

**Curriculum
for
Bachelor of Science in Mechanical Engineering
Technology Degree
(2026)**



**Higher Education Commission
Islamabad
Curriculum Division**

Acknowledgement

The successful development of this curriculum has been made possible through the valuable support, cooperation, and facilitation of various national and international organizations. We extend our sincere appreciation to the Higher Education Commission (HEC), National Technology Council (NTC), GIZ, and National University of Technology (NUTECH) for their significant contribution to this important academic initiative.

We especially acknowledge the provision of the necessary infrastructure, technical facilities, institutional support, and professional environment that enabled the curriculum development team to undertake extensive consultation, review, analysis, and refinement of the curriculum. Their continued support and facilitation provided the essential foundation for developing a curriculum that is responsive to contemporary academic, technological, industrial, and professional requirements.

We also acknowledge the valuable contributions of all NCRC members representing all provinces of Pakistan and the Federal Capital Territory (Islamabad), subject experts, industry representatives, academic professionals, and other stakeholders whose knowledge, recommendations, and constructive feedback strengthened the quality and relevance of this curriculum.

We are deeply grateful to all individuals and organizations who contributed directly or indirectly to this endeavor. Their collective efforts and support have been instrumental in shaping a forward-looking, competency-based, and industry-relevant curriculum aligned with national and international standards.



Curriculum for Bachelor of Mechanical Engineering Technology



Acronyms, Abbreviations & Definitions

Acronym/ Abbreviation	Definition
HEC	Higher Education Commission
NTC	National Technology Council
NCRC	National Curriculum Review Committee
IDEE	Integration of Data in Engineering Environment
IEA	International Engineering Alliance
IDTE	Inter Disciplinary Technology Elective
MATLAB	Matrix Laboratory
HEI	Higher Education Institution
SIT	Supervised Industrial Training
Th	Theory
Lab	Laboratory
Cr. Hrs.	Credit Hours
PLO	Program Learning Outcome
CLO	Course Learning Outcome
ICT	Information and Communication Technology



Curriculum for Bachelor of Mechanical Engineering Technology



Contents

Preamble:.....	4
Scope:.....	4
Rationale:	4
Vision Statement:	5
Program Educational Objectives (PEOs)	5
1. Introduction.....	6
2. Curriculum Development Methodology.....	7
2.1 Benchmarking.....	7
2.2 Curriculum Development Cycle	7
2.3 Historical Timeline of Meetings	7
3. Curriculum Details.....	8
Supervised Industrial Training.....	8
4. Admission Criteria.....	14
5. Semester-wise Scheme of Studies	15
6. Course Codes	18
7. Elective Courses	19
8. Course Contents.....	20
8.1 Workshop Technology	21
8.2 Applied Mechanics	23
8.3 Machine Design.....	25
8.4 Mechanics of Materials	27
8.5 Computer Programming	29
8.6 Basic Electrical Technology and Electronics	31
8.7 Introduction to Artificial Intelligence.....	34
8.8 Application of ICT.....	36
8.9 Quality Management and Reliability	38
8.10 Applied Energy Systems & Technologies	40
8.11 Heat and Mass Transfer	42
8.12 Industrial Maintenance and Safety.....	44



Curriculum for Bachelor of Mechanical Engineering Technology



8.13 Heating, Ventilation and Air-Conditioning (HVAC) Technologies	47
8.14 Applied Thermodynamics.....	49
Thermodynamics.....	49
8.15 Fluid Mechanics.....	51
8.16 Manufacturing Process I	54
8.17 Manufacturing Process II	57
8.18 Mechanical Vibrations.....	60
8.19 Industrial Engineering	62
8.20 Industrial Materials	64
8.21 Pakistan Studies	67
8.22 Applied Chemistry	70
8.23 Islamic Studies / Ethics.....	72
8.24 Entrepreneurship	74
8.25 Applied Mathematics-I	76
8.26 Applied Mathematics -II.....	78
8.27 Functional English	80
8.28 Communication Skills	82
8.29 Logic And Critical Thinking	84
8.30 Ideology & Constitution of Pakistan	86
8.31 Engineering Economics	89
8.32 Fehm e Quran I.....	91
8.33 Fehm e Quran II.....	93
8.34 Civics and Community Engagement.....	95
8.35 Instrumentation And Control.....	97
8.36 CAD Modeling	100
8.37 Technical Drawing	102
9.38 Professional Certification.....	105
9. Supervised Industrial Training	106
9.1 Background	106
9.2 Objectives.....	106



Curriculum for Bachelor of Mechanical Engineering Technology



9.3 Responsibility of HEI: Placement in SIT Program	106
9.4 Responsibilities of Students	106
9.5 Training Progress Assessment and Review by HEI	107
9.6 Changing Student Placement During SIT	107
9.7 Daily Training Logbook	108
9.8 Industrial Training Report.....	108
9.9 Guidelines for Preparation of Industrial Training Report	108
9.10 SIT Assessment.....	110
9.11 Completion of Industrial Training.....	110
APPENDIX A: Sydney Accord Knowledge and Attitude Profile	111
APPENDIX B: Engineering Technologist Graduate Attribute Profile.....	112
APPENDIX C: Engineering Technologist Professional Competence Profile	114
APPENDIX D: Minutes of Preliminary Meeting of NCRC.....	116
APPENDIX E: Minutes of the Final Meeting of NCRC	122
APPENDIX F: Supervised Industrial Training Logbook (Sample Format).....	126
APPENDIX G: Supervised Industrial Training Report (Sample Format)	127
APPENDIX H : Broadly Defined Problems.....	128
APPENDIX I : Definition of terms related to OBE and Sydney Accord.....	130



Curriculum for Bachelor of Mechanical Engineering Technology



Preamble:

The Bachelor of Science in Mechanical Engineering Technology (BSEMT) curriculum has been developed to prepare competent, innovative, and ethically responsible Engineering Technologists who can meet the evolving needs of industry and society. The curriculum is aligned with the Higher Education Commission (HEC) of Pakistan Undergraduate Education Policy, the National Technology Council (NTC) Pakistan Accreditation Manual and Curriculum Guidelines, and the National Qualifications Framework (NQF) of Pakistan, ensuring compliance with national quality standards and international best practices.

The curriculum is founded on the principles of Outcome-Based Education (OBE) and is aligned with the International Engineering Alliance (IEA) and the Sydney Accord for Engineering Technologists. It is designed to develop graduates who possess strong competencies in engineering technology fundamentals, problem analysis, system design, laboratory investigation, experimentation, modern engineering tools, digital technologies, project implementation, effective communication, teamwork, leadership, ethical and professional practice, project management, sustainability, entrepreneurship, and lifelong learning. These competencies enable graduates to solve broadly defined engineering technology problems while considering technical, economic, environmental, societal, health, safety, legal, and cultural aspects.

Recognizing the transformation of engineering practice in the era of Industry 5.0, the curriculum integrates emerging technologies, including artificial intelligence, Industrial Internet of Things (IIoT), embedded systems, industrial automation, collaborative robotics, digital twins, intelligent instrumentation, industrial cybersecurity, renewable energy technologies, and smart manufacturing. Equal emphasis is placed on human-centric innovation, sustainability, resilience, digital transformation, and interdisciplinary collaboration, preparing graduates to contribute effectively to intelligent and sustainable industrial ecosystems.

Developed through consultation with academia, industry, employers, professional bodies, alumni, and other stakeholders, the curriculum combines a strong foundation in engineering sciences with extensive laboratory work, project-based learning, industrial internships, and capstone design experiences. It equips graduates with the technical knowledge, practical skills, professional competencies, and innovative mindset required to excel in diverse sectors of the Mechanical industry, pursue higher education and research, support entrepreneurship, and contribute to Pakistan's technological advancement and sustainable socio-economic development.

The curriculum reflects the commitment of HEC and NTC to producing globally competitive Engineering Technologists who are technically proficient, professionally competent, socially responsible, and capable of adapting to rapidly evolving technologies while meeting the Graduate Attributes and Competency Profile prescribed by the International Engineering Alliance's Sydney Accord.

Scope:

The Bachelor of Science in Mechanical Engineering Technology program provides comprehensive education that combines sound engineering fundamentals with extensive laboratory experimentation, project-based learning, supervised industrial training, and an industry-oriented capstone project. The curriculum develops competencies in the design, implementation, integration, operation, testing, maintenance, troubleshooting, and continuous improvement of modern mechanical systems and technologies. The program provides opportunities for advanced study in areas such as Smart Manufacturing and Industrial Automation Advanced Manufacturing Technologies, Computer-Aided Design and Manufacturing (CAD/CAM), and Sustainable Energy and Mechanical Systems. Aligned with the NTC framework and the Sydney Accord, the program prepares graduates to design, implement, test, operate, maintain, and troubleshoot modern mechanical systems and technologies with professionalism, innovation, sustainability, and ethical responsibility.

Rationale:

The Bachelor of Science in Mechanical Engineering Technology program is designed to prepare competent engineering technologists capable of addressing the evolving technological needs of national and global industries. Graduates are



Curriculum for Bachelor of Mechanical Engineering Technology



equipped with Industry 5.0 practical skills to develop human-centric, sustainable, digitally enabled, and innovative mechanical engineering solutions. Rapid advancements in smart manufacturing, intelligent automation, advanced manufacturing technologies, robotics, and sustainable energy systems have created an increasing demand for graduates with interdisciplinary knowledge and application-oriented technical expertise. Developed in accordance with the HEC Undergraduate Education Policy, the NTC Curriculum Framework, and the Sydney Accord, the program prepares graduates to support industrial growth, technological innovation, and sustainable development. The program further aims to develop skilled engineering technologists capable of contributing to socio-economic development while meeting the evolving demands of the national and international workforce.

Vision Statement:

To be a globally recognized Mechanical Engineering Technology program that delivers excellence in outcome-based education by developing technically competent, innovative, ethical, and industry-ready engineering technologists who drive sustainable technological advancement and contribute to the socio-economic development of society through lifelong learning and professional excellence.

Mission Statement:

To produce globally competent Mechanical Engineering Technologists and technopreneurs through quality outcome-based education, applied research, and industry collaboration, equipping them with technical competence, innovation, professionalism, leadership, communication, teamwork, and lifelong learning to solve broadly defined engineering problems and contribute to sustainable technological, industrial, and societal development.

Program Educational Objectives (PEOs)

PEO-1: Solve broadly defined mechanical engineering technology problems using tools and sustainable practices.

PEO-2: Manage projects and operations in multidisciplinary environments through clear technical communication.

PEO-3: Uphold professional ethics while advancing technical capabilities through continued professional development.

PLO		PEO-1	PEO-2	PEO-3
1	Engineering Knowledge	✓		
2	Problem Analysis	✓		
3	Design / Development of Solutions	✓		
4	Investigation	✓		
5	Tool Usage	✓		
6	The Engineer and the World	✓		
7	Ethics			✓
8	Individual and Collaborative Team Work		✓	
9	Communication		✓	
10	Project Management and Finance		✓	
11	Lifelong Learning			✓



Curriculum for Bachelor of Mechanical Engineering Technology



1. Introduction

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

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

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

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

2. Curriculum Development Methodology

2.1 Benchmarking

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

The course of studies clearly defines and differentiates the program from Mechanical Engineering by contact hours spent in classrooms, laboratories, and industry.

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

2.2 Curriculum Development Cycle

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

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

2.3 Historical Timeline of Meetings

Historical Timeline of NCRC meetings to develop Bachelor of Mechanical Engineering Technology are enlisted below:

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



Curriculum for Bachelor of Mechanical Engineering Technology



3. Curriculum Details

Bachelor of Mechanical Engineering Technology Program			
Parameter	HEC Framework	Framework - A (SIT in 7th & 8th Semesters)	Framework - B (SIT in 8th Semester Only)
Program Type	Semester System	Semester System	Semester System
Program Duration	8 Semesters Min: 4 Years Max: 7 Years	8 Semesters Min: 4 Years Max: 7 Years	8 Semesters Min: 4 Years Max: 7 Years
Semester Duration	16 weeks of Teaching 2 weeks for Exams	16 weeks of Teaching 2 weeks for Exams	16 weeks of Teaching 2 weeks for Exams
Total Number of Courses	-	39	44 (Opt.**)
Engineering Technology Domain Courses	-	24	29 (Opt.)
Non-Engineering Technology Domain Courses	14	15	15 (Opt.)
Total Credit Hours	124 – 148	133	133
Engineering Technology Domain Credit Hours	90-114	67	83 (Opt.)
Supervised Industrial Training	-	32	16
Percentage of Engineering Technology Domain Courses	72.58 % - 77.02 %	74%	74%
Non-Engineering Technology Domain Credit Hours	34	34	34
Percentage of Non- Engineering Technology Domain Courses	22.97 % - 27.42 %	26%	26 %
No. of Credit Hours per Semester	15 – 18	15 – 18	15 – 18
** Optional Courses in 7 th Semester shall be included for Framework B (SIT in 8 th Semester only)			
1 credit hour: (1) For theory: 1 contact hour per week for a minimum of 16 weeks for theory. (2) For practical's: 3 contact hours per week for a minimum of 16 weeks for practical's.			



Curriculum for Bachelor of Mechanical Engineering Technology



Engineering Technology Domain Courses in Recommended Schemes of Studies as per Framework							
Knowledge Area	Name of Course	Credit Hours (Th+Lab)	Weekly Contact Hours (Th+Lab)	Total Credit Hours		Number of Courses	
				As per Scheme of Studies	HEC Guideline	As per Scheme of Studies	HEC Guideline
Mechanical Engineering Technology (Foundation)	Workshop Technology	0+2=2	0+6=6	12	-	5	-
	Applied Mechanics	2+1=3	2+3=5				
	Technical Drawing	0+2=2	0+6=6				
	CAD Modeling	0+2=2	0+6=6				
	Applied Thermodynamics	2+1=3	2+3=5				
Mechanical Engineering Technology (Breadth)	Fluid Mechanics	2+1=3	2+3=5	17	-	6	-
	Industrial Materials	2+1=3	2+3=5				
	Machine Design	2+0=2	2+0=2				
	Manufacturing Process I	1+2=3	1+6=7				
	Applied Energy Systems & Technologies	2+1=3	2+3=5				
	Instrumentation and Control	2+1=3	2+3=5				
Mechanical Engineering Technology (Depth)	Heat and Mass Transfer	2+1=3	2+3=5	19	-	7	-
	Industrial Engineering	2+0=2	2+0=2				
	Quality Management and Reliability	3+0=3	3+0=3				
	Heating, Ventilation and Air-Conditioning (HVAC) Technologies	2+1=2	2+3=5				
	Mechanical Vibrations	2+1=3	2+3=5				
	Manufacturing Process II	1+2=3	1+6=7				
	Mechanics of Materials	2+1=3	2+3=5				
Interdisciplinary Subjects	Computer programming	2+1=3	2+3=5	12	-	4	-
	Industrial Maintenance and Safety	2+1=3	2+3=5				
	Introduction To Artificial Intelligence	2+1=3	2+3=5				
	Basic Electrical Technology and Electronics	2+1=3	2+3=5				



Curriculum for Bachelor of Mechanical Engineering Technology



Project	Project Part-I	0+3=3	0+9=9	6	6	2	2
	Project Part-II	0+3=3	0+9=9				
Training	Supervised Industrial Training-(Framework-A only)	0+16=16	0+16=16	16		0	
	Supervised Industrial Training- (Framework-A & Framework-B*)	0+16=16	0+16=16	16		0	
Total Credit Hours and Courses (For Engineering Technology Domain Courses)		37+62 = 99	37+122=159				

General Education Domain Courses in Recommended Schemes of Studies as per Framework								
Knowledge Area	Sub-Area	Name of Course	Credit Hours (Th+Lab)	Weekly Contact Hours (Th+Lab)	Total Credit Hours		Number of Courses	
					As per Scheme of Studies	HEC Guidelines	As per Scheme of Studies	HEC Guidelines
Humanities and Social Sciences	English	Functional English	2+1=3	2+3=5	6	6	2	2
		Communication Skills	3+0=3	3+0=3				
	Culture	Islamic Studies / Ethics	2+0=2	2+0=2	8	8	5	5
		Pakistan Studies	2+0=2	2+0=2				
		Ideology & Constitution of Pakistan	2+0=2	2+0=2				
		Fehm e Quran-I / Any course of GE for Non-Muslims	0+1=1	0+3=3				
		Fehm e Quran-II / Any course of GE for Non-Muslims	0+1=1	0+3=3				
	Social Sciences	Civics and Community Engagement	1+1=2	1+3=4	2	2	1	1
		Engineering Economics	2+0=2	2+0=2	2	2	1	1
	Arts & Humanities	Logic And Critical Thinking (Elective) Any for language Courses(Elective) List is Given below	2+0=2	2+0=2	2	2	1	1
Management Sciences	Management Sciences	Entrepreneurship	2+0=2	2+0=2	2	2	1	1
Natural Sciences	Mathematic I & II	Quantitative Reasoning-I	3+0=3	3+0=3	6	6	2	2
		Quantitative Reasoning-II	3+0=3	3+0=3				
	Chemistry	Applied Chemistry	2+1=3	2+3=5	3	3	1	1
Computing	Computing	Applications of ICT	2+1=3	2+3=5	3	3	1	1
Total Credit Hours and Courses (For General Education Domain Courses)					Cr. Hrs. 34		Courses 15	

Introduction to Foreign Language and Culture

This course is intended to provide students with introductory communicative competence in a selected foreign language and an understanding of its associated culture. The course should focus on practical language use and intercultural awareness rather than advanced grammatical proficiency.

By the end of the 16-week course, students are expected to demonstrate the ability to communicate at a basic level in familiar situations, understand simple spoken and written language, produce basic written expressions, and demonstrate an informed understanding of relevant cultural practices and contexts.

The course objectives may include the following:

1. Recognize and use basic sounds, pronunciation features, and the writing system of the selected foreign language.
2. Read and write basic words, expressions, and sentences using the appropriate writing system of the foreign language.
3. Apply basic language and cultural knowledge in simple communicative situations, including everyday conversations and familiar social contexts.

Higher Education Institutions (HEIs) may select an appropriate foreign language based on the needs and interests of relevant stakeholders and the institutional context. The selected language should be supported by appropriate course learning outcomes, content, teaching and learning strategies, and assessment methods. These should be developed in accordance with the relevant course template (as per other courses in the curriculum) and the guidelines provided in the IEA Graduate Attributes and Professional Competencies document.



Curriculum for Bachelor of Mechanical Engineering Technology



Breadth Electives*	Depth Electives*
➤ Non-Destructive Testing of Materials/Structures ➤ Nuclear Technology and Materials for Nuclear Reactors ➤ Pressure Vessels and their Fabrication ➤ Renewable/Alternate Energy Resources ➤ Metal Technology ➤ Additive Manufacturing ➤ Composite Materials ➤ Foundations of Industry 4.0 and Industry 5.0 ➤ Metrology ➤ Elective Courses by HEI*	➤ Hybrid Engines and their Technology ➤ Vacuum Science and Technology ➤ Nanotechnology ➤ Automobile Technology ➤ Robotics and AI ➤ Mechanics of Machines ➤ Supply Chain Management ➤ Corrosion Control Technology ➤ Elective Courses by HEI*
*Any related course can be included with approval of the HEI's Statutory Bodies (maximum: 3 courses per elective knowledge area)	

4. Admission Criteria

Criteria for admission in Bachelor of Mechanical Engineering Technology program is defined in NTC's Program Accreditation Policy and Procedures Manual for Engineering & Other Technologies, Clause 3.2.4.1. Salient features for eligibility for admission are:

- (1) At least 50% marks in DAE/FSc (Pre-engineering)
or other equivalent qualifications such as A-level/ICS/B.Sc. (sports and Hafiz-e-Quran marks are not included)
and
- (2) Entrance Test
- (3) Weightage:
 - 70% for academics (DAE/FSc etc.)
 - 30% for Entrance Test

5. Semester-wise Scheme of Studies

Semester-wise scheme of studies for Bachelor of Mechanical Engineering Technology program spanning 4 years, spread over 8 semesters, and totaling 133 credit hours (Framework A) is presented below:

Semester – I				
Suggested Course Codes	Course Title	Knowledge Area/Domain	Credit Hrs. (Th+Lab)	Weekly Contact Hrs. (Th+Lab)
MEH-111	Islamic Studies / Ethics	General Education	2+0	2+0
MEE-111	Functional English	General Education	2+1	2+3
MEN-111	Applied Mathematics-I	General Education	3+0	3+0
MEN-112	Applied Chemistry	General Education	2+1	2+3
MEC-111	Application of ICT	General Education	2+1	2+3
MET-111	Technical Drawing	Foundation	0+2	0+6
MET-112	Workshop Technology	Foundation	0+2	0+6
Subtotal			11+7=18	11+21=32
Semester – II				
Suggested Course Codes	Course Title	Knowledge Area/Domain	Credit Hrs. (Th+Lab)	Weekly Contact Hrs. (Th+Lab)
MEN-121	Applied Mathematics -II	General Education	3+0	3+0
MEE-121	Communication Skills	General Education	3+0	2+0
MEH-121	Fehm e Quran I / Ethics-I	General Education	0+1	0+3
MEH-122	Pakistan Studies	General Education	2+0	2+0
MEI-121	Basic Electrical Technology and electronics	Interdisciplinary	2+1	2+3
MET-121	Applied Mechanics	Foundation	2+1	2+3
MEI-122	Computer Programing	Interdisciplinary	2+1	2+3
Subtotal			14+4=18	14+12=26
Semester – III				
Suggested Course Codes	Course Title	Knowledge Area/Domain	Credit Hrs. (Th+Lab)	Weekly Contact Hrs. (Th+Lab)
MEH-211	Logic And Critical Thinking	General Education	2+0	2+0
MES-211	Ideology & Constitution of Pakistan	General Education	2+0	2+0
MES-212	Civics and Community Engagement	General Education	1+1	1+3
MET-211	Applied Thermodynamics	Foundation	2+1	2+3
MET-213	Instrumentation and Control	Breadth	2+1	2+3
MET-212	CAD Modeling	Foundation	0+2	0+6
MEI-211	Introduction To Artificial Intelligence	Interdisciplinary	2+1	2+3
Subtotal			11+6=17	11+18=29



Curriculum for Bachelor of Mechanical Engineering Technology



Semester – IV				
Suggested Course Codes	Course Title	Knowledge Area/Domain	Credit Hrs. (Th+Lab)	Weekly Contact Hrs. (Th+Lab)
MES-221	Engineering Economics	General Education	2+0	2+0
MEM-221	Entrepreneurship	General Education	2+0	2+0
MET-221	Machine Design	Breadth	2+0	2+0
MEI-221	Industrial Maintenance and Safety	Interdisciplinary	2+1	2+3
MET-223	Industrial Materials	Breadth	2+1	2+3
MET-222	Manufacturing Process I	Breadth	1+2	1+6
MET-224	Fluid Mechanics	Breadth	2+1	2+3
Subtotal			13+5=18	13+15=28
Semester – V				
Suggested Course Codes	Course Title	Knowledge Area/Domain	Credit Hrs. (Th+Lab)	Weekly Contact Hrs. (Th+Lab)
MET-313	Heat and Mass Transfer	Depth	2+1	2+3
MET-312	Manufacturing Process II	Depth	1+2	1+6
MET-311	Mechanics of Materials	Depth	2+1	2+3
MET-314	Applied Energy Systems & Technologies	Breadth	2+1	2+3
MET-315	Project-I	Project-I	0+3	0+9
Subtotal			7+8 =15	7+24=31
Semester – VI				
Suggested Course Codes	Course Title	Knowledge Area/Domain	Credit Hrs. (Th+Lab)	Weekly Contact Hrs. (Th+Lab)
MEH-321	Fehm e Quran II // Ethics-II	General Education	0+1	1+3
MET-323	Mechanical Vibrations	Depth	2+1	2+3
MET-322	Industrial Engineering	Depth	2+0	2+0
MET-321	Heating, Ventilation and Air-Conditioning (HVAC) Technologies	Depth	2+1	2+3
MET-324	Quality Management and Reliability	Depth	3+0	3+0
MET-325	Project-II	Project-II	0+3	0+9
Subtotal			9+6 =15	9+18=27



Curriculum for Bachelor of Mechanical Engineering Technology



Semester – VII (Framework-A)				
Suggested Course Codes	Course Title	Knowledge Area/Domain	Credit Hrs. (Th+Lab)	Weekly Contact Hrs. (Th+Lab)
MET-411	Supervised Industrial Training (Optional)	Mechanical Engineering Technology Domain Industrial Training	16	48
Subtotal			0+16= 16	0+48= 48
Semester – VII (Framework-B)				
Suggested Course Codes	Course Title	Knowledge Area/Domain	Credit Hrs. (Th+Lab)	Weekly Contact Hrs. (Th+Lab)
MET-411	ELECTIVE I	Breath Elective	2+1	2+3
MET-412	ELECTIVE II	Breath Elective	2+1	2+3
MET-413	ELECTIVE I	Depth Elective	2+1	2+3
MET-414	ELECTIVE II	Depth Elective	2+1	2+3
MET-415	Automobile Technology	Compulsory Depth Elective	3+1	3+3
Subtotal			11+5=16	11+15=26
Semester – VIII				
Suggested Course Codes	Course Title	Knowledge Area/Domain	Credit Hrs. (Th+Lab)	Weekly Contact Hrs. (Th+Lab)
MET-421	Supervised Industrial Training	Mechanical Engineering Technology Domain Industrial Training	16	48
Subtotal			0+16= 16	0+48= 48
Total Credit Hours & Contact Hours in Four Years (Framework - A)			133	269
Theory vs Practical with respect to Contact Hours			Theory / Practical	(24.16%) / (75.84%)
Total Credit Hours & Contact Hours in Four Years (Framework - B)			133	247
Theory vs Practical with respect to Contact Hours			Theory / Practical	(30.77%) / (69.23%)

6. Course Codes

Details pertinent to course codes are presented below:

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

Letters in Course-Codes prefix are defined below:

- First two letters pertain to the program (e.g., M for Mechanical)
- Third letter pertains to specifics of the course (e.g., T for technology, E for expository writing etc.)

