

राष्ट्रीय प्रौद्योगिकी संस्थान मेघालय
NATIONAL INSTITUTE OF TECHNOLOGY
MEGHALAYA

UG Curriculum

with effect from

AY 2024-25

in view

of

NEP2020



यांत्रिक अभियांत्रिकी विभाग
Department of Mechanical Engineering

National Institute of Technology Meghalaya

UG Curriculum with effect from AY 2024-25

In view of NEP2020

DEPARTMENT OF MECHANICAL ENGINEERING

Abbreviations

SC	:	Science Core
ESA	:	Engineering Science & Arts
DSC	:	Dept. Specific Core
DSE	:	Dept. Specific Elective
OE	:	Open Elective
AECC	:	Ability Enhancement Compulsory Course
SECC	:	Skill Enhancement Compulsory Course
VAC	:	Value Added Course
L	:	Laboratory Course
A	:	Audit Course

Semester Wise Model Plan – First Semester

Course Code	Course Title	Course Type	Contact Hours			Credit	Pre-requisites
			L	T	P	C	
Science Core							
MA101	Engineering Maths-I (calculus, linear algebra, & statistics)	SC	3	1	0	4	None
CB101/ PH101	Engineering Chemistry/ Engineering Physics	SC	3	0	0	3	None
CB151/ PH151	Engineering Chemistry/Engineering Physics Laboratory	SC (L)	0	0	2	1	None
CB103	Biology for Engineers	SC	2	0	0	2	None
Engineering Science and Arts							
ME101	Engineering Mechanics	ESA	3	1	0	4	None
CS101	Computer & Coding	ESA	2	0	0	2	None
CS151	Computer & Coding Laboratory	ESA (L)	0	0	2	1	None
CE101	Engineering Graphics	ESA (L)	0	1	3	2	None
Skill Enhancement Compulsory Course							
HS151	Communication Skills	SECC(L)	0	1	2	2	None
Total Contact Hours – Component wise			13	4	9		-
Total Contact Hours			26			21	-

Semester Wise Model Plan – Second Semester

Course Code	Course Title	Course Type	Contact Hours			Credit	Pre-requisites
			L	T	P	C	
Science Core							
MA102	Engineering Maths-II	SC	3	1	0	4	None
PH101/ CB101	Engineering Physics/Engineering Chemistry	SC	3	0	0	3	None
PH151/ CB151	Engineering Physics/Engineering Chemistry Laboratory	SC (L)	0	0	2	1	None
Engineering Science and Arts							
CB102	Environmental Science	ESA	2	0	0	2	None
EE102	Basic Electrical & Electronics Engineering	ESA	3	0	0	3	None
EE152	Basic Electrical & Electronics Engineering Laboratory	ESA (L)	0	0	2	1	None
ME152	Workshop Practice	ESA (L)	0	0	3	1	None
Skill Enhancement Compulsory Course							
HS102	Creativity, Innovation and Entrepreneurship	SECC	2	0	0	2	None
Ability Enhancement Compulsory Course							
CS152	Python Programming	AECC (L)	0	1	2	2	None
Value Added Course							
HS104	Ethics and Morals	VAC	2	0	0	2	None
VA102	Skill Development & Prototyping	VAC (L)	0	0	2	1	None
Total Contact Hours – Component wise			15	2	11		-
Total Contact Hours			28			22	-

Semester Wise Model Plan – Third Semester

Course Code	Course Title	Course Type	Contact Hours			Credit	Pre-requisites
			L	T	P	C	
Department Specific Core							
ME201	Strength of Materials	DSC	3	0	0	3	None
ME203	Engineering Thermodynamics	DSC	3	0	0	3	None
ME205	Fluid Mechanics	DSC	3	0	0	3	None
ME207	Engineering Materials	DSC	3	0	0	3	None
Department Specific Elective (students to choose one)							
ME209	Introduction to Renewable Energy	DSE	3	0	0	3	None
ME211	Welding Technology	DSE	3	0	0	3	None
Value Added course/ Dissertation							
ME213	3D Printing Technologies	VAC	0	1	2	2	None
Open Elective							
ME271	Safety Engineering	OE	2	0	0	2	None
Laboratory							
ME251	Material Testing Laboratory	L	0	0	2	1	None
ME253	Advanced Workshop Practice	L	0	0	2	1	None
ME255	Fluid Mechanics Laboratory	L	0	0	2	1	None
ME257	Material Science Laboratory	L	0	0	2	1	None
Total Contact Hours – Component wise			17	1	10		-
Total Contact Hours			28			23	-

Semester Wise Model Plan – Fourth Semester

Course Code	Course Title	Course Type	Contact Hours			Credit	Pre-requisites
			L	T	P	C	
Department Specific Core							
ME202	Kinematics of Machineries	DSC	3	0	0	3	None
ME204	Manufacturing Technology-I	DSC	3	0	0	3	None
ME206	Fluid Machines	DSC	3	0	0	3	None
ME208	Applied Thermodynamics	DSC	3	0	0	3	None
Department Specific Elective (students to choose one)							
ME210	Modelling and Simulation of Mechanical Systems	DSE	2	0	2	3	None
ME212	Metrology & Instrumentation	DSE	3	0	0	3	None
ME214	Numerical Methods in Engineering	DSE	3	0	0	3	None
ME216	Dynamics of Rigid Bodies	DSE	3	0	0	3	None
Skill Enhancement Compulsory Course							
ME218	Indian Health, Wellness and Psychology	SECC	2	0	0	2	None
Open Elective							
ME272	Product Design and Development	OE	2	0	0	2	None
Laboratory							
ME252	Theory of Machine Laboratory	L	0	0	2	1	None
ME254	Manufacturing Technology Laboratory	L	0	0	2	1	None
ME256	Fluid Machines Laboratory	L	0	0	2	1	None
Total Contact Hours – Component wise			18/19	0	8/6		-
Total Contact Hours			26/25			22	-

