaker, industrial/field visits, group discussion, report writing

Assessment:

Mid-semester exam, report writing/presentation, assignments, project report, quizzes, end-semester exam

Suggested Books:

- Henslin, Sociology: A Down-to-Earth Approach, 11th edition.
- D. Kendall, Sociology in our Times. Wadsworth Pub Co.

Social Psychology

Area Scope:

To impart knowledge of social psychology of attraction; attitudes and prejudice; altruism and aggression; personal and social identities; conformity; group influence and their applications in the real world.

Course Outline:

- Principles of sociology and psychology with emphasis on the individual and his/her reciprocal interaction with groups,
- Basic psychological factors, attribution and perception of others, attitudes and attitudinal change, social attitudes, altruism, helping others, aggression, hurting others, prejudice, disliking others, discrimination and stereotypes,
- Language and communication, society and cultures, culture and personality, small groups and their relation to the individual, leadership and group dynamics. Attraction, attitudes and prejudice; altruism and aggression; personal and social identities, conformity, group influence, moral and ethical issues, harassment,
- Corruption and its control, thinking processes and decision making.

Teaching Methodology (Proposed as applicable):

Lectures (audio/video aids), written assignments/quizzes, tutorials, case studies relevant to engineering disciplines, semester project, guest speaker, industrial/field visits, group discussion, report writing

Assessment:

Mid-semester exam, report writing/presentation, assignments, project report, quizzes, end-semester exam

Suggested Books:

- Edward Alsworth Ross, "Social Psychology", Macmillan, 2006
- Emory Stephen Bogardus, "Essentials of Social Psychology", Univ. of Southern, California Press, 2006
- Hewstone, M., & Stroebe, W. (Eds.), "Introduction to Social Psychology", 3rd ed., Oxford: Blackwell Publishers, 2006
- Lesko, W.A. "Readings in social psychology General, classic, and contemporary selections, 6th ed., 2006

Community Services

Area Scope:

Community service-learning provides a variety of benefits to the students and the community service has a unique way of developing an individual's leadership skills, sense of community, civic ethic, self-esteem, and other personal characteristics. Every service activity benefits a specific individual or group. Whether it is building homes for the poor, serving victims of chronic or terminal illness, tutoring children, addressing environmental needs or any other service, there is a person or group who ultimately benefits from your time. Finally, the organization where you conduct your service benefits enormously. Volunteers can make important contributions to Community benefit agencies (nonprofit) and government programs in their attempt to deal with the complex and growing needs of society.

Course Outline:

- Develop and implement service programs
- Develop workplace communication strategies

- Analyze impacts of sociological factors on clients in community work and services
- Manage and promote diversity
- Manage legal and ethical compliance
- Facilitate workplace debriefing and support processes
- Reflect on and improve own professional practice
- Manage work health and safety
- Assess co-existing needs
- Coordinate complex case requirements
- Develop, facilitate and review all aspects of case management
- Provide case management supervision
- Undertake project work
- Lead and manage team effectiveness
- Manage personal work priorities and professional development
- Manage meetings

Teaching Methodology (Proposed as applicable):

Lectures (audio/video aids), written assignments/quizzes, tutorials, case studies relevant to engineering disciplines, semester project, guest speaker, industrial/field visits, group discussion, report writing

Assessment:

Mid-semester exam, report writing/presentation, assignments, project report, quizzes, end-semester exam

Suggested Books:

- Schools and Community: The Communitarian Agenda in Education By James Arthur; Richard Bailey, Falmer Press, 2000.
- Studying Service-Learning: Innovations in Education Research Methodology by Shelley H. Billig, Alan S. Waterman , Lawrence Erlbaum Associates, 2003

Organizational Behavior

Course Outline:

Introduction to Organizational Behavior

- Organizational Disciplines and topics
- Psychological Perspective
- Social-Psychological Perspectives

Structure and Control in Organization

- Introduction of Bureaucracy
- Managerial Work
- Contingency theory
- Organizational Design

Individual and Work Learning

- Learning Theories
- Learning and Work

Stress

- Types of Stress and Work
- Occupational Stress Management

Individual Differences

- Personality and its factors
- Personality dimensions and social learning Intelligence

Motivation and Job Satisfaction

- Needs at Work
- Theories of Motivation and job satisfaction
- Correlates of Job satisfaction