Digits in Course-Codes are defined in table below:

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

Course Code Examples		
Sr.	Course Code Prefix	Description
1	MET	Mechanical Engineering Technology Foundation/ Breadth/ Depth
2	MEE	Expository Writing
3	MEH	Art & Humanities
4	MES	Social Sciences
5	MEQ	Quantitative Reasoning
6	MEN	Natural Sciences
7	MEC	Computing
8	MEM	Management Sciences
9	MEI	Inter Disciplinary Technology Elective

7. Elective Courses

The lists of elective courses – grouped across depth and breadth categories – are presented below, showing credit hours and weekly contact hours.

ELECTIVES				
Sr. No.	Course Name	Knowledge Area	Credit Hours	
			Theory	Practical
1.	Non-Destructive Testing of Materials/Structures	Breadth Elective	2	1
2.	Nuclear Technology and Materials for Nuclear Reactors	Breadth Elective	3	0
3.	Pressure Vessels and their Fabrication	Breadth Elective	2	1
4.	Alternate Energy Resource	Breadth Elective	3	0
5.	Metal Technology	Breadth Elective	2	1
6.	Metrology	Breadth Elective	2	1
7.	Hybrid Engines and their Technology	Compulsory Depth Elective	3	1
8.	Vacuum Science and Technology	Depth Elective	3	0
9.	Nanotechnology	Compulsory Depth Elective	3	1
10.	Automobile Technology	Compulsory Depth Elective	3	1
11.	Robotics and AI	Depth Elective	2	1
12.	Supply Chain Management	Depth Elective	3	0
13.	Corrosion Control Technology	Depth Elective	2	1
14.	Polymer	Depth Elective	2	1
15.	Automobiles & Electric Vehicle Technologies	Foundation Elective	2	1
16.	Robotics And Automation	Interdisciplinary	2	1



Curriculum for Bachelor of Mechanical Engineering Technology



8. Course Contents

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

Program Learning Objectives (PLO's), Course Learning Objectives (CLO's) and Bloom's Taxonomy Levels are expected learning outcomes and are aligned to standards set by the Sydney Accord and the International Engineering Alliance.

8.1 Workshop Technology

(COURSE CODE) and TITLE		CREDITS HOURS:	PRE-REQUISITE
(MET-112) Workshop Technology		(0+2)	NA
CATEGORY AND DOMAIN		KNOWLEDGE & ATTITUDE PROFILE	SUSTAINABLE DEVELOPMENT GOALS SDGs:
Engineering Technology Foundation		SK6	SDGs 4
Course Objective			
To provide students with fundamental knowledge and practical skills of workshop tools, machines, manufacturing processes, and safe working practices used in mechanical engineering technology.			
Course Learning Outcomes	CLOs Statement		Taxonomy (Level)
	After completion of this course students will be able to:		
CLO-1	Demonstrate safety practices while working in the workshop		A-3
CLO-2	Perform the selection of a workshop process for a given task using collected information.		C-2
CLO-2	Operate different machines and tools to complete an assigned task.		P-3

Lab Work Outline for Practical

1. To understand basic Safety guidelines, tools, and gadgets
2. To familiarise with types of cutting tools and tool holders used with a standard centre lathe machine
3. To understand the pattern-making procedure and perform wood - working
4. To practice pattern making for different mechanical components
5. To practice boring operations on the lathe machine
6. To produce internal threads on components using different methods
7. To produce external threads on components using different methods
8. To identify and familiarization of various types of milling cutters
9. To understand the parts and accessories of a universal milling machine.
10. To perform basic Milling operations (side milling, end milling) on a universal milling machine
11. To familiarise with the parts, accessories, cutting tools and operations of a shaper machine
12. Perform facing and Slotting operation on Shaper Machine
13. To join two metal parts using different mechanical fastening techniques and welding technology
14. To understand the Basic fundamental of foundry processes
15. To produce a given mechanical component using casting, forging, and finishing processes

RECOMMENDED BOOKS

1. Begeman, M. L., & Hurs, H. Manufacturing technology. (ISBN: 13730303030).
2. Chapman, W. A. J. Workshop technology (Parts I–III).
3. Groover, M. P. (2002). Fundamentals of modern manufacturing (2nd ed.). John Wiley & Sons.
4. Hajra Choudhury, S. K. Elements of workshop technology. (ISBN: 1455594666).
5. Shrivastava, A. K., & Gautam, S. Workshop technology and practices. (ISBN: 9789395319164).

SUPPLEMENTAL RESOURCES

Open Educational Resources

1. **MIT OpenCourseWare** : Manufacturing Processes and Introduction to Machine Tools.
2. **NPTEL**: Workshop Technology, Manufacturing Processes, and Machine Tools.
3. **OpenLearn (The Open University)**: Engineering materials and manufacturing fundamentals.

Standards and Technical References

1. **ISO 45001**: Occupational Health and Safety Management Systems.
2. **OSHA Machine Shop Safety Guidelines**: Safe operation of workshop machines and equipment.
3. **Machinery's Handbook**: Standard reference for machining practices, threads, cutting tools, and workshop calculations.

Professional Organizations

1. **Society of Manufacturing Engineers (SME)**: Manufacturing fundamentals, machining, and workshop practices.
2. **American Welding Society (AWS)**: Introductory welding procedures and safety resources.
3. **ASM International**: Engineering materials, heat treatment, and manufacturing process references.

8.2 Applied Mechanics

(COURSE CODE) and TITLE	CREDITS HOURS:	PRE-REQUISITE
(MET-121) Applied Mechanics	(2+1)	NA
CATEGORY AND DOMAIN	KNOWLEDGE & ATTITUDE PROFILE	SUSTAINABLE DEVELOPMENT GOALS (SDGs):
Engineering Technology Foundation	SK1, SK3	SDGs 4

Course Objective

To develop students' ability to understand and apply mechanics principles in solving practical engineering technology problems.

Course Learning Outcomes	CLOs Statement	Program Outcomes (PLO)	Taxonomy (Level)
	After completion of this course students will be able to:		
CLO-1	Explain principles of forces, moments, and equilibrium in mechanical systems.	1	C-2
CLO-2	Apply concepts of forces, structures, and friction to solve engineering technology problems.	2	C-3
CLO-3	Apply principles of motion, work, and energy in practical mechanical systems.	2	C-3

Course Outline for Theory

Basic concepts of mechanics, scalars, vectors, units, force systems, resultant forces, vector addition, equilibrium of particles and rigid bodies, free body diagrams, equilibrium conditions, moments, and couples, with applications in lifting systems, cranes, bridges, wall fixtures, door hinges, wrenches, and levers.

Structures, friction, trusses, frames, machines, laws of friction, angle of friction, belt friction, screws, wedges with applications to roof structures, transmission towers, bridges, workshop frames, machine supports, walking, tire grip, brake pads, conveyor belts, screw jacks, and clamping devices.

kinematics, work, energy, power, momentum, rotational motion, work-energy principles, power calculation, efficiency, impulse, momentum, angular motion, and torque with applications to vehicles, elevators, conveyor systems, rotating tools, motors, pumps, engines, hammering, impact tools, fans, and rotating shafts.



Curriculum for
Bachelor of Mechanical Engineering Technology



Course Learning Outcome of Labs		
Course Learning Outcomes	CLOs Statement After completion of this course students will be able to:	Taxonomy (Level)
CLO-1	Determine forces, moments, frictional effects, and structural behavior using experimental setup.	P-3
CLO-2	Apply experimental results to solve practical engineering problems related to equilibrium, motion, and mechanical systems.	P-3
CLO-3	Apply experimental data and observations to interpret the behavior of mechanical systems and verify fundamental principles of mechanics.	P-3

Lab Work Outline for Practical

Following is the tentative list of Practical on Applied Mechanics. Institutions depending on their needs and available resources can add or remove practical.

1. Hooke's Law and Spring Behavior
2. Static Equilibrium of Forces
3. Truss analysis model
4. Struts and Mechanisms
5. Flywheel and Energy Storage
6. Simple Pendulum and Determination of g
7. Physical and Bifilar Pendulum Systems
8. Torsional Oscillations and Inertia
9. Friction on inclined plane
10. Work-energy experiment
11. Motion measurement
12. Power calculation

RECOMMENDED BOOKS

1. Walker, K. (2013). Applied mechanics for engineering technology (8th ed.). Pearson.
2. Hibbeler, R. C. (2021). Engineering mechanics: Statics & dynamics (15th ed.). Pearson.
3. Beer, F. P., Johnston, E. R., Mazurek, D. F., Cornwell, P. J., & Self, B. P. (2023). Vector mechanics for engineers: Statics and dynamics (13th ed.). McGraw-Hill Education.

SUPPLEMENTAL RESOURCES

1. <https://nptel.ac.in/courses/112106286>
2. PHET Simulations: <https://phet.colorado.edu/en/simulations/>

8.3 Machine Design

(COURSE CODE) and TITLE		CREDITS HOURS:	PRE-REQUISITE
(MET-221) Machine Design		(2+0)	NA
CATEGORY AND DOMAIN		KNOWLEDGE & ATTITUDE PROFILE	SUSTAINABLE DEVELOPMENT GOALS SDGs):
Engineering Technology Breadth		SK2, SK3, SK4, SK6	SDGs 8, SDGs 9
Course Objective			
This course introduces the principles of machine design, emphasizing the selection, application, and analysis of machine elements using engineering standards and established design practices for broadly-defined engineering problems.			
Course Learning Outcomes	CLOs Statement After completion of this course students will be able to:	Program Outcomes (PLO)	Taxonomy (Level)
CLO-1	Explain the design process, factor of safety, codes, standards, fits, tolerances, and reliability	2	SA-1
CLO-2	Apply selection criteria for mechanical joints, bearings, and other standard machine elements using engineering standards.	3	SA-3
CLO-3	Apply selection criteria for mechanical joints, bearings, and other standard machine elements using engineering standards.	4	SA-2
Course Outline for Theory			
Introduction to Design, Basic Concepts in Design of Machine Parts: Factor of Safety, Codes and Standards. Reliability, Fits, Allowances and Tolerances. Standard Threaded Fasteners and Joints, Power Screws, Riveted Joints, Design of Keys, Pins, Design of Welded Joints using codes and standards. Design of Clutches, Brakes, Flywheels and Couplings. Design of Shafts and its components: Shaft materials, Stress and strength, Stress concentration in shafts, Deflection and Slope in shafts. Couplings and its types, Design and Selection of bearings, including Rolling contact and sliding contact bearings. Pulleys and Belts drives, Selection of Roller Chains and Ropes. Types of Gears and their Design. Gear Trains and design of gearbox.			

Lab Work Outline for Practical

Introduction to Design, Basic Concepts in Design of Machine Parts: Factor of Safety, Codes and Standards. Reliability, Fits, Allowances and Tolerances. Standard Threaded Fasteners and Joints, Power Screws, Riveted Joints, Design of Keys, Pins, Design of Welded Joints using codes and standards. Design of Clutches, Brakes, Flywheels and Couplings. Design of Shafts and its components: Shaft materials, Stress and strength, Stress concentration in shafts, Deflection and Slope in shafts. Couplings and its types, Design and Selection of bearings, including Rolling contact and sliding contact bearings. Pulleys and Belts drives, Selection of Roller Chains and Ropes. Types of Gears and their Design. Gear Trains and design of gearbox.

RECOMMENDED BOOKS

1. D'Angelo Jr., A. (2021). Machine design for technology students: A systems engineering approach. Springer. ISBN: 9783031796845.
2. Juvinall, R. C., & Marshek, K. M. (2020). Fundamentals of machine component design (7th ed.). McGraw-Hill Education.
3. Norton, R. L. (2014). Machine design: An integrated approach (5th ed.). Pearson. ISBN: 9780133356717.
4. Mott, R. L., Vavrek, E. M., & Wang, J. (2021). Machine elements in mechanical design (6th ed.). Pearson.
5. Spotts, M. F., Shoup, T. E., Hornberger, L. E., & Jayram, S. (2004). Design of machine elements (8th ed.). Pearson.
6. Shigley, J. E., Mischke, C. R., & Budynas, R. G. (2020). Shigley's mechanical engineering design (11th ed.). McGraw-Hill Education.

SUPPLEMENTAL RESOURCES

1. MIT OpenCourseWare , Free lectures and notes on machine design, mechanics, and manufacturing.
<https://ocw.mit.edu/courses/21m-603-principles-of-design-fall-2005/>
2. Funda Engineering Fundamentals, Engineering formulas, machine elements, material properties, and design references.
https://www.efunda.com/designstandards/design_home.cfm
3. Engineering LibreTexts, Open-access engineering textbooks and learning materials.
https://eng.libretexts.org/?utm_source=chatgpt.com

8.4 Mechanics of Materials

(COURSE CODE) and TITLE	CREDITS HOURS:	PRE-REQUISITE
(MET-311) Mechanics of Materials	(2+1)	NA
CATEGORY AND DOMAIN	KNOWLEDGE & ATTITUDE PROFILE	SUSTAINABLE DEVELOPMENT GOALS (SDGS):
Engineering Technology Depth	SK1, SK2, SK3, SK4, SK6	SDGs 4, SDGs 9

Course Objective

To provide a solid foundation in the fundamental concepts of materials

Course Learning Outcomes	CLOs Statement After completion of this course students will be able to:	Program Outcomes (PLO)	Taxonomy (Level)
CLO-1	Describe mechanical behavior of materials under tensile, compressive, torsional, and combined loadings, and Factor of safety.	1	C-1
CLO-2	Explain causes of Failure and its prevention.	2	C-2
CLO-3	Investigate the methods of determining hardness fatigue, and creep.	4	C-4

Course Outline for Theory

1. Fundamental concepts

Fundamental concepts of stress, strain, and material behavior under tensile, compressive, shear, bending, torsional, fatigue, creep, and thermal loading. Effect strain rate on mechanical behavior of materials.

2. Stress Strain behaviour

Elastic and plastic deformation, stress-strain relationships, resilience, toughness, fracture mechanics, failure theories, hardness testing (Brinell, Rockwell, Vickers, and Shore), fatigue, creep, and safety factor. Stress transformation using Mohr's Circle for principal and shear stresses. Introduction to destructive and non-destructive testing (NDT), awareness of simulation analysis tools for stress and deformation analysis, intelligent engineering tools for given materials. Lightweight structural design and life-cycle analysis to support sustainable engineering and Industry 5.0 practices



Curriculum for
Bachelor of Mechanical Engineering Technology



Course Learning Outcome of Labs

Course Learning Outcomes	CLOs Statement	Taxonomy (Level)
	After completion of this course students will be able to:	
CLO-1	Work on experiments/task/project related to mechanics of materials laboratory independently.	P-2
CLO-2	Organize the results of experiments in written and graphical format.	P-4
CLO-3	Attempt participation in group discussion while practicing professional ethics.	A-2

Lab Work Outline for Practical

1. Perform tensile testing of mild steel and aluminum specimens to determine Young's modulus, yield strength, ultimate tensile strength, ductility, resilience, and toughness, and evaluate the effect of strain rate on material behaviour.
2. Compression testing of mild steel, aluminum, and concrete/cast iron specimens to determine compressive strength and deformation characteristics.
3. Determination of material hardness using Brinell, Rockwell and Vickers hardness tests.
4. Determination of impact energy using the Charpy and/or Izod Impact Test on metallic specimens.
5. Investigation of the fatigue behavior of metallic materials under cyclic loading.
6. Measurement of beam deflection under transverse loading and verification of theoretical deflection equations.
7. Introduction to computer-aided stress and deformation analysis using computational mechanics software (e.g., Finite Element Analysis) to compare simulation results with experimental observations.

RECOMMENDED BOOKS

1. Gere, J. M., & Goodno, B. J. (2024). Mechanics of materials (9th SI ed.). Cengage Learning
2. Silberschmidt, V., & Hearn, E. J. (2026). Mechanics of materials: An introduction to the mechanics of elastic and plastic deformation of solids and structural materials (4th ed.). Elsevier.
3. Hibbeler, R. C. (2025). Mechanics of materials (11th ed.). Pearson.
4. Beer, F. P., Johnston, E. R., DeWolf, J. T., & Mazurek, D. F. (2026). Mechanics of materials (8th ed.). McGraw

SUPPLEMENTAL RESOURCES

1. Engineer4Free: zero-cost video series: <https://www.engineer4free.com/mechanics-of-materials.html>
2. Jeff Hanson YouTube resource for engineering students: <https://www.youtube.com/@1234jhanson>
3. Coursera courses on Mechanics of Materials and Finite Element Analysis
4. NPTEL (National Programme on Technology Enhanced Learning): https://onlinecourses.nptel.ac.in/e-learning/preview/noc22_ce54
5. PhET Interactive Simulations (<https://phet.colorado.edu/>)

8.5 Computer Programming

(COURSE CODE) and TITLE		CREDITS HOURS:	PRE-REQUISITE
(MEI-122) Computer Programming		(2+1)	NA
CATEGORY AND DOMAIN		KNOWLEDGE & ATTITUDE PROFILE	SUSTAINABLE DEVELOPMENT GOALS (SDGS):
Interdisciplinary		SK2, SK6	SDGs 4, SDGs 8, SDGs 9
Course Objective			
Introduction to programming fundamentals including variables, data types, operators, control structures, functions, arrays, and object-oriented concepts such as classes for developing simple to intermediate level programs.			
Course Learning Outcomes	CLOs Statement After completion of this course students will be able to:	Program Outcomes (PLO)	Taxonomy (Level)
CLO-1	Demonstrate the use of basics of programming.	1	C-2
CLO-2	Develop simple programs using functions and controls.	3	C-3
CLO-3	lustrate the use of arrays, classes, and other functions to write intermediate level programs.	2	C-4
Course Outline for Theory			
Basics constants and variables, keywords, identifiers, data types, variables and their types, escape sequence, operators and statements, Decision and control: if statements, if-else-if statement, switch statement, for loop, while loop, do-while loop, nested loops, break statement, Functions: defining a function, types function, return statement, default argument, local and global variables, standard function and user defined functions, multifunction, arguments pass as reference or as a value, Arrays: declaration, initialization, arrays and function, multidimensional arrays Structures: declaration, initialization, functions and structures, arrays of structure, nested structure, enumerations, Classes: declaration, initialization, constructors.			

Course Learning Outcome of Labs

Course Learning Outcomes	CLOs Statement After completion of this course students will be able to:	Taxonomy (Level)
CLO-1	Express the basic knowledge of a suitable programming language	C-2
CLO-2	Apply the knowledge of programming to solve problems in effective way.	C-3
CLO-3	Examine short program code to detect bugs, evaluate code quality, and recommend improvements	C-4
CLO-4	Communicate effectively the flow charts, programming algorithms and procedures	A-2

Lab Work Outline for Practical

Following is the tentative list of Practical for Computer Programming. Institutions depending on their needs and available resources can add or remove practical.

1. Introduction to Programming Algorithms, Flowcharts, and Integrated Development Environment (IDE).
2. Program Development Using Variables, Data Types, Operators, and Input/Output Statements.
3. Implementation of Decision-Making Statements Using if, if-else, and switch.
4. Implementation of Iterative Structures Using for, while, and do-while Loops.
5. Problem Solving Using Nested Loops and Control Statements.
6. Development of Programs Using Standard and User-Defined Functions.
7. Function Parameter Passing Using Pass-by-Value and Pass-by-Reference.
8. Implementation of One-Dimensional and Multidimensional Arrays.
9. Structures, Enumerations, and Arrays of Structures.
10. Object-Oriented Programming Fundamentals: Classes, Objects, and Constructors.
11. Vibe Coding and cleansing/optimization



Curriculum for Bachelor of Mechanical Engineering Technology



RECOMMENDED BOOKS

1. Lee, K. D. (2015). Python programming fundamentals (2nd ed.). Springer. <https://doi.org/10.1007/978-1-4471-6642-9>
2. Palmer, W. J., & Rosse, C. (2021). The new Python programming for beginners. Caterina Rosse.
3. Gaddis, T. (2021). Starting out with Python (5th ed.). Pearson.
4. Phillips, D. (2021). Python 3 object-oriented programming: Build robust and maintainable object-oriented Python applications and libraries (4th ed.). Packt Publishing

SUPPLEMENTAL RESOURCES

1. Cursor, onlinedb, Kaggle, Github, Claude and vibe coding compilers
2. Python Development Certificate (Coursera or similar platform)

8.6 Basic Electrical Technology and Electronics

(COURSE CODE) and TITLE (MEI-121) Basic Electrical Technology and Electronics	CREDITS HOURS: (2+1)	PRE-REQUISITE NA	
CATEGORY AND DOMAIN	KNOWLEDGE & ATTITUDE PROFILE	SUSTAINABLE DEVELOPMENT GOALS SDGS):	
Interdisciplinary	SK1, SK2, SK3, SK6	SDGs 7, SDGs 9	
Course Objective			
To provide students with the knowledge and skills related to the principles and operation of basic electrical and electronic devices, including motors, transformers, rectifiers, and amplifiers, and analyze electrical circuits for performance evaluation and optimization.			
Course Learning Outcomes	CLOs Statement After completion of this course students will be able to:	Program Outcomes (PLO)	Taxonomy (Level)
CLO-1	Describe the construction and working of motors, transformers, rectifiers, and amplifiers.	1	C-4
CLO-2	Analyze electric circuits to determine their behavior and performance.	2	C-4
Course Outline for Theory			



Curriculum for **Bachelor of Mechanical Engineering Technology**



Basic concepts of voltage, current, resistance, capacitance, and inductance, series and parallel circuits, series parallel combination calculations, ohm law, law of resistance, Kirchhoff's Laws, construction and working principles of DC machines and their types, speed control of DC motors, working principles and applications of AC and servo motors, construction and working principles of single and three phase transformers, construction and application of various types of rectifiers. Base knowledge for current trends in multilayer Chip/PCB design and manufacturing.