Semester Wise Model Plan – Fifth Semester

Course Code	Course Title	Course Type	Contact Hours			Credit	Pre-requisites
			L	T	P	C	
Department Specific Core							
ME301	Manufacturing Technology-II	DSC	3	0	0	3	None
ME303	Machine Design-I	DSC	3	0	0	3	None
ME305	Heat Transfer	DSC	3	0	0	3	None
ME307	Dynamics of Machineries	DSC	3	0	0	3	None
Department Specific Elective (students to choose one)							
ME309	Non-Traditional Machining	DSE	3	0	0	3	None
ME311	Energy Conversion Systems	DSE	3	0	0	3	None
ME313	Tribology	DSE	3	0	0	3	None
ME315	Design of Thermal Systems	DSE	3	0	0	3	None
Skill Enhancement Compulsory Course							
ME351	Seminar and Technical Report Writing	SECC	0	0	2	1	None
Open Elective							
ME371	Power Plant Engg. and Energy Audit	OE	2	0	0	2	None
Dissertation							
ME381	Minor Project-1	VAC	0	0	4	2	None
Ability Enhancement Compulsory Course							
ME383	Internship-1	AECC	0	0	0	1	None
Laboratory							
ME353	Non-Traditional Machining Laboratory	L	0	0	2	1	None
ME355	Thermal Engineering Laboratory-1	L	0	0	2	1	None
ME357	Machine Design and Drawing	L	0	0	2	1	None
Total Contact Hours – Component wise			17	0	12		-
Total Contact Hours			29			24	-

Semester Wise Model Plan – Sixth Semester

Course Code	Course Title	Course Type	Contact Hours			Credit	Pre-requisites
			L	T	P	C	
Department Specific Core							
ME302	Machine Design-II	DSC	3	0	0	3	None
ME304	Industrial Engineering	DSC	3	0	0	3	None
Department Specific Elective (students to choose one)							
ME306	Power Plant Engineering	DSE	3	0	0	3	None
ME308	CAD-CAM	DSE	3	0	0	3	None
ME310	Robotics	DSE	3	0	0	3	None
ME312	Machine Tool Technology	DSE	3	0	0	3	None
Department Specific Elective (students to choose one)							
ME314	Aerodynamics	DSE	3	0	0	3	None
ME316	Refrigeration and Air Conditioning	DSE	3	0	0	3	None
ME318	Additive Manufacturing	DSE	3	0	0	3	None
ME320	Structural Health Monitoring	DSE	3	0	0	3	None
Open Elective							
ME372	Industry 4.0 and 6.0 Sigma Engineering	OE	2	0	0	2	None
Value Added course/ Dissertation							
ME382	Minor Project-2	VAC	0	0	4	2	None
HS302	Indian Culture and Civilization	VAC	2	0	0	2	None
Laboratory							
ME352	Automation Laboratory	L	0	0	2	1	None
ME354	Advanced Manufacturing Laboratory	L	0	0	2	1	None
ME356	Thermal Engineering Laboratory-2	L	0	0	2	1	None
Total Contact Hours – Component wise			16	0	10		-
Total Contact Hours			26			21	-

Semester Wise Model Plan – Seventh Semester

Course Code	Course Title	Course Type	Contact Hours			Credit	Pre-requisites
			L	T	P	C	
Department Specific Elective (students to choose three)							
ME411	IC Engine	DSE	3	0	0	3	None
ME413	Optimization Techniques	DSE	3	0	0	3	None
ME415	Experimental Stress Analysis	DSE	3	0	0	3	None
ME417	Processing of Advanced Materials	DSE	3	0	0	3	None
ME419	Mechanical Vibrations	DSE	3	0	0	3	None
ME421	Mechanical Micromachining	DSE	3	0	0	3	None
ME423	Wind and Solar Energy	DSE	3	0	0	3	None
ME425	Mechatronics and Control	DSE	3	0	0	3	None
ME427	Fundamentals of Food Process Engineering	DSE	3	0	0	3	None
Open Elective (students to choose one)							
ME471	Hybrid and Electric Vehicles	OE	2	0	0	2	None
ME473	Optimization Techniques	OE	2	0	0	2	None
ME475	Electronic Packaging and Manufacturing	OE	2	0	0	2	None
ME477	Foundation of Computational Fluid Dynamics	OE	2	0	0	2	None
Dissertation							
ME481	Major Project-1	VAC	0	0	8	4	None
Ability Enhancement Compulsory Course							
ME483	Internship-2	AECC	0	0	0	1	None
Total Contact Hours – Component wise			11	0	8		-
Total Contact Hours			17			16	-

