Curriculum

for

Bachelor of Mechanical Engineering Technology Degree

(2023)

Higher Education Commission
Islamabad
Curriculum Division

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

Contents

1. Introduction

Curriculum is the total learning experience of a student that occurs in the educational process. The term refers specifically to a planned sequence of 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]

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	41	35	40 (Opt.**)
Engineering Technology Domain Courses	28	22	27 (Opt.)
Non-Engineering Technology Domain Courses	13	13	13 (Opt.)
Total Credit Hours	124 – 136	133	132
Engineering Technology Domain Credit Hours	85	101	100 (Opt.)
Percentage of Engineering Technology Domain Courses	68%	63%	68%
Non-Engineering Technology Domain Credit Hours	39	32	32
Percentage of Non-Engineering Technology Domain Courses	32%	37%	32 %
No. of Credit Hours per Semester	15 – 18	15 – 18	15 – 18
** Optional Courses in 7th Semester shall be included for Framework B (SIT in 8th 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.			

Engineering Technology Domain Courses in Recommended Schemes of Studies as per Framework							
Knowledge Area	**Course Code**	**Course**	**Credit Hours**		**Weekly Contact Hours**		**Total Credit Hours**
			Theory	**Practical**	**Theory**	**Practical**	
Computing	MES-143	Computer Fundamentals	1	2	1	6	3
	MES-212	Computer Programming	1	1	1	3	2
	MES-153	Information and communication Technologies	3	0	3	0	3
Mechanical Engineering Technology (Foundation)	MET-113	Workshop Technology	1	2	1	6	3
	MET-123	Technical Drawing and Graphics	1	2	1	6	3
	MET-133	Applied Mechanics	2	1	2	3	3
	MET-144	Basic Electrical & Electronics	2	2	2	6	4
	MET-223	Industrial Materials	2	1	2	3	3
	MET-233	Mechanics of Material	2	1	2	3	3
	MET-244	Applied Thermodynamics	3	1	3	3	4
Mechanical Engineering Technology (Breadth)	MET-252	Machine Design	2	0	2	0	2
	MET-264	Fluid Mechanics and Hydraulic machines	3	1	3	3	4
	MET-343	Manufacturing Processes	2	1	2	3	3
	MET-212	Computer aided drafting and Modeling	0	2	0	6	2
	MEM-233	Industrial maintenance and Safety	2	1	2	3	3
	MEM-333	Total Quality Management	2	1	2	3	3
	MET-353	Instrumentation and Control	2	1	2	3	3
Mechanical Engineering Technology (Depth)	MET-313	Heat and Mass Transfer	2	1	2	3	3
	MET-323	Energy and Power Technologies	2	1	2	3	3
	MET-363	Mechanical Vibration	2	1	2	3	3

	MET-373	Heating, Air-condition and Ventilation Technologies	2	1	2	3	3
	MET-383	Project	0	6	0	18	6
Total			**39**	**30**	**39**	**90**	**69**

Recommendations for Non-Technological Courses Proposed Social Humanities and Social Sciences Courses							
Knowledge Area	**Course Code**	**Course**	**Credit Hours**		**Weekly Contact Hours**		**Total Credit Hours**
			Theory	**Practical**	**Theory**	**Practical**	
Humanities and Social Sciences	MEH-112	Islamic Studies/Professional Ethics	2	0	2	0	2
	MEH-122	Pakistan Studies	2	0	2	0	2
	MEH-213	Communication Skills	3	0	3	0	3
	MEH-222	Functional English	1	1	1	3	2
	MEM-211	Psychology	1	0	1	0	1
	MEM-223	Entrepreneur	2	1	2	3	3
	MEM-322	Economics	2	0	2	0	2
Total			**13**	**2**	**13**	**6**	**15**

Proposed Management Sciences Courses							
Knowledge Area	**Course Code**	**Course**	**Credit Hours**		**Weekly Contact Hours**		**Total Credit Hours**
			Theory	**Practical**	**Theory**	**Practical**	
Management Sciences	MEM-112	Introduction to Industrial Management	2	0	2	0	2
	MEM-313	Project Management	2	1	2	3	3
Total			**4**	**1**	**4**	**3**	**5**

Proposed Natural Sciences Courses							
Knowledge Area	**Course Code**	**Course**	**Credit Hours**		**Weekly Contact Hours**		**Total Credit Hours**
			Theory	**Practical**	**Theory**	**Practical**	
Natural Sciences	MES-123	Applied Mathematics-I	3	0	3	0	3
	MET-273	Probability and Statistics	2	1	2	3	3
	MES-113	Applied Physics	2	1	2	3	3
	MES-133	Applied Chemistry	2	1	2	3	3
Total			**9**	**3**	**9**	**9**	**12**

List of Elective Topics	
Breadth Electives*	**Depth Electives***
➢ Joining of Materials ➢ Non-Destructive Testing of Materials/Structures ➢ Nuclear Technology and Materials for Nuclear Reactors ➢ Pressure Vessels and their Fabrication ➢ Renewable/Alternate Energy Resources ➢ Metal Technology ➢ Metrology ➢ Elective Courses by HEI*	➢ Hybrid Engines and their Technology ➢ Vacuum Science and Technology ➢ Nanotechnology ➢ Automobile Technology ➢ Robotics and AI ➢ 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					
Course Code	**Course Name**	**Knowledge Area/Domain**	**Credit Hours**		**Total Credit Hours**
			Theory	**Practical**	
MEH-112	Islamic Studies/Professional Ethics	Civilization – I	2	0	2
MES-113	Applied Physics	Natural Science	2	1	3
MES-123	Applied Mathematics-I	Natural Science	3	0	3
MES-133	Applied Chemistry	Natural Science Elective-1	2	1	3
MES-143	Computer Fundamentals	Computer Science	1	2	3
MET-113	Workshop Technology	Engineering Foundation	1	2	3
Total			**11**	**6**	**17**
SEMESTER-II					
Course Code	**Course Name**	**Knowledge Area/Domain**	**Credit Hours**		**Total Credit Hours**
			Theory	**Practical**	
MES-153	Information and Communication Technologies	Quantitative and Reasoning E1	3	0	3
MEH-122	Pakistan Studies	Civilization – 2	2	0	2
MET-123	Technical Drawing and Graphics	Engineering Foundation	1	2	3
MET-133	Applied Mechanics	Engineering Foundation	2	1	3
MET-144	Basic Electrical & Electronics	Engineering Foundation	2	2	4
MEM-112	Introduction to Industrial Management	Major based Breadth	2	0	2
Total			**12**	**5**	**17**
SEMESTER-III					
Course Code	**Course Name**	**Knowledge Area/Domain**	**Credit Hours**		**Total Credit Hours**
			Theory	**Practical**	
MEH-213	Communication Skills	Expository Writing E1	3	0	3
MET-212	Computer aided drafting and Modeling	Major based Breadth	0	2	2
MET-223	Industrial Materials	Engineering Foundation	2	1	3
MET-233	Mechanics of Material	Engineering Foundation	2	1	3
MET-244	Applied Thermodynamics	Engineering Foundation	3	1	4
MES-212	Computer Programming	Computer Science	1	1	2
Total			**11**	**6**	**17**

SEMESTER-IV					
Course Code	**Course Name**	**Knowledge Area/Domain**	**Credit Hours**		**Total Credit Hours**
			Theory	**Practical**	
MET-252	Machine Design	Major based Breadth	2	0	2
MET-264	Fluid Mechanics and Hydraulic machines	Major based Breadth	3	1	4
MEH-211	Psychology	Social Sciences – E1	1	0	1
MET-273	Probability and Statistics	Quantitative and Reasoning E2	2	1	3
MEH-222	Functional English	Expository Writing E2	1	1	2
MEH-223	Entrepreneurship	Social Sciences E2	2	1	3
MET – 233	Industrial maintenance and Safety	Major based Breadth	2	1	3
Total			**13**	**5**	**18**
SEMESTER-V					
Course Code	**Course Name**	**Knowledge Area/Domain**	**Credit Hours**		**Total Credit Hours**
			Theory	**Practical**	
MET-313	Heat and Mass Transfer	Major based Depth	2	1	3
MET-323	Energy and Power Technologies	Major based Depth	2	1	3
MET-333	Project-I	Major based depth	0	3	3
MET-343	Manufacturing Processes	Major based Breadth	2	1	3
MEM-313	Project Management	Major based Breadth	2	1	3
MEH-322	Economics	Social Sciences – E3	2	0	2
Total			**10**	**7**	**17**
SEMESTER-VI					
Course Code	**Course Name**	**Knowledge Area/Domain**	**Credit Hours**		**Total Credit Hours**
			Theory	**Practical**	
MET-353	Instrumentation and Control	Major based Breadth	2	1	2
MET-363	Mechanical Vibration	Major based Depth	2	1	2
MET-373	Heating, Air-condition and Ventilation Technologies	Major based Depth	2	1	2
MET-333	Total Quality Management	Major based Breadth	2	1	2
MET-333	Project-II	Major based depth	0	3	0
Total			**8**	**7**	**15**
SEMESTER-VII					
Course Code	**Course Title**	**Knowledge Area/Domain**	**Credit Hours**		**Total Credit Hours**
			Theory	**Practical**	
MET- 411	**16 Weeks Supervised Industrial/ Field Training (8x5=40 Hrs / Week)**	**Major Depth**	**0**	**16**	**16**
MET-411	Breadth Elective-I	Breadth Elective-I	2	1	3
MET-412	Breadth Elective-II	Breadth Elective-II	2	1	3
MET-413	Depth Elective-I	Depth Elective-I	2	1	3
MET-414	Depth Elective-II	Depth Elective-II	2	1	3

MET-415	Depth Elective-III	Depth Elective-III	3	1	4
Total			**11**	**5**	**16**
SEMESTER-VIII					
Course Code	**Course Name**	**Knowledge Area/Domain**	**Credit Hours**		**Total Credit Hours**
			Theory	**Practical**	
MET- 421	16 Weeks Supervised Industrial/ Field Training (8x5=40 Hrs / Week)	Major Depth	0	16	16
Total			**0**	**16**	**16**
Total Credit Hours & Contact Hours in Four Years (When SIT conducted in both 7th and 8th Semester)				**Credit Hours**	**Contact Hours**
				65+68 = 133	**65+204=269**
Theory vs Practical with respect to Contact Hours				Theory Practical	65 (24.16%) 204 (75.84%)
Total Credit Hours & Contact Hours in Four Years (When optional courses conducted instead of SIT in 7th semester**)**				**76+57 = 133**	**76+171 =247**
Theory vs Practical with respect to Contact Hours				Theory Practical	76 (30.77%) 171 (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	ME**T**	Mechanical Engineering Technology Foundation/ Breadth/ Depth
2	ME**E**	Expository Writing
3	ME**H**	Art & Humanities
4	ME**S**	Social Sciences
5	ME**Q**	Quantitative Reasoning
6	ME**N**	Natural Sciences
7	ME**C**	Computing
8	ME**M**	Management Sciences
9	ME**I**	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.