Group and Work

- Social Interaction
- Dramaturgy and impression Management
- Social Skill

Group and Inter Group Behavior

- Group Structure & Norms
- Group Processes
- How throne Studies

Leadership

- Leadership as an attribute
- Leadership Style

Patterns of Work

- Work-the classical approach
- Marx, Weber, & The critique of labor
- Foucault & Disciplinary Power
- Conflict and Consent in Work
- The labor Process debate
- Work place control and resistance
- Industrial conflict and industrial relations

Organizational Culture

- Organizational culture and strategic management
- Exploring organizational culture
- Evaluating concept of culture

Teaching Methodology (Proposed as applicable):

Lectures (audio/video aids), written assignments/quizzes, tutorials, case studies relevant to engineering disciplines, semester project, guest speaker, industrial/field visits, group discussion, report writing

Assessment:

Mid-semester exam, report writing/presentation, assignments, project report, quizzes, end-semester exam

Suggested Books:

- Finchan, R., & Rhodes, P. (2003), Principles of Organizational Behaviour, 3rd Oxford.

- Noe, R., Hollenbeck, J. Gerhart, B., & Wright, P. (2006), Human Resource Management, 5th ed., McGraw Hill.
- Newstrom John W. (2007), Organizational Behaviour, (12th Ed), McGraw Hill.
- Luthan Fred, (2005), Organizational Behaviour, McGraw Hill Inc.
- Robins, Stephen, (2005), Organizational Behaviour, McGraw Hill Inc.

Professional Ethics

Area Scope:

The objective of this course is to grasp ideals and principles as they have been spelled out in a variety of traditional ethical systems and to apply these conceptual structures and guidelines to major problems and dilemmas of engineering practices in a corporate culture.

Course Outline:

- Engineering Ethics, Ethical concepts, and Types
- Moral Autonomy, Kohlberg's & Gilligan's Theory
- Profession and Professionalism
- Moral Reasoning, Ethical Theories
- Critique codes of ethics
- Moral frameworks, Personal commitments and professional life
- Engineering as social experimentation
- Involving the public in the design process, Case studies for engineering as social experimentation
- Assessment of safety and risk, Design considerations, uncertainty
- Risk-benefit analysis, Safe-exit and fail safe systems
- Case Studies for the Design Process Case studies in impact of safety/risk on design
- Employee/employer rights and responsibilities
- Confidentiality and conflict of interest
- Whistle-blowing, case studies on professional behavior/policies on the job
- Environment, sustainable development, Multinational corporations, globalization of engineering

Teaching Methodology (Proposed as applicable):

Lectures (audio/video aids), Written Assignments/ Quizzes, Tutorials, Case Studies relevant to engg disciplines, Semester Project, Guest Speaker, Industrial/ Field Visits, Group discussion, Report Writing

Assessment

Mid Term, Report writing/ Presentation, Assignments, Project Report, Quizzes, Final Term

Suggested Books:

- Ethics in Engineering 4th edition, by Mike W. Martin, Roland Schinzinger, McGraw-Hill, New York, 2005.
- Fundamentals of Engineering Economics, 3rd ed., by Chan S. Park
- Engineering Ethics: Concepts and Cases, 4th edition, by Charles E. Harris, Michael S. Pritchard, Michael J. Rabins, Wadsworth, 2008.
- The Seven Habits of Highly effective people by Stephan r. Covey
- Principle Centered Leadership Stephan r. Covey
- Change your lens change your life by (Faiez H. Seyal)
- How to Manage by Ray Wild
- Happiness by Richard Layard

Engineering Economics

Area Scope:

- Apply the appropriate engineering economics analysis method(s) for problem solving i.e. present worth, annual cost, rate of return, payback, break-even, benefit-cost ratio
- Evaluate the cost effectiveness of individual projects using the methods learnt, draw inferences for investment decisions, and compare the life cycle cost of multiple projects.
- Compute the depreciation of an asset using standard depreciation techniques to assess its impact on present or future value

Course Outline:

Engineering Economics

- Role of engineers in business
- Economic decisions v/s design decisions
- Large scale engineering projects and types of strategic economic decisions
- Fundamental principles of engineering economics

Interest Rate and Economic Equivalence

- Interest: The Cost of Money
- Economic Equivalence
- Development of Formulas for Equivalence Calculation
- Unconventional Equivalence Calculations