Curriculum for
Bachelor of Mechanical Engineering Technology



Course Learning Outcome of Labs

Course Learning Outcomes	CLOs Statement	Taxonomy (Level)
	After completion of this course students will be able to:	
CLO-1	Conduct and accurately measure various physical quantities and perform circuit analysis experiments using appropriate tools and procedures.	P-3
CLO-2	Organize the results of experiments in written and graphical format.	P-4

Lab Work Outline for Practical

Following is the tentative list of Practicals for Basic Electrical Technology and Electronics. Institutions depending on their needs and available resources can add or remove practical.

1. Measurement of Voltage, Current, and Resistance Using Analog and Digital Multimeters.
2. Verification of Ohm's Law and Determination of Resistance from Voltage-Current Characteristics.
3. Analysis of Series, Parallel, and Series-Parallel Resistive Circuits.
4. Verification of Kirchhoff's Voltage Law (KVL) and Kirchhoff's Current Law (KCL).
5. Investigation of the Charging and Discharging Characteristics of RC Circuits.
6. Study and Performance Analysis of Half-Wave, Full-Wave, and Bridge Rectifier Circuits.
7. Open-Circuit and Load Testing of a Single-Phase Transformer.
8. Study of Construction, Operating Characteristics, and Speed Control of a DC Motor.
9. Investigation of the Operating Principles and Applications of AC and Servo Motors.
10. Design and Assembly of a Simple Printed Circuit Board (PCB) for an Electronic Circuit.

RECOMMENDED BOOKS

1. Boylestad, R. L., & Olivari, B. (2022). Introductory circuit analysis (14th ed.). Pearson.
2. Floyd, T. L. (2018). Electronic devices (10th ed.). Pearson.
3. Hughes, A., & Drury, B. (2019). Electric motors and drives: Fundamentals, types and applications (5th ed.). Elsevier.

SUPPLEMENTAL RESOURCES

1. Altium, Pretues, MultiSim, Cadence or similar circuit design and analysis software
2. Electrical Circuits MOOCs on edx or coursera

8.7 Introduction to Artificial Intelligence

(COURSE CODE) and TITLE (MEI-211) Introduction to Artificial Intelligence	CREDITS HOURS: (2+1)	PRE-REQUISITE NA
CATEGORY AND DOMAIN	KNOWLEDGE & ATTITUDE PROFILE	SUSTAINABLE DEVELOPMENT GOALS (SDGs):
Interdisciplinary	SK2, SK6, SK8	SDGs 4, SDGs 9, SDGs 3

Course Objective

To enable students for utilization of AI Technology including data handling and basic model development, with application to practical tasks and analysis based on modern AI approaches considering ethical and societal implications in engineering contexts.

Course Learning Outcomes	CLOs Statement After completion of this course students will be able to::	Program Outcomes (PLO)	Taxonomy (Level)
CLO-1	Develop basic concepts of machine learning and their use in real-world engineering problems, considering ethical and societal implications.	1	C-2
CLO-2	Apply basic machine learning techniques to solve practical tasks.	3	C-3
CLO-3	Analyze current AI-based approaches to problem solving in a structured manner to derive valid conclusions for engineering applications.	2	C-4

Course Outline for Theory

Introduction to Artificial Intelligence and Machine learning, scope, and real-world engineering applications; Prompt Engineering, Agentic AI and Sovereign AI; basic concepts such as data types, features, datasets, and model representation; data preprocessing including cleaning, normalization, and feature selection; fundamental machine learning techniques including supervised and unsupervised learning, regression and classification methods, and basic clustering; model training and testing concepts including over fitting, under fitting, and performance metrics; implementation of simple machine learning models using appropriate tools; analysis of AI-based approaches for problem solving, including comparison of methods, interpretation of results, and drawing valid conclusions for engineering applications; Vibe Coding; hardware compute technologies including GPUs, TPUs, and NPUs; introduction to Natural Language Processing (NLP), Large Language Models (LLMs), prompt engineering, Agentic AI, and current trends in artificial intelligence.

Course Learning Outcome of Labs

Course Learning Outcomes	CLOs Statement After completion of this course students will be able to:	Taxonomy (Level)
CLO-1	Explain data gathering, visualization, and representation techniques based on guided activities for basic applications.	C-2
CLO-2	Test AI-based methods in a structured manner to produce valid results for engineering applications.	C-4

Lab Work Outline for Practical

Following is the tentative list of Practical for Introduction to Artificial Intelligence. Institutions depending on their needs and available resources can add or remove practical.

1. Prompt Engineering for Technology / Domain area problem
2. Data Collection and Dataset Preparation for AI Applications.
3. Data Visualization and Exploratory Data Analysis.
4. Data Cleaning, Normalization, and Feature Engineering.
5. Implementation of Linear Regression for Engineering Applications.
6. Implementation of Classification Models for Engineering Data.
7. Clustering and Unsupervised Learning Techniques.
8. Model Training, Validation, and Performance Evaluation.
9. Analysis of Overfitting, Underfitting, and Model Improvement Techniques.
10. Comprehensive Generative AI, Large Language Models (LLMs), and Prompt Engineering.
11. AI-Based Engineering Problem Solving and Comparative Analysis of Machine Learning Models.

RECOMMENDED BOOKS

1. Fenner, M. (2020). *Machine learning with Python for everyone*. Addison-Wesley Professional.
2. Negnevitsky, M. (2025). *Artificial intelligence: A guide to intelligent systems* (4th ed.). Pearson.
3. Russell, S., & Norvig, P. (2020). *Artificial intelligence: A modern approach* (4th ed.). Pearson.

SUPPLEMENTAL RESOURCES

1. Python, Kaggle, Github
2. AI Agents (Masnooi Muawin) and related tools like NTIN, Nano Banana etc.
3. SuperWize, Claude, ChatGPT, DeepSeek
4. CANN/CUDA for GPU/NPU configuration and management.

8.8 Application of ICT

(COURSE CODE) and TITLE		CREDITS HOURS:	PRE-REQUISITE
(MEC-111) Application of ICT		(2+1)	NA
CATEGORY AND DOMAIN		KNOWLEDGE & ATTITUDE PROFILE	SUSTAINABLE DEVELOPMENT GOALS SDGs):
General Education		Not Applicable	SDGs 4, SDGs 8, SDGs 9, SDGs 17
Course Objective			
To develop students' knowledge and skills in applying information and communication technologies for effective problem-solving, data management, and engineering applications.			
Course Learning Outcomes	CLOs Statement After completion of this course students will be able to:	Program Outcomes (PLO)	Taxonomy (Level)
CLO-1	Know the basic management functions, planning & decision making of organizations by applying engineering management concepts (knowledge).	1	C-1
CLO-2	Explain organizational structures, tools for developing solutions, human aspects of management and describe elements to control them (comprehension).	4	C-2
CLO-2	Analyze the market and new business ideas select methods to motivate and lead technical people (analysis).	4	C-4
Course Outline for Theory			
The applications of ICT - particularly for technologists, Transforming data into information, How computers represent and process data Processing Devices, CPU architectures, The Internet and the World Wide Web- browsers, HTML, URLs/ How DNS works, Uses of networks, Common types of networks (LAN, WAN, MAN etc.), Introduction to OSI Model, Future of Networks, Hierarchy of Data, Maintaining Data and Database Management Systems, Privacy and security of Data, Future trends			



Curriculum for
Bachelor of Mechanical Engineering Technology



Course Learning Outcome of Labs

Course Learning Outcomes	CLOs Statement	Taxonomy (Level)
	After completion of this course students will be able to:	
CLO-1	Explain the possible applications of ICT.	P-2
CLO-2	Explain how to use web without being attacked by viruses, spywares, spams etc.	P-2
CLO-3	Explain use of networking and relevant concepts with data security.	P-2

Lab Work Outline for Practical

Evaluating and Sourcing Information Found on the Web, Multimedia Search Tools: Image, Audio, & Video Searching, avoiding spams, viruses, spywares, Web search and Plagiarism, Web documents creation, Starting Over with Hard Drive: Erasing, Reformatting, & Reloading, Online Safety: Antivirus Software, Firewalls, Passwords, Biometric Authentication, & Encryption, setting up virtual meetings, Object oriented languages, HTML 5, VML

RECOMMENDED BOOKS

1. Norton, P. (2005). Introduction to computers (6th ed.). McGraw-Hill.
2. Williams, B. K., & Sawyer, S. C. (2015). Using information technology: A practical introduction to computers & communications (6th ed.). McGraw-Hill.

8.9 Quality Management and Reliability

(COURSE CODE) and TITLE	CREDITS HOURS:	PRE-REQUISITE
(MET-324) Quality Management and Reliability	(3+0)	NA
CATEGORY AND DOMAIN	KNOWLEDGE & ATTITUDE PROFILE	SUSTAINABLE DEVELOPMENT GOALS SDGs:
Engineering Technology Depth	SK4	SDGs 9

Course Objective

To provide fundamental knowledge of quality management, statistical quality control, and reliability engineering for continuous quality improvement.

Course Learning Outcomes	CLOs Statement After completion of this course students will be able to:	Program Outcomes (PLO)	Taxonomy (Level)
CLO-1	Use statistical software for quality control and reliability.	5	C-3
CLO-2	Apply lean methodologies for the benefits of local industry.	6	C-3

Course Outline for Theory

Introduction to Quality: Definition and dimensions of quality, QC and QA, Cost of Quality, Quality Policy, 7 QC tools, Cycle time, Lead time, Takt-time,

Statistical Process Control: Controls charts, PPM defective, Process Capability Indices, Acceptance sampling plan, introduction to six-sigma.

Japanese Production System: Toyoda precept, Quality circle, Kanban 5S, Pokayoka, 3M (Mura, Muri, Muda), Kanban, Jidoka, Gemba, KAIZEN, JIT system.

TQM: Customer satisfaction, KANO model, Leadership, Failure Modes & Effects Analysis (FMEA), PDCA Cycle, Quality Function Deployment(QFD), Introduction to Quality Management System (ISO9000).

Reliability: Definition, failure rate functions, Hazard functions, Reliability function, Weibull distribution, Bath-tub curve, series parallel reliability network, MTBF, MTTR, Availability, Product liability and warranty.

RECOMMENDED BOOKS

1. Jiang, R. (2015). Introduction to quality and reliability engineering. Springer
2. Besterfield, D. H. (2015). Total quality management (3rd ed., International ed.). Pearson.
3. Montgomery, D. C. (2009). Introduction to statistical quality control (6th ed.). John Wiley & Sons.
4. Mitra, A. (2016). Fundamentals of quality control and improvement (4th ed.). John Wiley & Sons.

SUPPLEMENTAL RESOURCES

1. Python (Pandas, NumPy, Matplotlib, Reliability package)
2. MATLAB, Minitab, Microsoft Excel
3. Coursera / edX
4. ASQ (quality tools and certifications) <https://asq.org/quality-resources/quality-tools>
5. ISO (ISO 9001 and related standards)

8.10 Applied Energy Systems & Technologies

(COURSE CODE) and TITLE (MET-314) Applied Energy Systems & Technologies		CREDITS HOURS: (2+1)	PRE-REQUISITE NA
CATEGORY AND DOMAIN		KNOWLEDGE & ATTITUDE PROFILE	SUSTAINABLE DEVELOPMENT GOALS SDGS):
Engineering Technology Breadth		SK1, SK3, SK5, SK6, SK7	SDGs 7, SDGs 9, SDGs 13
Course Objective			
To provide students with practical knowledge of conventional and renewable energy systems, energy technologies, efficiency improvement techniques, and their applications in engineering technology.			
Course Learning Outcomes	CLOs Statement After completion of this course students will be able to:	Program Outcomes (PLO)	Taxonomy (Level)
CLO1	Explain the working principles and applications of conventional and renewable energy systems in industrial and building contexts	1	C2
CLO2	Calculate and assess the performance and efficiency of energy systems such as boilers, motors, and compressors.	2	C3
CLO3	Analyze energy utilization and identify energy efficiency and conservation measures considering environmental and sustainability aspects.	7	C4
Course Outline for Theory			
Energy and power technologies, conventional and non-conventional energy systems, fossil fuels and their utilization, Combined Heat and Power (CHP), Tri-generation IC engines: basic types, performance and emission characteristics (overview), thermal power plants and hydroelectric systems (operational aspects), renewable energy systems including solar, wind, biomass, geothermal and small-scale hydro systems with focus on selection and installation of industrial energy systems including motors, compressors, fans and HVAC applications, energy storage technologies, hybrid energy systems, energy efficiency and conservation techniques, waste heat recovery, hydrogen economy and green hydrogen, introduction to energy audit and measurement techniques, ISO 50001 fundamentals, safety and environmental considerations.			

Course Learning Outcome of Labs

Course Learning Outcomes	CLOs Statement	Taxonomy (Level)
	After completion of this course students will be able to:	
CLO 1	Demonstrate ethical practices, teamwork and effective communication while conducting energy-related experiments and reporting results.	A3
CLO 2	Analyze the performance of energy systems using measurements obtained through appropriate instruments	P4

Lab Work Outline for Practical

1. Familiarization with energy systems and energy measurement instruments (power analyzer, clamp meter, thermal camera).
2. Measurement of electrical parameters (voltage, current, power, power factor) for different loads.
3. Power factor improvement using capacitor banks.
4. Performance evaluation of solar PV panels under varying environmental conditions.
5. Solar panel connections in series and parallel with load and performance comparison.
6. Determination of I–V characteristics and fill factor of solar panels.
7. Study of battery charging and discharging characteristics for energy storage systems.
8. Performance testing of inverter systems under different loading conditions.
9. Boiler efficiency determination using direct method (demonstration/rig-based).
10. Flue gas analysis for combustion efficiency assessment.
11. Thermal imaging for detection of heat losses in building or piping systems.
12. Measurement of energy consumption of electrical appliances and load profiling.
13. Detection of compressed air leakage and estimation of energy losses.
14. Basic energy audit of a classroom, laboratory, or building and preparation of audit report.

RECOMMENDED BOOKS

1. Breeze, P. (2014). Power generation technologies (2nd ed.). Newnes.
2. El-Wakil, M. M. (1985). Powerplant technology. McGraw-Hill.
3. Thollander, P., & Palm, J. (2012). Improving energy efficiency in industrial energy systems: An interdisciplinary perspective on barriers, energy audits, energy management, policies, and programs. Springer.
4. Twidell, J., & Weir, T. (2015). Renewable energy resources (3rd ed.). Routledge.

SUPPLEMENTAL RESOURCES

1. Biogas Plant Calculator: <https://biogas-calculator.soft112.com/>
2. RETSCREEN Software: <https://photovoltaic-software.com/pv-softwares-calculators/free-photovoltaic-software/retscreen-can>
3. Tri Generation: An Overview: <https://www.sciencedirect.com/topics/engineering/tri-generation>
4. Capehart, B. L., Turner, W. C., & Kennedy, W. J. (2020). Guide to energy management. River Publishers.
5. Marimon, F., & Casadesús, M. (2017). Reasons to adopt ISO 50001 energy management system. Sustainability, 9(10), 1740.

8.11 Heat and Mass Transfer

(COURSE CODE) and TITLE		CREDITS HOURS:	PRE-REQUISITE
(MET-313) Heat and Mass Transfer		(2+1)	NA
CATEGORY AND DOMAIN		KNOWLEDGE & ATTITUDE PROFILE	SUSTAINABLE DEVELOPMENT GOALS SDGs):
Engineering Technology Depth		SK1, SK2, SK3, SK4, SK6	SDGs 7, SDGs 9, SDGs 13
Course Objective			
To calculate temperature distribution or heat transfer rate			
Course Learning Outcomes	CLOs Statement After completion of this course students will be able to:	Program Outcomes (PLO)	Taxonomy (Level)
CLO1	Calculate heat transfer rates for conduction, convection, and radiation	2	C3
CLO2	Analyze the performance of heat exchangers under various conditions.	3	C4
Course Outline for Theory			
Basic concepts of heat transfer and heat flow in engineering systems, conduction through simple and composite walls, thermal conductivity, insulation, and overall heat transfer coefficient. Convection heat transfer with applications in natural and forced convection systems, basic fluid flow concepts, boiling and condensation in refrigeration and power systems. Thermal radiation, radioactive properties, and use of radiation shields in practical applications. Types of Heat exchangers and applications, selection, basic design considerations, performance evaluation, fouling, operation and maintenance of heat exchangers, LMTD Method, NTU Method, extended surfaces (fins) and their applications. Types and classification of boilers, mountings, safe operation, and maintenance. Condensers and cooling towers with performance evaluation, system operation, flow control, and energy-saving practices in industrial and HVAC systems. Mass Transfer: Concentration Boundary Layer, Fick’s law, HMT analogy.			

Course Learning Outcome of Labs

Course Learning Outcomes	CLOs Statement	Taxonomy (Level)
	After completion of this course students will be able to:	
CLO 1	Demonstrate ethical behavior, teamwork, and effective communication while performing heat and mass transfer experiments and reporting results.	A3
CLO 2	Perform measurements of heat and mass transfer systems using appropriate instruments and standard procedures.	P2

Lab Work Outline for Practical

1. Experimental demonstration of Fourier's law of heat conduction and measurement of thermal conductivity (k) of a metallic bar using appropriate instruments.
2. Measurement of heat transfer rate and study of the effect of cross-sectional area on heat transfer.
3. Measurement of temperature distribution and evaluation of insulation effect in conductors of different diameters.
4. Determination of heat transfer coefficient (h) in natural convection over flat surfaces.
5. Determination of heat transfer coefficient (h) in forced convection over flat surfaces.
6. Measurement of fin performance and determination of efficiency of extended surfaces (fins).
7. Performance evaluation of finned heat exchangers under different operating conditions.
8. Measurement and plotting of temperature distribution in shell and tube heat exchangers for parallel and counter flow.
9. Determination of Logarithmic Mean Temperature Difference (LMTD) in heat exchangers.
10. Determination of overall heat transfer coefficient (U) of shell and tube heat exchangers.

RECOMMENDED BOOKS

1. Kamaraj, G., & Raveendiran, P. (2014). Heat and mass transfer (2nd ed.). Scitech Publications.
2. Çengel, Y. A. (2007). Heat transfer: A practical approach (3rd ed.). McGraw-Hill.
3. Teir, S. (2002). Steam boiler technology. Helsinki University of Technology.
4. Bergman, T. L., Lavine, A. S., Incropera, F. P., & DeWitt, D. P. (2017). Incropera's principles of heat and mass transfer (8th Global ed.). Wiley.

SUPPLEMENTAL RESOURCES

1. Ansys Fluent Software
2. Comsol Software
3. REFPROP software

8.12 Industrial Maintenance and Safety

(COURSE CODE) and TITLE	CREDITS HOURS:	PRE-REQUISITE
(MEI-221) Industrial Maintenance and Safety	(2+1)	NA
CATEGORY AND DOMAIN	KNOWLEDGE & ATTITUDE PROFILE	SUSTAINABLE DEVELOPMENT GOALS SDGS):
Interdisciplinary	SK3, SK5, SK6, SK7, SK9	SDGs 3, SDGs 8

Course Objective

To develop knowledge and practical skills in industrial maintenance and occupational health and safety for improving equipment reliability, operational efficiency, and workplace safety.

Course Learning Outcomes	CLOs Statement After completion of this course students will be able to:	Program Outcomes (PLO)	Taxonomy (Level)
CLO1	Explain the principles of industrial maintenance management, including maintenance planning and scheduling, inventory control, productivity improvement, plant layout, material handling, quality control, and facility operations.	1	C4
CLO2	Apply maintenance strategies, predictive maintenance techniques, and reliability and maintainability engineering tools to improve equipment performance and operational reliability.	2	C2
CLO3	Analyze workplace hazards and recommend appropriate occupational health and safety measures using Job Safety Analysis (JSA), risk assessment, OSHA guidelines, Personal Protective Equipment (PPE), Lockout/Tagout (LOTO), fire safety, emergency response, and ergonomic principles.	2	C3

Course Outline for Theory

Industrial Maintenance : Introduction to Maintenance Management (Maintenance objectives, Scheduling ,inventory control) Optimizing manufacturing processes, reducing waste, and boosting factory productivity in core areas of Productivity and Work Study , Plant Layout and Material Handling, Quality Control, Facility Economics and Operations Research. Maintenance Strategies (Maintenance Strategies, Predictive Maintenance (PdM), Reliability and Maintainability Engineering (Failure analysis, Analytical tools etc)

Industrial safety: Safety Fundamentals & Standards: Introduction to local and global safety standards ,Hazard Identification(Job Safety Analysis (JSA), hazard mapping, and risk assessment matrices), OSHA Guidelines (overview), Personal Protective Equipment (PPE)(selection, use, and maintenance), Lockout/Tagout



Curriculum for
Bachelor of Mechanical Engineering Technology



(LOTO)(Procedures for isolating energy sources during maintenance) Fire Safety & Emergency Response(Fire triangle, extinguisher types, and evacuation planning) Workplace Ergonomics , ISO 45001 Occupational Health & Safety Management System.