Sr. No.	Course Name	Knowledge Area	Credit Hours		Weekly Contact Hours		Credit Hours
			Theory	Practical	Theory	Practical	
1.	Joining of Materials	Breath Elective	2	1	2	3	3
2.	Non-Destructive Testing of Materials/Structures	Breath Elective	2	1	2	3	3
3.	Nuclear Technology and Materials for Nuclear Reactors	Breath Elective	3	0	3	0	3
4.	Pressure Vessels and their Fabrication	Breath Elective	2	1	2	3	3
5.	Alternate Energy Resource	Breath Elective	3	0	3	0	3
6.	Metal Technology	Breath Elective	2	1	2	3	3
7.	Metrology	Breath Elective	2	1	2	3	3
8.	Hybrid Engines and their Technology	Depth Elective	2	1	2	3	3
9.	Vacuum Science and Technology	Depth Elective	3	0	3	0	3
10.	Nanotechnology	Depth Elective	2	1	2	3	3
11.	Automobile Technology	Depth Elective	3	1	3	3	4a
12.	Robotics and AI	Depth Elective	2	1	2	3	3
13.	Supply Chain Management	Depth Elective	3	0	3	0	3
14.	Corrosion Control Technology	Depth Elective	2	1	2	3	3
15.	Polymer	Depth Elective	2	1	2	3	3

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.

Course Content

8.1 Workshop Technology

COURSE TITLE (MET-113) **Workshop Technologies**		**CREDITS HOURS** (1+2) **16 Theory + 96 Lab**	**KNOWLEDGE AREA/ DOMAIN** **Major Based Foundation**
After completion of this course, students will be able to:		**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Practice** different machining operations.	P-3	5
CLO-2	**Make** different model of the given components using different processes.	P-4	3
CLO-3	**Apply**, explain, express, and collect information regarding the course contents.	C-3	4
Course Outline for Theory			
Basic introduction to fundamentals of safety precautions in workshop practices, machines operations, and tools utilization. Wood working technology, tools and applications for pattern making. Understanding and applications of different measuring and gauging instruments. Performing foundry operations such as forging and casting. Hands-on joining operations such as different welding processes, fastening, riveting and adhesive bonding. Basics of lathe & milling operations, drillings and cutting etc.			
Course Learning Outcome of Labs			
After completion of this course, students will be able to:		**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Apply** ethical principles while working in the workshop and adopt necessary guidelines for student's health & safety.	A-3	8
CLO-2	**Explain**, express and collect information regarding the course contents and workshop.	C-3	4
CLO-3	**Use** different machines to develop an assigned task.	P-3	5
CLO-4	**Ability** to work and complete group projects.	A-2	9

Sample Lab Experiments
• To understand of basic Safety guidelines, tools, and gadgets • To familiarize with types of cutting tools and tool holders used with a standard center lathe machine • To understand of pattern making procedure and perform wood working • To practice pattern making for different mechanical components • To practice boring operation on the lathe machine • To produce internal threads on components using different methods • To produce external threads on components using different methods • To identify and familiarization of various types of milling cutters • To understand the parts and accessories of a universal milling machine. • To manufacture a given component for the practice of Milling operations (side milling, end milling, slot milling, engraving) on a universal milling machine • To familiarize with the parts, accessories, cutting tools and operations of a shaper machine • To join two metals parts using different mechanical fastening techniques and welding technology • To Understand the Basic fundamental of foundry processes • To produce a given mechanical components using casting, forging, and finishing process
Recommended Books
1. Krar Steve F., Check Albert F., Machine Tools, 5th edition, ISBN: 0-07-116421-9 McGraw-Hill, 1998. 2. Workshop Technology by Hajira Chohdry, ISBN: 1455594666 3. Chapman W.A.J. "Workshop Technology (Part I, II & III) ISBN: 3. Manufacturing Technology By M.L Begeman, Hazel Hurs, ISBN:13730303030 4. Fundamentals of Modern Manufacturing, 2nd Edition By M.P. Groover HT John Wiley & Sons

Course Content

8.2 Islamic Studies and Professional Ethics

COURSE TITLE (MEH-112) **Islamic Studies and Professional Ethics**	**CREDITS HOURS** (2+0) **32 Theory + 0 Lab**	**KNOWLEDGE AREA/ DOMAIN** **Humanities**	
After completion of this course, students will be able to:		**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Narrate** basic concepts related to Quran and Sunnah with special emphasis on Islamic Belief System & values.	C-2	12
CLO-2	**Illustrate** important lessons derived from the life of the Holy Prophet (Peace Be Upon Him) and Islamic culture & Civilization.	C-3	12
CLO-3	**Explain** the role, responsibilities, rights, and obligations of an individual in society.	C-2	8
CLO-4	**Demonstrate** the issues related to the code of professional conduct.	C-3	8

Course Outline for Theory

Introduction to Quranic Studies. Basic Concepts of Quran, History of Quran and Uloom-ul –Quran. Study of Selected Text of the Holy Quran such as Verses of Surah Al-Baqra Related to Faith (Verse No-284-286) 2), Verses of Surah Al-Hujrat Related to Adab Al-Nabi (Verse No-1-18), Verses of Surah Al-Mumanoon Related to Characteristics of faithful (Verse No-1-11) 4), Verses of Surah al-Furqan Related to Social Ethics (Verse No.63-77) 5), Verses of Surah Al-Inam Related to Ihkam(Verse No-152-154), Verses of Surah Al-Ihzab Related to Adab al-Nabi (Verse No.6,21,40,56,57,58.), Verses of Surah Al-Hashar (18,19,20) Related to thinking, Day of Judgment and Verses of Surah Al-Saf Related to Tafakar,Tadabar (Verse No1,14). Seerat of Holy Prophet (Peace and Blessings be Upon Him), Sunnah & Hadith, Life of the Holy Prophet (Peace and Blessings be Upon Him) in Makkah & Madina and important lessons derived from his life in both phases. Basic Concepts of Islamic Culture & Civilization and Social System of Islam. Morals and ethics, comparison of ethics and engineering ethics, ethics at personal and student level, The concept of professions, The importance of ethics in science and engineering, The role of codes of ethics, Professional responsibilities of engineers, The concept of morality, The importance of core values, Moral/ethical dilemmas and hierarchy of moral values, Factors affecting moral responsibility, and degrees of responsibility, Overview of ethical theories and applications, Basics of ethical analyses and decision-making, The importance if intention, Truth (personal and social), The concept of whistleblowing, Ethical leadership in engineering and society, Conflicts of interests, Ethics in the workplace, Fairness (personal and social), Ethics in the electronic and digital age, Responsible conduct of research, Intellectual property and society, Sustainable engineering.

Recommended Books

1. Hameed Ullah Muhammad, "Emergence of Islam", IRI
2. Hameed Ullah Muhammad, "Muslim Conduct of State"
3. Hameed Ullah Muhammad, "Introduction to Islam"
4. Hussain Hamid Hasan, "An Introduction to the study of Islamic Law", Leaf Publication , Islamabad
5. H.S.Bhattia, "Study in Islamic Law, Religion & Society", Deep & Deep Publication, New Delhi (1989)

6. Fundamental of Ethics for Scientists and Engineers, Seebauer, E.G. and Barry, R.L. Oxford University Press)
7. Ethics in Engineering – Practice and Research, Whitbeck, Caroline. Cambridge University Press.

Course Content

8.3 Applied Physics

COURSE TITLE (MES-113) **Applied Physics**	**CREDITS HOURS** (2+1) **32 Theory + 48 Lab**	**KNOWLEDGE AREA/ DOMAIN** **Natural Science**

After completion of this course, students will be able to:		**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Illustrate** simple mechanical systems using Newton's Laws of motion.	C-2	1
CLO-2	**Solve** basic problems related to electric circuits using fundamentals of electrical engineering.	C-3	1
CLO-3	**State** fundamentals of oscillations related to mechanical systems.	C-1	1

Course Outline for Theory

Mechanics: Definitions of Work, Energy & Power, Work Energy Theorem and its applications, Mechanical Energy of System, Conservation of Mechanical Energy, practice problems, Gravitational potential energy, Hooks Law & restoring force, Review of angular variables, K.E. Energy of Rotation and moment of Inertia, Torque and Newton's 2nd law of rotation, Work and Rotational K.E., Angular Momentum for System of Particles. Electricity: Basic terms & definitions; Electric Forces and Fields, Electric flux and Coulomb's Law, Electric field due to the Point and Various charges, Gauss' law and its application, Conductors in Electric Fields, Parallel Metal Plates, Capacitance, Resistance, Electric Potential and potential energy, Ohm's Law. Waves & Oscillations: Periodic motion & Simple Harmonic Oscillation (SHO), Simple Pendulum, Transverse & Longitudinal Waves, Speed of a traveling Wave, Damped Harmonic Oscillator, EM waves.

Course Learning Outcome of Labs

After completion of this course, students will be able to:		**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Work** on experiments/task/project related to applied physics laboratory independently.	P-2	9
CLO-2	**Organize** the results of experiments in written and graphical format.	P-4	4
CLO-3	**Attempt** participation in group discussion while practicing professional ethics.	A-2	8

Sample Lab Experiments

Lab experiments related to measurements, calculations, and study of the magnetic field, EMF, current, voltage drop across resistors, diode circuits, wave rectification, kinetic and potential energies, light and diffraction. Sample Experiment "Measure light wavelength using a diffraction grating.

Recommended Books
1. Halliday and Resnick and Walker, 2018, Fundamentals of Physics, 11th Edition, ISBN: 978-1-119-30685-6, Wiley

Course Content

8.4 Applied Mathematics-1

COURSE TITLE (MES-123) **Workshop Technologies**	**CREDITS HOURS** (2+0) **32 Theory + 0 Lab**	**KNOWLEDGE AREA/ DOMAIN** **Natural Science**	
After completion of this course, students will be able to:		**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Solve** rate and integration problems related to various domains of mechanical engineering technology.	C-3	1
CLO-2	**Analyze** system of linear equations to predict the behavior of Mechanical systems.	C-4	2
CLO-3	**Solve** problems related to functions, complex numbers, and analytical geometry.	C-3	3

Course Outline for Theory

Basic definition of derivative, differentiation of different functions, rule of differentiation, chain rule implicit differentiation, Applications: slope, equation of tangent and normal. maxima, minima and point of inflection. Indefinite integral, different technique or integration i.e. integration by parts, integration by substitution, by partial fraction, integration of different trigonometric identity. Define definite integral: Application of definite integral, i.e., Area under the curve. Area between the curve, mean value theorem, finding the volume by slicing, volume of solid revolution Disk and Washer method, moment and center of mass etc. Linear equations and their solutions. Vector in plane: Dot product and cross products, line and plane in space. Application: work, angle between two vectors, Area of triangle, Area of parallelogram; Functions, Even and odd functions, Graphs of functions, Limits and continuity, Complex numbers, Exponential and polar forms, DeMoiver's theorem.