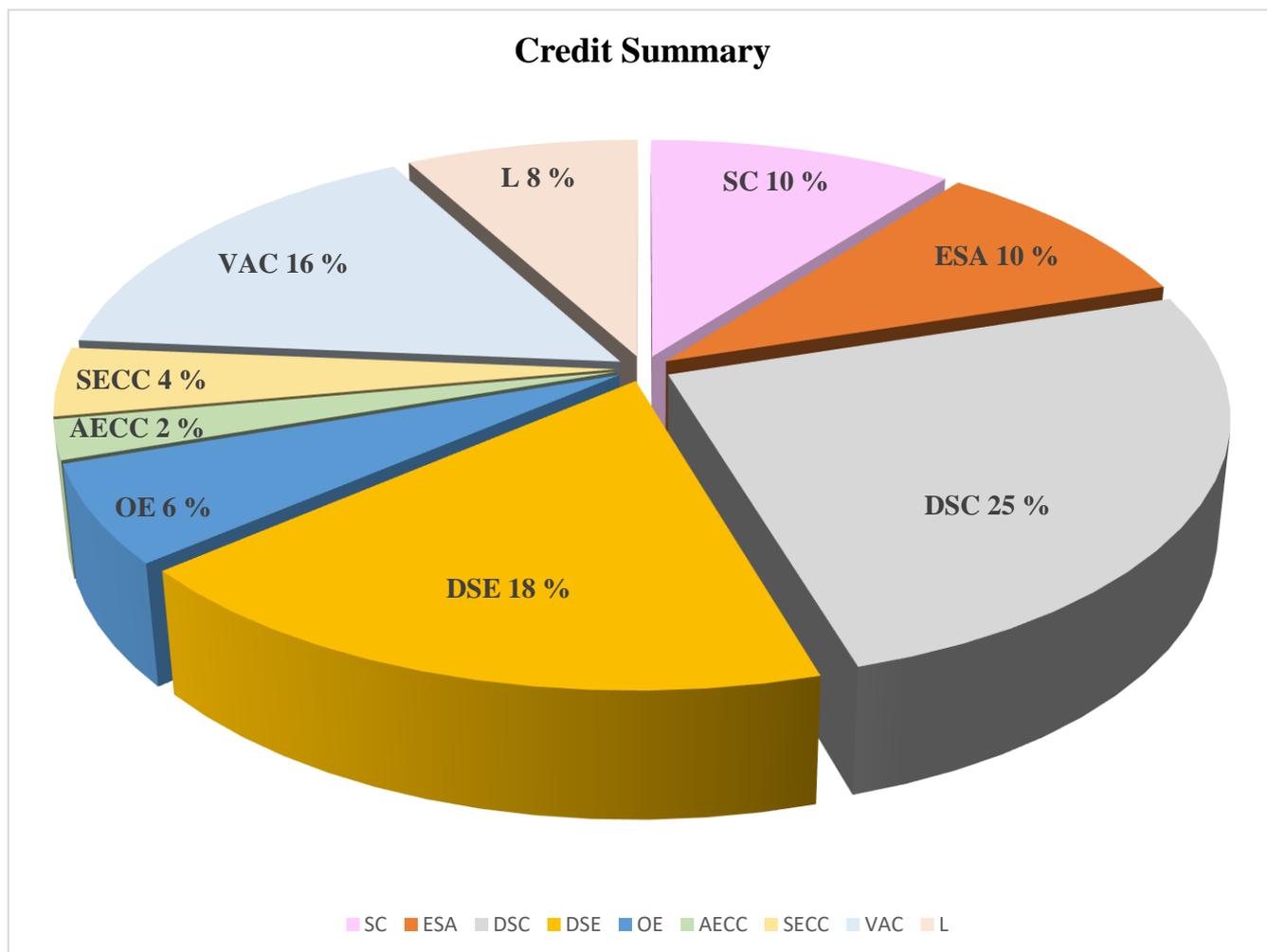
Semester Wise Model Plan – Eighth Semester

Course Code	Course Title	Course Type	Contact Hours			Credit	Pre-requisites
			L	T	P	C	
Department Specific Elective (students to choose two)							
ME412	Fracture Mechanics	DSE	3	0	0	3	None
ME414	Heat Exchangers: Fundamentals and Design Analysis	DSE	3	0	0	3	None
ME416	Fundamentals of Artificial Intelligence	DSE	3	0	0	3	None
ME418	Automobile Engineering	DSE	3	0	0	3	None
ME420	Supply Chain and Logistics Management	DSE	3	0	0	3	None
ME422	Industrial Hydraulics and Automation	DSE	3	0	0	3	None
ME424	Farm Machinery	DSE	3	0	0	3	None
Dissertation							
ME482	Major Project-2	VAC	0	0	22	11	None
Total Contact Hours – Component wise			06	0	22		-
Total Contact Hours			28			17	-

Model Plan

Sem	SC	ESA	DSC	DSE	OE	AECC	SECC	VAC	Lab	Total Credit
I	SC1 [4] SC2 [3] SC3 [2] SC-L [1]	ESA1 [4] ESA2 [2] ESA-L [1] ESA-L [2]					SECC-L [2]	VAC-A [0]		21
II	SC4 [4] SC5 [3] SC-L [1]	ESA3 [2] ESA4 [3] ESA-L [1] ESA-L [1]				AECC-L [2]	SECC1 [2]	VAC1 [2] VAC-L [1] VAC-A [0]		22
III			DSC1 [3] DSC2 [3] DSC3 [3] DSC4 [3]	DSE1 [3]	OE1 [2]			VAC2 [2]	L1 [1] L2 [1] L3 [1] L4 [1]	23
IV			DSC5 [3] DSC6 [3] DSC7 [3] DSC8 [3]	DSE2 [3]	OE2 [2]		SECC2 [2]		L5 [1] L6 [1] L7 [1]	22
V			DSC9 [3] DSC10 [3] DSC11 [3] DSC12 [3]	DSE3 [3]	OE3 [2]	AECC1 [1]	SECC3 [1]	VAC3 [2]	L8 [1] L9 [1] L10 [1]	24
VI			DSC13 [3] DSC14 [3]	DSE4 [3] DSE5 [3]	OE4 [2]			VAC4 [2] VAC5 [2]	L11 [1] L12 [1] L13 [1]	21
VII				DSE6 [3] DSE7 [3] DSE8 [3]	OE5 [2]	AECC2 [1]		VAC6 [4]		16
VIII				DSE9 [3] DSE10 [3]				VAC7 [11]		17
Total Credit	18	16	42	30	10	4	7	26	13	166

Components Credit Summary - BTech Curriculum										
Course Type with Abbreviation		I	II	III	IV	V	VI	VII	VIII	Total
SC	Science Core	10	7							17
ESA	Engineering Science & Arts	9	7							16
DSC	Dept. Specific Core			12	12	12	6			42
DSE	Dept. Specific Elective			3	3	3	6	9	6	30
OE	Open Elective			2	2	2	2	2		10
AECC	Ability Enhancement Compulsory Course		2			1		1		4
SECC	Skill Enhancement Compulsory Course	2	2		2	1				7
VAC	Value Added Course		3	2		2	4	4	11	26
L	Laboratory Course			4	3	3	3			13
Total Credits										165



First Semester Courses



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Programme	Bachelor of Technology	Year of Regulation	2024-25
Department	Mathematics	Semester	I