Course Learning Outcome of Labs		
Course Learning Outcomes	CLOs Statement	Taxonomy (Level)
	After completion of this course students will be able to:	
CLO 1	Actively contribute individually and as team member.	A2
CLO 2	Practice the experimental task and writing skills as per subject requirements(List of Practical of each course).	P2
CLO 3	Organize report in a given format.	A4

Lab Work Outline for Practical

Following is the tentative list of Practical / Labs

1. **OSHA Hazard Inspection** – Conduct a mock workplace safety audit; identify and document violations (unguarded machines, improper chemical storage, electrical hazards, missing PPE).
2. **Lockout/Tag out (LOTO) Procedure** – Identify all energy isolation points on a machine; write a written LOTO procedure and perform a simulated lockout per OSHA 1910.147.
3. **PPE & Emergency Response** – Select correct Personal Protective Equipment for specific tasks; practice fire extinguisher operation and emergency evacuation procedures.
4. **Micrometer & Caliper Use** – Measure shaft diameters, component clearances, and part tolerances using precision measuring tools.
5. **Dial Indicator & Alignment** – Measure shaft run out, deflection, and surface flatness using dial indicators. **Bearing Inspection & Replacement** – Identify bearing wear patterns; measure shaft run out; practice proper bearing installation using press or heat induction methods.
6. **Belt & Chain Drive Alignment** – Align motor and driven pulleys; set proper belt tension using tension gauges; inspect chain drives for stretch and wear.
7. **Gearbox Inspection** – Inspect gear teeth for wear and pitting; check backlash; drain and replace lubricant.
8. **Hydraulic System Troubleshooting** – Build basic hydraulic circuits; intentionally introduce faults; measure pressure and flow; diagnose issues and document repairs.
9. **Pneumatic Circuits & Electro-Pneumatics** – Assemble pneumatic circuits with valves and actuators; integrate electrical control using PLC or relay logic.
10. **Vibration Analysis** – Measure machine vibration using meters or accelerometers; identify faults including imbalance, misalignment, bearing defects, and looseness.
11. **Thermal Imaging** – Use thermal cameras to inspect electrical panels (loose connections, overloaded breakers) and rotating equipment (bearing hotspots, insulation failures).
12. **Oil Analysis** – Sample lubricant from a gearbox or engine; interpret results including viscosity, particle count, and wear metals.
13. **Preventive Maintenance (PM) Task Sheet** – Develop a written PM procedure for a specific machine; include inspection intervals, required parts/tools, and step-by-step instructions.
14. **Shutdown Planning** – Plan a 2-day plant shutdown; sequence work orders; balance maintenance tasks with production downtime and labor constraints.

RECOMMENDED BOOKS

1. Brumbach, M. E., & Clade, J. A. (2014). Industrial maintenance (2nd ed.).
2. Spellman, F. R., & Whiting, N. E. (2009). Handbook of safety engineering.
3. Dhillon, B. S. (2023). Advanced concepts: System safety, maintainability, and maintenance for engineers.

SUPPLEMENTAL RESOURCES

1. OSHAcademy Safety and Health Training: offers short courses
2. Alison free modules in industrial operations : for reference material
3. NPTEL (National Programme on Technology Enhanced Learning): offers free of cost material



8.13 Heating, Ventilation and Air-Conditioning (HVAC) Technologies

(COURSE CODE) and TITLE	CREDITS HOURS:	PRE-REQUISITE
(MET-321) Heating, Ventilation and Air- Conditioning (HVAC) Technologies	(2+1)	NA
CATEGORY AND DOMAIN	KNOWLEDGE & ATTITUDE PROFILE	SUSTAINABLE DEVELOPMENT GOALS SDGS):
Engineering Technology Depth	SK1, SK2, SK3, SK4, SK6, SK7	SDGs 3, SDGs 7, SDGs 11, SDGs 13
Course Objective		



Curriculum for Bachelor of Mechanical Engineering Technology



To develop students' understanding of HVAC technologies, refrigeration cycles, system components, load calculations, and applications for efficient thermal management in buildings and industries.

Course Learning Outcomes	CLOs Statement After completion of this course students will be able to:	Program Outcomes (PLO)	Taxonomy (Level)
CLO1	Explain fundamentals of heating, ventilation, and air-conditioning systems.	1	C2
CLO2	Calculate basic heating/cooling load estimations.	2	C3
CLO3	Apply ventilation principles for indoor air quality.	6	C3

Course Outline for Theory

Saturated and Superheated vapors: Saturation temperature, Superheated vapors, Sub cooled liquids, Evaporation, Vaporization, Condensation, Critical temperature, Critical pressure, Enthalpy, Entropy, Vapor Tables, Refrigeration cycles, vapor compression and vapor absorption systems, COP, pressure-enthalpy chart, types of refrigerants, air cycle refrigeration, multiple effect compression, multi-stage compression, Psychometric, comfort conditions and comfort zone, indoor air quality,

Central air-conditioning system, Essential components of central air-conditioning plant, Split air-conditioning system

Refrigerants: Introduction, Classification of refrigerants Thermodynamic Properties of Refrigerant, Chemical Properties of Refrigerants (Safe Properties, Toxicity, Flammability and explosiveness), Economic and other considerations, Ozone depletion, Other Important Terms, Load calculation, Cooling and heating load calculation procedures, Sources of heat load, Sensible & Latent Heat Load, Cooling Load types, the wall gain load, the air change load, The product load, the miscellaneous/supplementary load duct sizing and piping design, air handling unit for untreated fresh air, forced convection based air ventilator design.

Course Learning Outcome of Labs

Course Learning Outcomes	CLOs Statement After completion of this course students will be able to:	Taxonomy (Level)
CLO 1	Measure air properties and analyses psychometric processes using lab instruments.	P3
CLO 2	Demonstrate safe and responsible use of HVAC tools, equipment, and controls. .	A3
CLO 3	Work effectively in teams and prepare structured technical lab reports.	A4

Lab Work Outline for Practical



Curriculum for Bachelor of Mechanical Engineering Technology



Following is the tentative list of Practical on Heating, Ventilation and Air-condition Technologies

1. Performance Testing of Vapor Compression Refrigeration System (VCRS)
2. Effect of Evaporator Pressure on COP of VCRS
3. Effect of Condenser Temperature on System Performance
4. Refrigeration Cycle Analysis on P-h Diagram
5. Performance Analysis of HVAC System Trainer (Cooling Mode)
6. Performance Evaluation of HVAC System in Heat Pump Mode (Heating Mode)
7. Psychometric Analysis of Cooling and Dehumidification Process
8. Effect of Airflow Rate on HVAC System Performance
9. Study of Sensible Heating and Cooling Processes in HVAC System
10. Bypass Factor and Coil Efficiency Determination
11. Performance Optimization of Cooling Tower under Variable Conditions (Forced & Induced Draft)
12. Design of Residential HVAC System Based on Cooling Load Estimation

RECOMMENDED BOOKS

1. Dossat, R. J. (2002). Principles of refrigeration (2nd ed.). Pearson.
2. McQuiston, F. C., Parker, J. D., & Spitler, J. D. (2005). Heating, ventilating, and air-conditioning: Analysis and design. John Wiley & Sons.
3. Kreider, J. F., Curtiss, P. S., & Rabl, A. (2002). Heating and cooling of buildings: Design for efficiency. McGraw-Hill.
4. Haines, R. W., & Wilson, L. W. (1998). HVAC systems design handbook (4th ed.). McGraw-Hill.
5. American Society of Heating, Refrigerating and Air-Conditioning Engineers. (2009). ASHRAE handbook: Fundamentals. ASHRAE.
6. Jones, J. W., & Stoecker, W. F. (1982). Refrigeration and air conditioning. McGraw-Hill.

SUPPLEMENTAL RESOURCES

1. ANSYS Fluent software
2. HAP Software
3. COMSOL software
4. Any other relevant software

8.14 Applied Thermodynamics

(COURSE CODE) and TITLE (MET-211) Applied Thermodynamics	CREDITS HOURS: (2+1)	PRE-REQUISITE NA
CATEGORY AND DOMAIN	KNOWLEDGE & ATTITUDE PROFILE	SUSTAINABLE DEVELOPMENT GOALS SDGS):
Engineering Technology Foundation	SK1, SK2, SK3, SK6	SDGs 7, SDGs 9, SDGs 13

Course Objective

To provide students with knowledge of thermodynamic laws, cycles, energy systems, and their practical applications in engineering technology.

Course Learning Outcomes	CLOs Statement After completion of this course students will be able to:	Program Outcomes (PLO)	Taxonomy (Level)
CLO1	Determine thermodynamic properties of fluids at a given state using property tables.	1	C2
CLO2	Apply laws of thermodynamics for open and Closed systems involving energy interaction devices	1	C3
CLO3	Calculate performance parameters for thermodynamic cycles.	1	C3

Course Outline for Theory

Thermodynamic equilibrium, Thermodynamic properties, Properties of pure substance, Phases, Properties of vapor and steam, PVT surfaces, Energy-Entropy-Exergy interaction, Application of Laws of Thermodynamics (Zeroth, First, Second and Third law) for open and closed systems, Thermodynamics cycles (Carnot, Otto, Diesel, Dual Combustion, Rankine, Brayton) and their application, Fuel and Combustion: Calorific value, stoichiometric air-fuel ratio, Octane and Cetane Numbers, Nozzle, Diffusers, Reciprocating Compressor, Steam Turbine and Gas turbine as energy interaction devices.

Course Learning Outcome of Labs

Course Learning Outcomes	CLOs Statement After completion of this course students will be able to:	Taxonomy (Level)
CLO 1	Perform basic thermodynamic experiments using modern equipment to illustrate foundational principles.	P4
CLO 2	Apply ethical principles while working in the Thermodynamics laboratory and adopt necessary guidelines for student's health & safety.	A3

Lab Work Outline for Practical

1. To study different types of Thermometers
- 1b. Calibration of Thermometers
2. Measuring DBT at different locations using different thermometers
3. To Validate the Zeroth Law of Thermodynamics
- 4a. To study Sling Psychrometer
- 4b. To determine relative humidity using sling hygrometer (concept of dry bulb and wet bulb temperature)
- 5a. To demonstrate Boyle's Law (Isothermic Compression)
- 5b. To demonstrate Boyles's Law (Isothermic Expansion)
- 6a. To demonstrate Gay-Lussac's Law (Isochoric Heating)
- 6b. To demonstrate Gay-Lussac's Law (Isochoric Cooling)
1. To demonstrate Charles's Law
2. To demonstrate the correlation between steam pressure and heating temperature on an enclosed model steam boiler (Marcet Boiler)
9. Calibration of a Pressure Gauge Using Dead-Weight Tester
- 10a. To measure Positive Pressure with U-Tube Manometer
- 10b. To measure Negative Pressure with Inclined Tube Manometer
- 10c. To measure Positive Pressure with Bourdon Tube Manometer
- 10d. To measure Negative Pressure with Bourdon Tube Manometer
- 11a. To measure Positive Pressure with U-Tube Manometer and Bourdon Tube Manometer
- 11b. To measure Negative Pressure with U-Tube Manometer and Bourdon Tube Manometer
12. To determine experimentally the adiabatic exponent of air using the Clement-Desormes method.
13. To Determine the Calorific Values of Different Fuels

RECOMMENDED BOOKS

1. Çengel, Y. A., Boles, M. A., & Kanoğlu, M. (Year). Thermodynamics: An engineering approach (Edition). McGraw Hill.
2. Moran, M. J., Shapiro, H. N., Boettner, D. D., & Bailey, M. B. (Year). Fundamentals of engineering thermodynamics (Edition). Wiley.

SUPPLEMENTAL RESOURCES

1. EES software
2. Any other relevant software

8.15 Fluid Mechanics

(COURSE CODE) and TITLE	CREDITS HOURS:	PRE-REQUISITE
(MET-224) Fluid Mechanics	(2+1)	NA



Curriculum for Bachelor of Mechanical Engineering Technology



CATEGORY AND DOMAIN	KNOWLEDGE & ATTITUDE PROFILE	SUSTAINABLE DEVELOPMENT GOALS (SDGs):
Engineering Technology Breadth	SK1, SK2, SK3, SK6	SDGs 6, SDGs 7, SDGs 9

Course Objective

To develop students' understanding of fluid properties, fluid flow analysis, and the application of fluid mechanics principles in engineering systems and technologies. Calculate velocity and pressure distribution for static and dynamic problems.

Course Learning Outcomes	CLOs Statement After completion of this course students will be able to:	Program Outcomes (PLO)	Taxonomy (Level)
CLO1	Explain basic fluid properties, pressure variation, buoyancy, and fluid statics principles.	1	C-2
CLO2	Apply continuity, Bernoulli, and momentum equations to solve fluid-flow problems.	2	C-3
CLO3	Solve pipe flow problems using energy equations parameters.	4	C-3

Course Outline for Theory

Introduction to Pressure, pressure measurement gauges, Buoyancy and stability of submerged and floating bodies, Types of flow, flow rate and mean velocity, equation of continuity, steady and unsteady flow, fluid dynamics, properties and types of fluids, Bernoulli's theorem, energy equations and their applications, Flow through pipes and channels, losses in pipes, Piping standards

Course Learning Outcome of Labs

Course Learning Outcomes	CLOs Statement	Taxonomy (Level)
	After completion of this course students will be able to:	
CLO 1	Measure fluid properties such as pressure, flow rate, and velocity using standard instruments.	P3
CLO 2	Use modern engineering tools (manometers, flow meters, data acquisition systems) for experiments.	P3
CLO 3	Work effectively in teams and prepare structured technical lab reports.	A4

Lab Work Outline for Practical

Following is the tentative list of Practical for Fluid Mechanics and Hydraulic Machines

1. Familiarization with hydraulic bench and measurement of flow parameters using standard devices.
2. Determination of coefficient of discharge of a Venturi meter and evaluation of its practical applications.
3. Calibration of a rectangular notch and measurement of flow rate for different head conditions.
4. Calibration of a triangular (V-notch) weir and evaluation of discharge characteristics.
5. Determination of coefficient of discharge for orifice/flow measuring devices.
6. Calibration of pressure gauges and measurement of pressure in fluid systems.
7. Measurement of force exerted by jet on vanes and analysis of momentum change.
8. Performance evaluation of centrifugal pumps by measuring head, discharge, and efficiency.
9. Performance evaluation of Francis turbine and plotting of characteristic curves.
10. Performance analysis of hydraulic ram under varying operating conditions (valve lift and supply head).

RECOMMENDED BOOKS

1. Arora, K. R. (2005). Fluid mechanics and hydraulic machinery (9th ed.). Standard Publishers.
2. Finnemore, E. J., & Franzini, J. B. (2002). Fluid mechanics with engineering application (10th ed.). McGraw-Hill.
3. Shames, I. H. (1992). Fluid mechanics (3rd ed.). McGraw-Hill.
4. Purohit, R. K. (2007). Hydraulic machines. Scientific Publishers.

SUPPLEMENTAL RESOURCES

1. ANSYS FLUENT software
2. REFPROP software

8.16 Manufacturing Process I

(COURSE CODE) and TITLE	CREDITS HOURS:	PRE-REQUISITE
(MET-222) Manufacturing Process I	(1+2)	Workshop Technology
CATEGORY AND DOMAIN	KNOWLEDGE & ATTITUDE PROFILE	SUSTAINABLE DEVELOPMENT GOALS (SDGs):
Engineering Technology Breadth	SK3, SK4, SK6	SDGs 8, SDGs 9, SDGs 12

Course Objective

To develop fundamental understanding and hands-on skills in manufacturing processes, enabling students to select appropriate materials and processes, perform basic machining, Advanced Welding and Heat Treatment processes, and analyze product quality and defects in practical engineering applications.

Course Learning Outcomes	CLOs Statement After completion of this course students will be able to:	Program Outcomes (PLO)	Taxonomy (Level)
CLO-1	Select appropriate manufacturing processes based on material and application.	1	C-2
CLO-2	Calculate machining parameters, cutting forces, tool wear mechanisms	1	C-3
CLO-3	Define the Heat Treatment and Surface Treatment processes for Metals and Alloys	1	C-2

Course Outline for Theory

Manufacturing processes and their classifications, Materials used in Manufacturing, Jigs and Fixtures. Fundamentals of Machining Technology, Lathe and milling machines operations, Forces in cutting operations and effect of cutting fluid in cutting operations, Tools used in different manufacturing operations and causes of tool failure. Advance Welding such as TIG, MI, Laser Beam Welding, Friction Welding, Plasma Arc Welding, and Ultrasonic welding. Problems in welding, and Welding Inspection. Casting operations, Types of casting, Sand Casting, Mold design, Die casting, Problems in casting, Investment casting. Basic concept behind metal forming, Hot-working and cold working environment, Sheet metal forming, Extrusion, Wire drawing. Surface roughness, Grinding, Polishing, Painting. Injection Molding, Blow Molding and Rotational Molding. Electrical discharge machining (EDM), Laser beam machining (LBM), Water jet cutting (WJC), Heat Treatment Processes for Metal and Alloys including Annealing, Normalizing, Hardening, Tempering, surface Treatment processes i.e., Carburizing, Nitriding, Carbonitriding, Electroplating, Galvanizing Powder coating, shot peening, Sandblasting etc.

Course Learning Outcome of Labs		
Course Learning Outcomes	CLOs Statement	Taxonomy (Level)
	After completion of this course students will be able to:	
CLO-1	Demonstrate safe operation and perform machining processes.	P-3
CLO-2	Fabricate components using welding, and sheet metal working processes,	P-2
CLO-2	Apply Heat treatment, Surface treatment, finishing techniques	P-4

Lab Work Outline for Practical
1. Machining 1. Perform Complex Job on Milling Machine using Jig and Fixtures 2. Manufacture Gears using Indexing Head in Milling Machine 2. Casting (Sand Casting) 3. Prepare a sand mold with proper pattern and core assembly. 4. Produce a circular flange with four holes using sand casting technique. 5. Identify common casting defects in produced components. 3. Welding 6. Perform a Welding Operation Using TIG/ MIG Welding in 6 welding Positions 7. Perform a Friction Welding Operation 3. Sheet Metal Working 8. Fabricate a rectangular box using aluminum sheet through shearing, bending, and joining operations. 9. Study the working of sheet metal machines (shear, press brake). 4. Finishing Operations 10. Perform grinding operation to achieve required surface finish. 11. Measure and compare surface quality before and after finishing. 5. Heat Treatment 1. Perform an Annealing Process to an Alloy

2. Perform a Normalizing Process to an Alloy

3. Perform Tempering Process to an Alloy

6. Surface Treatment

1. Perform a Surface treatment process to a Metal Plate

RECOMMENDED BOOKS

1. Youssef, H. A., El-Hofy, H. A., & Ahmed, M. H. (2012). Manufacturing technology: Materials, processes, and equipment. CRC Press.
2. Kalpakjian, S., & Schmid, S. R. (2014). Manufacturing engineering and technology (7th ed.). Pearson Education.

SUPPLEMENTAL RESOURCES

1. **MIT OpenCourseWare** – Manufacturing Processes and Materials Engineering.
2. **NPTEL** – Manufacturing Processes, Welding Technology, Metal Casting, and Heat Treatment.
3. **Coursera** – Manufacturing Process Technology and Materials Engineering courses.
4. **edX** – Fundamentals of Manufacturing and Industrial Engineering.

Engineering Materials and Standards

1. **MatWeb** – Online engineering materials database.
2. **ASM International** – Technical resources on heat treatment, surface engineering, and materials.
3. **American Welding Society (AWS)** – Welding standards, procedures, and inspection resources.

SME (Society of Manufacturing Engineers) – Manufacturing process references and technical articles.

8.17 Manufacturing Process II

(COURSE CODE) and TITLE		CREDITS HOURS:	PRE-REQUISITE
(MET-312) Manufacturing Process II		(1+2)	Manufacturing Process I
CATEGORY AND DOMAIN		KNOWLEDGE & ATTITUDE PROFILE	SUSTAINABLE DEVELOPMENT GOALS SDGS):
Engineering Technology Depth		SK2, SK4, SK6, SK8	SDGs 8, SDGs 9, SDGs 12
Course Objective			
To develop advanced knowledge and practical skills in modern manufacturing systems, including CNC machining, CAD/CAM, automation, additive manufacturing, reverse engineering, and Industry 4.0 technologies, enabling students to analyze, operate, and evaluate advanced manufacturing processes in industrial applications.			
Course Learning Outcomes	CLOs Statement	Program Outcomes (PLO)	Taxonomy (Level)
CLO-1	After completion of this course students will be able to: Understanding of CAD/CAM, CNC Machining processes including cutting mechanics, tool life, high-speed Machining, and tool path generation.	1	C-2
CLO-2	Apply CIM concepts including PLC basics, robotics, industrial automation, and reverse engineering using CMM and 3D scanning.	4	C-3
CLO-2	Comprehend advanced manufacturing systems including non-traditional machining, additive manufacturing, Industry 4.0, and quality optimization techniques.	5	C-2
Course Outline for Theory			
Advanced machining processes including cutting mechanics, tool life optimization and high-speed machining. CNC machining including multi-axis machining, CAD/CAM integration, tool path generation and simulation. Computer Integrated Manufacturing (CIM), PLC basics, robotics and industrial automation. Reverse Engineering Techniques including contact CMM or non-contact 3D Scanners Optical / laser. Advanced non-traditional machining including wire EDM, electron beam machining (EBM), ultrasonic machining (USM), abrasive water jet machining (AWJM). Additive manufacturing processes including FDM, SLA, SLS and DED, design for additive manufacturing and defects. Industry 4.0 concepts including IoT, smart manufacturing and digital twins. Quality and optimization including surface integrity, process capability and lean manufacturing.			

Course Learning Outcomes	CLOs Statement After completion of this course students will be able to:	Taxonomy (Level)
CLO-1	Demonstrate CNC machining operations including toolpath generation, simulation, CNC turning, CNC milling, and multi-operation machining using standard laboratory equipment and procedures.	P-3
CLO-2	Develop engineering components using mold design, CNC EDM, reverse engineering, and additive manufacturing technologies through appropriate CAD/CAM and fabrication workflows.	P-4
CLO-3	Apply automation, robotic simulation, process parameter optimization, and quality assessment techniques to evaluate and improve modern manufacturing processes.	P-5

Lab Work Outline for Practical

1. CNC Machining

- Generate toolpaths for complex parts
- Perform simulation and verification of CNC programs
- Perform Step turning operation on CNC turning center
- Perform thread cutting operation on CNC turning center
- Perform profile/curve cutting operation on CNC turning center
- develop a rectangular plate with holes through CNC milling
- Develop CNC programs for complex parts on machining center
- Perform multi-operation machining with automatic tool change
- Perform EDM operation using CNC EDM machine

2. Mold Design and Manufacturing

- Develop a simple two-piece mold for injection molding/ blow Molding machine

3. Reverse Engineering

- Perform 3D scanning of a part
- Generate and prepare STL file from scanned data

4. Additive Manufacturing

- Perform slicing operations and set process parameters (layer height, orientation, infill, etc.)
- Identify defects and analyze layer adhesion issues

- Fabricate components using 3D printing technologies: FDM / SLA / SLS (polymers) SLM / DED / Binder Jetting (metals)

5. Automation in Manufacturing Processes

- Understand basic robot programming
- Develop and simulate pick-and-place operation

RECOMMENDED BOOKS

1. Kalpakjian, S., & Schmid, S. R. (2014). Manufacturing engineering and technology (7th ed.). Pearson Education.
2. Smid, P. (2010). CNC programming handbook (3rd ed.). Industrial Press.
3. Groover, M. P. (2015). Automation, production systems, and computer-integrated manufacturing. Pearson Education.
4. Gibson, I., Rosen, D. W., & Stucker, B. (2015). Additive manufacturing technologies: 3D printing, rapid prototyping, and direct digital manufacturing. Springer.

SUPPLEMENTAL RESOURCES

Open-Source Software

1. **FreeCAD (Path Workbench):** CAD modeling and basic CAM toolpath generation.
2. **Blender:** 3D modeling, mesh editing, and STL file preparation for additive manufacturing.
3. **PrusaSlicer / OrcaSlicer / Cura:** Open-source slicing software for FDM 3D printing.