Recommended Books

1. Thomas, Finney, Weir and Giordano, Calculus and analytical Geometry, 11th Edition, ISBN-13: 978-0321185587, Addison Wesley
2. James Stewart, 2016, Calculus: Early Transcendentals - 8th edition, ISBN13: 9781285741550, Cengage

Course Content

8.5 Applied Chemistry

COURSE TITLE (MES-133) **Applied Chemistry**	**CREDITS HOURS** (2+1) **32 Theory + 48 Lab**	**KNOWLEDGE AREA/ DOMAIN** **Natural Science**

After completion of this course, students will be able to:		**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Solve** first order problems related to chemical reaction kinetics.	C-3	1
CLO-2	**Explain** electrochemical processes, work and thermodynamics, composites, and polymers.	C-2	1
CLO-3	**Explain** sources and causes generally attributed to water pollution, and their potential remedies.	C-2	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. 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.

Course Learning Outcome of Labs

After completion of this course, students will be able to:		**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Work** on experiments/task/project related to applied chemistry laboratory independently.	P-2	9
CLO-2	**Organize** the results of experiments in written and graphical format.	P-4	4
CLO-3	**Attempt** participation in group discussion while practicing professional ethics.	A-2	8

Sample Lab Experiments

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
Brown and Holmes, 2018, Chemistry for Engineering Students 4th Edition, ISBN-13: 978-0357026991, Cengage Atkins, Paula, and Keeler, 2014, Atkins' Physical Chemistry 11th Edition, Oxford.

Course Content

8.6 Computer Fundamentals

COURSE TITLE (MES-143) **Computer Fundamentals**	**CREDITS HOURS** (1+2) **16 Theory + 96 Lab**	**KNOWLEDGE AREA/ DOMAIN** **Computer Science**

After completion of this course, students will be able to:		**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Explain** the construction and working of computer components.	C-2	1
CLO-2	**Explain** the working of OS systems, application, and productivity software's.	C-2	5

Course Outline for Theory

Introduction to Computer: Functional Block Diagram, History, Evolution, Input Devices, Output Devices, Audio input/output, Storage Devices, Memory and Memory Management, Motherboard and components, CPU, GPU, Binary numbers and working of 8088 microprocessors, Cabinet, Power supply and UPS, Device Drivers, Internet and Networking, Operating Systems, Application and Productivity Software, Controllers: Keyboard, Interrupt & DMA Controller, Clock Generator & Bus Controller, Math Co-processor, Hard Disk Drive and Controller, Display Controller, Serial Interface, Parallel Interface & Printer Port, Universal Serial Bus (USB)

Course Learning Outcome of Labs

After completion of this course, students will be able to:		**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Diss-assemble** and assemble computer components.	P-3	1
CLO-2	**Assemble** a computer for customer needs.	P-4	5
CLO-3	**Demonstrate** the use of Application and Productivity Software.	C-3	10

Sample Lab Experiments

Introduction to various components of PC computer, Dissembling Computer Components, Assembling Computer Components, Assembling PC computers for customers with different needs, Use of different ports, Device Drivers, Networking, Internet, Intranet and Search Engines, Introduction to micro-programming, Use of Application and Productivity Software's

Sample Experiment

- Install a motherboard and attach power supply, and all other connectors.

Recommended Books

1. Andrew S. Tanenbaum, 2013, Structured Computer Organization, 6th Edition, ISBN-13: 978-0132916523, Pearson
2. Minasi, Wempen, and Doctor, 2005, The Complete PC Upgrade and Maintenance Guide, 16th Edition, ISBN-13: 978-0782144314, Sybex

Course Content

8.7 Information and Communication Technologies

COURSE TITLE (MES-153) **Information and Communication Technologies**		**CREDITS HOURS** (1+1) **16 Theory + 48 Lab**	**KNOWLEDGE AREA/ DOMAIN** **Computer Science**
After completion of this course, students will be able to:		**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Know** the basic management functions, planning & decision making of organizations by applying engineering management concepts (knowledge).	C-1	1
CLO-2	**Explain** organizational structures, tools for developing solutions, human aspects of management and describe elements to control them (comprehension).	C-2	4
CLO-2	**Analyze** the market and new business ideas select methods to motivate and lead technical people (analysis).	C-4	4
Course Outline for Theory			
Computer and Communication Technology, 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.			
Course Learning Outcome of Labs			
After completion of this course, students will be able to:		**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Explain** the possible applications of ICT.	P-2	1
CLO-2	**Explain** how to use web without being attacked by viruses, spywares, spams etc.	P-2	5
CLO-3	**Explain** use of networking and relevant concepts with data security.	P-2	8
Lab Content			
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. Peter Norton, 2005, Introduction to Computers, 6th edition, ISBN-13 : 978-0071117166, McGraw Hill 2. Williams Sawyer, 2015, Using Information Technology: A Practical Introduction to Computer & Communications 6th edition, ISBN-13: 978-0073516882, McGraw Hill.

Course Content

8.8 Pakistan Studies

COURSE TITLE (MEH-122) **Pakistan Studies**	**CREDITS HOURS** (2+0) **32 Theory + 0 Lab**	**KNOWLEDGE AREA/ DOMAIN** **Humanities**	
After completion of this course, students will be able to:		**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Analyze** the contemporary problems faced by Pakistan (social, human resource, economic development, food safety / water resources) through discussion.	C-4	6
CLO-2	**Describe** the understanding of political and constitutional system of Pakistan through discussion.	C-2	12
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.	C-2	8

Course Outline for Theory

Ideology of Pakistan ----- definition and elucidation, historical aspects: Muslim rule in the Sub-continent, its downfall, and efforts for Renaissance. Ideology of Pakistan in the light of Speeches and statements of Allama Iqbal and Quaid i Azam Muhammad Ali Jinnah. Land and people of Pakistan - Geography, Society, Natural resources, Agriculture, Industry, and education with reference to characteristics, trends, and problems. Pakistan and Changing Regional Apparatus

Regional Economic Cooperation (SAARC, ECO, SCO) and the Role of Pakistan Economic Challenges in Pakistan Non-Traditional Security Threats in Pakistan: Role of Non-State Actors Changing Security Dynamics for Pakistan: Challenges to National Security of Pakistan Political Evolution Since 1971 Foreign Policy of Pakistan Post 9/11 Ethnic Issues and National Integration, Pakistan's Energy Problems and their Effects Pakistan's Relations with Neighbors, Kashmir Issue, Economic Conditions of Pakistan, the Most Recent Economic Survey, the Previous and Current Budgets, and the Problems and Performance of Major Sectors of Economy, The Prevailing Social Problems of Pakistan and the Strategies to Deal with Them, Poverty, Education, Health and Sanitation

Recommended Books

1. The Future of Pakistan, Cohen Stephen P. et al. Washington: Brookings Institute Press, 2011
2. Modern South Asia: History, Culture, Political Economy, Jalal, Aisha and Bose, Sugata. New York: Routledge, 1998
3. Kashmir in Conflict: India, Pakistan and the Unending War, Schofield, Victoria. New York: I.B.Tauria, 2003
4. A Brief History of Pakistan, Wynbrandt, James. New York: Infobase Publishing, 2009

Course Content

8.9 Technical Drawing and Graphics

COURSE TITLE (MET-123) **Technical Drawing and Graphics**	**CREDITS HOURS** (1+2) **16 Theory + 96 Lab**	**KNOWLEDGE AREA/ DOMAIN** **Engineering Foundation**	
After completion of this course, students will be able to:		**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Understand** the basic concepts of standard mechanical engineering drawing.	C-1	1
CLO-2	**Explain** engineering visualization principles and projection theory and apply those principles in engineering drawing development.	C-3	2
CLO-3	**Produce** orthographic projections, sectional views, and isometric views of different mechanical parts.	P-3	3
CLO-4	**Produce** Assembly drawing for catalogues, manuals etc.	P-4	3

Course Outline for Theory

Introduction to Engineering Drawing: Principles of Engineering Graphics, drawing instruments, Scales Plane, sketching layouts, lines, lettering, and Dimensioning. Conic sections. Technical Drawing Standards and presentation, conventional representation of dimensioning and sectioning. Abbreviations and symbols. Projection of points, lines, Planes and solids. Principles of Orthographic and Isometric projection, Development of surfaces. Fits, Tolerances and Allowances. Assembly drawing, Assembly Drawing for Installation, catalogues, and instruction manuals.

Lab Content

Introduction to drawing instruments, safety guidelines, layout, Lettering, Free-hand Sketching, Scaling and line types. Hands on practice of Geometric drawings, Drawing Sheet Planning, Orthographic Projections (1st and 3rd Angle). Practice projections and surface development. Practice and drawing of three views of different objects using orthographic projection. Conversion of orthographic projection into isometric view. Creating drawings of engineering fasteners like rivets, cotter joints, threads, etc. Introduction to Geometric Dimensioning and Tolerances. Practice of various Assembly Drawings.