Course Code	Course Name	Pre-Requisite	Credit Structure				Marks Distribution			
			L	T	P	C	INT	MID	END	Total
MA101	Engineering Mathematics-I	---	3	1	0	4	50	50	100	200
				CO's		Statement				Bloom's Taxonomy
Course Objectives	To enable the students to have a good understanding of fundamental concepts of single and multivariable calculus.	Course Outcomes	MA101.1			Able to acquire knowledge of limit, continuity and differentiation for functions of single and multi-variables and the consequences of different mean value theorems.				Understand, Analyze
	To provide the basic and important concepts of linear algebra.		MA101.2			Able to apply Taylor's series to approximate differentiable functions of single and multi-variables and estimate the error.				Apply, Evaluate
	To prepare the students to apply the mathematical principles of calculus and linear algebra to solve engineering problems.		MA101.3			Able to apply definite integrals to evaluate length of plane curves, volume and surface area of solids of rotation.				Apply, Evaluate
			MA101.4			Able to understand the basic concepts of vector spaces and to solve systems of linear equations.				Understand, Evaluate
			MA101.5			Able to demonstrate and apply estimation of parameters, confidence interval, and testing hypotheses for normal distribution.				Understand, Apply
	To enable the students to have a good understanding of essential methods of statistical inference.		MA101.6			Able to formulate relationships among random variables using regression and correlation.				Create

COs	Mapping with Program Outcomes (POs)												Mapping with PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
MA101.1	2														
MA101.2	3														
MA101.3	3														
MA101.4	3														
MA101.5	2														
MA101.6	3														
MA101	2.67														

SYLLABUS

No.	Content	Hours	COs
I	Differential Calculus: Real valued functions of single variable: Limit; continuity; differentiation, Taylor & Maclaurin series, indeterminate forms, L'Hospital's rule. Real valued functions of two/three variables: Limit, continuity, partial differentiation; Taylor and Maclaurin series for function of two variables; Extreme values of functions of two variables.	14	MA101.1 MA101.2
II	Integral Calculus: Definite integral: length of a plane curve, surface area of revolution, volume of solids of revolution; Differentiation under sign of integral: Leibnitz rule; Improper integrals, convergence tests, beta and gamma functions; Multiple Integrals: double and triple integrals, volume and surface integrals.	16	MA101.3
III	Linear Algebra: Vector space over R , subspaces, bases and dimension; Echelon form, rank of a matrix, system of linear equations-direct & iterative methods; eigenvalues and eigenvectors; Symmetric, skew-symmetric, Hermitian, skew-Hermitian, orthogonal, and unitary matrices.	14	MA101.4
IV	Statistics: Random variables, Probability distributions, Point estimation of parameters, Confidence Intervals, Testing Hypotheses, goodness of fit: Chi-square test, Regression: fitting straight lines, correlation.	12	MA101.5 MA101.6
Total Hours (4 Modules)		56	

Essential Readings

1. J. Stewart, D. K. Clegg and S. Watson, "Calculus", Cengage Learning India Pvt. Limited, 9th edition, 2023.
2. E. Kreyszig, "Advanced Engineering Mathematics", John Wiley & Sons, 10th edition 2023.

Supplementary Readings

1. R. K. Jain and S. R. K. Iyengar, "Advanced Engineering Mathematics", Narosa Publishing House, 5th edition, 2019.
2. N. Piskunov, "Differential Calculus and Integral Calculus – I", CBS, 1996.
3. N. Piskunov, "Differential Calculus and Integral Calculus – II", CBS, 1996.
4. D. C. Montgomery and G. C. Runger, "Applied Statistics and Probability for Engineers", John Wiley & Sons, 7th edition, 2018.



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CURRICULUM

Programme	Bachelor of Technology										Year of Implementation			2024-2025	
Department	Physics										Semester			I/II	
Course Code	Course Name	Pre-Requisite	Credit Structure				Marks Distribution								
			L	T	P	C	INT	MID	END	Total					
PH101	Engineering Physics	----	3	0	0	3	50	50	100	200					
				CO's	Statement					Bloom's Taxonomy					
Course Objectives	To understand the concepts of fundamentals of em wave, vectors, vector calculus and its relevance to science and engineering		Course Outcomes	PH101.1	Able to gain the knowledge of electromagnetism applied to Engineering concepts					Understanding Applying					
	To introduce various concepts of special theory of relativity			PH101.2	Able to gain the knowledge of special theory of relativity					Understanding					
	To introduce various concepts of different optical phenomena observed in nature.			PH101.3	Able to gain the knowledge about Geometrical and Physical Optics and its applications .					Understanding Applying					
	To introduce the developments of Quantum Physics in the beginning of 20th century and the development thereafter.			PH101.4	Able to understand the concepts and theories of 20-th century Physics and its applications .					Understanding Applying					
COs	Mapping with Program Outcomes (POs)												Mapping with PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
PH101.1	3	2													
PH101.2	3	2													
PH101.3	3	2													
PH101.4	3	2													
PH101	3	2													
SYLLABUS															
No.	Content												Hours	COs	
I	Electromagnetism: Vector calculus, Gauss's law and its applications, divergence and curl of electrostatic fields, electrostatic potential. Lorentz force, Biot-Savart and Ampere's laws and their applications, divergence and curl of magnetostatic fields, force and torque on a magnetic dipole, motional EMF, Faraday's law, Lenz's law, Maxwell's equations, Postulates of Special theory of relativity, Lorentz transformation, time dilation, length contraction.												14	PH101.1, PH101.2	
II	Optics: Interference - coherence, principle of superposition, Young's double slit experiment, Newton's rings, diffraction - Fresnel and Fraunhofer diffracting, grating and its usages, polarization, Malus' law, polarization by reflection and Brewster's law.												14	PH101.3	
III	Modern Physics: Old quantum theory, black body radiation, Planck's law, photoelectric effect, Compton effect, de-Broglie's hypothesis, Heisenberg uncertainty principle, wave packet, group and phase velocities, postulates of Quantum mechanics. Schrödinger's equation, application in 1-dimension: particle in a box.												14	PH101.4	
Total Hours												42			
Essential Readings															
1. R. A. Serway and J. W. Jewett, "Physics for Scientists and Engineers with Modern Physics", CENGAGE Learning Custom Publishing, 10th edition, 2017.															
2. Paul G. Hewitt, "Conceptual Physics", Pearson, 13th edition, 2022.															
Supplementary Readings															
1. J. C. Morrison, Modern Physics for Scientists and Engineers, Elsevier; 2nd edition, 2015.															
2. M. Mansfield and C. O'Sullivan, "Understanding Physics", Wiley-Blackwell; 3rd Edition, 2020.															