Understanding Money and Its Management

- Nominal and Effective Interest Rates
- Equivalence Calculations with Effective Interest Rates and with Continuous Payments
- Changing Interest Rates
- Debt Management
- Investing in Financial Assets

Present-Worth Analysis

- Project Cash Flows
- Initial Project Screening Methods: payback Screening and Discounted Cash Flow Analysis
- Variations of Present-Worth Analysis
- Comparing Mutually Exclusive Alternatives

Annual Equivalent-Worth-Analysis

- Annual Equivalent-Worth Criterion
- Capital Costs versus Operating Costs
- Applying Annual-Worth Analysis
- Life-Cycle Cost Analysis
- Design Economics

Rate-of-Return Analysis

- Rate of Return and Methods of Finding It
- Internal Rate-of-Return Criterion
- Mutually Exclusive Alternatives

Cost Concepts Relevant to Decision Making

- General Cost Terms; Classifying Costs for Financial Statements
- Cost Classifications for Predicting Cost Behavior
- Future Costs for Business Decisions
- Estimating Profit from Production

Depreciation and Corporate Taxes

- Asset Depreciation: Economic versus Accounting
- Book and Tax Depreciation Methods (MACRS)
- Depletion
- Income Tax Rate to be used in Economic Analysis
- The Need for cash Flow in Engineering Economic Analysis

Developing Project Cash Flows

- Cost-Benefit Estimation for Engineering Projects
- Developing Cash Flow Statements

Project Risk and Uncertainty

- Origins of Project Risk
- Methods of Describing Project Risk: Sensitivity, Break-Even and Scenario Analysis

Special Topics in Engineering Economics

- Replacement Decisions
- Capital Budgeting Decisions
- Economic Analysis in the Service Sector

Teaching Methodology (Proposed as applicable):

Lectures (audio/video aids), written assignments/quizzes, tutorials, case studies relevant to engineering disciplines, semester project, guest speaker, industrial/field visits, group discussion, report writing

Assessment:

Mid-semester exam, report writing/presentation, assignments, project report, quizzes, end-semester exam

Suggested Books:

- Contemporary Engineering Economics by Chan S. Park, 6th edition, Pearson 2015, ISBN: 9780134105598
- Engineering Economic Analysis by Donal G. Newnan, Jerome P. Lavelle, Ted G. Eschenbach, 12th edition, Oxford University Press, ISBN: 978-0199339273
- Engineering Economy by Leland T. Blank and Anthony Tarquin

Cultural Courses

Islamic Studies and Ethics

Course Description:

The Islam is a religion of peace and harmony for all humans based on knowledge and guidance in the Holy Quran. The basic teachings of Islam are comprehensive, practicable and universal. Therefore, this course briefly presents the vision of life and applied aspects of ethical system.

Area Scope:

- To enhance understanding of Islamic Culture and Civilization
- To understand values and social system in Islam
- To improve students' ethical and professional skill and critical thinking

Course Outline:

Islam – Religion of Peace and Harmony

- Basic Concepts – Islam, Quran and Hadith
- Faith and Religious Life
  - Selected Verses of Surah Al-Baqara Related to Faith (Verse No-284-286)
  - Selected Verses of Surah Al-Mumanoon Related to Characteristics of Faithful (Verse No-1-11)

Islamic Culture and Civilization

- Basic Concepts and of Characteristics of Islamic Culture and Civilization
- Education System of Islam
- Political System of Islam – Dynamics, Sovereignty and Institutions
- Economic System of Islam – Principles, Riba, Trade and Commerce
- Acceptance of Other Religions – Interfaith Harmony
- Foreign Policy

Social System of Islam

- Basic Concepts of Social System in Islam
- Elements of Family and their Rights - Parents, Women, Husband & Wife, Children
- Inheritance – Rights and Laws
- Social Rights – Neighbors, Relatives and Society
- Equality and Brotherhood
  - Selected Verses of Surah al-Furqan Related to Social Ethics (Verse No.63-77)
- Concept of Welfare State – Period of Khilafat-e-Rashida