Industrial Software (Student/Educational Versions)

1. **Autodesk Fusion 360:** CAD/CAM, CNC programming, and simulation.
2. **SolidWorks with SolidCAM:** Product design and manufacturing.
3. **Mastercam (Educational Edition):** CNC programming and machining simulation.
4. **Autodesk PowerMill (Educational)** – High-speed and multi-axis CNC machining.
5. **Ultimaker Cura** – Industrial slicing software for additive manufacturing.

Online Learning Platforms

1. **Coursera:** Manufacturing, CAD/CAM, Robotics, and Industry 4.0 courses.
2. **edX:** Advanced manufacturing and automation courses.
3. **MIT OpenCourseWare:** Manufacturing processes and machine design.
4. **NPTEL:** Manufacturing Technology, CNC, Robotics, and Additive Manufacturing.

Standards and Technical References

1. **ISO 6983:** Numerical Control of Machines (G-Code).
2. **ISO 10303 (STEP):** Product data exchange for CAD/CAM.
3. **ASTM F42 Standards:** Additive Manufacturing Technologies.
4. **ISO/ASTM 52900:** Additive Manufacturing, General Principles and Terminology.

8.18 Mechanical Vibrations

(COURSE CODE) and TITLE		CREDITS HOURS:	PRE-REQUISITE
(MET-323) Mechanical Vibrations		(2+1)	NA
CATEGORY AND DOMAIN		KNOWLEDGE & ATTITUDE PROFILE	SUSTAINABLE DEVELOPMENT GOALS SDGS):
Engineering Technology Depth		SK4, SK5, SK6	SDGs 9, SDGs 11
Course Objective			
To develop the ability to apply vibration principles for analysis and control of mechanical systems in real-world engineering applications.			
Course Learning Outcomes	CLOs Statement	Program Outcomes (PLO)	Taxonomy (Level)
CLO-1	After completion of this course students will be able to: Apply fundamental concepts of vibration to determine motion characteristics of mechanical systems.	2	C-3
CLO-2	Apply vibration analysis methods to evaluate system response under free and forced vibrations.	3	C-3
CLO-2	Analyze vibration behavior of mechanical systems and interpret results for engineering applications.	4	C-4
Course Outline for Theory			
Basic concepts, terminology, types of mechanical vibrations, Single Degree of Freedom (SDOF) systems, spring-mass systems, equations of motion, un damped and damped free vibrations, damping types, and logarithmic decrement, with practical applications in engines, fans, machine mounts, shock absorbers, and rotating shafts. Forced vibration, vibration isolation, transmissibility, Multi Degree of Freedom systems, torsional vibrations, continuous systems and their applications in vehicles, shafts, gear systems, bridges, and structural elements. Industrial applications through case studies on bearing faults, rotor imbalance, misalignment, predictive.			

Course Learning Outcomes	CLOs Statement After completion of this course students will be able to:	Taxonomy (Level)
CLO-1	Demonstrate free and forced vibration experiments using standard laboratory setups and procedures.	P-2
CLO-2	Apply experimental techniques to measure damping, natural frequency, vibration isolation, and system response.	P-3
CLO-3	Apply sensor-based vibration measurement and basic FFT/signal observation to identify vibration characteristics of mechanical systems.	P-3

Lab Work Outline for Practical

Following is the tentative list of Practical on Mechanical Vibrations. Institutions depending on their needs and available resources can add or remove practical.

1. Free vibration experiment
2. Damping measurement
3. Forced vibration setup
4. Vibration isolation experiment
5. Sensor-based vibration measurement
6. FFT/basic signal observation

RECOMMENDED BOOKS

1. Rao, S. S. (2016). Mechanical vibrations (6th ed.). Pearson.
2. Inman, D. J. (2022). Engineering vibration (5th ed.). Pearson.
3. Wowk, V. (1991). Machinery vibration: Measurement and analysis. McGraw-Hill. (This is the standard edition commonly catalogued by libraries.)

SUPPLEMENTAL RESOURCES

1. <https://nptel.ac.in/courses/101102090>
2. <https://ocw.mit.edu/courses/8-03sc-physics-iii-vibrations-and-waves-fall-2016/pages/syllabus/>

8.19 Industrial Engineering

(COURSE CODE) and TITLE	CREDITS HOURS:	PRE-REQUISITE
(MET-322) Industrial Engineering	(2+0)	NA
CATEGORY AND DOMAIN	KNOWLEDGE & ATTITUDE PROFILE	SUSTAINABLE DEVELOPMENT GOALS (SDGS):
Engineering Technology Depth	SK2, SK6, SK7	SDGs 4, SDGs 8, SDGs 9

Course Objective

Understanding of Industrial Engineering and Operations Management principles, enabling them to improve productivity, optimize industrial systems, and apply quality and continuous improvement techniques in engineering organizations.

Course Learning Outcomes	CLOs Statement	Program Outcomes (PLO)	Taxonomy (Level)
	After completion of this course students will be able to:		
CLO-1	Explain the principles, functions, and tools of Industrial Engineering and Operations Management, including productivity measurement, facility planning, work systems, and operations planning	1	C-2
CLO-2	Apply industrial engineering techniques such as process analysis, facility layout, work measurement, inventory management, production planning, and quality tools to improve operational performance	3	C-3
CLO-3	Analyze manufacturing and service systems using Lean Manufacturing, 5S, Six Sigma, ERP, and continuous improvement methodologies to enhance organizational efficiency and sustainability.	4	C-4

Course Outline for Theory

Module 1: Fundamentals of Industrial Engineering and Operations Management

- Introduction to Industrial Engineering and Operations Management
- Functions and Scope of Industrial Engineering
- Productivity Measurement and Improvement
- Forecasting Techniques
- Process Design and Process Selection
- Facility Location and Plant Layout
- Introduction to Work Systems and Ergonomics

Module 2: Production Planning and Quality Management

- Work Design and Job Design
- Capacity Planning

- Production Planning and Control (PPC)
- Inventory Management (EOQ, ABC Analysis, JIT)
- Material Requirement Planning (MRP)
- Enterprise Resource Planning (ERP)
- Supply Chain Management
- Quality Management Fundamentals
- Statistical Process Control (SPC)

Module 3: Lean Manufacturing and Continuous Improvement

- Lean Manufacturing Principles
- 5S Workplace Organization
- Kaizen and Continuous Improvement
- Waste Identification and Elimination
- Six Sigma Fundamentals
- Project Management (PERT/CPM)
- Industrial Case Studies and Productivity Improvement Applications
- Sustainable Manufacturing Practices and Industry Best Practice

RECOMMENDED BOOK

1. Stevenson, W. J. (2024). Operations management (15th ed.). McGraw Hill.
2. Niebel, B. W., & Freivalds, A. (2014). Niebel's methods, standards, and work design (13th ed.). McGraw-Hill Education.
3. Jacobs, F. R., & Chase, R. B. (2022). Operations and supply chain management (17th ed.). McGraw Hill.
4. Heizer, J., Render, B., & Munson, C. (2023). Operations management: Sustainability and supply chain management (15th ed.). Pearson.

SUPPLEMENTAL RESOURCES

1. Google Sheets / Microsoft Excel (Student Version) for Forecasting, EOQ, Inventory Analysis, Productivity Analysis, ABC Analysis, Scheduling
2. Gantt Project for Project Scheduling, Gantt Charts, Resource Planning: <https://www.ganttproject.biz/>
3. ProjectLibre for Project Management, CPM, PERT, Resource Allocation: <https://www.projectlibre.com/>
4. FlexSim Personal Learning Edition for Manufacturing and Production System Simulation: <https://www.flexsim.com/>
5. AnyLogic Personal Learning Edition (PLE) for Discrete Event Simulation, Supply Chain and Manufacturing Simulation: <https://www.anylogic.com/>
6. Odoo Community Edition software for ERP, MRP, Inventory, Manufacturing, CRM
7. YouTube Educational Channels (MIT: OpenCourseWare, NPTEL: Industrial Engineering, Learn Engineering, Lean Smarts, and Six Sigma Academy)

8.20 Industrial Materials

(COURSE CODE) and TITLE (MET-223) Industrial Materials	CREDITS HOURS: (2+1)	PRE-REQUISITE NA
CATEGORY AND DOMAIN Engineering Technology Breadth	KNOWLEDGE & ATTITUDE PROFILE SK1, SK2, SK3, SK6	SUSTAINABLE DEVELOPMENT GOALS (SDGS): SDGs 9, SDGs 12

Course Objective

To develop knowledge of engineering materials, their properties, testing, selection, and industrial applications for solving broadly-defined engineering technology problems.

Course Learning Outcomes	CLOs Statement	Program Outcomes (PLO)	Taxonomy (Level)
	After completion of this course students will be able to:		
CLO-1	Explain the classification, properties, and engineering applications of industrial materials.	1	C-2
CLO-2	Select appropriate engineering materials for mechanical components based on their properties and service requirements.	4	C-3
CLO-2	Evaluate material testing results and their significance engineering applications.	2	C-4

Course Outline for Theory

Introduction to Engineering Materials: Classification of engineering materials, atomic structure and bonding, crystalline and non-crystalline structures, defects in materials, and the relationship between material structure and engineering properties.

Mechanical Properties of Materials: Stress and strain, elasticity, plasticity, strength, hardness, ductility, brittleness, toughness, fatigue, and the significance of mechanical properties in engineering design and material selection.

Metallic Materials: Classification of ferrous and non-ferrous metals, engineering alloys, properties of metallic materials, and their industrial applications.

Polymeric Materials: Classification; thermoplastics and thermosetting polymers; properties; processing methods; and engineering applications.

Ceramic Materials: Classification, properties, manufacturing processes, limitations, and engineering applications of



Curriculum for Bachelor of Mechanical Engineering Technology



ceramic materials.

Composite Materials: Classification of composites, reinforcement materials, matrix materials, properties, manufacturing methods, advantages, limitations, and engineering applications of composite materials.

Material Selection and Testing: Material identification techniques, selection of engineering materials based on service requirements, commonly used material testing methods (tensile, hardness, impact, compression, and non-destructive testing), and applications of engineering materials in industrial practice.

Lab Work Outline for Practical

The lab course provides hands-on experience in material identification and testing, reinforcing the theoretical concepts of engineering materials and their industrial applications.

1. Introduction to engineering materials laboratory, material testing equipment, laboratory safety, and standard operating procedures.
2. Identification and classification of engineering materials, including ferrous metals, non-ferrous metals, polymers, ceramics, and composite materials.

Course Learning Outcomes	CLOs Statement		
	CLOs Statement		
3	To prepare steel specimens for different heat treatment processes (Quenching, Annealing).	TC	
4	To study the mechanical properties of different heat-treated steel samples using Tensile Testing.	(Level)	
5	To prepare the specimens of brass, bronze and copper and steel for microscopic examinations.		
CLO-1	To conduct the micro examinations of Aluminum and Stainless steel samples using a metallurgical microscope.		
CLO-2	To conduct different heat treatment processes and identify grain structures formed as a result of these heat treatment processes.		
CLO-2	To conduct a micro examination of Polymers by preparing their specimens using a metallurgical microscope.		
CLO-2	To determine the Brinell hardness number of the given specimens of ferrous, non-ferrous and non-metallic materials using suitable equipment's.		

9. To determine the Rockwell hardness number of the given specimens of ferrous, non-ferrous and non-metallic materials.
10. To perform the hardening process on the given part.
11. To perform the tempering process on the given part.
12. To study the different mechanical properties of heat treated and untreated specimens.
13. To study the grain structure of heat treated and untreated materials specimens.
14. **OEL: Comparative Investigation of Engineering Materials :** Students shall **experimentally compare two or more engineering materials** by evaluating mechanical behaviour and recommend the most suitable material for a specified engineering application.

RECOMMENDED BOOKS

1. Callister, W. D., Jr., & Rethwisch, D. G. (2018). Materials science and engineering: An introduction (10th ed.). John Wiley & Sons. ISBN: 9781119405498.
2. Smith, W. F., & Hashemi, J. (2010). Foundations of materials science and engineering (5th ed.). McGraw-Hill Higher Education. ISBN: 9780073529240.
3. Budinski, K. G., & Budinski, M. K. (2010). Engineering materials: Properties and selection (9th ed.). Pearson. ISBN: 9780137128426.
4. Gupta, G. K. (2014). Engineering materials: Research, applications and advances. CRC Press.

SUPPLEMENTAL RESOURCES

1. https://eng.libretexts.org/Bookshelves/Materials_Science/TLP_Library_I?utm_source=chatgpt.com



Curriculum for
Bachelor of Mechanical Engineering Technology



8.21 Pakistan Studies

(COURSE CODE) and TITLE	CREDITS HOURS:	PRE-REQUISITE
(MEH-122) Pakistan Studies	(2+0)	NA
CATEGORY AND DOMAIN	KNOWLEDGE & ATTITUDE PROFILE	SUSTAINABLE DEVELOPMENT GOALS SDGS):
General Education	Not Applicable	SDGs 4, SDGs 16
Course Objective		

To enhance students' knowledge of Pakistan's historical, constitutional, cultural, and social development and develop awareness of national responsibilities and societal values.

Course Learning Outcomes	CLOs Statement After completion of this course students will be able to:	Program Outcomes (PLO)	Taxonomy (Level)
CLO-1	Analyze the contemporary problems faced by Pakistan (social, human resource, economic development, food safety / water resources) through discussion.	6	C-4
CLO-2	Describe the understanding of political and constitutional system of Pakistan through discussion.	12	C-2
CLO-3	Explain the economic outlook of Pakistan and discuss ethics of government policies to narrow the gap between various demographic groups living in Pakistan.	8	C-2

Course Outline for Theory

1. Introduction to Pakistan: Geographical location and significance. Historical background: Ancient civilizations in the region. Factors leading to the creation of Pakistan.
2. Political History of Pakistan: Formative phase. Military interventions and democratic transitions.
3. Geography of Pakistan: Physiography: Mountains, plains, plateaus, deserts, valleys and coastal areas River systems: Indus River and its tributaries. Climatic regions of Pakistan.
4. Society and Culture of Pakistan: Socio-cultural diversity. Languages and literature of Pakistan.
5. Economic Development of Pakistan: Agriculture and industrial sectors of Pakistan. Economic challenges of Pakistan.
6. Contemporary Issues: Foreign relations of Pakistan. Security challenges: terrorism, extremism, and regional conflicts. Environmental problems and sustainable development (SDGs). Media and social change.



Curriculum for
Bachelor of Mechanical Engineering Technology



RECOMMENDED BOOKS

1. Jalal, A. (1985). The sole spokesman: Jinnah, the Muslim League, and the demand for Pakistan.
2. Qureshi, I. H. (1965). The struggle for Pakistan.
3. Sayeed, K. B. (1968). Pakistan: The formative phase, 1857–1948.
4. Hayat, S. (Ed.). (1998). Pakistan studies: A book of readings.
5. Khan, H. (2005). Constitutional and political history of Pakistan.

8.22 Applied Chemistry

(COURSE CODE) and TITLE	CREDITS HOURS:	PRE-REQUISITE
(MEN-112) Applied Chemistry	(2+1)	NA
CATEGORY AND DOMAIN	KNOWLEDGE & ATTITUDE PROFILE	SUSTAINABLE DEVELOPMENT GOALS (SDGS):
General Education Natural Science	Not Applicable	SDGs 3, SDGs 6, SDGs 9, SDGs 12, SDGs 13

Course Objective

To understand the fundamental concepts of chemical kinetics, reaction rates, reaction mechanisms, and catalysis and their applications in engineering processes.

Course Learning Outcomes	CLOs Statement After completion of this course students will be able to:	Program Outcomes (PLO)	Taxonomy (Level)
CLO-1	Solve first order problems related to chemical reaction kinetics.	1	C-3
CLO-2	Explain electrochemical processes, work and thermodynamics, composites, and polymers.	1	C-2
CLO-3	Explain sources and causes generally attributed to water pollution, and their potential remedies.	2	C-2

Course Outline for Theory

Chemical kinematics and catalysis: Introduction to rate equation and reaction order, reaction mechanism, relation between rate equation and reaction mechanism, Thermodynamics, and electrochemical Phenomenon: Heat, work and energy, reversible and irreversible processes, work done in an isothermal reversible expansion of ideal gas. Enthalpy, Entropy, Electrochemical and galvanic series, polarization, decomposition potential, over voltage. Theories of corrosion. Types of corrosion and corrosion control of corrosion, Sources and conservation of fresh water, impurities in water and their effects. WHO guidelines and BIS guidelines for drinking water. Chemistry involved in sedimentation, coagulation, and sterilization. Softening of water, lime-soda, ion-exchange process. Chemistry of Engineering Materials: Glass, ceramics, refractory, composites, magnetic materials, Polymers & structure property relationship. Thermoplastic & thermosetting plastics. Preparation, properties & applications of some commodity and engineering polymers. Conducting polymers.



Curriculum for
Bachelor of Mechanical Engineering Technology



Course Learning Outcomes	CLOs Statement After completion of this course students will be able to:	Taxonomy (Level)
CLO-1	Work on experiments/task/project related to applied chemistry laboratory independently.	P-2
CLO-2	Organize the results of experiments in written and graphical format.	P-4
CLO-3	Attempt participation in group discussion while practicing professional ethics.	A-2

Lab Work Outline for Practical

Chemical kinematics and catalysis, Exothermic & Endothermic reactions, Calorific value of edible oils, electroplating, salt analysis, accelerated corrosion, galvanic battery, PH value and TDS of water, softening of water.

RECOMMENDED BOOKS

1. Brown, L. S., & Holme, T. (2018). Chemistry for engineering students (4th ed.)
2. Atkins, P., & Keeler, J. (2014). Atkins' physical chemistry (11th ed.).

8.23 Islamic Studies / Ethics

(COURSE CODE) and TITLE	CREDITS HOURS:	PRE-REQUISITE
(MEH-111) Islamic Studies / Ethics	(2+0)	NA
CATEGORY AND DOMAIN	KNOWLEDGE & ATTITUDE PROFILE	SUSTAINABLE DEVELOPMENT GOALS SDGS):
General Education	Not Applicable	SDGs 10, SDGs 16

Course Objective

To provide understanding of Islamic teachings, values, ethics, and principles and develop moral awareness, professional responsibility, and respectful conduct in society.

Course Learning Outcomes	CLOs Statement	Program Outcomes (PLO)	Taxonomy (Level)
	After completion of this course students will be able to:		
CLO-1	Narrate basic concepts related to Quran and Sunnah with special emphasis on Islamic Belief System & values.	12	C-2
CLO-2	Illustrate important lessons derived from the life of the Holy Prophet (Peace Be Upon Him) and Islamic culture & Civilization.	12	C-3
CLO-3	Explain the role, responsibilities, rights, and obligations of an individual in society.	8	C-2
CLO-4	Demonstrate the issues related to the code of Professional conduct.	8	C-3

Course Outline for Theory

1. Introduction to Islam: Definition of Islam and its core beliefs. The Holy Quran (introduction, revelation and compilation). Hadith and Sunnah (compilation, classification, and significance). Key theological concepts and themes (Tawhid, Prophet Hood, Akhirat etc.).
2. Sirah of the Holy Prophet (Peace Be Upon Him) as Uswa-i-Hasana: Life and legacy of the Holy Prophet PBUH. Diverse roles of the Holy Prophet PBUH (as an individual, educator, peace maker, leader etc.).
3. Islamic History and Civilization: World before Islam. The Rashidun Caliphate and expansion of Islamic rule. Contribution of Muslim scientists and philosophers in shaping world civilization.
4. Islamic Jurisprudence (Fiqh): Fundamental sources of Islamic jurisprudence Pillars of Islam and their significance. Major schools of Islamic jurisprudence. Significance and principles of Etihad.
5. Family and Society in Islam: Status and rights of women in Islamic teachings. Marriage, family, and gender roles in Muslim society. Family structure and values in Muslim society.

RECOMMENDED BOOKS

1. Al-Azami, M. M. The five pillars of Islam: A journey through the divine acts of worship.
2. Hussain, M. The five pillars of Islam: A framework for Islamic values and character building.
3. Mawdudi, A. A. Towards understanding Islam.
4. Ahmad, K. Islamic nazria e hayat.
5. Renard, J. An introduction to Islamic theology.
6. Mawdudi, A. A. Islamic civilization: Foundations, belief & principles.
7. Ahmad, A. Women and social justice: An Islamic paradigm.
8. Ahmad, K. Islam: Its meaning and message.

8.24 Entrepreneurship

(COURSE CODE) and TITLE (MEM-221) Entrepreneurship	CREDITS HOURS: (2+0)	PRE-REQUISITE NA
CATEGORY AND DOMAIN	KNOWLEDGE & ATTITUDE PROFILE	SUSTAINABLE DEVELOPMENT GOALS SDGS):
General Education	Not Applicable	SDGs 1, SDGs 8, SDGs 9

Course Objective

To develop entrepreneurial knowledge, innovation skills, and business understanding for identifying opportunities, managing resources, and creating sustainable solutions.

Course Learning Outcomes	CLOs Statement	Program Outcomes (PLO)	Taxonomy (Level)
	After completion of this course students will be able to:		
CLO-1	Develop new Entrepreneurial ideas.	2	C-3
CLO-2	Testing and experimenting in the markets and ability to use design thinking.	4	C-4
CLO-2	Evaluate business models, revenues, and marketing strategies.	4	C-5

Course Outline for Theory

1. Introduction to Entrepreneurship: Definition and concept of entrepreneurship. Why to become an entrepreneur?
2. Entrepreneurial process. Role of entrepreneurship in economic development.
3. Entrepreneurial Skills: Characteristics and qualities of successful entrepreneurs (including stories of successes and failures). Areas of essential entrepreneurial skill and ability such as creative and critical thinking, innovation and risk taking abilities etc.
4. Opportunity Recognition and Idea Generation: Opportunity identification, evaluation and exploitation; Innovative idea generation techniques for entrepreneurial ventures.
5. Marketing and Sales Target market identification and segmentation; Four P's of Marketing. Developing a marketing strategy. Branding.
6. Financial Literacy: Basic concepts of income, savings and investments. Basic concepts of assets, liabilities and equity. Basic concepts of revenue and expenses.



Curriculum for
Bachelor of Mechanical Engineering Technology



RECOMMENDED BOOKS
1. Barringer, B. R., & Ireland, R. D. (2018). Entrepreneurship: Successfully launching new ventures (6th ed.). 2. Kuratko, D. F. Entrepreneurship: Theory, process, and practice. 3. Timmons, J. A., Spinelli, S., Jr., & Adams, R. New venture creation: Entrepreneurship for the 21st century. McGraw-Hill. 4. Abrams, R. Entrepreneurship: A real-world approach. 5. Ries, E. (2011). The lean startup: How today's entrepreneurs use continuous innovation to create radically successful businesses. 6. Read, S., Sarasvathy, S. D., Dew, N., Wiltbank, R., & Ohlsson, A. V. Effectual entrepreneurship.