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CURRICULUM

Programme	Bachelor of Technology	Year of Implementation	2024-2025
Department	Physics	Semester	I/II
Course Code	Course Name	Pre-Requisite	Credit Structure
PH 151	Engineering Physics Laboratory	-----	

			L	T	P	C	Continuous Assessment	Total
			0	0	2	1	01 Experiment	10
			CO's		Statement		Bloom's Taxonomy	
Course Objectives	To understand the fundamentals of electromagnetism	Course Outcomes	PH151.1	Able to gain the knowledge of electromagnetism applied to Engineering		Understanding Applying		
	To understand various concepts of Optical phenomena in Physics and Engineering		PH151.2	Able to gain the knowledge about Geometrical and Physical Optics		Understanding		
	To understand the fundamentals of General Physics		PH151.3	Able to understand the concepts of General Physics and its applications		Understanding Applying		
	To understand the fundamentals of Semiconductor Physics		PH 151.4	Able to gain the knowledge of Semiconductor Physics and its applications		Understanding Applying		

COs	Mapping with Program Outcomes (POs)											Mapping with PSOs				
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	
PH 151.1	3	2														
PH 151.2	3	2														
PH 151.3	3	2														
PH 151.4	3	2														
PH 151	3	2														

SYLLABUS

S. No.	Title of the Experiment	Hours	COs
I	To verify inverse square law (using a point source of light)	02	PH 151.1
II	To verify Coulomb's Law of force between two electric poles	02	
III	To determine the variation of magnetic field along the axis of the current carrying coil	02	
IV	To find resonance frequency in series and parallel LCR circuit	02	
V	To find the refractive index of prism by measuring angle of prism and angle of minimum deviation	03	PH 151.2
VI	Determination of wavelength of monochromatic light (LASER) using Fresnel Biprism	02	
VII	To determine the wavelength of sodium light by measuring the diameters of Newton's rings	03	
VIII	To determine the wavelength of LASER using Diffraction grating	02	
IX	To find the refractive index of a glass plate & water by using a travelling microscope	02	PH 151.3
X	To determine frequency of A.C. Mains using sonometer	03	
XI	To determine the Young's modulus of elasticity of the material of a sample beam by bending	02	
XII	I-V characteristic curve of a P-N junction in forward bias and reverse bias	02	PH 151.4
XIII	Half-wave rectifier circuit without and with filter (HWR)	02	
XIV	Evaluation and Viva of all experiments	03	PH 151.1, PH 151.2, PH 151.3, PH 151.4
XV	Laboratory written test	01	PH 151.1, PH 151.2, PH 151.3, PH 151.4
Total Hours (for any 10 experiments from Sl. No. I to XIII)		27	

Essential Readings

- R. A. Serway and J. W. Jewett, "Physics for Scientists and Engineers with Modern Physics", CENGAGE Learning Custom Publishing, 10th edition, 2017.
- Paul G. Hewitt, "Conceptual Physics", Pearson, 13th edition, 2022.
- D. J. Griffiths, "Introduction to Electrodynamics", Prentice-Hall of India, 5th Edition, 2023
- A. Ghatak, "Optics", Tata McGraw-Hill, 7th Edition, 2020

Supplementary Readings

- D. Kleppner, and R. J. Kolenkow, "An Introduction to Mechanics", Cambridge University Press, 2nd Edition, 2021.
- R. Eisberg, and R. Resnick, "Quantum Physics of Atoms, Molecules, Solids, Nuclei and Particles", Wiley, 2nd Edition, 2006



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CURRICULUM

Programme	Bachelor of Technology (All branches)	Year of Regulation	2024-2025
Department	Chemical and Biological Sciences	Semester	I/II

Course Code	Course Name	Credit Structure				Marks Distribution			
		L	T	P	C	INT	MID	END	Total
CB 103	Biology for Engineers	2	0	0	2	50	50	100	200

Course Objectives	Course Outcomes	COs	Statement	Bloom's Taxonomy
		<p>To provide the basic knowledge of various biomolecules, which are essential for life, their structures, and functions.</p> <p>To discuss the structure and function of cells, different cellular processes, and biological signal transduction.</p> <p>To provide the knowledge of heredity, how genes work, the concept of the central dogma of life, genetic engineering, and genomics.</p> <p>To provide basic knowledge on engineering tools in disease biology, stem cell engineering, 3D printing of artificial organs and various biomaterials.</p>	<p>CY103.1</p> <p>CY103.2</p> <p>CY103.3</p> <p>CY103.4</p>	<p>Able to understand the significance of biomolecules for sustaining life, including the knowledge of the structure of the cell and the biological signal transduction process.</p> <p>Able to interpret the heredity, variation, and central dogma of life followed by gene expression and their applications.</p> <p>Able to apply the concepts of engineering tools to solve the issues related to disease aspects, diagnosis, etc.</p> <p>Able to apply the concepts of biomaterial processing and their applications.</p>

No.	COs	Mapping with Program Outcomes (POs)												Mapping with PSOs		
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	CB103.1	2	3	3	-	-	-	-	-	-	-	-	-	-	-	-
2	CB103.2	2	3	3	-	-	-	-	-	-	-	-	-	-	-	-
3	CB103.3	2	3	3	-	-	-	-	-	-	-	-	-	-	-	-
4	CB103.4	2	3	3	-	-	-	-	-	-	-	-	-	-	-	-
	CB103	2	3	3												