Professional Ethics and Morality

- Basic Concepts - Islam and Ethics
  - Selected Verses of Surah Al-Inam Related to Ihkam (Verse No-152-154)
- Profession and Professionalism in Islam
- Characteristics of a Professional
  - Truthfulness, Honesty, Sincerity, Patience, Gratitude, Meditation and Research
- Role for Human Safety and Environment
- Time Management
- Prophet Muhammad (PBUH) – Role Model
  - Selected Verses of Surah Al-Hujrat Related to Adab Al-Nabi (Verse No-1-18)
  - Selected Versus of Surah Al-Ihzab Related to Adab Al-Nabi (Verse No. 6, 21, 40, 56, 57, 58)

Islam and Science

- Islam and Science
- Role of Muslims in Science and Education
- Critical Thinking and Innovation
  - Selected Verses of Surah Al-Hashar (18,19,20) Related to thinking, Day of Judgment
  - Selected Verses of Surah Al-Saf Related to Tafakar, Tadabar (Verse No1,14)

Note: All topics should be taught/covered in the light of relevant Verses from Holy Quran and Ahadiths.

Teaching Methodology (Proposed as applicable):

Lectures (audio/video aids), Written Assignments/ Quizzes, Tutorials, Case Studies relevant to engg disciplines, Semester Project, Guest Speaker, Industrial/ Field Visits, Group discussion, Report Writing

Assessment:

Mid Term, Report writing/ Presentation, Assignments, Project Report, Quizzes, Final Term

Suggested Books:

- Al-Qur'ān **القرآن (**selected text).
- Sayyid Tāhir Rasūl Qādri **52 دروس قرآن** (Karachi: Islamic Research Academy, 7th ed., 2017).
- Sayyid Hasan-uddin Ahmad**, تعلیمات قرآنی** 2-vols., (Karachi: Jasarat Publications, 1998).
- Muhammad Shafī‘,**معارف القرآن** (Karachi: Dar-ul-Isha'at, 2000).
- Sayyid Abu'l A‘lā Mawdūdī, **تفہیم القرآن** 6vols., (Lahore: Islamic Publications, 1998). [Preambles of all (114) chapters.]
- Amin Ahsan Islahi, **تدبرالقرآن** (Lahore: Farān Publications, 2005).
- Khawaja Abdul Waheed, **موضوعات قرآن وانسانی زندگی** (Islamabad: Islamic Research Institute, 3rd ed., 1997).
- Khurram Murad, **رب کا پیغام** (Lahore: Manshūrat, Mansoora, 2000)
- Hameed ullah Muhammad, "Emergence of Islam", Islamic Research Institute (IRI), Islamabad

- Hameed ullah Muhammad, "Muslim Conduct of State" Sh Muhammad Ashraf, Kashmir Bazar, India (Latest Edition)
- Hameed ullah Muhammad, "Introduction to Islam" Compiled by The CSS Point, www.thecsspoint.com
- Hussain Hamid Hassan, "An Introduction to the Study of Islamic Law" leaf Publication Islamabad, Pakistan, (Latest Edition).
- H.S. Bhatia, "Studies in Islamic Law, Religion and Society" Deep & Deep Publications New Delhi (1989).
- Islamic Education by A. S. Bukhari & M. D Zafar, Latest Edition.
- Muslim's character by M. Al-Ghazali, Latest Edition.

Pakistan Studies and Global Perspective

Area Scope:

The knowledge units in this area collectively encompass the following:

- Have a better understanding of the rationale for the creation of Pakistan.
- Enable students to contribute in social, political and economic growth of Pakistan.
- Become a part of strong nation with a sense of ownership and responsibility towards Pakistan
- Play an active role toward sustainable development of Pakistan in global perspective.

Course Outline: **Time Duration**

Historical and Ideological Perspective **5 hrs**

a. Pakistan Movement
   - Aligarh Movement
   - Two Nations Theory

b. Founders of Pakistan
   - Allama Muhammad Iqbal
   - Quaid-e-Azam Muhammad Ali Jinnah
   - Other Leaders (Women and other Pakistan Movement Leaders)

c. Quaid's Vision for Pakistan

d. Kashmir – An unfinished Agenda of Partition

Constitution of Pakistan **4 hrs**

a. An overview of constitutional development in Pakistan
b. Salient features of the Constitution of 1973
c. Constitutional Amendments
d. Fundamental Rights and Responsibilities of Citizens