8.25 Applied Mathematics-I

(COURSE CODE) and TITLE	CREDITS HOURS:	PRE-REQUISITE
(MEN-111) Applied Mathematics -I	(3+0)	None
CATEGORY AND DOMAIN	KNOWLEDGE & ATTITUDE PROFILE	SUSTAINABLE DEVELOPMENT GOALS SDGS):
General Education Quantitative Reasoning	SK2	NA

Course Objective

This course provides the mathematical foundation by developing students' ability to apply calculus, ordinary differential equations, and analytical geometry to apply and solve practical engineering problems involving rates of change, optimization, integration, differential equations, and three-dimensional geometric relationships.

Course Learning Outcomes	CLOs Statement After completion of this course students will be able to:	Program Outcomes (PLO)	Taxonomy (Level)
CLO-1	Apply differential and integration techniques to solve problems of optimization, area, volume and centroid.	1	C-3
CLO-2	Formulate ordinary differential equations from physical problems.	2	C-3
CLO-3	Solve problems related to analytical geometry.	1	C-3

Course Outline for Theory

Calculus: Concept of Function and its inverse, plots of basic functions (algebraic, trigonometric, exponentials and logarithmic), limits and continuity, differentiation, rate of change, maxima and minima, point of inflexion, Anti-differentiation, Definite and Indefinite integrals, Application of integrals; Area, Volume and Centroid.

Differential Equation: Introduction to ordinary differential equation(ode), Natural occurrence of differential equation, Formation of simple odes from physical problems. Solutions of differential equation as superposition of basic functions.

Analytical Geometry: Geometrical properties of triangle, circle, and cyclic quadrilaterals; geometrically similar figures, Length, area, volume ratios of similar figures, Coordinate systems, direction cosines/ratios, equations of a line in space, equation of plane.



RECOMMENDED BOOKS

1. Kreyszig, E., Kreyszig, H., & Normington, E. J. (2011). Advanced engineering mathematics (10th ed.). John Wiley & Sons.
2. Stewart, J., Clegg, D., & Watson, S. (2021). Calculus: Early transcendentals (9th ed.). Cengage Learning. James, G., Burley, D., Alabaster, E., Kyle, J., & Steele, N. (2019). Modern engineering mathematics (5th ed.). Pearson.
3. Zill, D. G. (2018). A first course in differential equations with modeling applications (11th ed.). Cengage Learning.
4. Thomas, G. B., Weir, M. D., & Hass, J. (2022). Thomas' calculus (15th ed.). Pearson.

SUPPLEMENTAL RESOURCES

1. Maple software
2. Sci Lab <https://www.scilab.org/>.
3. Matlab software
4. GNU Octave <https://octave.org/> (Open source alternative to Matlab)
5. WolframAlpha <https://www.wolframalpha.com/> (A computational Intelligence tool)
6. Geogebra <https://www.geogebra.org/>
7. <https://falstad.com/diffeq/>

8.26 Applied Mathematics -II

(COURSE CODE) and TITLE (MEN-121) Applied Mathematics -II	CREDITS HOURS: (3+0)	PRE-REQUISITE Applied Mathematics -I
CATEGORY AND DOMAIN General Education Quantitative Reasoning	KNOWLEDGE & ATTITUDE PROFILE SK2	SUSTAINABLE DEVELOPMENT GOALS SDGS): NA

Course Objective

This course develops students' ability to apply linear algebra, numerical methods, and probability and statistics, supported by statistical software, to analyze data and solve practical engineering technology problems

Course Learning Outcomes	CLOs Statement	Program Outcomes (PLO)	Taxonomy (Level)
CLO-1	Solve system of linear equations using matrices	1	C-3
CLO-2	Apply the Newton–Raphson iterative method to obtain numerical solutions of nonlinear engineering equations with convergence/accuracy.	1	C-3
CLO-2	Perform statistical analysis including measures of central tendency, dispersion, graphical techniques, correlation, and simple regression using statistical software	5	C-3

Course Outline for Theory

Linear Algebra: Algebra of matrices, transpose, Determinants, Adjoint and Inverse of a matrix, rank of a matrix, consistency of linear systems, Solving systems of linear equations, Eigenvalues and eigenvectors, interpretation of Eigen values in engineering problems.

Numerical solution: Introduction to Numerical solution, need for numerical solutions, graphical solution of non-linear equations, Newton Raphson Method, convergence criteria, errors and approximation in engineering computation.

Probability and statistics: Measures of central tendency and dispersion, Mutually exclusive, independent and exhaustive events, Total probability, Bayes theorem, Random variables (discrete and continuous), Probability distributions (Normal, Binomial, Poisson etc.), graphical representation of data, correlation coefficient, simple regression analysis, Use of statistical software.



RECOMMENDED BOOKS

1. Anton, H., & Rorres, C. (2019). Elementary linear algebra: Applications version (12th ed.). John Wiley & Sons.
2. Walpole, R. E., Myers, R. H., Myers, S. L., & Ye, K. (2017). Probability and statistics for engineers and scientists (10th ed.). Pearson.
3. Chapra, S. C. (2022). Applied numerical methods with MATLAB for engineers and scientists (5th ed.). McGraw-Hill Education.
4. Grima Cintas, P., Marco-Almagro, L., & Tort-Martorell Llabres, X. (2012). Industrial statistics with Minitab. John Wiley & Sons.

SUPPLEMENTAL RESOURCES

1. Minitab software (Version 17 and above)
2. Sci Lab <https://www.scilab.org/>.
3. Matlab software
4. GNU Octave <https://octave.org/> (Open source alternative to Matlab)
5. WolframAlpha <https://www.wolframalpha.com/> (A computational Intelligence tool)
6. MIT OCW Linear Algebra course by Gilbert Strang: https://ocw.mit.edu/courses/18-06-linear-algebra-spring-2010/video_galleries/video-lectures

8.27 Functional English

(COURSE CODE) and TITLE	CREDITS HOURS:	PRE-REQUISITE
(MEE-111) Functional English	(2+1)	NA
CATEGORY AND DOMAIN	KNOWLEDGE & ATTITUDE PROFILE	SUSTAINABLE DEVELOPMENT GOALS SDGS):
General Education Functional English / Expository Writing	Not Applicable	SDGs 4, SDGs 5, SDGs 17

Course Objective

To develop effective communication skills in English, including reading, writing, speaking, and professional communication for academic and workplace environments.

Course Learning Outcomes	CLOs Statement	Program Outcomes (PLO)	Taxonomy (Level)
	After completion of this course students will be able to:		
CLO-1	Show the proficiency and accuracy of the target language to use it effectively as a tool to succeed in academic activities.	10	C-3
CLO-2	Employ reading skills that are coincided with study skills directly required by students as basic skills to pursue other subjects more meaningfully.	12	C-2
CLO-2	Illustrate different genre of writing to enhance their writing skills and make use of them in their academic activities.	10	C-4

Course Outline for Theory

Greetings, Reading skills importance & strategies, Previewing, Reading practice through variety of reading texts and comprehension exercises, Skimming & Scanning, Summarizing, Types of listening; active, content, critical, selective Problems in listening and coping strategies, Listening skills and sub skills, Note Taking, Techniques for taking notes from lectures, from books, different forms paragraphs, points, figures, processes, tables, graphs, Vocabulary Development, Inferring meaning from context, Process of Writing and In formal Writing strategies, Writing correctly: sentence structure and punctuation, error correction, Paragraphs writing, Unity, adequate development and coherence in paragraphs, Essays: Types of essays: narrative, descriptive, argumentative, Structure of essays: thesis statement and the paragraphs, informational and analytical reports, Letters: routine requests and intimation, invitation, thank you and condolence letters etc,



Curriculum for Bachelor of Mechanical Engineering Technology



RECOMMENDED BOOKS

1. Azar, B. S. (2016). Understanding and using English grammar (5th ed.). Pearson.
2. Murphy, R. (2019). English grammar in use (5th ed.). Cambridge University Press.
3. Straus, J. (2008). The blue book of grammar and punctuation (10th ed.). Jossey-Bass.
4. Hutchinson, T., & Waters, A. (1987). English for specific purposes: A learning-centred approach. Cambridge University Press.
5. Downes, C. (2008). Cambridge English for job-hunting. Cambridge University Press.
6. Swan, M. (2016). Practical English usage (4th ed.). Oxford University Press.
7. James, M., & Merickel, A. P. (2009). Reading literature and writing argument. Pearson.
8. Johns, J., & Lenski, S. (2014). Improving reading: Strategies, resources, and common core connections. Kendall Hunt Publishing.
9. Kintsch, W. (1998). Comprehension: A paradigm for cognition. Cambridge University Press.
10. Verma, J. P., & Raman, M. (2019). Communication skills for business professionals. Oxford University Press

8.28 Communication Skills

(COURSE CODE) and TITLE		CREDITS HOURS:	PRE-REQUISITE
(MEE-121) Communication Skills		(3+0)	NA
CATEGORY AND DOMAIN	KNOWLEDGE & ATTITUDE PROFILE	SUSTAINABLE DEVELOPMENT GOALS (SDGS):	
General Education Functional English / Expository Writing	Not Applicable	SDGs 4, SDGs 5, SDGs 17	
Course Objective			
To enhance students’ communication abilities through effective language skills, technical writing, interpersonal communication, and professional presentation practices.			
Course Learning Outcomes	CLOs Statement After completion of this course students will be able to:	Program Outcomes (PLO)	Taxonomy (Level)
CLO-1	Explain basic theories of communications.	10	C-2
CLO-2	Demonstrate report technical contents both orally and in writing.	10	C-3
CLO-3	Participate in group discussions while practicing professional ethics.	8	A-3
Course Outline for Theory			
Importance, Theories, Barriers and components of communication, The seven C’s of effective communication, Listening skills, Notes taking, Giving feedback, Active reading techniques, Skimming, General and careful reading, Planning, Drafting and editing, Emphasis and connections in writing, Technical and business vocabulary, Constructing formal sentences, Communication as a Tool For Effective Interpersonal Engagement, Communication barriers and their mitigation strategies, Preparing and presenting using modern tools.			

RECOMMENDED BOOKS

1. Axelrod, R. B., & Cooper, C. R. The St. Martin's guide to writing.
2. Graff, G., & Birkenstein, C. They say/I say: The moves that matter in academic writing.
3. Rosenwasser, D., & Stephen, J. Writing analytically.
4. Williams, J. M., & Bizup, J. Style: Lessons in clarity and grace.
5. Strunk, W., Jr., & White, E. B. The elements of style.
6. Faigley, L., & Selzer, J. Good reasons with contemporary arguments.
7. Zinsser, W. Writing to learn: How to write and think clearly about any subject at all.
8. Bullock, R., Goggin, M. D., & Weinberg, F. The Norton field guide to writing.
9. Longknife, A., & Sullivan, K. D. The art of styling sentences.
10. Johnson-Sheehan, R., & Paine, C. Writing today.

8.29 Logic And Critical Thinking

(COURSE CODE) and TITLE	CREDITS HOURS:	PRE-REQUISITE
(MEH-211) Logic And Critical Thinking	(2+0)	NA
CATEGORY AND DOMAIN	KNOWLEDGE & ATTITUDE PROFILE	SUSTAINABLE DEVELOPMENT GOALS (SDGS):
General Education Arts & Humanities	Not Applicable	SDGs 4, SDGs 16

Course Objective

This course explores the relationship of communications and critical thinking with a focus on good reasoning and the impediments to its mastery.

Course Learning Outcomes	CLOs Statement After completion of this course students will be able to:	Program Outcomes (PLO)	Taxonomy (Level)
CLO-1	Understand basic concepts of logic, reasoning, and argument structure Taxonomy	2	C2
CLO-2	Analyze arguments, identify fallacies, and evaluate reasoning	3	C4
CLO-2	Apply logical reasoning and critical thinking to real-life problems Taxonomy	3	C3

Course Outline for Theory

This course provides an introduction to the fundamental concepts of logic, reasoning, and critical thinking. It covers the basic terminology of logic, including concepts, propositions, inferences, arguments, premises, conclusions, and the structure of arguments. Students will learn to recognize arguments, differentiate between deductive and inductive reasoning, and evaluate arguments based on validity, truth, soundness, strength, and cogency. The course also explores language, meaning, and definitions, including varieties of meaning, intension and extension of terms, and the purposes and types of definitions.

The course further introduces propositional logic, including logical symbols, translation of statements, truth functions, truth tables for propositions and arguments, and methods for evaluating logical validity. Students will study natural deduction in propositional logic through rules of implication and replacement. In addition, the course develops understanding of thinking processes, effective thinking, goal setting, decision-making, career choices, and issue analysis. Students will explore critical thinking skills by differentiating between thinking, critical thinking, and creative thinking, evaluating evidence, considering multiple perspectives, asking effective questions, and applying critical thinking tools such as PMI, STAR Method, Shewhart Cycle, Socratic Method, and RW&D.



Curriculum for
Bachelor of Mechanical Engineering Technology



RECOMMENDED BOOKS

1. Hodges, W. (2002). Logic: An introduction to elementary logic (2nd ed.).
2. Hurley, P. J. (2005). A concise introduction to logic (9th ed.). Wadsworth Publishing Co.
3. Jason, G. (2001). Critical thinking: Developing an effective world view. Wadsworth Publishing Co.
4. Moore, B. N., & Parker, R. (2005). Critical thinking (8th ed.). McGraw-Hill.
5. Vaughn, L. (2005). The power of critical thinking. Oxford University Press.

8.30 Ideology & Constitution of Pakistan

(COURSE CODE) and TITLE	CREDITS HOURS:	PRE-REQUISITE
(MES-211) Ideology & Constitution of Pakistan	(2+0)	NA
CATEGORY AND DOMAIN	KNOWLEDGE & ATTITUDE PROFILE	SUSTAINABLE DEVELOPMENT GOALS SDGS):
General Education	Not Applicable	SDG 4, SDG 16

Course Objective

To develop students' understanding of the ideology, constitutional framework, and civic responsibilities in Pakistan

Course Learning Outcomes	CLOs Statement After completion of this course students will be able to:	Program Outcomes (PLO)	Taxonomy (Level)
CLO-1	Explain the ideology of Pakistan with reference to contribution of founding fathers of Pakistan.	11	C-2
CLO-2	Demonstrate fundamental knowledge about the Constitution of Pakistan 1973 and its evolutionary phase with reference to the structure.	6	C-3

Course Outline for Theory

This course provides a comprehensive understanding of the ideology and constitutional development of Pakistan. It begins with an introduction to the concept and significance of ideology, followed by a detailed study of the historical context of the creation of Pakistan, highlighting the socio-political, religious, and cultural dynamics of British India from 1857 to 1947. The course explores the contributions of key founding figures such as Allama Muhammad Iqbal and Quaid-e-Azam Muhammad Ali Jinnah, along with the role of women and students in the freedom movement. It further examines the evolution of the Two-Nation Theory through significant historical events including the Urdu-Hindi controversy, Partition of Bengal, Simla Deputation (1906), Iqbal's Address (1930), Congress Ministries (1937), and the Lahore Resolution (1940), emphasizing the impact of communalism and religious differences. The course also introduces the Constitution of Pakistan, discussing its definition, importance, and ideological foundations, particularly the Objectives Resolution (1949), along with key constitutional developments. Additionally, it covers the structure of the state, including the roles of the executive, legislature, and judiciary, and the distribution of powers between federal and provincial governments, with special focus on the 18th Amendment. The course further highlights fundamental rights (Articles 8–28), principles of policy (Articles 29–40), and the responsibilities of citizens (Article 5). Finally, it discusses the procedures for constitutional amendments and reviews major amendments and their implications, enabling students to develop a critical understanding of Pakistan's constitutional framework and civic responsibilities.



Curriculum for
Bachelor of Mechanical Engineering Technology



RECOMMENDED BOOKS

1. Cohen, S. P. (2004). The idea of Pakistan. Brookings Institution Press.
2. Iqbal, J. Ideology of Pakistan.
3. Qureshi, I. H. The struggle for Pakistan.
4. Sayeed, K. B. Pakistan: The formative phase.
5. Mahmood, S. Pakistan: Political roots and development.
6. Mujahid, S. Ideology of Pakistan.
7. Jalal, A. The struggle for Pakistan: A Muslim homeland and global politics.
8. Ahmed, A. S. Jinnah, Pakistan and Islamic identity: The search for Saladin.
9. Aziz, K. K. The making of Pakistan: A study in nationalism.
10. Talbot, I. Pakistan: A new history.

8.31 Engineering Economics

(COURSE CODE) and TITLE	CREDITS HOURS:	PRE-REQUISITE
(MES-221) Engineering Economics	(2+0)	NA
CATEGORY AND DOMAIN	KNOWLEDGE & ATTITUDE PROFILE	SUSTAINABLE DEVELOPMENT GOALS SDGS):
General Education Social Sciences	Not Applicable	SDGs 8, SDGs 9, SDGs 12

Course Objective

To provide students with the knowledge and skills to evaluate engineering projects using economic principles and financial analysis techniques.

Course Learning Outcomes	CLOs Statement	Program Outcomes (PLO)	Taxonomy (Level)
	After completion of this course students will be able to:		
CLO-1	Define engineering economics and describe its role in decision making.	1	C-2
CLO-2	Calculate simple and compound interest amounts for one or more time periods.	1	C-3
CLO-2	Develop spread sheets based on engineering economy principal using Microsoft excel.	5	C-3

Course Outline for Theory

Engineering economy study approach, Ethics and economics, Interest rate, Cash flows, Economic equivalence, Simple and compound interest, MARR and opportunity cost, Spread sheet functions F/P and P/F factor, P/A and A/P factors, Factor values, Arithmetic gradient, Geometric gradient, Calculations for Uniform Series That Are Shifted, Calculations Involving Uniform Series and Randomly Placed Single Amounts, Calculations for Shifted Gradients, Nominal and Effective Interest Rate Statements, Effective Interest Rates for Any Time Period, Effective Annual Interest Rates, Effective Interest Rate for Continuous Compounding, Interest Rates That Vary over Time, Progressive Example—Water for Semiconductor Manufacturing Case, Formulating Alternatives, Present Worth Analysis of Equal-Life Alternatives, Present Worth Analysis of Different-Life Alternatives, Future Worth Analysis, Capitalized Cost Analysis, Advantages and Uses of Annual Worth Analysis, Calculation of Capital Recovery and AW Values, Evaluating Alternatives by Annual Worth Analysis, Life-Cycle Cost Analysis.



Curriculum for
Bachelor of Mechanical Engineering Technology



RECOMMENDED BOOKS
1. Mankiw, N. G. (2015). Principles of economics (7th ed.) 2. Finance Division, Government of Pakistan. (n.d.). Pakistan economic survey.

8.32 Fehm e Quran I

(COURSE CODE) and TITLE		CREDITS HOURS:	PRE-REQUISITE
(MEH-121) Fehm e Quran I		(0+1)	NA
CATEGORY AND DOMAIN		KNOWLEDGE & ATTITUDE PROFILE	SUSTAINABLE DEVELOPMENT GOALS SDGS):
General Education		Not Applicable	SDGs 10, SDGs 16
Course Objective			
To develop a foundational understanding of Quranic Arabic for partial comprehension of the Holy Quran.			
Course Learning Outcomes	CLOs Statement	Program Outcomes (PLO)	Taxonomy (Level)
	After completion of this course students will be able to:		
CLO 1	Discuss and explain the meanings of the words of Quran, its phrases and sentences	11	C-2
Course Outline for Theory			
This course is designed to build a foundational understanding of Quranic Arabic by focusing on basic vocabulary, phrases, and sentence structures derived from the Muallim-ul-Quran book. It enables students to comprehend simple Quranic words and sentences without verbs, and gradually introduces present tense sentence structures. The course emphasizes understanding key linguistic components such as particles (operative and non-operative), pronouns, adjective and possessive compounds, and different types of plurals through Quranic examples. Students will also learn to recognize various styles of Quranic sentences, including nominal, emphatic, negative, interrogative, and oath-based structures. Furthermore, the course strengthens students’ familiarity with Quranic expressions, idioms, and linguistic patterns, ultimately enabling them to understand approximately 30–40% of each page of the Holy Quran with clarity and confidence			



Curriculum for
Bachelor of Mechanical Engineering Technology



RECOMMENDED BOOKS

1. Rehman Bashir, U. (n.d.). Muallim ul Quran (Vols. 1–3).

8.33 Fehm e Quran II

(COURSE CODE) and TITLE	CREDITS HOURS:	PRE-REQUISITE
(MEH-321) Fehm e Quran II	(0+1)	Fehm e Quran I
CATEGORY AND DOMAIN	KNOWLEDGE & ATTITUDE PROFILE	SUSTAINABLE DEVELOPMENT GOALS SDGs):
General Education	Not Applicable	SDGs 10, SDGs 16

Course Objective

To develop students' ability to understand and interpret the Holy Quran through proficiency in Quranic Arabic.

Course Learning Outcomes	CLOs Statement	Program Outcomes (PLO)	Taxonomy (Level)
CLO 1	After completion of this course students will be able to: Discuss and explain the meanings of the words of Quran, its phrases and sentences	11	C-2

Course Outline for Theory

This course is designed to develop students' ability to understand the Holy Quran directly through the Arabic language. It focuses on building a strong foundation in Quranic Arabic by enabling students to comprehend commonly used vocabulary, sentence structures, and recurring themes across different Quranic verses. The course emphasizes understanding the linguistic features of Arabic, including basic and advanced grammar, verb forms (past, present, and imperative), and sentence composition. Students will learn to recognize patterns in Quranic text, improving their ability to understand a significant portion of each page of the Holy Quran. Additionally, the course develops the skill to comprehend longer verses independently and interpret their meanings with clarity. By the end of the course, students will gain confidence in understanding Quranic text directly and enhance their linguistic proficiency in Arabic.



Curriculum for
Bachelor of Mechanical Engineering Technology



RECOMMENDED BOOKS
1. Rehman Bashir, U. (n.d.). Muallim ul Quran (Vols. 3–5)

8.34 Civics and Community Engagement

(COURSE CODE) and TITLE (MES-212) Civics and Community Engagement	CREDITS HOURS: (1+1)	PRE-REQUISITE NA
CATEGORY AND DOMAIN General Education Social Sciences	KNOWLEDGE & ATTITUDE PROFILE Not Applicable	SUSTAINABLE DEVELOPMENT GOALS (SDGs): SDGs 10, SDGs 11, SDGs 16

Course Objective

To understand the fundamental concepts of civics, citizenship, civic engagement, and the role of citizens in modern society.

Course Learning Outcomes	CLOs Statement After completion of this course students will be able to:	Program Outcomes (PLO)	Taxonomy (Level)
CLO-1	Students will become familiar with various areas of community service (such as community service learning. Community service development and community service empowerment) and become aware of relevant ongoing philanthropic activities in the community and social consciousness.	6	C-2
CLO-2	Students will be able to provide different sustainable development approaches to address local or global community challenges.	7	C-2
CLO-3	Students will develop sense of responsibility, compassion and empathy towards society and through different community service projects contribute to have a discernible impact on the community.	10	A-2

Course Outline for Theory

1. civics and Citizenship: Concepts of civics, citizenship, and civic engagement. Foundations of modern society and citizenship. Types of citizenship: active, participatory, digital, etc.
2. State, Government and Civil Society: Structure and functions of government in Pakistan. The relationship between democracy and civil society. Right to vote and importance of political participation and representation.
3. Rights and Responsibilities: Overview of fundamental rights and liberties of citizens under Constitution of Pakistan 1973. Civic responsibilities and duties. Ethical considerations in civic engagement (accountability, non-violence, peaceful dialogue, civility, etc.)
4. Community Engagement: Concept, nature and characteristics of community. Community development and social cohesion. Approaches to effective community engagement. Case studies of successful community driven initiatives.
5. Advocacy and Activism: Public discourse and public opinion. Role of advocacy in addressing social issues. Social action movements.