SYLLABUS

No.	Content	Hours	COs
I	Molecules of life: Chemical basis of life, protein structure and function, nucleic acids and the RNA, carbohydrates, lipids, membranes, and cells, cellular interactions, cell cycle, biological signal transduction.	06	CB103.1
II	Gene structure and expression: Mitosis, meiosis, Mendelian Genetics. DNA and the gene- Synthesis and repair, how genes work, the central dogma of life, transcription, RNA processing, translation, control of gene expression, analyzing and engineering genes, genomics.	06	CB103.2
III	Trends in bioengineering: Genetic engineering, disease biology and biopharmaceuticals, stem cell engineering, metabolic engineering, biosafety, and bioethics. Bioprinting techniques and materials, 3D printing of ear, bone, and skin. Bioimaging and Artificial Intelligence for disease diagnosis.	08	CB103.3
IV	Biomaterials Processing: Classification, concept of biocompatibility, quantification of structure-property correlation - bioglass/ glass-ceramics, biodegradable polymers, biocomposites, bioplastics, macroporous scaffolds. Self-healing bioconcrete (based on bacillus spores, calcium lactate nutrients and biomineralization processes) and bioremediation via microbial surface adsorption (removal of heavy metals like lead, cadmium, mercury, arsenic).	08	CB103.4
Total Hours		28	

Essential Readings

1. E. Engner, R. Ross, D. Bailey, "*Concepts in Biology*", 14th Edition, McGraw Hill Education, New York, 2011.
2. R. Renneberg, V. Berkling and V. Lorch, "*Biotechnology for Beginners*", 2nd Edition, Academic Press, 2016.

Supplementary Readings

1. G.K. Suraishkumar, "*Biology for Engineers*", 1st Edition, Oxford University Press, New Delhi, 2019.
2. G. Karp, "*Cell and Molecular Biology: Concepts and Experiments*", 7th edition, Wiley, New York, 2013.
3. D. Floreano and C. Mattiussi, "*Bio-Inspired Artificial Intelligence: Theories, Methods and Technologies*", 1st Edition, MIT Press, 2008.



National Institute of Technology Meghalaya
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CURRICULUM

Programme	Bachelor of Technology in Mechanical Engineering	Year of Regulation	2024-25
Department	Mechanical Engineering	Semester	I

Course Code	Course Name	Pre-Requisite	Credit Structure				Marks Distribution							
			L	T	P	C	INT	MID	END	Total				
ME101	Engineering Mechanics	----	3	1	0	4	50	50	100	200				
Course Objectives This course describes the different laws of forces associated with different engineering elements. This course introduces the use of force, moments and MOs in various conditions. This course illustrates the use of subject knowledge in the fields of engineering. This course introduces the states of engineering elements and structures under various loading conditions. This course explains how to solve the practical problems of mechanics to determine the static forces with their magnitudes and directions.	Course Outcomes ME101.1 ME101.2 ME101.3 ME101.4 ME101.5	COs	Statement				Bloom's Taxonomy							
		Able to understand vector mechanics and classify the different laws of forces associated with engineering systems	Knowledge Identification											
		Able to i) Illustrate the use of force and moments in various working conditions (Understanding). ii) understand the centre of gravity, centroid, centre of mass and details of MOs.	Knowledge Identification and Application											
		Able to identify the equilibrium conditions of engineering structures (truss, beams, frames) under various loads.	Knowledge Identification and Analyse											
		Able to solve the basics of friction and its associated laws along with the related problems.	Knowledge Identification and Analyse											
		Able to understand the kinematics of particles and Rigid Bodies and principle of work along with the related problems.	Knowledge Identification and Analyse											
COs	Mapping with Program Outcomes (POs)											Mapping with PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
ME 101.1	3	2	2	2								2	3	2
ME 101.2	3	2	2	2								2	3	2
ME 101.3	3	2	2	2								2	2	2
ME 101.4	3	2	1	1								2	2	2
ME 101.5	3	2	1	2								2	2	2
ME 101	3	2	1.6	1.8								2	2.4	2

SYLLABUS

No.	Content	Hours	COs
I	Vector Mechanics with applications: Definition and representation of vectors, projection and decomposition, force vector and types, dot product, resolving force vector along and perpendicular to a given direction, cross product and scalar triple product	06	ME101.1
II	Compositions of two force system, Resolution of forces, General method of composition of forces, Equilibrium of bodies, Free body diagram. Lami's theorem, Equilibrium of connected bodies	06	ME101.1
III	Moment of force, Varignon's theorem, Couple, Resolution of a force into a force and couple, Resultant of non-concurrent force system, Equilibrium of non-concurrent system of forces.	06	ME101.2
IV	Center of gravity, Centroid, Use of axis of symmetry, Centroid of a composite section, Center of gravity of a flat plate, Difference between center of gravity and centroid, Determination of centroid from first principle.	06	ME101.1 ME101.2 ME101.3
V	Moment of inertia, Radius of gyration, Polar moment of inertia, Moment of inertia from first principles, Theorems of moment of inertia, Moment of inertia of composite sections, Moment of inertia of standard sections	06	ME101.3
VI	Frames, Truss, Assumptions in analysis of frame and Truss, Nature of forces, Methods of analysis, Method of joints, Method of sections	06	ME101.3
VII	Laws of friction, Angle of friction, angle of repose, cone of friction, Wedges, Problems involving non-concurrent force system, Rope/belt friction, pulleys, screw-jack, rolling resistance	05	ME101.1 ME101.2 ME101.4
VIII	Types of supports, Types of beam, Types of loading, finding reactions at support, shear force and bending moment, axial force and twisting moment, Concept of Stress and Strain – Stress strain, diagram, factor of safety, uniaxial loading, single and double shear, applications. Generalized Hooke's law - Poisson's ratio, Generalized Hooke's law, Relations between E, G and K	06	ME101.2 ME101.4
IX	Kinematics of Particles and Rigid Bodies: rectilinear motion, curvilinear motion, velocity and acceleration in cylindrical and path coordinate system, relative and constrained motion, rate of change of a vector in a rotating frame, three-dimensional motion of a particle relative to a rotating frame, rigid body kinematics.	05	ME101.1
X	Work, Work done by varying force, Energy, Power, Work energy equation for translation, Motion of connected bodies, work done by spring	04	ME101.1
Total Hours		56	