Contemporary Pakistan **4 hrs**

a. Pakistan's society, culture and demography – celebrating diversity
b. Current Challenges: social, economic, environmental, political and external
c. Nation's resilience in War on Terror

Economy of Pakistan **4 hrs**

a. An overview of Economy
b. Services, Manufacturing and Agricultural Profile of Pakistan
c. Regional Economic Cooperation
d. One Belt One Road (OBOR) – CPEC

Land of Opportunities **4 hrs**

a. Physical features: diversity and beauty
b. Natural resources - mineral, water, energy, agriculture & livestock, and marine resources
c. Tourism and Culture

Pakistan's Foreign Policy **5 hrs**

a. Foreign Policy – Principles and Objectives
b. Relations with Neighbors
c. Major Economies
d. Muslim World
e. Geo-political and strategic significance of Pakistan in Regional and Global Politics

Pakistan in pursuit of Global Agenda **4 hrs**

a. SDGs-2030 - Pakistan Goals
b. Commitments on Climate Change
c. Peace and Security

Teaching Methodology (Proposed as applicable):

Lectures (audio/video aids), Written Assignments/ Quizzes, Tutorials, Case Studies relevant to engg disciplines, Semester Project, Guest Speaker, Industrial/ Field Visits, Group discussion, Report Writing

Assessment:

Mid Term, Report writing/ Presentation, Assignments, Project Report, Quizzes, Final Term

Suggested Books:

- Khalid B. Sayeed, Pakistan: The Formative Phase 1857 – 1948, Pakistan Publishing House, 1960
- Gulam Allana, Quaid-e-Azam: the story of Pakistan, Ferozsons, 1967.
- Shahid M. Amin, Pakistan's Foreign Policy: A Reappraisal, Oxford University Press, 2010.
- S. Akbar Zaidi, Issues in Pakistan's economy, Oxford University Press, 2003.
- Hamid Khan, Constitutional & political history of Pakistan, Oxford University Press, 2003
- Rafi Raza, *Pakistan in Perspective 1947-1997*, Oxford University Press, 2003
- Sharif-ul-Mujahid, *The Ideology of Pakistan*, Progressive Publishers, 1974.
- Ziring Lawrence, *Pakistan in the Twentieth Century*, Oxford University Press, 1997 -
- Burke S. M. & Ziring Lawrence, *Pakistan's Foreign Policy,* Oxford University Press, 1973. Mohammad Qadeer , Pakistan
- Climate Change Policies-Ministry of Climate Change, Islamabad-http://mocc.gov.pk/
- Sustainable Development Goals (SDGs)- www.pc.gov.web/sdg/sdgpak
- Economic Survey of Pakistan- http://finance.gov.pk/survey_1617.html
- Foreign Policies- Ministry of Foreign Affairs, Pakistan http://mofa.gov.pk/
- Population Census of Pakistan- Economic Survey of Pakistan http://finance.gov.pk/survey_1617.html
- Issues in Pakistan's Economy by S. Akbar Zaidi, ISBN: 0195790529.

- Pakistan's Foreign Policy: A Reappraisal by Shahid M. Amin. ISBN: 0195798015
- Newspapers editorial and selected journalistic writings on current affairs.
- Pakistan (Lands, Peoples, & Cultures) by Carolyn Black, Bobbie Kalman. ISBN: 0778797147

Management Sciences Courses

Engineering Project Management

Area Scope:

The primary objective of this course is to get the fair understanding of core issues pertaining to Engineering Project Management. This course is aimed at providing both basic and some advanced exposure to emerging trends in the field of Project Management, so as to enable the engineering professionals of tomorrow to successfully complete sophisticated projects within the constraints of capital, time, and other resources with due regards to stakeholders set of expectations. Engineering students will learn key Project Management skills and strategies and will be able to face emerging challenges.

Core Objectives of this course are:

- To develop competencies in project costing, budgeting, and financial appraisal;
- To gain exposure to project Planning Control and Management, using standard tools and schedule variance analysis;
- To appreciate the elements of risk and quality in hi-tech projects;
- To learn Project Management by “practice”, through the medium of “End of Semester Group Project”; and
- To appreciate and understand the use of computers in Project Management, especially a tool like MS Project & Primavera etc.