Recommended Books

1. Bhutt, N.D., Engineering Drawing, 50th edition, ISBN: 9380358172, Charotar Publishing House, 2010.
2. Bertoline, Gary; Wiebe, Eric; Hartman, Nathan; Ross, William ISBN 10: 0073522635, Publisher: McGraw-Hill Education, 2010
3. Parkinson, A.C., First Year Engineering Drawing, 6th edition, ISBN: 0273413937, Pitman Publishing, 1962
4. Minasi, Wempen, and Doctor, 2005, The Complete PC Upgrade and Maintenance Guide, 16th Edition, ISBN-13: 978-0782144314, Sybex

Course Content

8.10 Applied Mechanics

COURSE TITLE (MET-133) **Applied Mechanics**	**CREDITS HOURS** (2+1) **32 Theory + 48 Lab**	**KNOWLEDGE AREA/ DOMAIN** **Major Based Breadth**	
After completion of this course, students will be able to:		**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Comprehend** concepts of vectors and scalars, forces, moments and couples, Key concepts related to kinematics and kinetics of particles in different Coordinate Systems.	C-2	1
CLO-2	**Apply** the concepts of mechanics to solve problems of equilibrium in 2-D and 3-D, friction, Kinematics and Kinetics of particles.	C-3	2
CLO-3	**Analyze** structures such as plain trusses, frames, and machines for reaction forces.	C-4	SA-3
Course Outline for Theory			
Force System, force, rectangular components, moment, couples, resultant of forces, equilibrium, mechanical systems, isolation and equilibrium equations. Free body diagram, two force and three force members, plane trusses, method of joints, method of sections, frames and machine analysis, forces in beams and cables, friction, types of friction, dry friction, application of friction. Impulse and momentum, angular impulse and angular momentum, Instantaneous centre of zero velocity, relative acceleration planar kinetics of rigid bodies. Force, mass, acceleration, equation of motion. Work and Energy relationship. Dynamics of particles and rigid body including kinematics and kinetics. Fundamental concepts and principles of mechanics. Important vector quantities. Fundamental units. Moments and couples, resultants of force and couples. Law of equilibrium and application.			
Course Learning Outcome of Labs			
After completion of this course, students will be able to:		**Bloom's Taxonomy Level**	**PLO**
CLO-4	**Work** on experiments/task/project related to applied mechanics	P-3	9
CLO-5	**Organize** the results of experiments in written and graphical format.	P-4	4
CLO-6	**Attempt** participation in group discussion while practicing professional ethics.	A-2	8

Lab Content
Verify Hook's law, determination of static equilibrium by using coplanar concurrent forces, determination of reactions and moments in beams, tension in hanging ropes. Verification of Force Polygon Method for various Co-planer forces, relation of Coefficient of Friction of different solid materials, determination of Coefficient of Friction for various materials, Determination of Moment of Inertia of Fly Wheel. Determination of the Efficiency, velocity ratio, mechanical advantage of various systems such as screw jack worm and worm wheel, Pulleys and Tie and Jib crane. Determination of Linear and Angular speed. Determination of centrifugal force. Measurement of Angular Momentum.
Recommended Books
1. Meriam, J.L. And Kraige, L.G., Engineering Mechanics: Dynamics (Vol. 2). 2012, John Wiley & Sons. 2. RC Hibbeler. Engineering Mechanics (Dynamics), 13th Ed. 2012, Prentice Hall 3. Beer, F.P., Johnston Jr, E.R. And Oler, J.W., 2010. Vector Mechanics For Engineers

Course Content

8.11 Basic Electrical and Electronics

COURSE TITLE (MET-143) **Basic Electrical and Electronics**	**CREDITS HOURS** (2+2) **32 Theory + 96 Lab**	**KNOWLEDGE AREA/ DOMAIN** **Engineering Foundation**

After completion of this course, students will be able to:		**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Describe** the construction and working of motors, transformers, rectifiers, and amplifiers.	C-1	1
CLO-2	**Analyze** electric circuits.	C-4	2

Course Outline

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.

Course Learning Outcome of Labs

After completion of this course, students will be able to:		**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Follow** instructions to measure various physical quantities, circuit analysis, and other experiments.	P-3	1
CLO-2	**Organize** the results of experiments in written and graphical format.	P-4	4

Lab Content

Use of ohm, volt, Am-meters, resistor color coding, equivalent resistance of a series, parallel and series parallel combination of resistors, speed control of DC motor, turn ratio of transformer, half wave and full wave rectifiers, construction various types of amplifiers using BJT, measure gain and efficiency of an amplifier.

Sample experiment

Find the Equivalent resistance of a series, parallel and series parallel combination of Resistors.

Recommended Books

1. Robert Boylestad, 2015, Introductory Circuit Analysis13th edition, ISBN-13: 978-0133923605, Pearson
2. Thomas L. Floyd, 2018, Electronic Devices 10th edition, ISBN-13: 9780134420325, Pearson
3. Hughes and Drury, 2019, Electric Motors and Drives: Fundamentals, Types and Applications 5th Edition, ISBN-13: 978-0081026151, Pearson

Course Content

8.12 Introduction to Industrial Management

COURSE TITLE (MEM-112) **Introduction to Industrial Management**		**CREDITS HOURS** (2+0) **32 Theory + 0 Lab**	**KNOWLEDGE AREA/ DOMAIN** **Major Based Breadth**
After completion of this course, students will be able to:		**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Know** the basic management functions, planning & decision making of organizations by applying engineering management concepts (knowledge).	C-1	1
CLO-2	**Explain** organizational structures, tools for developing solutions, human aspects of management and describe elements to control them (comprehension).	C-2	4
CLO-3	**Analyze** the market and new business ideas select methods to motivate and lead technical people (analysis).	C-4	4
Course Outline			
The vision and mission of management, the management process and strategy, Strategic management, the planning process, organization structures, human factors and ergonomics, motivation & leadership, basics elements of control, managing, designing and new product development, managing the supply systems, marketing, introduction to entrepreneurship.			
Recommended Books			
1. Lucy Morse and Danial Babcock (2014), Managing Engineering and Technology, 6th Edition, ISBN-10: 0133485102, Prentice Hall 2. Harold Koontz and Heinz Weihrich (1988), Management, 9th Edition, ISBN-10 : 0070355541, McGraw-hill			

Course Content

8.13 Communication Skills

COURSE TITLE (MEH-233) **Communication Skills**		**CREDITS HOURS** (3+0) **48 Theory + 0 Lab**	**KNOWLEDGE AREA/ DOMAIN** **Humanities/English**
After completion of this course, students will be able to:		**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Explain** basic theories of communications.	C-2	10
CLO-2	**Demonstrate** report technical contents both orally and in writing.	C-3	10
CLO-3	**Participate** in group discussions while practicing professional ethics.	A-3	8

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. Murphy H. A., Hildebrandt H. W. and Thomas J.P. "Effective Business Communications". McGraw Hill, USA
2. Norman S. "We're in Business" Longman Group Ltd., UK 3. Thomson A. J. and Martinet A.V. "A practical English Grammar" Oxford University Press, UK.

Course Content

8.14 Computer Aided Drafting and Modeling

COURSE TITLE (MET-212) **Computer Aided Drafting and Modeling**		**CREDITS HOURS** (0+2) **00 Theory + 96 Lab**	**KNOWLEDGE AREA/ DOMAIN** **Major Based Breadth**
After completion of this course, students will be able to:		**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Practice** and manipulate the concepts of 2D drawing using AutoCAD software.	P-3	1
CLO-2	**Produce** 3D models and drawing views of mechanical components and assemblies in AutoCAD.	P-4	4

Lab Content

An overview of AutoCAD, installing and configuring AutoCAD. The drawing environment, Controlling and accelerating the drawing process, creating simple drawings, creating complex entities. Editing and plotting drawings: Editing drawing entities, changing the drawing display, printing, and plotting the drawings, measuring different variables, designing shapes and text fonts. Create various 2D drawings such as bolts and nuts, Plummer block bearing, non-return valve, safety valve. Create isometric dimensional drawing of a connecting rod using isometric. Draw quarter sectional isometric view of a cotter joint etc. Draw 3D models by extruding simple 2D objects, dimensioning, and naming of objects. Draw 3D assembly of flange coupling, universal coupling, assembly of knuckle joint, 3D assembly gib and cotter joint, assembly drawing of connecting rod.

Recommended Books

1. French, Thomas E.; Vierck, Charles J. Engineering Drawing and Graphic Technology 12th Edition, ISBN 10: 0070221588, McGraw-Hill, 1978.
2. T. Jeyapoovan, Engineering Drawing and Graphics Using AutoCAD, 3rd edition, ISBN 10: 8125940006, Vikas Publishing, 2010.
3. N.D Bhatt, Engineering Drawing, 53rd Edition, ISBN-10: 9380358962, Charotar Publishing House Pvt. Ltd, 2014.

Course Content

8.15 Industrial Materials

COURSE TITLE (MET-223) **Industrial Materials**		**CREDITS HOURS** (2+1) **32 Theory + 48 Lab**	**KNOWLEDGE AREA/ DOMAIN** **Major Based Breadth**
After completion of this course, students will be able to:		**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Define** various types and properties of industrial materials.	C-1	1
CLO-2	**Describe** different materials and testing techniques of various industrial materials.	C-2	4
CLO-2	**Use** common Material for different applications to make mechanical components.	C-3	2
Course Outline for Theory			
Materials classification, material structure, atomic structure bonding, crystalline structure and non-crystalline structure, defects in materials, mechanical properties of materials (stress, strain, tensile strength, ductility, brittleness and toughness etc.) Types of metal alloys, metal extraction technology, polymers and their classifications, ceramics and their classifications, composites, and their classifications. Identification of different materials and their applications, commonly use materials, different materials testing techniques.			
Course Learning Outcome of Labs			
After completion of this course, students will be able to:		**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Apply** ethical principles while working in the laboratory and adopt necessary guidelines for student's health & safety.	A-3	8
CLO-2	**Conduct** different heat treatment processes and identify grain structures formed as a result of these heat treatment processes.	P-4	5
CLO-2	**Measure** mechanical properties of materials such as micro hardness using suitable equipment's.	P-3	4
Lab Content			
Experiments covered theory topics such as material structure, defects in materials, synthesis and characterization of polymers, ceramics, and composite materials. **Sample** • To familiarize with different materials Testing Technology and equipment. • To identify different materials (Metals, polymers and ceramics etc,) • To prepare steel specimens using different heat treatment processes (Quenching, Annealing).			

- To study the mechanical properties of differently heat-treated steel samples using Tensile Testing.
- To prepare the specimens of brass, bronze and copper and steel for microscopic examinations.
- To conduct the micro examinations of Aluminum and stainless-steel samples using metallurgical microscope.
- To conduct the micro examination of Polymers by preparing their specimens using metallurgical microscope.
- To determine the Brinell hardness number of the given specimens of ferrous, non-ferrous and non-metallic materials.
- To determine the Rockwell hardness number of the given specimens of ferrous, non-ferrous and non-metallic materials.
- To perform the hardening process on the given part.
- To perform the tempering process on the given part.
- To study the different mechanical properties of heat treated and untreated specimens.
- To study the grain structure of heat treated and untreated materials specimens.

Recommended Books

1. Materials for Engineers. By Kempster MHA English Language Book Society UK
2. Engineering Metallurgy: Higgins R.A. ISBN: 1482257971, 9781482257977
3. Material Science and Engineering an Introduction: By Willium D. Callister, Jr.
4. Engineering Materials: Research, Applications and Advance. By G.K. Gupta

Course Content

8.16 Mechanics of Materials

COURSE TITLE (MET-233) **Mechanics of Materials**	**CREDITS HOURS** (2+1) **32 Theory + 48 Lab**	**KNOWLEDGE AREA/ DOMAIN** **Engineering Foundation**

After completion of this course, students will be able to:		**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Describe** mechanical behavior of materials under tensile, compressive, torsional, and combined loadings, and Factor of safety.	C-1	1
CLO-2	**Explain** causes of Failure and its prevention.	C-2	2
CLO-2	**Investigate** the method of determining hardness, fatigue, and creep.	C-4	4

Course Outline for Theory

Mechanical Behavior of Ductile and Brittle materials, Recognize Failure due to axial loading in bars, columns etc, Determine strength, resilience, toughness and fracture under tensile and compressive loadings. Factor of safety calculations for different applications. Equation of Torsion, Prediction of Failure due to torsional loads in shafts, rotors etc. Determination of impact energy of material using standard testing such as charpy, Izod etc. Determination of Hardness using Brinell, Rockwell and Vickers methods. Perform Fatigue analysis to understand the effect of cyclic loading. Flexure formula, Investigation of Failure due to bending in beams. Mohr's circle and its application.