Essential Readings

- F.P. Bear, E. R. Johnston, Vector Mechanics for Engineers, Tata McGraw Hill, 12th Edition 2019,
- S. Timoshenko, D.H., Young, JV Rao, S. Pati, Engineering Mechanics, McGraw Hill Education, 5th Edition, 2017

Supplementary Readings

- H. J. Shah, S. B. Junarkar, Applied Mechanics, Charotar Publication, 19th Edition 2015
- S. S. Bhavikatti, K. G. Rajashekarappa, Engineering Mechanics, Wiley Eastern Ltd., 2018
- R. C. Hibbeler, Engineering Mechanics –Statics & Dynamics, Macmillan Publication Co., 11th Edition, 2006



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CURRICULUM

Programme		Bachelor of Technology in Computer Science and Engineering						Year of Regulation				2024-25			
Department		Computer Science and Engineering						Semester				I			
Course Code	Course Name	Pre-Requisite	Credit Structure				Marks Distribution								
			L	T	P	C	INT	MID	END	Total					
CS101	Computer and Coding		3	0	0	3	50	50	100	200					
Course Objectives	Course Outcomes		CO's	Statement								Bloom's Taxonomy			
	To introduce the basic architecture of a computer, the concept of algorithm, the basic concepts and terminology of programming in general and concept of functional hierarchical code organization.		CS101.1	Able to explain the basic architecture of a computer, the concept of algorithm, and the basic concepts and terminology of programming in general.								Understand			
	To inculcate the ability to do algorithmic thinking to analyse real-world problems and develop algorithms to solve those.		CS101.2	Able to develop the ability to do algorithmic thinking to analyse a problem and develop an algorithm to solve it.								Create			
	To introduce programming using C language and writing programs in C on a computer, and edit, compile, debug, correct, recompile and run those.		CS101.3	Able to apply the C programming language to implement various algorithms.								Apply			
	To train the students in choosing right data representation formats based on a problem specification.		CS101.4	Able to choose the right data representation formats based on the requirements of the problem.								Apply			
			CS101.5	Able to develop programs on a computer, edit, compile, debug, correct, recompile and run those.								Create			
		CS101.6	Able to understand the concept of functional hierarchical code organization.								Understand				
COs	Mapping with Program Outcomes (POs)												Mapping with PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CS101.1	3		1		1					1	1	1			
CS101.2	2	3	3	2	1	1			1				1	1	1
CS101.3	3	3	3	2	1				1					1	1
CS101.4	3	1	1	2										2	3
CS101.5	3		3	1	3				1					1	1
CS101.6	3	2	2	2					2						1
CS101	2.83	2.25	2.17	1.80	1.50	1.00			1.25	1.00	1.00	1.00	1.00	1.25	1.40

SYLLABUS

No.	Content	Hours	COs
I	<p style="text-align: center;">Introduction</p> <p>Organization of a Computer: Von Neumann architecture; CPU; Memory; RAM; ROM; Hardware; Software; Application Programs; System Programs; Operating Systems; Number Systems. Concept of Programming and Programming Languages: Machine Language; Assembly Language; High-Level Programming language; Compiler; Assembler; Interpreter; Linker; Loader; Compiling a C program in command line and in an IDE Concept of Algorithm, Flowchart, Pseudo code, Illustrative Problem Solving Examples.</p>	5	CS101.1 CS101.2
II	<p>Introduction to C programming language Features of a Programming Language: Character Set; Constants; Escape Sequences; Identifiers; Keywords; Data Types; Data Type Qualifiers; Variables; Declarations; enum; typedef; Operators & Expressions - Binary operators :- Arithmetic Operators, Logical Operators, Relational Operators, Bitwise Operators; Assignment Operator; Shorthand Assignment Operators; Unary Operators; Ternary Operators; Special Operators; sizeof(); Operator Precedence and Associativity in expressions; Data type conversion: coercion (implicit type conversion), type casting (explicit type conversion); Statements: Assignment statements, Input/ Output statements for standard input/ output devices.</p> <p>Flow Control - Conditionals and Branching:- Simple if Statement, if-else Statement, Nested if-else Statement, Ladder structure of if-else, switch-case statement, goto statement;</p> <p>Iteration - while Statement, do-while Statement, for Statement, break and continue.</p> <p>Functions; Function Types - standard library functions, user defined functions; syntax of functions; Arguments and Parameters; Call by Value; Call by Reference; parameterized main function; Storage Classes - auto, register, static, extern; Scope Rule: Variable scope - local, global; Recursion.</p> <p>Arrays - Single Dimensional Arrays, Multi-Dimensional Arrays, Introduction to strings :- Definition of a string, character arrays and strings, pointers and strings, standard library string functions, arrays of strings; Pointers - different types of pointers, pointer arithmetic, pointers and arrays.</p> <p>Structures - creating structures using struct, Arrays in Structures, Array of Structures, Difference between arrays and structures; Unions - creating structures using union, difference between structures and unions.</p> <p>Preprocessor directives and Files - Preprocessor directives :- File inclusion by macro, macros, macros and functions; Basic Input/ Output operations on Files :- Text files and binary files, file opening modes, opening, closing, reading, writing and appending to a file. (A programming language like C/ C++ shall be used as a basis language. The same language is to be used for the laboratory).</p>	23	CS101.3 CS101.4 CS101.5 CS101.6
Total Hours		28	

Essential Readings

- E. Balagurusamy, "Programming in ANSI C", McGraw-Hill Education, 8th edition, 2019.
- V. Rajaraman, "Fundamentals of Computers", PHI Learning, 6th revised edition, 2014.

3. Yashavant Kanetkar, "Let Us C", BPB Publications, 19th edition, 2022.

Supplementary Readings

1. Byron S. Gottfried, "Programming with C", McGraw-Hill Education, 4th edition, 2018.

2. Brian W. Kernighan, Dennis M. Ritchie, "The C Programming Language: ANSI C Version", Pearson Education India, 2nd edition, 2015.