Curriculum for
Bachelor of Mechanical Engineering Technology



RECOMMENDED BOOKS

1. McGraw-Hill Education. (n.d.). Civics today: Citizenship, economics, & you. McGraw-Hill Education.
2. Kymlicka, W., & Norman, W. Citizenship in diverse societies.
3. Youniss, J., & Levine, P. Engaging youth in civic life.
4. Mattson, K. Digital citizenship in action: Empowering students to engage in online communities.
5. Pike, G., & Selby, D. Globalization and citizenship: In the pursuit of a cosmopolitan education.
6. Feldpausch, B. J., & Omilian, S. M. Community engagement: Principles, strategies, and practices.
7. Clarke, M., & Steckel, M.-M. Creating social change: A blueprint for a better world.

8.35 Instrumentation And Control

(COURSE CODE) and TITLE) (MET-213) Instrumentation and Control	CREDITS HOURS: (2+1)	PRE-REQUISITE NA	
CATEGORY AND DOMAIN Engineering Technology Breadth	KNOWLEDGE & ATTITUDE PROFILE SK2, SK3, SK4, SK6	SUSTAINABLE DEVELOPMENT GOALS SDGS): SDGs 9, SDGs 12	
Course Objective			
To develop applied knowledge for selection and utilization of sensors, transducers, and dynamic systems, It would facilitate and to equip students with the skills to select, calibrate, test, and analyze measurement and control systems used in engineering applications.			
Course Learning Outcomes	CLOs Statement After completion of this course students will be able to:	Program Outcomes (PLO)	Taxonomy (Level)
CLO-1	Explain the working principles of various sensors and transducers.	1	C-2
CLO-2	Select appropriate methods for installation, calibration, and testing of sensors/transducers.	2	C-3
CLO-3	Analyze the response of 1 st and 2 nd order system.	5	C-4
Course Outline for Theory			
Basic concepts of sensors and transducers. Types, characteristics, and working principles of common sensors and transducers. Signal conditioning, installation, testing, calibration, and maintenance of sensors and transducers. Working principles and construction of Transistors and MOSFETs. Intelligent machines and their key components. Fundamentals of signal processing. Open-loop and closed-loop control systems. Dynamic response of first- and second-order systems. Industrial automation and process control fundamentals. Closed-loop process control, PID control fundamentals, introduction to adaptive control, Application of Controls using Fans/blowers, Hydraulics /Pneumatics, Vibrations etc.			

Course Learning Outcome of Labs

Course Learning Outcomes	CLOs Statement After completion of this course students will be able to:	Taxonomy (Level)
CLO-1	Follow instructions to take readings using sensors/transducers.	P-3
CLO-2	Calibrate the sensors/transducers.	P-4
CLO-3	Sketch dynamic response of 2 nd order system using a software	C-3
CLO-4	Revise /rearrange and optimize control algorithms using suitable software.	C-4

Lab Work Outline for Practical

Following is the tentative list of Practical for Instrumentation and Controls. Institutions depending on their needs and available resources can add or remove practical:

Familiarization with Industrial Sensors and Transducers for Measurement Applications.

1. Measurement of Temperature Using Thermocouples and RTD Sensors.
2. Measurement and Calibration of Pressure Sensors and Pressure Transducers.
3. Calibration and Performance Evaluation of Displacement/Position Sensors.
4. Flow Measurement Using Flow Sensors and Analysis of Sensor Characteristics.
5. Signal Conditioning and Data Acquisition from Industrial Sensors.
6. Simulation and Analysis of First- and Second-Order System Responses Using MATLAB/Simulink (or equivalent software).
7. Determination of Dynamic Characteristics of a Second-Order System (Rise Time, Settling Time, Overshoot, and Damping Ratio).
8. Development, Testing, and Troubleshooting of Basic PLC Ladder Logic Programs.
9. PLC-Based Process Control: Program Optimization, Interlocking, Sequencing, and Monitoring of an Automated Process.

RECOMMENDED BOOKS

1. Nakra, B. C., & Chaudhry, K. K. (2016). Instrumentation, measurement and analysis (4th ed.). McGraw-Hill Education.
2. Nise, N. S. (2019). Control systems engineering (8th ed.). John Wiley & Sons.
3. Hibbeler, R. C. (Year). Engineering mechanics (Edition). Pearson.
4. Dorf, R. C., & Bishop, R. H. (2021). Modern control systems (14th ed.). Pearson.
5. Collins, K. (2007). PLC programming for industrial automation. Exposure Publishing.

SUPPLEMENTAL RESOURCES

1. Software tools Matlab Simulink, LabView, ADAMS or similar
2. Certified Automation Professional (CAP)
3. Simulink Onramp
4. SciPy, PySide, PyVISA and similar open source libraries/tools



Curriculum for
Bachelor of Mechanical Engineering Technology



8.36 CAD Modeling

(COURSE CODE) and TITLE	CREDITS HOURS:	PRE-REQUISITE
(MET-212) CAD Modeling	(0+2)	Technical Drawing
CATEGORY AND DOMAIN	KNOWLEDGE & ATTITUDE PROFILE	SUSTAINABLE DEVELOPMENT GOALS SDGs):
Engineering Technology Foundation	SK3, SK4, SK6	SDGs 4, SDGs 9



Curriculum for Bachelor of Mechanical Engineering Technology



Course Objective

To develop the ability to create parametric 3D models, assemblies, and engineering drawings using CAD tools in accordance with standard engineering practices for design and manufacturing applications.

Course Learning Outcomes	CLOs Statement	Program Outcomes (PLO)	Taxonomy (Level)
	After completion of this course students will be able to:		
CLO-1	Develop 2D sketches, 3D Models and engineering drawings using CAD tools with proper standards and annotations	3	P-2
CLO-2	Construct assemblies using constraints and generate detailed working drawings	3	P-3
CLO-3	Prepare CAD models for manufacturing using standard file formats and basic tolerancing concepts	3	P-4

Lab Work Outline for Practical

1. Introduction to CAD Systems
Familiarization with the CAD environment, user interface, templates, units, file management, and customization.
2. 2D Sketching and Parametric Modeling
Creation of sketches using geometric entities, constraints, dimensions, and design intent.
3. Feature-Based Part Modeling
Development of parametric 3D models using Extrude, Revolve, Sweep, Loft, Fillet, Chamfer, Shell, Draft, Rib, Pattern, Mirror, and Reference Geometry.
4. Advanced Part Modeling
Multi-body modeling, configurations, design tables, equations, and introductory sheet metal modeling.
5. Assembly Modeling
Assembly creation using standard and advanced mates, sub-assemblies, interference detection, collision detection, and mass properties.
6. Engineering Drawings
Preparation of production drawings including orthographic, sectional, auxiliary, detail, and exploded views, dimensioning, annotations, tolerances, and introductory GD&T.
7. Product Visualization Application of materials and appearances, rendering, lighting, camera views, and photo-realistic image generation.
8. Motion Study and Assembly Simulation
Basic mechanism animation, motion analysis, exploded animations, and evaluation of assembly movement.
9. Introduction to Engineering Simulation
Basic finite element analysis (FEA) including static stress, displacement, strain, and factor of safety analysis of mechanical components.
10. CAD for Manufacturing
Export of CAD models in STEP, IGES, STL, DXF, and DWG formats, preparation for CNC machining and additive manufacturing, and introduction to the CAD-CAM-CNC workflow.
11. Mini Design Project
Reverse engineering or product design involving complete part modeling, assembly creation, engineering drawings, stress validation, motion study, rendering, manufacturing documentation, and project presentation.

RECOMMENDED BOOKS



Curriculum for Bachelor of Mechanical Engineering Technology



1. Tickoo, S. (n.d.). SOLIDWORKS for designers.
2. Plantenberg, K. (n.d.). Engineering graphics with SolidWorks.

SUPPLEMENTAL RESOURCES

1. Engineering drawing software (e.g., Fusion 360, AutoCAD, CATIA, or SolidWorks Drawing Module) for demonstration purposes.
2. Open-source tools such as FreeCAD, may be used to reinforce CAD concepts and facilitate self-directed learning.
3. ISO Standards related to technical drawings, dimensioning, tolerancing, and engineering documentation.

8.37 Technical Drawing



Curriculum for
Bachelor of Mechanical Engineering Technology



(COURSE CODE) and		CREDITS HOURS:	PRE-REQUISITE
Course Learning Outcome of Labs			
Course Learning Outcomes	CLOs Statement	Taxonomy (Level)	
	After completion of this course students will be able to:		
CLO-1	Understand the basic concepts of standard mechanical engineering drawing.	C-1	
CLO-2	Explain engineering visualization principles and projection theory and apply those principles in engineering drawing development.	C-3	
CLO-4	Produce Assembly drawing for catalogues, manuals etc.	P-4	
Course Objective			
To understand the basic principles, standards, symbols, and conventions used in engineering and technical drawings.			

Lab Work Outline for Practical

1. Familiarization with drawing instruments, engineering drawing standards, laboratory safety guidelines, drawing sheet layout, lettering, line types, scales, and free-hand sketching.
2. Practice of geometric constructions, engineering curves, and drawing sheet planning.
3. Preparation of first-angle and third-angle orthographic projections and multiview drawings of engineering components.
4. Preparation of sectional views, auxiliary views, and surface developments of engineering components.
5. Preparation of detailed drawings of machine elements including rivets, cotter joints, threaded fasteners, keys, shafts, couplings, and bearings.
6. Preparation of assembly and detail drawings of simple mechanical assemblies with appropriate dimensions and annotations.
7. Introduction to Geometric Dimensioning and Tolerancing (GD&T), including datums, feature control frames, form, orientation, location, and runout tolerances, and application of basic GD&T symbols to engineering drawings.
8. Preparation of a complete engineering drawing project comprising detail drawings, assembly drawings, and basic manufacturing documentation in accordance with relevant engineering drawing standards.

RECOMMENDED BOOKS

1. Bhatt, N. D. (2010). Engineering drawing (50th ed.).
2. Bertoline, G., Wiebe, E., Hartman, N., & Ross, W. (2010). Technical graphics communication. McGraw-Hill Education.
3. Parkinson, A. C. (1962). First year engineering drawing (6th ed.).

SUPPLEMENTAL RESOURCES

1. ISO Standards related to technical drawings, dimensioning, tolerancing, and engineering documentation.
2. ASME Y14 Series standards for engineering drawing practices and Geometric Dimensioning and Tolerancing (GD&T).

9.38 Professional Certification

The following table presents a list of prospective courses that align with and contribute toward obtaining relevant professional certifications.

Sr no	Course titles	Professional Certifications
1.	Quality Management and Reliability	Quality Technician (CQT) Certified Quality Engineer (CQE) Certified Reliable Engineer (CRE)
2.	Project Management	Project Management Professional PMP
3.	CAD	Solid Works
4.	Instrumentation and Control	Matlab Certification
5.	Manufacturing Processing	Certified Manufacturing Technologist

9. Supervised Industrial Training

9.1 Background

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

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

9.2 Objectives

Through the SIT, students will:

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

9.3 Responsibility of HEI: Placement in SIT Program

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

9.4 Responsibilities of Students

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



Curriculum for Bachelor of Mechanical Engineering Technology



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

9.5 Training Progress Assessment and Review by HEI

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

The purpose of monitoring of SIT by Training Administrator/Coordinator are:

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

9.6 Changing Student Placement During SIT

- a. Students are discouraged to change placement during the training period from one organization to another.
- b. However, written permission may be granted by the training Administrator/Coordinator, if new placement of the student is available and confirmed in another organization, provided the student does not suffer loss of training hours due to this changeover

- c. After getting written permission from the Training Administrator/Coordinator, a fresh approval should be applied for the new placement.

9.7 Daily Training Logbook

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

The Training logbook must reflect:

- a. The student's learning experience during the industrial training
- b. Training records and evidence of supervised training, with evidence of participation of student, on- the-job Trainer and HEI's training Administrator/Coordinator.
- c. Part of professional practice in engineering profession where incidence and evidence are properly documented.
- d. Information that becomes a source of reference in preparing the Industrial Training Report [See Section 8.8].
- e. The Logbook must be submitted along with the Industrial Training Report.

9.8 Industrial Training Report

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

9.9 Guidelines for Preparation of Industrial Training Report

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

9.9.1 Contents of Industrial Training Report

(a) Table of Contents

This section of the report shall consist of:

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

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

(b) Background & Profile of the Training Organization

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

- i. Background /profile of the organization
- ii. Vision and Mission



Curriculum for Bachelor of Mechanical Engineering Technology



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

(c) Schedule of Duties Performed as Trainee

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

(d) Experience During SIT

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

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

(e) Conclusion

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

- i. Major works performed during SIT
- ii. Different modules of SIT
- iii. Comments whether SIT met the training objectives
- iv. Suggestions and recommendations for improvement of the SIT

(f) References

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

(g) Appendixes

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

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

(h) Figures and Tables

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

(i) Notations, Symbols & Acronyms

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



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

9.9.2 Format of the Report

(a) General

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

(b) Abstract or Preface

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

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

9.10 SIT Assessment

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

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

It is also be noted that:

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

9.11 Completion of Industrial Training

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

APPENDIX A: Sydney Accord Knowledge and Attitude Profile

(Retrieved from www.ieagrements.org)

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



APPENDIX B: Engineering Technologist Graduate Attribute Profile

(Retrieved from www.ieagrements.org)

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



Curriculum for Bachelor of Mechanical Engineering Technology



Individual and Teamwork

SA9: An ability to Function effectively as an individual, and as a member or leader in diverse teams.

Communication

SA10: An ability to communicate effectively on broadly defined Engineering Technology activities with the Engineering Technologist community and with society at large, by being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

Project Management

SA11: An ability to demonstrate knowledge and understanding of Engineering Technology management principles and apply these to one's own work, as a member or leader in a team and to manage projects in multidisciplinary environments.

Lifelong Learning:

SA12: An ability to recognize the need for and have the ability to engage in independent and life-long learning in specialist Engineering Technologies.

APPENDIX C: Engineering Technologist Professional Competence Profile

(Retrieved from www.icagreements.org)

As per Sydney Accord, Engineering Technologist Graduate is expected to demonstrate the following competencies:
Comprehend and apply universal knowledge: TC1: Comprehend and apply the knowledge embodied in widely accepted and applied procedures, processes, systems, or methodologies.
Comprehend and apply local knowledge: TC2: Comprehend and apply the knowledge embodied procedures, processes, systems, or methodologies that is specific to the jurisdiction of practice.
Problem analysis: TC3: Identify, clarify, and analyze broadly defined problems using the support of computing and information technologies where applicable.
Design and development of solutions: TC4: Design or develop solutions to broadly defined problems considering a variety of perspectives.
Evaluation: TC5: Evaluate the outcomes and impacts of broadly defined activities.
Protection of society: TC6: Recognize the foreseeable economic, social, and environmental effects of broadly defined activities and seek to achieve sustainable outcomes (represented by the 17 UN-SDGs).
Legal, regulatory, and cultural: TC7: Meet all legal, regulatory, and cultural requirements and protect public health and safety during all activities.
Ethics: TC8: Conduct activities ethically
Manage engineering activities: TC9: Manage part or all of one or more broadly defined activities.
Communication and Collaboration: TC10: Communicate and collaborate using multiple media clearly and inclusively with a broad range of stakeholders during all activities.
Continuing Professional Development (CPD) and Lifelong learning: TC11: Undertake CPD activities to maintain and extend competences and enhance the ability to adapt to emerging technologies and the ever-changing nature of work.



Curriculum for Bachelor of Mechanical Engineering Technology



Judgement:

TC12: Choose appropriate technologies to deal with broadly defined problems. Exercise sound judgement in the course of all broadly defined activities.

Responsibility for decisions:

TC13: Be responsible for making decisions on part or all of one or more broadly defined activities.



APPENDIX D: Minutes of Preliminary Meeting of NCRC

Summary of the 3-Day Proceedings of the Preliminary NCRC Meeting on Mechanical Engineering Technology (27–29 April 2026)

Summary - Day 1

- Introduction of NCRC members
- Selection of the Convener, Co-Convener, and Secretary
- The Convener outlined the seven objectives of the NCRC meeting as per the agenda
- The Chairman NTC / Rector NUTECH welcomed all members and opened the forum for discussion. The following points were raised:
 1. **Dr. Azfar (Foreign Expert Member)** emphasized the inclusion of topics such as Artificial Intelligence, Additive Manufacturing, and Sustainability in the curriculum.
 2. **Dr. Khurram Pervaiz Amber** raised the issue of faculty placement in industry and shared correspondence sent to the Chairman HEC.
 3. **Representatives of GIZ** emphasized incorporating eligibility criteria aligned with Level 5 of NAVTTC.
 4. The **Chairman NTC** requested Air Commodore (R) Engr. Naveed Yousuf to showcase the facilities and centers developed at NUTECH to the NCRC members.
 5. The **Chairman NTC** directed that the mentors' reports of the Sydney Accord (New Zealand and Malaysia) be shared with members to facilitate curriculum alignment with Sydney Accord requirements.
 6. **Dr. Alamgir Khan** proposed establishing a funding mechanism for technologists, similar to PEC, to support paid internships and initial job training, thereby enhancing employment opportunities.
 7. **Mr. Muhammad Bilal Afzal** suggested clarifying the role of technologists in industrial employment. The Chairman acknowledged the challenges related to the service structure for technologists and informed that efforts are underway to enhance their recognition. He further noted that the Pakistan Engineering Council (PEC) is in the process of integrating technologist education alongside engineering education. Additionally, Mr. Afzal emphasized the need to enhance hands-on skills for technologists and suggested that organizations such as PCSIR may facilitate Universities and Institutes in this regard.
 8. Members emphasized strengthening university–industry liaison for projects and Supervised Industrial Training (SITs) for technologists.
 9. The **HEC representative, Mr. Kasi**, delivered a presentation on curriculum development and program structure and shared a template for implementation.



Curriculum for Bachelor of Mechanical Engineering Technology



- Formation of three expert subgroups among NCRC members:
 - **Group 1:** Thermo-Fluids and Energy
 - **Group 2:** Design, Materials, and Manufacturing
 - **Group 3:** Control and Automation (including futuristic courses)
- 10. The **Secretary, Dr. Asim**, populated the HEC template with courses of Mechanical Engineering Technology and General Education, indicating foundation, breadth, and depth.
- 11. The **Convener** shared the document on Graduate Attributes and Professional Competencies by IEA and developed a course profile template, including Knowledge Profile (SKs), Course Objectives, Technologist Competencies (TCs), CLOs, Bloom's Taxonomy, recommended books, course content, and PLO mapping.
- 12. Courses were assigned to respective subgroups for the development of course profiles as per the approved template.

Summary - Day 2

1. Subgroups worked on the development of their respective course profiles.
2. The Convener provided guidance on the appropriate incorporation and mapping of Knowledge Profiles (SKs) and Technologist Competencies (TCs) within the course profiles.

Summary - Day 3

- Peer review of course profiles was conducted.
- Visit to the National Incubation Center (NIC) and other facilities at NUTECH.
- In the closing meeting, the following points were discussed:
 1. **Dr. Wasim** reiterated the objectives of the NCRC meeting, with emphasis on incorporating Sydney Accord requirements into the curriculum.
 2. The **Convener, Dr. Mushahid**, presented a summary of the three-day proceedings and informed members that two online meetings would be conducted prior to the final NCRC meeting.
 3. **The Co-Convener, Dr. Muhammad Khurram**, highlighted
 4. A **GIZ representative** highlighted the need to ensure gender diversity in the composition of NCRC committees; the point was acknowledged by the Chairman NTC.



Curriculum for Bachelor of Mechanical Engineering Technology



5. The **Chairman NTC** thanked all members for their valuable contributions toward this national initiative of curriculum development.
6. Shields were distributed by the Chairman NTC to all NCRC participants.

The following members attended the meeting:

Sr#	NCRC Members	Role
1	Prof. Dr. Syed Mushahid Hussain Hashmi NED University of Engineering & Technology (UET), Karachi Prof. Dr. Saeed Badshah University of Technology (UoT), Nowshera	Convener
2	Prof. Dr. Muhammad Khurram National University of Technology (UTECH), Islamabad	Co-Convener
3	Dr. Muhammad Asim Waris National University of Sciences and Technology (NUST), Islamabad	Secretary
4	Prof. Dr. Sadiq Khattak University of Engineering & Technology (UET), Peshawar	Member
5	Prof. Dr. Saeed Badshah University of Technology (UoT), Nowshera	Member
6	Prof. Dr. Muhammad Mansoor Janjua National University of Technology (UTECH), Islamabad	Member
7	Dr. Irfan Ahmed Gondal National Skills University (NSU), Islamabad	Member
8	Prof. Dr. Abdul Aziz Mazhar Industrial Rep (PoP) Institute of Space Technology (IST), Islamabad	Member
9	Prof. Dr. Azmatullah Khan Sherani Balochistan University of Information Technology, Engineering and Management Sciences (BUIITEMS), Quetta	Member
10	Prof. Dr. Khuram Pervez Amber Mirpur University of Sciences & Technology (MUST), AJK	Member
11	Prof. Dr. Abdul Shakoar University of Engineering & Technology (UET), Peshawar	Member
12	Dr. Muhammad Asim University of Engineering and Technology, Lahore-Punjab	Member
13	Dr. Sohail Malik Pak-Austria Fachhochschule (PAF) Institute of Applied Sciences and Technology (IAST), Haripur	Member
14	Prof. Dr. Tipu Sultan Punjab Tianjin University of Technology (PTUT), Lahore	Member
15	Prof. Dr. Alamgir Akhtar Khan Muhammad Nawaz Shareef University of Agriculture (MNSUA), Multan	Member
16	Mr. Muhammad Bilal Afzal Chief Technology Officer (CTO) PCSIR, Peshawar	(Technologist)
17	Dr. Syed Gul Hassan Naqvi Director Operations Asterisk Solutions Pvt Ltd Islamabad	(Industrial Rep)



Curriculum for Bachelor of Mechanical Engineering Technology



Sr#	NCRC Members	Role
18	Dr. Azfar Khalid Senior Lecturer Nottingham Trent University, UK	International Expert
19	Mr. Hidayatullah Kasi Deputy Director Academics Division HEC, Islamabad	(HEC) Representative
20	Hafiz Ghulam Muhammad Deputy Director NTC, Islamabad	NTC Representative

The NCRC meeting for Mechanical Engineering Technology was convened to address the following agenda items:

Agenda Item 1: Curriculum Revision: The committee commenced the meeting with a comprehensive discussion on revising the existing curriculum in the discipline of Mechanical Engineering Technology (2026). The primary objective was to align it with national and international standards and best practices. Recognizing the need to stay abreast of global advancements in engineering education, the committee agreed to incorporate modern methodologies, emerging technologies, and industry-relevant content to equip graduates with competitive skills and knowledge.