Course Learning Outcome of Labs

After completion of this course, students will be able to:		**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Work** on experiments/task/project related to applied physics laboratory independently.	P-2	9
CLO-2	**Organize** the results of experiments in written and graphical format.	P-4	4
CLO-2	**Attempt** participation in group discussion while practicing professional ethics.	A-2	8

Lab Content

Following is the tentative list of Practical on Mechanical Behavior of Ductile and Brittle materials, strength, resilience, toughness and fracture under tensile and compressive loadings, impact energy, Hardness, and effect of cyclic loading. Institutions depending on their needs and available resources can add or remove practical.

- Investigating Mechanical behavior under Tensile loading
  a) Steel b) Aluminium

- Investigating Mechanical behavior under Compressive loading
  a) Steel b) Aluminium
- Determination of Impact Energy using Charpy/Izod testing on steel and Aluminum specimen.
- Determination of Brinell Hardness number for steel and Aluminium specimen
- Determination of Vickers Hardness for steel and Aluminium specimen
- Investigate the behaviour of steel and Aluminum under cyclic loading
- Investigate the deformation of beams under transverse loading

Recommended Books

1. Mechanics of materials – R. C. Hibbeler
2. Mechanics of Materials – Ferdinand Beer and E. Johnston and John DeWolf and David Mazurek
3. Mechanics of Materials – James M. Gere, Barry J. Goodno

Course Content

8.17 Applied Thermodynamics

COURSE TITLE (MET-244) **Applied Thermodynamics**	**CREDITS HOURS** (3+1) **48 Theory + 48 Lab**	**KNOWLEDGE AREA/ DOMAIN** **Engineering Foundation**	
After completion of this course, students will be able to:		**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Apply** energy balances to the closed and open systems.	C-3	1
CLO-2	**Solve** problems related to vapor and gas, positive displacement, and roto-dynamic machines.	C-3	2
CLO-2	**Analyze** technologies related to diffusers, turbines, nozzles and boilers.	C-4	4

Course Outline for Theory

Thermodynamic systems, Thermodynamic properties, Laws of Thermodynamics and applications, Energy and work, Properties of vapor and steam, Properties of ideal and real fluid and their relationships, Applications of thermodynamic principles to fluids, Closed and Open systems, Thermodynamics cycles (Carnot Cycle, Otto Cycle, Diesel Cycle, Dual Combustion Cycle, Rankine Cycle, Brayton Cycle) and application, Fuel and Combustion: calorific values, air fuel ratio, chemical equation and conservation of mass in a combustion process, Nozzles, Diffusers, Compressors and, Steam and Gas turbines, Heat balance sheet for thermal systems.

Course Learning Outcome of Labs

After completion of this course, students will be able to:		**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Behave** ethically, demonstrate teamwork and effectively communicate the experimental results.	A-3	12
CLO-2	**Experimentally** investigate performance of various thermodynamic systems and applications.	P-4	4

Lab Content

Labs will be conducted on topics covered in theory such as Thermodynamic properties, Laws of Thermodynamics, Energy, and work, Closed and Open systems, Thermodynamics cycles and Fuel and Combustion.

Sample

- Study of working principal of external combustion engine.
- Study of working principal of internal combustion engine.
- To measure indicated and brake horsepower of an IC engine.
- To draw the heat balance sheet of internal combustion engine.
- Study of working principal of water tube and fire tube boilers.

- To measure the isentropic efficiency of steam turbine.
- To draw the performance characteristics of a compressor.
- To draw the pressure curves of a diffuser.
- To determine the critical ratio of a nozzle.
- To determine the calorific value of different fossil fuels.

Recommended Books

1. T. D. Eastop & A. McConkey (1994), Applied Thermodynamics for Engineering Technologist 5th edition, ISBN: 9780582086708, Longman Education,
2. Y. A. Cengel and M. A. Boles, (2018), Thermodynamics, An Engineering Approach, 9th edition, ISBN: 9781259822674, McGraw-Hill
3. Rayner Joel, (1996), Basic Engineering Thermodynamics 5th edition ISBN:8131718883, Pearson Education

Course Content

8.18 Computer Programming

COURSE TITLE (MES-212) **Computer Programming**		**CREDITS HOURS** (1+1) **16Theory + 48 Lab**	**KNOWLEDGE AREA/ DOMAIN** **Computer Science**
After completion of this course, students will be able to:		**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Demonstrate** the use of basics of programming.	C-2	1
CLO-2	**Develop** simple programs using functions and controls.	C-3	5
CLO-2	**Illustrate** the use of arrays, classes, and other functions to write intermediate level programs.	C-4	5
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			
After completion of this course, students will be able to:		**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Express** the basic knowledge of a suitable programming language	C-2	1
CLO-2	**Apply** the knowledge of programming to solve problems in effective way	C-3	5
CLO-3	**Construct** programs using Integrated Development Environment (IDE)	P-4	5
CLO-4	**Communicate** effectively the flow charts, programming algorithms and procedures	A-2	10
Lab Content			
Develop multiple programming codes including Data types and operators, Functions, Conditions, Recursion, Iteration (for loop, while, do-while), Iteration (do-while), Strings.			

Recommended Books
1. Kent Lee, 2015, Python Programming Fundamentals, 2nd edition, ISBN-13: 978-1447166412, Springer

Course Content

8.19 Mechanical Design

COURSE TITLE (MEH-252) **Mechanical Design**		**CREDITS HOURS** (3+0) **48 Theory + 0 Lab**	**KNOWLEDGE AREA/ DOMAIN** **Major Based Breadth**
After completion of this course, students will be able to:		**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Understand** the mechanical engineering Design Process.	C-1	1
CLO-2	**Describe** various mechanical joints.	C-2	3
CLO-2	**Analyze** common power transmission elements.	C-4	3

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 its Design. Gear Trains and design of gearbox.

Recommended Books

1. Shigley's Mechanical Engineering Design Richard G. Budynas and J. Keith Nisbett 11th Edition, 2019, Mc -Hill Publications.
2. Fundamentals of Machine Component Design Robert Juvinall, 2020 Mc-Hill Publications
3. Machine Design by Robert L. Norton, 5th edition, 2014, ISBN 978-0133356717, Perason Prentice Hall

Course Content

8.20 Fluid Mechanics and Hydraulic Machines

COURSE TITLE (MET-264) **Industrial Materials**		**CREDITS HOURS** (3+1) **48 Theory + 48 Lab**	**KNOWLEDGE AREA/ DOMAIN** **Major Based Breadth**
After completion of this course, students will be able to:		**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Describe** the fundamental properties of fluids, including viscosity, Newtonian and non-Newtonian rheology and classification of fluid flows.	C-3	1
CLO-2	**Analyze** flow in pipes and over bodies.	C-4	2
CLO-2	**Apply** technological knowledge to solve problems related to various hydraulic machines applications.	C-3	2

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

Hydraulic Turbines, Draft Tubes, performance curves, Pumps, and their types (Reciprocating pumps, centrifugal pump, turbine pump), selection of pump. Hydraulic Equipment: Hydraulic press and ram, hydraulic crane, hydraulic accumulator and intensifier, hydraulic lifts, hydraulic circuits.

Course Learning Outcome of Labs

After completion of this course, students will be able to:		**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Behave** ethically, demonstrate teamwork and effectively communicate the experimental results.	A-3	12
CLO-2	**Experimentally** investigate performance of various hydraulic systems and their applications.	P-2	4

Lab Content

Topics taught in theory will be used to design practicals.

Sample

- Study of Hydraulic Bench.
- To determine the co-efficient of Venturi meter & discuss its application.
- To calibrate the given rectangular notch and discuss its application.
- To calibrate a triangular notch and discuss its application.

- To find the co-efficient of discharge.
- To calibrate the given pressure gauge & discuss its application.
- To study the impact of jets on vanes.
- To study the performance characteristics of centrifugal pump.
- To study the performance characteristics of Francis turbine.
- To study the characteristics curves of a hydraulic ram at constant valve lift and constant supply head.

Recommended Books

1. K R Arora, (2005), Fluid Mechanics and Hydraulic Machinery, 9th edition, ISBN: 9788180140709, Standard Publishers
2. E. John Finnemore, Joseph B. Franzini, (2002), Fluid Mechanics with Engineering Application 10th edition, ISBN: 9780071121965, McGraw-Hill
3. Irving H. Shames, (1992), Fluid Mechanics, 3rd edition, ISBN: 9780070563889, McGraw-Hill
4. R K Purohit, (2007), Hydraulic Machines, ISBN: 9788172334871, Scientific Publishers

Course Content

8.21 Psychology

COURSE TITLE (MEM-211) **Psychology**		**CREDITS HOURS** (1+0) **16 Theory + 0 Lab**	**KNOWLEDGE AREA/ DOMAIN** **General Education**
After completion of this course, students will be able to:		**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Define** various types and science of psychology	C-1	1
CLO-2	**Describe** different aspects of behavioral psychology.	C-2	8
CLO-2	**Adopt** and adjust yourself with different work environment and personalities.	A-4	9
Course Outline for Theory			
Introduction to Psychology, The science of Psychology, The origins of psychology, The fundamental of psychological theories , Early Behavioral psychology, Human development and language, Cognitive psychology (perception, perceive the world) , Clinical psychology (self and others), Social psychology , Variation in personalities (Intelligence and personality) , sports psychology , stress , lifestyle , Anxiety & Depression , Emotions & Motivation.			
Recommended Books			
1. Introduction to Psychology by Charles Stangor : ISBN: 1453365753 2. Psychology for Beginners by Max Krone ASIN : B089CVL6YG			

Course Content

8.22 Probability and Statistics

COURSE TITLE (MET-273) **Probability and Statistics**		**CREDITS HOURS** (2+0) **32 Theory + 0 Lab**	**KNOWLEDGE AREA/ DOMAIN** **Quantitative and Reasoning E2**
After completion of this course, students will be able to:		**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Be** able to know the use of graphical and descriptive techniques to describe the statistical data.	C-2	1
CLO-2	**Classify** probability distributions and determine probabilities for discrete and continuous distributions.	C-3	2
CLO-2	**Recognize** the concept of sample correlation coefficient and analyze real life problems using regression including estimation and testing of model parameters.	C-4	4
Course Outline for Theory			
Measures of central tendency and dispersion, Moments, Introduction to classical Probability theory, Bayes theorem, Random variables (discrete and continuous), Probability distributions (Normal, Binomial, Poisson etc.), Expectation, Conditional distribution and conditional expectations, Correlation, and regression.			
Recommended Books			
1. Introduction to statistical (Latest Edition) by Sher Muhammad Chaudhary 2. An Introduction to Probability Theory and Its Applications (Latest Edition), by William Feller 3. Applied statistics and probability for engineers, (Latest Edition) by Douglas C Montgomery			