Course Outline:

Project Management Concepts

History of Project Management, Introduction to Project Management, Project, Program & Portfolio Management, Project characteristics, Objectives& Requirements, Project Phases/Stages, Project Life Cycle, Project Environment, Project Scope & Project Charter, Project Manager, Project Stakeholder Analysis.

Project Proposal Development

Project Proposal, Characteristics of good proposal, Types of Proposals, Request for Proposal, Request for Quotation etc.). Proposal Templates etc.

Project Feasibility

Brief review of various aspects of Project Feasibility like Technical, Social, Managerial, Economic, Financial & Marketing, Administrative etc.

Project Selection Criteria (Economic Analysis of Engineering Projects)

Using Break Even Analysis, Cost Benefit Ratio, Internal Rate of Return, Net Present Value etc.

Project Contract & Procurement Management

Engineering contracts, Type of contracts, understanding of procurement Process & Cycle, PPRA Rules

Project Planning and Scheduling

Project Planning (Resource & HR Planning), Work Breakdown Structure, Project Network & Scheduling, Manning Schedule and Activity Charts, Critical Path Method (CPM)/Project Evaluation & Review Techniques

Project Costing & Estimation

Cost Estimation in Projects, Cost components in projects and methods for cost estimation in projects, Cost Control in Projects, Estimation of Outstanding Work, Earned Value Management, Schedule & cost variance analysis

Project HRM & Communication Management

Effective organization and communication for Successful Projects, Project Organizational Structures (Project matrix and project based organizations), Project

HR Plan preparation, HR Need Assessment and HR Matrix, Building and Managing effective project team, Selection & control mechanism of HRM in Projects, Effective Communication Plan.

Project Risk Management

Definitions Project Risk, Project Risk Management Tools, Types of Project Risk, Project Risk Assessment, Risk Identification and Mitigation, Monitoring & Controlling Risk, Generic Risk Management Strategies & Technique.

Computer Application in Project Management

Basic/Elementary Introduction and hands on basic exposure of use of MS Project & Primavera P6 Software in Project Management

Project Quality Management

Defining Quality, Quality Assurance, Quality Management, 7 Quality Improvement Tools as applied to Project Management, Project Quality Management Plan, Quality Management Processes and Strategies

Project Closure & Termination

Project Evaluation, defining project success, Project Completion Criteria, Project Audit, Project Termination &When to close a project, the termination process, Project Close Up & lesson learnt, & Project Archive

Teaching Methodology (Proposed as applicable):

Lectures (audio/video aids), written assignments/quizzes, tutorials, case studies relevant to engineering disciplines, semester project, guest speaker, industrial/field visits, group discussion, report writing

Assessment:

Mid-semester exam, report writing/presentation, assignments, project report, quizzes, end-semester exam

Suggested Books:

- Project Management: A system Approach to Planning, Scheduling and Controlling 11th Edition, Harold Kerzner
- Bennett, F. Lawrence. 1996. The management of engineering. New York: Wiley.

- Cleland, David. Field guide to project management. New York: Wiley.
- Eisner, H. Essentials of project management and systems engineering management. New York: Wiley.
- Frame, J. D. Managing projects in organizations. San Francisco: Jossey-Bass
- Goldratt, Eliyahu. Critical chain. North River Press.
- Haynes, M.E. Project management: From idea to implementation. Los Altos, CA: Crisp Publications.
- Lewis, James, Project planning, scheduling & control. New York: McGraw-Hill
- Lewis, James, P. 1998. Mastering project management. New York: McGraw-Hill
- Lientz, Bennet & Rea, Kathryn. 1995. Project management for the 21st century. San Diego: Academic Press.
- Miller, Roger & Lessard, Donald. 2000. The strategic management of large engineering projects. Cambridge, MA: MIT Press.
- Nicholas, J.M. Managing business & engineering projects. Englewood Cliffs, NJ: Prentice Hall.
- Shtub, Avraham, Bard, Jonathan, & Globerson, Shlomo. 1994. Project management: Engineering, technology, and implementation. Englewood Cliffs, Prentice-Hall.
- Project Management by Adrienne Watt
- J.R. Meredith and S.J. Mantel. Project Management: A Managerial Approach. John Wiley and Sons. New York. 2019. (Reference).