Agenda Item 2: Preface and Rationale Update: The committee then dedicated time to review, revise, and update the preface and rationale of the subject. The aim was to provide a concise and compelling introduction that articulates the purpose and relevance of the curriculum. By offering a clear vision and rationale, the committee aimed to engage stakeholders and promote a deeper understanding of the program's objectives and societal significance.

Agenda Item 3: Scheme of Studies: During the committee meeting, a key agenda item was to chalk out the scheme of studies for the Mechanical Engineering Technology program. This scheme would serve as the foundation for the entire curriculum, outlining the sequence and structure of courses that students would undertake throughout their academic journey.

To ensure that the curriculum encompassed a comprehensive range of topics and expertise, the committee decided to form subcommittees in various areas of mechanical engineering (see Table below). These subcommittees were composed of experts with specialized knowledge and experience in their respective fields. The goal was to leverage their insights and perspectives to design courses that aligned with the latest developments and emerging trends in the industry.



Curriculum for Bachelor of Mechanical Engineering Technology



Mechanical Engineering Technology Sub Committees Subject Groups		
Group-I: Thermofluids and Energy		
Name	Designation	Role
Dr. Syed Mushahid Hussain Hashmi	Professor	Convener
Dr. Muhammad Khurram	Professor	Co- Convener
Dr. Tipu Sultan	Professor	Member
Dr. Irfan Ahmed Gondal	Professor	Member
Dr. Syed Gul Hassan Naqvi	Professor	Industrial rep
Group II: Design , Material and Manufacturing		
Name	Designation	Role
Dr. Abdul Shakoor	Professor	Member
Dr. Alamgir Akhtar Khan	Professor	Member
Dr. Azmatullah Khan Sherani	Professor	Member
Dr. Abdul Aziz Mazhar Industrial Rep (PoP)	Professor	Member
Mr. Muhammad Bilal Afzal		Technologist
Group III: Control and Automation		
Name	Designation	Role
Dr. Muhammad Khurram	Professor	Co- Convener
Dr. Muhammad Mansoor Janjua	Professor	Member
Dr. Muhammad Asim		Member
Dr.Zohaib		Member
Dr. Azfar Khalid		International Expert
Note: Each group has also the mandate to recommend the electives subjects in their respective groups		

Each sub-committee was assigned specific areas of expertise, such as thermodynamics, fluid mechanics, materials science, machine design, robotics, automation, and renewable energy, among others. The experts within each subcommittee were tasked with developing course outlines, learning objectives, and content that would equip students



Curriculum for Bachelor of Mechanical Engineering Technology



with a diverse and robust skill set in their chosen domain.

Agenda Item 4: Program Education Objectives and Course Learning Outcomes: The sub-committee was assigned the critical task of formulating the Program Education Objectives (PEOs) and Course Learning Outcomes (CLOs) for the Mechanical Engineering Technology program. This responsibility involved conducting comprehensive discussions to ensure that these objectives and outcomes were clear, measurable, and aligned with the undergraduate program and other relevant standards. To achieve these goals, the sub-committee took into account appropriate taxonomy levels, ensuring that the CLOs reflected the depth and complexity of the knowledge and skills expected from the students.

Agenda Item 5: Incorporation of Latest Reading Materials and References: The committee acknowledged the significance of keeping the curriculum up-to-date with the latest research and advancements in the field. To achieve this, sub-committee will proposed the incorporation of relevant and current reading materials and references, both from local and international sources. These resources would enhance students' understanding and keep them informed about the latest developments in Mechanical Engineering Technology.

Agenda Item 6: Uniformity and Non-Overlapping Contents: Ensuring consistency and coherence in the curriculum was a major point of consideration. The committee aimed to devise course contents that maintained uniformity across other disciplines within the engineering domain, while also avoiding unnecessary overlapping. This approach would provide a structured and seamless learning experience for students pursuing various engineering specializations.

Agenda Item 7: Recommendations for Discipline: The committee devoted time to brainstorming and formulating recommendations for the discipline of Mechanical Engineering Technology. These recommendations were designed to address the futuristic needs of society, the evolving job market, and the ever-changing technological landscape. The committee emphasized the importance of preparing graduates to be adaptable, innovative, and capable of contributing significantly to the development and progress of the nation.

The meeting concluded on a positive note, with all members expressing their wholehearted commitment to effectively finalize the task of proposed course contents, CLOs, PLOs, and their mapping. The NCRC members unanimously agreed to collaborate in the coming weeks to further refine the curriculum and compile a comprehensive report for submission to the relevant authorities for approval. This collective dedication and cooperation clearly demonstrate the committee's unwavering determination to ensure the Mechanical Engineering Technology program upholds the highest standards and remains adaptive to the evolving needs of the engineering field.

APPENDIX E: Minutes of the Final Meeting of NCRC

NCRC Meeting on Mechanical Engineering Technology (13–15 July 2026)

Summary - Day 1

1. Opening and welcome statement to NCRC members
2. Convenor briefed about the plan of NCRC activities and segregate teams into working groups as:
 - **Group 1:** Thermo-Fluids and Energy
 - **Group 2:** Design, Materials, and Manufacturing
 - **Group 3:** Control and Automation (including futuristic courses)
3. **Dr. Asim Waris** briefed the committee on the current state of courses and outline the remaining tasks.
4. Several courses were reviewed, and suggestions were made to incorporate revisions in courses such as *Applied Chemistry, Manufacturing Processes, and Instrumentation and Controls*, among others.
5. The titles of a few courses, such as *CAD and 3D Modeling* and *Industrial Engineering*, were revised to better reflect the course content and incorporate more relevant topics.
6. **Dr. Mushahid Hussain** suggested including supplementary resources for each course to enhance the effectiveness of course delivery.
7. **Dr. Azfar (Foreign Expert Member)** based on the international trends suggested to have topics of Industry 5.0 and additive manufacturing which were incorporated in the course of Manufacturing processes.
8. **Dr. Mansoor Janjua** highlighted that there were two management courses in the curriculum. The committee decided to replace one of them with *Quality Management and Reliability*.
9. The committee discussed the inclusion of professional certifications as part of the curriculum and recommended developing a formal policy to facilitate their integration.

Summary - Day 2

1. **Dr. Asim Waris** briefed the committee on the current state of courses and outline the remaining tasks.
2. **Dr. Mushahid** briefed the committee on the updated content of the two mathematics courses in the curriculum.
3. **Dr. Abdul Shakoor** shared a policy document Professional Certification
4. **Mr. Bilal** included the introductory topics related to Industry 5.0 into Manufacturing Processes 2.
5. **Dr. Saeed Badsha** suggested initiating discussions with other curriculum development committees to develop a common curriculum for shared courses.



Curriculum for Bachelor of Mechanical Engineering Technology



The following members attended the meeting:

Sr#	NCRC Members	Role
1	Prof. Dr. Saeed Badshah University of Technology (UoT), Nowshera	Convener
2	Prof. Dr. Syed Mushahid Hussain Hashmi NED University of Engineering & Technology (UET), Karachi	Co-Convener
3	Dr. Muhammad Asim Waris National University of Sciences and Technology (NUST), Islamabad	Secretary
4	Prof. Dr. Muhammad Khurram National University of Technology (UTECH), Islamabad	Member
5	Prof. Dr. Sadiq Khattak University of Engineering & Technology (UET), Peshawar	Member
6	Prof. Dr. Muhammad Mansoor Janjua National University of Technology (UTECH), Islamabad	Member
7	Dr. Irfan Ahmed Gondal National Skills University (NSU), Islamabad	Member
8	Prof. Dr. Abdul Aziz Mazhar Industrial Rep (PoP) Institute of Space Technology (IST), Islamabad	Member
9	Prof. Dr. Azmatullah Khan Sherani Balochistan University of Information Technology, Engineering and Management Sciences (BUIITEMS), Quetta	Member
10	Prof. Dr. Khuram Pervez Amber Mirpur University of Sciences & Technology (MUST), AJK	Member
11	Prof. Dr. Abdul Shakoor University of Engineering & Technology (UET), Peshawar	Member
12	Dr. Sohail Malik Pak-Austria Fachhochschule (PAF) Institute of Applied Sciences and Technology (IAST), Haripur	Member
13	Prof. Dr. Tipu Sultan Punjab Tianjin University of Technology (PTUT), Lahore	Member
14	Prof. Dr. Alamgir Akhtar Khan Muhammad Nawaz Shareef University of Agriculture (MNSUA), Multan	Member
15	Mr. Muhammad Bilal Afzal Chief Technology Officer (CTO) PCSIR, Peshawar	(Technologist)
16	Dr. Syed Gul Hassan Naqvi Director Operations Asterisk Solutions Pvt Ltd Islamabad	(Industrial Rep)
17	Dr. Azfar Khalid Senior Lecturer Nottingham Trent University, UK	International Expert
18	Mr. Hidayatullah Kasi Deputy Director Academics Division HEC, Islamabad	(HEC) Representative
19	Hafiz Ghulam Muhammad Deputy Director NTC, Islamabad	NTC Representative

The NCRC meeting for Mechanical Engineering Technology was convened to address the following agenda items:



Curriculum for Bachelor of Mechanical Engineering Technology



Agenda Item 1: Finalization of Preliminary Curriculum Draft: The committee diligently worked on finalizing the preliminary draft of the curriculum for the discipline of Mechanical Engineering Technology. The paramount objective was to align it with both national and international standards, ensuring that it meets the evolving demands of the engineering field. Through extensive discussions and expert input, the committee successfully shaped a curriculum that reflects the latest developments and incorporates best practices in the industry.

During the meeting, the committee achieved a significant milestone by finalizing the curriculum scheme of studies. This framework will serve as the backbone of the entire program, outlining the sequence and structure of courses that students will undertake throughout their academic journey. In addition, the committee meticulously examined and finalized the course contents, which will form the foundation of students' knowledge and understanding in various areas of mechanical engineering technology.

Agenda Item 2: Finalization of Objectives, Learning Outcomes, and Assessment Criteria: Another crucial aspect of the meeting was the finalization of objectives and learning outcomes for each course. The committee focused on devising clear and measurable outcomes that align with the Bachelor programs in Mechanical Engineering Technology. Additionally, they dedicated thorough attention to establishing comprehensive assessment criteria, encompassing both formative and summative evaluations, to effectively gauge students' progress.

The meeting also saw an in-depth discussion on the Program Learning Outcomes (PLOs). These outcomes were meticulously crafted to articulate the specific knowledge, skills, and attitudes that students should acquire upon completing the Mechanical Engineering Technology program.

Agenda Item 3: Incorporation of Latest Reading Materials and References: The committee actively engaged in suggesting the incorporation of the latest reading materials and references, sourced both locally and internationally, for each course. By integrating up-to-date resources, the curriculum aims to enhance students' understanding of cutting-edge technologies, research, and advancements in the field of Mechanical Engineering Technology.

Agenda Item 4: Ensuring Uniformity and Non-Overlapping Contents: The committee emphasized the importance of maintaining uniformity and coherence across the curriculum. With meticulous effort, they finalized the course contents while avoiding unnecessary overlaps with other disciplines within the field of engineering. This approach ensures a streamlined and holistic learning experience for students pursuing various engineering specializations.

Agenda Item 5: Final Recommendations for Discipline: The meeting culminated with the committee making final recommendations for the discipline of Mechanical Engineering Technology. These recommendations were carefully considered in light of futuristic societal needs and the rapidly evolving technological landscape. The committee's collective efforts were dedicated to preparing graduates who are not only well-equipped with technical knowledge but also possess the adaptability and innovation necessary to address future challenges.

Additionally, the committee dedicated time to finalize the Vision and Mission Statement for the program. These statements will serve as guiding principles for the program's overall direction and will inspire students and faculty to work towards a common goal.

Furthermore, the meeting addressed the recommendations put forth by foreign experts and the benchmarking of similar programs. These recommendations were thoroughly considered to ensure that the program aligns with global standards and incorporates best practices from around the world.

The National Curriculum Review Committee (NCRC) stressed the importance of contemporary knowledge regarding engineering technology programs. They acknowledged that the landscape of technology and engineering is constantly evolving, and the curriculum must be flexible enough to adapt to these changes. By incorporating the latest advancements and industry trends into the curriculum, the Mechanical Engineering Technology program will produce graduates who are well-prepared to tackle real-world challenges and contribute effectively to the field of engineering.

In conclusion, the NCRC meeting for Mechanical Engineering Technology at UET Lahore marked a significant milestone in the development of the program's curriculum. With the scheme of studies, course contents, CLOs, PLOs, Vision and Mission Statement, and recommendations from experts now finalized, the program is on track to provide



Curriculum for **Bachelor of Mechanical Engineering Technology**



students with a comprehensive and up-to-date education in mechanical engineering technology. The committee's dedication and collaborative efforts ensure that the program remains at the forefront of technological advancements, contributing to the growth and success of both individuals and the nation as a whole. By incorporating the latest advancements and industry trends into the curriculum, the Mechanical Engineering Technology program is poised to produce graduates who are well-prepared to tackle real-world challenges and contribute effectively to the field of engineering. The committee's commitment to preparing students for future needs demonstrates their forward-thinking approach, positioning the program to be a catalyst for innovation, progress, and excellence in the ever-evolving landscape of mechanical engineering technology.



APPENDIX F: Supervised Industrial Training Logbook (Sample Format)

Student Details:

Name:

Roll Number:

Address:

Email:

Course of Study:

Year/Semester of Study:

Training Start Date:

Training End Date:

Training Organization Details:

Name of Organization:

Address:

Contact Person:

Contact Number:

On-the-job Trainer Name:

On-the-job Trainer Contact Number:

Daily Training Log

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

Training Week: _____

Date	Time	Training Log

Declaration:

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

Student signature with date

Organization Supervisor signature with date

HEI Coordinator signature & date



APPENDIX G: Supervised Industrial Training Report (Sample Format)

Sample table of content for supervised industrial training report is provided so that students can develop an understanding of what is expected of them when making the submission. Students are encouraged to expand upon the content presented below. A declaration page validating the originality of work duly signed by the student and the trainee is also to be attached at the beginning of the submitted report.

Chapter 1	Background of Training Organization	XX
Chapter 2	Schedule of Training and Duties as Trainee	XX
	2.1 Sub-heading	XX
	2.2 Sub-heading	XX
	2.3 Sub-heading	XX
	2.4.....	
Chapter 3	Working Experience	XX
	3.1 Projects carried out (as assigned by the on-the-job trainer)	XX
	3.2 Hands-on skills acquired	XX
	3.3 Problems and challenges encountered	XX
	3.4 Problem solving process/	XX
	3.5 Supervisory tasks	XX
	3.6 Suggestions for enhancing productivity	XX
	3.7 Quality management systems in place	XX
	3.8 Safety features at workplace	XX
	3.9 Additional sub-headings	XX
	3.10.....	
	XX	
Chapter 4	Conclusion	XX
	References	XX
	Appendices	XX

APPENDIX H : Broadly Defined Problems

Definition of Broadly Defined Problem:				
Broadly Defined Engineering Problems have characteristic SP1 and <u>some or all</u> of SP2 to SP7.				
SP1-Depth of Knowledge required: Cannot be resolved without engineering knowledge at the level of one or more of SK4, SK5, and SK6 supported by SK3 with a strong emphasis on the application of developed technology				
SK3	Engineering fundamentals	SP2	Range of conflicting requirements	
SK4	Engineering Specialist Knowledge	SP3	Depth of analysis required	
SK5	Engineering Design	SP4	Familiarity of issues	
SK6	Engineering Technology	SP5	Partially Outside the extent of applicable codes	
		SP6	Extent of stakeholder involvement and level of conflicting requirements	
		SP7	Interdependence	
Example of a Broadly Defined Problem for Mechanical Technology:				
A mid-sized manufacturing plant has an old conveyor system that causes low efficiency, high power use, and frequent belt failures (SP1/SP2). The task is to redesign and improve (SK5) the conveyor system (SP7) by: Choosing proper belt size, pulley arrangement, and tensioning method (SK6). Selecting an energy-efficient motor and drive suitable for variable loads (SK7). Using simple simulation or software tools (SK2) to check throughput and energy use. Ensuring the system connects smoothly with existing PLC-based automation (SK8). The final solution should propose a practical conveyor (SP4) design that improves throughput, saves energy, and meets safety standards at a reasonable cost.				
Rubric for the assessing the Broadly Defined problem:				
Criteria	Score 4 – Excellent	Score 3 – Good	Score 2 – Fair	Score 1 – Poor
Application of mechanical design principles	Demonstrates deep understanding and applies principles effectively in all design aspects	Applies principles with minor gaps or simplifications	Basic application with limited integration	Misapplies or omits key design principles
Use of simulation and analysis tools	Uses appropriate tools with accurate modeling and optimization	Uses tools with reasonable accuracy and interpretation	Uses tools but with limited insight or errors	No use or incorrect use of tools
Integration with automation systems	Seamlessly integrates with existing systems and anticipates future scalability	Integrates with current systems but lacks future-proofing	Partial integration with limited compatibility	No integration or incompatible design
Cost-benefit and energy efficiency analysis	Provides detailed analysis with clear	Includes cost and energy	Mentions cost/efficiency but lacks depth	Ignores cost or energy implications



Curriculum for
Bachelor of Mechanical Engineering Technology



	economic justification	considerations with minor gaps		
Safety and compliance considerations	Fully addresses safety standards and regulatory compliance	Addresses most safety aspects with minor omissions	Basic safety considerations included	Safety and compliance not considered

APPENDIX I : Definition of terms related to OBE and Sydney Accord

S. No.	Term	Meaning	Source
1	Knowledge	Recognizing and comprehending terminology, facts, methods, trends, classifications, structures, or theories. It involves learning as well as demonstrating what has been learned. The demonstration of a specific knowledge is invariably by means of work done based on that knowledge	IEA-2021
2	Skill	The demonstration of a specific knowledge is invariably by means of work done based on that knowledge	IEA-2021
3	Competence	A professionally or occupationally competent person has the attributes necessary to perform the activities within the profession or occupation to the standards expected in independent employment or practice. (IEA outlines professional competence profile for each using a set of attributes corresponding largely to the graduate attributes, but with different emphasis)	IEA-2021
4	Awareness	Recognizing the context and implications while using or applying what has been learned. The demonstration of awareness can be more varied than a demonstration of knowledge. Asking the right questions, including among the assumptions made, complying with or respecting when faced with a situation may be acceptable demonstrations.	IEA-2021
5	Solution	An effective proposal for resolving a problem, taking into account all relevant technical, legal, social, cultural, economic and environmental issues and having regard to the need for sustainability.	IEA-2021
6	Manage	It means planning, organising, leading and controlling in respect of risk, project, change, financial, compliance, quality, ongoing monitoring, control and evaluation	IEA-2021
7	Engineering problem	A problem that exists in any domain that can be solved by the application of engineering knowledge and skills and generic competences.	IEA-2021
8	Mathematical sciences	Includes mathematics, numerical analysis, statistics and aspects of computer science cast in an appropriate mathematical formalism.	IEA-2021
9	Natural sciences	Provide, as applicable in each engineering discipline or practice area, an understanding the physical world including physics, mechanics, chemistry, earth sciences and the biological sciences.	IEA-2021
10	Engineering sciences	Include engineering fundamentals that have roots in the mathematical and physical sciences, and where applicable, in other natural sciences, but extend knowledge and develop models and methods in order to lead to applications and solve problems, providing the knowledge base for engineering specializations.	
11	Branch of engineering	A generally-recognized, major subdivision of engineering such as the traditional disciplines of Chemical, Civil, or Electrical Engineering, or a cross-disciplinary field of comparable breadth including combinations of engineering fields, for example Mechatronics, and the application of engineering in other fields, for example Bio-Medical Engineering.	IEA-2021

12	Engineering speciality or specialization	A generally-recognized practice area or major subdivision within an engineering discipline, for example Structural and Geotechnical Engineering within Civil Engineering; the extension of engineering fundamentals to create theoretical frameworks and bodies of knowledge for engineering practice areas.	
13	Practice area (in the educational context)	It is synonymous with generally-recognized engineering speciality.	IEA-2021
14	Practice area (at the professional level)	A generally recognized or distinctive area of knowledge and expertise developed by an engineering practitioner by virtue of the path of education, training and experience followed.	IEA-2021
15	Engineering practice area	A generally accepted or legally defined area of engineering work or engineering technology.	IEA-2021
16	Engineering fundamentals	A systematic formulation of engineering concepts and principles based on mathematical and natural sciences to support applications.	IEA-2021
17	Engineering design knowledge	Knowledge that supports engineering design in a practice area, including codes, standards, processes, empirical information, and knowledge reused from past designs.	IEA-2021
18	Engineering management	The generic management functions of planning, organising, leading and controlling, applied together with engineering knowledge in contexts including the management of projects, construction, operations, maintenance, quality, risk, change and business.	IEA-2021
19	Engineering technology	An established body of knowledge, with associated tools, techniques, materials, components, systems or processes that enable a family of practical applications and that relies for its development and effective application on engineering knowledge and competence.	IEA-2021
20	Program Educational Objectives (PEOs)	Broad statements that describe what graduates are expected to attain within a few years of graduation. Program educational objectives are based on the needs of the program's constituencies.	ABET Glossary
21	Assessment	One or more processes that identify, collect and prepare data to evaluate the attainment of program educational objectives and student outcomes. Effective assessment uses relevant direct, indirect, quantitative, and qualitative measures as appropriate to the objective or outcome being measured. Appropriate sampling methods may be used as part of an assessment process.	ABET Glossary
22	Evaluation	One or more processes for interpreting the data and evidence accumulated through assessment practices. Evaluation determines the extent to which program educational objectives and student outcomes are being attained. Evaluation results in decisions and actions regarding program improvement.	ABET Glossary
23	Substantial Equivalency	Accreditation systems have comparable standards, outcomes, and processes, though they may not be identical. Can also mean that a program is comparable in content and educational experience to others, but may differ in format or method of delivery. Substantial equivalency implies reasonable confidence that the program has prepared its graduates to begin professional practice at the entry level.	ABET Glossary

24	Accord	An agreement among the bodies responsible for accrediting specific degree programs in each of the signatory countries. Accords recognize the substantial equivalency of programs accredited by each of these bodies and recommends that graduates of accredited programs in any of the signatory countries be recognized by the other countries as having met the academic requirements for entry-level practice. Accords are intended to improve technical education worldwide and foster the mobility of students and graduates.	ABET Glossary
25	Concern	Statement that a program currently satisfies a criterion, policy, or procedure, but the potential exists for the situation to change such that the criterion, policy, or procedure may not be satisfied.	ABET Glossary
26	Weakness	Statement that a program lacks the strength of compliance with a criterion, policy, or procedure to ensure that the quality of the program will not be compromised. Remedial action is required to strengthen compliance with the criterion, policy, or procedure prior to the next review.	ABET Glossary
	Deficiency	Statement that a criterion, policy, or procedure is not satisfied. The program is not in compliance with the criterion, policy, or procedure.	ABET Glossary
27	Observation	A comment or suggestion that does not relate directly to the accreditation action but is offered to assist the institution in its continuing efforts to improve its programs.	ABET Glossary
28	Continuous Quality Improvement (CQI)	An approach based on evaluating a product or a process and on understanding the needs and expectations of those who use or benefit from a product or a process.	ABET Glossary