Course Content

8.23 Functional English

COURSE TITLE (MEH-222) **Functional English**	**CREDITS HOURS** (1+1) **16 Theory + 48 Lab**	**KNOWLEDGE AREA/ DOMAIN** **Humanities/English**	
After completion of this course, students will be able to:		**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Show** the proficiency and accuracy of the target language to use it effectively as a tool to succeed in academic activities.	C-3	10
CLO-2	**Employ** reading skills that are coincided with study skills directly required by students as basic skills to pursue other subjects more meaningfully.	C-2	12
CLO-2	**Illustrate** different genre of writing to enhance their writing skills and make use of them in their academic activities.	C-4	10
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, Presentation skills			
Course Learning Outcome of Labs			
After completion of this course, students will be able to:		**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Explain** basic concepts and importance of communications.	A-1	10
CLO-2	**Identify** common errors usually made by learners of English as a second language	A-2	10
CLO-3	**Follow** effective communication techniques in technical writing and presentation.	P-2	9

Lab Content
Language lab to acquire language skills in an easy and interactive way. English Language lab may be based on the methodology of LSRW skills that are listening, speaking, reading and writing by providing an educational platform for students to learn and understand the basics of a language in a structured way. Digital language lab should allow a student to interact, study, experiment with the language skills in a practical manner.
Recommended Books
1. Kakarla, Gupta, Pundir, 2019, Functional English for Communication, ISBN: 9789353282073, Sage

Course Content

8.24 Entrepreneurship

COURSE TITLE (MEM-223) **Entrepreneurship**		**CREDITS HOURS** (2+1) **32 Theory + 48 Lab**	**KNOWLEDGE AREA/ DOMAIN** **Social Sciences E2**
After completion of this course, students will be able to:		**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Develop** new Entrepreneurial ideas.	C-3	2
CLO-2	**Testing** and experimenting in the markets and ability to use design thinking.	C-4	4
CLO-2	**Evaluate** business models, revenues, and marketing strategies.	C-5	4
Course Outline for Theory			
Entrepreneurship: A global social movement, practicing entrepreneurship, developing an entrepreneurial mindset, Generating New Ideas, Using Design Thinking, Testing and Experimenting in Markets, Building Business Models, Creating Revenue Models, Bootstrapping for Resources, Financial Statements and Projections for Startups			
Course Learning Outcome of Labs			
After completion of this course, students will be able to:		**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Develop** the process of idea assessment and feasibility analysis	C-3	10
CLO-3	**Describe** different types of ownership and franchising and the role of e-commerce in small businesses through case study	C-2	12
CLO-2	**Prepare** a business plan with an appropriate business model and marketing plan through case study	C-3	11
Lab Content			
Instructors are required to encourage the students to formulate a business idea and follow all the requisites leading to successful marketing plan.			
Recommended Books			
1. Neck, Neck, and Murray, 2018, Entrepreneurship: the practice and mindset, 2nd edition, ISBN-13: 978-1483383521, Sage Publishers			

Course Content

8.25 Industrial Maintenance and Safety

COURSE TITLE (MEM-233) **Industrial Maintenance**	**CREDITS HOURS** (2+1) **32 Theory + 48 Lab**	**KNOWLEDGE AREA/ DOMAIN** **Major Based Breadth**	
After completion of this course, students will be able to:		**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Know** about the importance of plant and equipment maintenance, its types, and different systems of maintenance. (Knowledge).	C-1	1
CLO-2	**Discuss** maintenance and safety plans, illustrate accidents prevention measures and standards (Application).	C-3	2
CLO-2	**Outline** maintenance, safety plans, accidents prevention measures and standards (Application).	C-4	2
Course Outline for Theory			
Importance of plant maintenance, factors influencing the maintenance, Considerations in designing plant maintenance, economic aspects of maintenance, care and maintenance of common industrial equipment (like bearings, piping, filters, pumps, compressors, and lubricating systems), maintenance linkage to safety, different systems/types of maintenance, laws of accident proneness, accident preventions. Legal, humanitarian & economic reasons to prevent accidents, safety measures, analysis & procedures, safety equipment, OHSAS 18000.			
Course Learning Outcome of Labs			
After completion of this course, students will be able to:		**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Actively** Contribute individually and as team member.	A-2	9
CLO-2	**Practice** the Experimental Task and writing skills as per subject requirements (List of Practical of each course).	P-3	5
CLO-3	**Be** able to apply, explain, express, and collect information regarding the course contents and labs.	C-2	4
CLO-4	**Organize** report in a given format.	A-4	10
Lab Content			
Lab experiments may be related to care and maintenance of common industrial equipment (like bearings, piping, valves, filters and strainers, alignments, pumps, turbine, compressors, pressure vessel, and lubricating systems), maintenance linkage to safety, color coding, job safety analysis. If possible, tutorials or demos or videos may be shown to the students which covers Computer based Maintenance Management System (MMS) software, SAP or similar.			

Recommended Books
1. Thomas A. Wester-Kamp (1997) Maintenance Manager's Standard Manual, ISBN-10: 0132437341, Prentice-Hall 2. Jack W. Boley, A Guide to Effective Industrial Safety (1977), ISBN-13 , 978-0872017986, Gulf Publishing Company. 3. Engineering Maintenance by .S. Dhillon, Ph.D. CRC press. 4. R. Keith Mobley Editor in Chief, Lindley R. Higgins and Darrin J. Wikoff, Maintenance engineering handbook (7th edition), ISBN-10: 0071546464 McGraw Hills Handbooks. 5. Anthony Kelly Maintenance Planning and Control (1984) Butterworths Publishers ISBN-13 : 978-0408013758 6. Mohmad Ben-Daya, Salih O. Duffuaa Abdul Raouf et. al. (2009) Handbook of Maintenance Management and Engineering, Springer Publishers ISBN-13 ISBN-10: 1848824718

Course Content

8.26 Heat and Mass Transfer

COURSE TITLE (MET-313) **Heat and Mass Transfer**	**CREDITS HOURS** (2+1) **32 Theory + 48 Lab**	**KNOWLEDGE AREA/ DOMAIN** **Major Based Breadth**

After completion of this course, students will be able to:		**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Explain** different modes of heat transfer and mass transfer.	C-2	1
CLO-2	**Analyze** the heat transfer through different geometries, modes, and flow regimes.	C-4	2
CLO-2	**Apply** the knowledge of heat and mass transfer to solve the problems related to Heat and Mass Transfer Applications.	C-3	2

Course Outline for Theory

Basic Concepts of heat flow, heat conduction, thermal conductivity, overall heat transfer coefficient, Convection, continuity equation; Natural and Forced Convection, boiling & condensation heat transfer; Thermal Radiations, radiative properties, radiation shields,

Heat Exchangers design and sizing, heat exchanger operation and maintenance, extended surfaces, Fins, types of fins, Boiler: classification of Boiler, Water tube Boiler, Fire tube Boiler, Mountings and accessories of boiler, Boiler operation and maintenance,

Condensers and Cooling Tower: performance evaluation of cooling towers, Efficient system operation, Flow control strategies and energy saving opportunities.

Course Learning Outcome of Labs

After completion of this course, students will be able to:		**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Behave** ethically, demonstrate teamwork and effectively communicate the experimental results.	A-3	12
CLO-2	**Experimentally** investigate performance of various Heat and mass transfer systems.	P-2	4

Lab Content

Practical's must be designed based on topics covered in the theory.

Samples

- To conduct the experimental demonstration of Fourier's law of heat conductions and determination of the Thermal conductivity "k" in a simple bar.
- To observe effect of cross-sectional area on heat transfer.
- To observe the insulating effect in a metallic bar of different diameter conductor.

- To obtain heat transfer coefficient (h) in free convection in flat surfaces.
- To obtain heat transfer coefficient in forced convection in flat surfaces.
- To calculate the efficiency of pinned exchangers.
- To calculate efficiency of finned exchangers.
- To obtain and plot the temperature distribution in a shell and tube heat exchanger for counter current and parallel flow.
- To calculate the Logarithmic mean temperature difference (LMTD) of a shell and tube exchanger.
- To calculate the overall heat transfer coefficient (U) in shell and tube heat exchanger.

Recommended Books

1. G. Kamaraj & P. Raveendiran (2014), Heat and Mass Transfer, 2nd edition, ISBN: 9788183715027, Scitech Publications
2. Y.A. Cengel (2007), Heat Transfer, A Practical Approach, 3rd edition, ISBN: 9780073129303, McGraw-Hill
3. Sebastian Teir, (2002), Steam Boiler Technology, ISBN: 9789512261970, Helsinki University of Technology

Course Content

8.27 Energy and Power Technologies

COURSE TITLE (MET-323) **Energy and Power Technologies**	**CREDITS HOURS** (2+1) **32 Theory + 48 Lab**	**KNOWLEDGE AREA/ DOMAIN** **Major Based Breadth**	
After completion of this course, students will be able to:		**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Comprehend** the social and economic benefits of Renewable resources for Pakistan.	C-2	6
CLO-2	**Analyze** Renewable energy resources conversion and energy storage systems.	C-4	2
CLO-2	**Calculat**e the Environmental impact and sustainability of energy resources.	C-2	7

Course Outline for Theory

Energy and power technologies, Conventional and non-conventional energy systems, fossil fuels, IC engines: types, performance, emission measurement and controls, alternative fuels for IC engines, Jet engines, types and applications, Thermal power plants, Hydro electric energy, Renewable energy systems, (Nuclear power system, wind energy, solar energy, energy from biomass geothermal, tidal and wave energy, hydrogen gas as renewable energy resource), energy storage technologies, Hybrid power technologies, energy audit and energy conservation, ISO 50001.

Course Learning Outcome of Labs

After completion of this course, students will be able to:		**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Behave** ethically, demonstrate teamwork and effectively communicate the experimental results.	A-3	12
CLO-2	**Experimentally** investigate performance of various energy and power systems.	P-2	4

Lab Content

Practical's must be designed based on topics covered in the theory.

Samples

- Familiarization with renewable energy gadgets.
- Familiarization with solar energy gadgets.
- Measure the electricity generation by solar panel.
- Solar panel in parallel and series with load.
- Fill Factor and IV curve of Solar Power
- Effects of different time of the day on solar power.