Entrepreneurship

Area Scope:

- Develop a business plan with an appropriate business model
- Demonstrate the ability to provide a self-analysis in the context of an entrepreneurial career
- Demonstrate the ability to find an attractive market that can be reached economically

Course Outlines:

- Basic Concept-Entrepreneurship
- Innovation and Entrepreneurship
- Basic Plan Development Cycle
- Intellectual Rights
- Financial and Legal Modalities
- Marketing
- Industrial Competiveness
- Gap Analysis, Critical Thinking and Idea Generation
- Business Plan Development
- Successful Case Studies (local)

Teaching Methodology (Proposed as applicable):

Lectures (audio/video aids), written assignments/quizzes, tutorials, case studies relevant to engineering disciplines, semester project, guest speaker, industrial/field visits, group discussion, report writing

Assessment:

Mid-semester exam, report writing/presentation, assignments, project report, quizzes, end-semester exam

Suggested Books:

- Michael J Etzel, Bruce J Walker, William J Stanton, Marketing, McGraw-Hill 2010
- William D. Bygrave and Andrew Zacharak, Entrepreneurship 2nd Edition, Wiley, 2012.
- Entrepreneurship by Hisrich, McGraw- Hill, 2009
- Principles of Marketing, Cotrell McGraw- Hill 2012
- Paul Burns and Jim Dew Hurst: Small Business and Entrepreneurship
- P.N. Singh: Entrepreneurship for Economic Growth
- Peter F. Drucker: Innovation and Entrepreneurship Peter F. Drucker
- John B. Miner: Entrepreneurial Success
- "Marketing that Works: How Entrepreneurial Marketing Can Add Sustainable Value to Any Sized Company", by Leonard Lodish, Howard Morgan, Shellye Archambeau and Jeffrey Babin, Pearson FT Press

- "Entrepreneurial Marketing," Lessons from Wharton's Pioneering MBA Course, Morgan, H. L., A. Kallianpur, and L. M. Lodish, John Wiley & Sons, 2001

Principles of Management

Area Scope

- The focus will be on the learning fundamental principles of management and of managing people and organization.
- Develop analytical and conceptual framework of how people are managed in small, medium and large public and private national and international organizations.

Course Outline:

- Introduction, overview and scope of discipline
- The evolution and emergence of management thought
- Management functions
- Planning concepts, objectives, strategies and policies
- Decision making
- Organizing; departmentalization, line/staff authority, commitments and group decision making
- Staffing: principles of selection, performance, career planning
- Leading: Motivation, leadership, communication
- Controlling: the system, process and techniques of controlling
- Management and Society: future perspective

Teaching Methodology (Proposed as applicable):

Lectures (audio/video aids), Written Assignments/ Quizzes, Tutorials, Case Studies relevant to engg disciplines, Semester Project, Guest Speaker, Industrial/ Field Visits, Group discussion, Report Writing

Assessment:

Mid Term, Report writing/ Presentation, Assignments, Project Report, Quizzes, Final Term

Suggested Books:

- Stephen P. Robins, Mary Coulter: Management, latest edition.
- H. Koontz Odonnel and H. Weihrich: Management, latest edition.
- Mc Farland: Management: Foundation and Practice, latest edition.
- Robert M. Fulmer: The New Management, latest edition.

Engineering Management

Course Outline:

- Industrial networks
- Fundamentals of Product and Process development
- Business Community and New Generations of Managers
- Practical Skills Knowledge and Experience in Commercialization of New Technological Inventions
- Use of Multidisciplinary Science Based Knowledge,
- Problem Solving, Teamwork and Outreach Activity,
- Major steps in proof of concept to intellectual property protection,
- Prototype development
- Fabrication and assembly routes
- Materials procurement,
- Identification and creation of new markets
- Development of business plan
- Appropriate technology and marketing
- Distribution and financing
- Routes and strategies for specific technology under development.

Teaching Methodology (Proposed as applicable):

Lectures (audio/video aids), Written Assignments/ Quizzes, Tutorials, Case Studies relevant to engg disciplines, Semester Project, Guest Speaker, Industrial/ Field Visits, Group discussion, Report Writing

Assessment:

Mid Term, Report writing/ Presentation, Assignments, Project Report, Quizzes, Final Term

Suggested Books:

- R. A. Bulgelman, Strategic Management of Technology and innovation, latest Edition McGraw Hill.

Available at:
http://www.pec.org.pk