- Energy audit and Inspection.
- To study the valve timing diagram of four stroke SI engine
- To study the emission characteristics of IC Engine
- To draw the performance curve of Hydrogen generation unit
- To study the working of jet engine model
- To study the difference between electric and conventional vehicle

Recommended Books

1. Paul Breeze, (2014), Power Generation Technologies, 2nd edition, ISBN:9780080983301, Newnes
2. M. M El-Wakil, (1985), Powerplant Technology, ISBN: 9780070662742, McGraw Hill
3. John Twidell & Tony Weir, (2015), Renewable Energy Resources, 3rd edition, ISBN: 9781317660378, Routledge

Course Content

8.28 Economics

COURSE TITLE (MEM-322) **Economics**		**CREDITS HOURS** (2+0) **32 Theory + 0 Lab**	**KNOWLEDGE AREA/ DOMAIN** **Social Science**
After completion of this course, students will be able to:		**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Define** engineering economics and describe its role in decision making.	C-2	1
CLO-2	**Calculate** simple and compound interest amounts for one or more time periods.	C-3	1
CLO-2	**Develop** spread sheets based on engineering economy principal using Microsoft excel.	C-3	5

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.

Recommended Books

1. Engineering Economy by Leland blank and Anthony Tarquin.
2. Eengineering economy by paul degarmo
3. Project Management – A Managerial Approach. Jack R. Meredith & Samuel J. Mantel, Jr.:
4. Project management body of knowledge "PMBOK"

Course Content

8.29 Manufacturing Processes

COURSE TITLE (MET-343) **Manufacturing Processes**	**CREDITS HOURS** (2+1) **32 Theory + 48 Lab**	**KNOWLEDGE AREA/ DOMAIN** **Major Based Breadth**

After completion of this course, students will be able to:		**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Describe** different traditional manufacturing operations used in industry.	C-3	1
CLO-2	**Describe** Computer Numerical Control (CNC) machining.	C-2	5
CLO-2	**Define** different Non-traditional machining methods.	C-1	12

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. Fundamentals of CNC machining, Subroutines for CNC Machining, G&M codes, CNC Lathe, CNC Milling, CNC Work center. 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), 3D Printing.

Course Learning Outcome of Labs

After completion of this course, students will be able to:		**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Work** on experiments/task/project related to applied physics laboratory independently.	P-2	9
CLO-2	**Organize** the results of experiments in written and graphical format.	P-4	4

Lab Content

Practical are designed based on the contents covered in the theory. The following is the tentative list of Practical. Institutions, depending on their needs and available resources, can add or remove any practical.

Samples

- CNC Lathe and Milling
  1) To understand the basic knowledge of CNC machines
  2) To perform step turning on CNC Lathe

3) To develop a rectangular plate with holes through CNC milling

- Casting.

1) To prepare mold and core assembly for sand casting
2) Produce circular flange having four holes using sand casting

- Sheet Metal Working.

1) To make a rectangular box using aluminium metal sheet with the help of shearing and bending machines

- Finishing operations.

1) Apply different finishing operations such as grinding, painting on plate with holes

- Polymer Manufacturing

Understanding blow moulding machine operation. Manufacturing of hollow plastic parts using blow moulding

Recommended Books

1. Paul Breeze, (2014), Power Generation Technologies, 2nd edition, ISBN:9780080983301, Newnes
2. M. M El-Wakil, (1985), Powerplant Technology, ISBN: 9780070662742, McGraw Hill
3. John Twidell & Tony Weir, (2015), Renewable Energy Resources, 3rd edition, ISBN: 9781317660378, Routledge

Course Content

8.30 Project Management

COURSE TITLE (MEM-313) **Project Management**	**CREDITS HOURS** (2+1) **32 Theory + 48 Lab**	**KNOWLEDGE AREA/ DOMAIN** **Major Based Breadth**

After completion of this course, students will be able to:		**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Define** the basic terms and functions of project management, project manager and team role and formation. Select the criteria for project selection (Knowledge).	C-1	1
CLO-2	**Apply** the concepts such as planning, scheduling, monitoring, and controlling through PERT and CPM (Application).	C-3	2
CLO-3	**Analyze** risk and select risk management techniques and analysis.	C-4	2
CLO-4	**Describe** and use the concepts of project management knowledge in different domains.	C-2	11

Course Outline for Theory

Project management concepts, project proposals and feasibility, initiating, planning, execution, monitoring and control, closing and exit strategy, introduction to any Project Management's Software.

Course Learning Outcome of Labs

After completion of this course, students will be able to:		**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Actively** Contribute individually and as team member.	A-2	9
CLO-2	**Practice** the software based and writing skills as per subject requirements.	P-3	5
CLO-3	**Organize** report in a given format.	A-4	10

Lab Content

Project management (pm) tools review, application, and demonstration, how to use the basic tools and commands in the software tool to manage projects.to add and assign resources in the project management of manufacturing product using pm tool. work breakdown structure (WBS) of the engineering projects (to construct a sport complex) using pm tool. To find the critical path in a given project using pm tool. Leveling the resources of the given project for the best utilization to minimize the cost and time. The setting of the baseline in the project to compare the result of the actual against the planned/scheduled settings (duration and cost).to develop and set the status date in the project to measure the status in terms of cost performance index (CPI) and schedule performance index (SPI) index.

How to crash the project by increasing the resources and adjusting overtime using pm tool. To perform earned value analysis (EVA) for a given project to understand the actual value, budgeted value, and earned value using tool.to generate and review the pm report considering cost, time and budget statistics. To assess the project and evaluate on the basis of significant indicators i.e., cost variance, schedule variance, SPI, CPI, cost at completion etc.

Recommended Books

1. Lucy C. Morse, and Daniel L. Babcock Managing Engineering and Technology,4th edition, Prentice Hall, UK ISBN-10: 0131994212
2. Gido, J. and Clements, J.P., Successful Project Management,7th edition, Thomson South-Western, 2003, ISBN 0-324-07168-X
3. Meredith, J.R. and Mantel, S.J., Project Management: A Managerial Approach, 8th Edition, John Wiley, 3rd Edition. ISBN-10: 0470533021
4. Clifford F. Gray, Erik W. Larson Project Management: The Managerial Process(2020) 2nd Edition McGraw-Hill Irwin
5. Jay Heizer, Barry Render, Operations Management, (11th edition) Prentice Hall ISBN-10: 0132921146
6. Industrial Management, by Zuberi M. H, Rabbani Printing Press Lahore
7. Cynthia Snyder Dionisio Project Management Body of Knowledge (PMBOK) Guide,3rd edition. Wiley, ISBN-10: 1119393981.

Course Content

8.31 Instrumentations and Controls

COURSE TITLE (MET-353) **Instrumentations Controls**	**CREDITS HOURS** (2+1) **32 Theory + 48 Lab**	**KNOWLEDGE AREA/ DOMAIN** **Major Based Breadth**

After completion of this course, students will be able to:		**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Explains** the working of various sensors and transducers.	C-2	1
CLO-2	**Select** appropriate methods for calibration, installation, and testing of sensors/transducers.	C-3	2
CLO-3	**Analyze** the response of 2nd or higher order system.	C-4	5
CLO-4	**Apply** the concepts of PLCs and SCADA for process control.	C-3	5

Course Outline for Theory

Basic concepts behind sensors and transducers. Working principles of various sensors and transducers. Installation, testing and calibration of sensors/transducers. Intelligent Machines and components. Basics of signal processing, Open loop, and closed loops systems. Dynamic response of 2nd order system. Programable logic controllers, SCADA for process control, Closed loop process control systems, Introduction to adaptive control and Manufacturing Process Control.

Fans and blowers: Types, Performance evaluation, Efficient system operation, Flow control strategies and energy conservation opportunities.

Course Learning Outcome of Labs

After completion of this course, students will be able to:		**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Follow** instructions to take readings using sensors/transducers.	P-3	1
CLO-2	**Calibrate** the sensors/transducers.	P-4	1
CLO-3	**Sketch** dynamic response of 2nd order system using Matlab.	P-4	12
CLO-4	**Revise** /rearrange and optimize PLC code using Simulink PLC coder.	P-5	12

Recommended Books

1. Sensors and Transducers, Characteristics, Applications, Instrumentation, Interfacing by M. J. Usher and D. A. Keating, 2nd edition, Springer 1996
2. PLC Programming for Industrial Automation by de Kevin Collins, 2007, Exposure Publishing

3. Control Systems Engineering by Norman Nise, 8th edition, 2019, John Wiley & Sons

Course Content

8.32 Mechanical Vibrations

COURSE TITLE (MET-363) **Mechanical Vibrations**	**CREDITS HOURS** (2+1) **32 Theory + 48 Lab**	**KNOWLEDGE AREA/ DOMAIN** **Major Based Depth**	
After completion of this course, students will be able to:		**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Describe** various techniques of vibration response for single / multiple degrees of freedom mechanical systems.	C-2	2
CLO-2	**Solve** problems of damped, undammed, forced, and free vibration systems.	C-3	3
CLO-3	**Analyze** the dynamic response of a vibrating system by measuring and analyzing its vibration parameters.	C-4	4

Course Outline for Theory

Fundamental concepts in vibration and modeling: Introduction to mechanical vibrations, its modeling and analysis. Free vibration of single degree of freedom systems: un-damped vibration, simple harmonic motion, damped vibration, energy and Newton's methods; measurement of vibration components. Design consideration; stability forced harmonic excitation of single degree of freedom systems, un-damped vibration, damped vibration, base excitation, rotating unbalance, coulomb damping vibration of single degree of freedom systems under general forcing conditions, impulsive inputs, arbitrary non-periodic inputs, arbitrary periodic inputs, stability vibration of multi degree of freedom systems, modeling, free un-damped vibration, free damped vibration, forced vibration dynamic vibration absorbers.

Lab Content

Measurement of gravitational acceleration and Radius of Gyration, time period for simple and compound pendulum, measurement of the Natural Frequency of Undamped Free and Forced Vibration system, identification of Degree of Damping and Damping Coefficient for Damped free and forced vibrations. Determination of the Coefficient for Torsional Vibration Without Damping. Whirling response of shafts with and without loading and relate to Dun Kerley's equation.

Recommended Books

1. Thomson W.T., and Dahleh M.D., Theory of Vibrations with Applications, 5th edition, 2014, Pearson Education.
2. Palm W.J., Mechanical Vibration, 2006, ISBN: 978-0-471-34555-8, Wiley Publishers
3. Meirovitch L., Fundamentals of Vibrations, International edition 2001, McGraw-Hill.

Course Content

8.33 Total Quality Management

COURSE TITLE (MET-363) **Total Quality Management**	**CREDITS HOURS** (2+1) **32 Theory + 48 Lab**	**KNOWLEDGE AREA/ DOMAIN** **Major Based Breadth**

After completion of this course, students will be able to:		**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Describe** quality management quality assurance, ISO 9000, Six Sigma, and other TQM terms.	C-2	1
CLO-2	**Analyze** different TQM topics mentioned in courses contents.	C-4	2
CLO-3	**Prepare** maintenance, safety plans, accidents prevention measures and standards (Application).	C-3	2

Course Outline for Theory

Understanding quality, commitment and leadership, design for quality, planning for quality, quality system requirements, quality measuring tools and the improvement cycle, Quality assurance, ISO 9000, Six sigma, Kaizen, Balanced score card.

Course Learning Outcome of Labs

After completion of this course, students will be able to:		**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Actively** Contribute individually and as team member.	A-2	9
CLO-2	**Practice** the software based and writing skills as per subject requirements.	P-3	5
CLO-3	**Organize** report in a given format.	A-4	10

Lab Content

Demonstration of different Statistical tools i.e. SPSS and Minitab its Installation, working environment, sample example discussion & comparison between tools, find Mean, Median & Mode of the data using Minitab, create and analyze Data-Set and define variable in SPSST, perform frequency analysis of the given data using different charts/graphs in SPSS, find the central tendency of the given data and make comparison between different variables in SPSS perform Chi-Square Analysis of the given data model using SPSS, find relation between two dependent & Independent variables using SPSS, perform Regression Analysis of the data in given model using SPSS, perform Pareto Analysis and develop Pareto charts of different variables in SPSS, perform reliability analysis (Cronbach's Alpha test) in SPS, perform normality test and analyzing variables in different data set using SPSS, develop and analyze different control charts using SPSS.

Recommended Books
1. John S. Oakland (2003) Total Quality Management 3rd edition, Butterworth-Heinemann, ISBN-10: 0750657405. 2. Bester fields Total Quality Management, (1998) 2nd edition ISBN-10: 0136394035 Prentice Hall

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.

c. Total contact hours per semester are: 16 weeks per semester x 5 working days per week x 8 hours per day = 640. If an HEI opts SIT in 2 semesters (7^{th} and 8^{th}), these credit hours and contact hours will be doubled.

d. Students will maintain a daily Logbook, signed by the SIT supervisor at site, Training Administrator appointed by HEI and the student.

e. Students must observe safety & 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
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.ieagreements.org)

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

APPENDIX B: Engineering Technologist Graduate Attribute Profile

(Retrieved from www.ieagreements.org)

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

Individual and Teamwork **SA9:** An ability to Function effectively as an individual, and as a member or leader in diverse teams.
Communication **SA10:** An ability to communicate effectively on broadly defined Engineering Technology activities with the Engineering Technologist community and with society at large, by being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
Project Management **SA11:** An ability to demonstrate knowledge and understanding of Engineering Technology management principles and apply these to one's own work, as a member or leader in a team and to manage projects in multidisciplinary environments.
Lifelong Learning: **SA12:** An ability to recognize the need for and have the ability to engage in independent and life-long learning in specialist Engineering Technologies.

APPENDIX C: Engineering Technologist Professional Competence Profile

(Retrieved from www.ieagreements.org)

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

Judgement: **TC12:** Choose appropriate technologies to deal with broadly defined problems. Exercise sound judgement in the course of all broadly defined activities.
Responsibility for decisions: **TC13:** Be responsible for making decisions on part or all of one or more broadly defined activities.

APPENDIX D: Minutes of Preliminary Meeting of NCRC

1. The preliminary meeting of the National Curriculum Revision Council (NCRC) was successfully convened from November 03 to 05, 2021, spanning three days. The meeting took place at the prestigious University of Engineering and Technology (UET), Lahore, and brought together a diverse group of experts from both academia and industry.

2. The inauguration session began with a recitation of the Holy Quran and was graced by the presence of the esteemed Prof. Dr. Syed Mansoor Sarwar, Vice Chancellor of UET, Lahore and Engr. Imtiaz Hussain Gillani, Chairman of the National Technology Council (NTC). This solemn start added significance and reverence to the proceedings, setting the tone for a productive and meaningful meeting.

3. The Vice Chancellor of University of Engineering and Technology (UET), Lahore, Prof. Dr. Syed Mansoor Sarwar warmly welcomed the experts and members, emphasizing the significance of reviewing the curriculum. He highlighted the importance of this exercise in ensuring the program's relevance and quality.

4. The esteemed Chairman of the National Technology Council (NTC) of HEC, Mr. Imtiaz Hussain Gillani, illuminated the efforts undertaken by the NTC in revitalizing technologist and technology programs. He expressed unwavering confidence in the panel of experts, entrusting them to meticulously review the curriculum with a keen eye on preparing future generations of technologists. The Chairman shed light on the invaluable contributions of technologists in nation-building. He further added that investing in the education and development of future technologists, the NTC aims to create a strong and innovative workforce capable of driving the nation towards progress and prosperity.

5. The members in this crucial meeting comprised professionals, scholars, and experts who collectively possess a wealth of knowledge and experience in the field of Mechanical Engineering Technology. Their diverse backgrounds and expertise created a rich environment for fruitful discussions and productive exchanges on curriculum revision.

6. In the second session, the house nominated a Convener, Co-Convener, Secretary and Co-Secretary of the NCRC. After discussion among members, Prof. Dr. Mohammad Parvez Mughal was nominated as Convenor, Prof. Dr. Shahid Maqsood, as Co-Convener, Prof. Dr. Maaz Akhtar were nominated as Secretary.

   The following members attended the meeting:

Sr#	NCRC Members	Role
1	Prof. Dr. Mohammad Parvez Mughal University of Management and Technology, Lahore-Punjab	Convener
2	Prof. Dr. Shahid Maqsood University of Engineering and Technology, Peshawar- Khyber Pakhtunkhwa	Co- Convener
3	Prof. Dr. Maaz Akhtar NED University of Engineering and Technology, Karachi-Sindh	Secretary
4	Prof. Dr. Abdul Aziz Mazhar Ex-Dean IST, Islamabad-Federal	Member
5	Prof. Dr. Abdul Shakoor University of Engineering and Technology, Peshawar, Khyber Pakhtunkhwa	Member
6	Dr. Afzal Khan University of Engineering and Technology, Peshawar-Khyber Pakhtunkhwa	Member

Sr#	NCRC Members	Role
7	Dr. Syed Ali Raza Shah BUET, Khuzdar-Baluchistan	Member
8	Engr. Ayaz Ali Mandan BBSUTSD, Khairpur-Sindh	Member
9	Prof. Dr. Riffat Asim Pasha University of Engineering and Technology, Taxila-Punjab	Member
10	Prof. Dr. Shahid Imran University of Engineering and Technology, Lahore-Punjab	Member
11	Prof. Dr. Fahad Noor University of Engineering and Technology, Lahore-Punjab	Member
12	Dr. Muhammad Asim University of Engineering and Technology, Lahore-Punjab	Member
13	Dr. Muhammad Usman University of Engineering and Technology, Lahore-Punjab	Member
14	Hafiz Ghulam Muhammad National Technology Council, Higher Education Commission, Pakistan	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 (2016). 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.

Mechanical Engineering Technology Sub Committees Subject Groups		
Group-I: Design		
Name	**Designation**	**Role**
Prof. Dr. Afzal Khan	Professor	Convener
Dr. Abdul Aziz Mazhar	Professor	Co-Convener
Prof. Dr. Riffat Asim Pasha	Professor	Secretary
Group II: Humanities		
Name	**Designation**	**Role**
Prof. Dr. Pervez Mughal	Professor & Dean	Convener
Prof. Dr. Shahid Imran	Professor & HOD	Secretary
Group III: Thermo-fluids		
Name	**Designation**	**Role**
Prof. Dr. Fahad Noor	Professor	Convener
Dr. Muhammad Asim	Associate Professor	Co- Convener
Dr. Muhammad Usman	Associate Professor	Secretary
Group IV: Manufacturing and Materials		
Name	**Designation**	**Role**
Prof. Dr. Abdul Shakoor	Professor	Convener
Prof. Dr. Maaz Akhtar	Professor	Secretary
Group V: Management Sciences		
Name	**Designation**	**Role**
Prof. Dr. Ali Raza Shah	Professor & Dean	Convener
Prof. Dr. Shahid Maqssod	Professor & HOD	Co- Convener
Engr. Ayaz Ali Mandan	Assistant Professor	Secretary
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 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

1. The Final meeting of the National Curriculum Review Committee (NCRC) meeting for Mechanical Engineering Technology at UET Lahore was convened as a follow-up meeting in person from November 03 to 05, 2021. The meeting aimed to discuss and finalize various aspects of the curriculum to ensure the program's relevance and effectiveness in meeting the industry demands and contemporary knowledge requirements.

2. The inauguration session commenced with the recitation of the Holy Quran and was presided over by the esteemed Prof. Dr. Syed Mansoor Sarwar warmly, Vice Chancellor of UET, Lahore, adding a sense of solemnity and importance to the proceedings.

3. Engr. Imtiaz Hussain Gilani, Chairman of NTC, online, conveyed his appreciation for the dedicated efforts of the committee members. He lauded their valuable contributions to the national cause, emphasizing their role in setting high standards for quality education in the field of electrical engineering technology.

4. The Chairman NTC also expressed his gratitude to the entire team and provided an overview of the objectives and arrangements for the second National Curriculum Review Committee (NCRC) meeting.

5. Representing NTC, Mr. Hafiz Ghulam Muhammad actively participated in the meeting, bringing valuable insights and perspectives to the discussions.

   The following members attended the meeting:

Sr#	NCRC Members	Role
1	Prof. Dr. Mohammad Parvez Mughal University of Management and Technology, Lahore-Punjab	Convener
2	Prof. Dr. Shahid Maqsood University of Engineering and Technology, Peshawar- Khyber Pakhtunkhwa	Co- Convener
3	Prof. Dr. Maaz Akhtar NED University of Engineering and Technology, Karachi-Sindh	Secretary
4	Prof. Dr. Abdul Aziz Mazhar Ex-Dean IST, Islamabad-Federal	Member
5	Prof. Dr. Abdul Shakoor University of Engineering and Technology, Peshawar, Khyber Pakhtunkhwa	Member
6	Dr. Afzal Khan University of Engineering and Technology, Peshawar-Khyber Pakhtunkhwa	Member
7	Dr. Syed Ali Raza Shah BUET, Khuzdar-Baluchistan	Member
8	Engr. Ayaz Ali Mandan BBSUTSD, Khairpur-Sindh	Member
9	Prof. Dr. Riffat Asim Pasha University of Engineering and Technology, Taxila-Punjab	Member
10	Prof. Dr. Shahid Imran University of Engineering and Technology, Lahore-Punjab	Member
11	Prof. Dr. Fahad Noor University of Engineering and Technology, Lahore-Punjab	Member
12	Dr. Muhammad Asim University of Engineering and Technology, Lahore-Punjab	Member
13	Dr. Muhammad Usman University of Engineering and Technology, Lahore-Punjab	Member

Sr#	NCRC Members	Role
14	Hafiz Ghulam Muhammad National Technology Council, Higher Education Commission, Pakistan	NTC Representative

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

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 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.