3. Darrel L. Graham, "C Programming Language", Createspace Independent Publishing, 1st edition, 2016.



National Institute of Technology Meghalaya

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CURRICULUM

Programme	Bachelor of Technology in Computer Science and Engineering	Year of Regulation	2024-25
Department	Computer Science and Engineering	Semester	I

Course Code	Course Name	Pre-Requisite	Credit Structure				Marks Distribution		
			L	T	P	C	Continuous Evaluation	Quiz/ Viva	Total

CS151	Computer & Coding Lab		0	0	2	1	70	30	100
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		CO's	Statement	Bloom's Taxonomy
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Course Objectives	To introduce programming using C language and to write programs in C on a computer, and to edit, compile, debug, correct, recompile and run those.	Course Outcomes	CS151.1	Able to explain the basic concepts and terminology of programming in general.	Understand)
	To inculcate the ability to do algorithmic thinking to analyse real-world problems and develop algorithms to solve those.		CS151.2	Able to do algorithmic thinking to analyse a problem and develop an algorithm to solve it.	Create
	To train the students in choosing right data representation formats based on a problem specification.		CS151.3	Able to use the C programming language to implement various algorithms.	Apply
			CS151.4	Able to choose the right data representation formats based on the requirements of the problem.	Apply
			CS151.5	Able to develop programs on a computer, edit, compile, debug, correct, recompile and run those.	Create
			CS151.6	Able to understand the concept of functional hierarchical code organization.	Understand

COs	Mapping with Program Outcomes (POs)												Mapping with PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CS151.1	3		1		1					1	1	1			
CS151.2	2	3	3	2	1	1			1					1	
CS151.3	3	3	3	2	1				1					3	
CS151.4	3	2	1	2										1	
CS151.5	3		3	2	3	1			1					2	
CS151.6	3	2	2	2					2					1	
CS151	2.83	2.50	2.17	2.00	1.50	1.00			1.25	1	1	1		1.60	

SYLLABUS

No.	Content	Hours	COs
I	1. C program to print the paragraph as shown below: " Hello World " % Hello World % \\ Hello World \\ 2. C program to print the result of the following arithmetic expression where a=4, b= 5. $\frac{5a + ab^2}{\sqrt{a^2+9}}$	02	CS101.1 CS101.2 CS101.3 CS101.4 CS101.5 CS101.6
II	3. C program to check a given number is odd or even and positive or negative. 4. C program to read three numbers and find the greatest one.	02	
III	5. C program to read five numbers and find the second smallest number. 6. C program to find GCD and LCM of two numbers.	02	
IV	7. C program to store ten numbers in an array and find the largest and smallest. 8. C program to store N numbers in an array and count the total positive, negative, odd and even numbers [0 < N < 11].	02	
V	9. C program to check whether a given number is prime or not. 10. C program to print first N numbers of Fibonacci series.	02	
VI	11. C program to find a key from n numbers using sequential search (Linear search), and if found, show the position. 12. Implementation of an algorithm to insert an element at any arbitrary position in an array of integer numbers and also the implementation of an algorithm to display the condition of the array before and after insertion.	04	
VII	13. Implementation of an algorithm to delete an element in an array of integer numbers and also the implementation of an algorithm to display the condition of the array before and after deletion. 14. Implementation of an algorithm to reverse the elements of an array of integer numbers and also the implementation of an algorithm to display the condition of the array before and after reversal.	04	
VIII	15. C program to solve Tower of Hanoi problem for n disks. 16. C program to generate n Fibonacci numbers using both recursive and non-recursive methods.	04	
IX	17. C program to implement a swap function to swap the values of two variables. 18. C program to store the name, roll number, marks and grades of 5 students using array of structure.	04	
X	19. C program to create a file named "StudentDatabase" and storing the name, roll number, phone number and average marks of N students, where N is a natural number between 2 to 10.	02	
Total Hours		28	

Essential Readings

- E. Balagurusamy, "Programming in ANSI C", McGraw-Hill Education, 8th edition, 2019.

2. V. Rajaraman, "Fundamentals of Computers", PHI Learning, 6th revised edition, 2014.

3. Yashavant Kanetkar, "Let Us C", BPB Publications, 19th edition, 2022.

Supplementary Readings

1. Byron S. Gottfried, "Programming with C", McGraw-Hill Education, 4th edition, 2018.

2. Brian W. Kernighan, Dennis M. Ritchie, "The C Programming Language: ANSI C Version", Pearson Education India, 2nd edition, 2015.

3. Darrel L. Graham, "C Programming Language", Createspace Independent Publishing, 1st edition, 2016.

		National Institute of Technology Meghalaya An Institute of National Importance										CURRICULUM			
Programme		Bachelor of Technology in Civil Engineering								Year of Regulation			2024-25		
Department		Civil Engineering								Semester			I		
Course Code	Course Name	Pre-Requisite	Credit Structure				Marks Distribution								
			L	T	P	C	INT	MID	END	Total					
CE 101	Engineering Graphics	----	0	1	3	2	50	50	100	200					
			CO's		Statement						Bloom's Taxonomy				
Course Objectives	<ul style="list-style-type: none"> To develop the student's ability to understand the role and importance of technical drawings in engineering drawing process, and application of BIS and ISO conventions. To develop the student's ability to understand the proper representation and practice of Lines, Lettering, and dimensioning. To develop student's ability to understand the importance of types of scales. To develop the student's ability to construct plane geometry. To develop the student's ability to understand the concepts of projection and their application in technical drawing. To develop the student's ability to apply projection technique to draw Multi-view, pictorial view (Isometric View) drawings. To develop the student's ability to understand development process of surfaces of various objects. 	Course Outcomes	CE101.1	Able to acquire knowledge about BIS conventions and it's application to draw letters, lines and dimensions.						Knowledge Application					
			CE101.2	Able to acquire knowledge about developing various types of scales associated with engineering drawing and it's application.						Knowledge Application					
			CE101.3	Able to acquire knowledge about constructing points, lines, curves, polygons, planes, solids etc. and it's application.						Knowledge Application					
			CE101.4	Able to acquire knowledge about the system of projection with respect to the observer, object, the reference planes and it's application.						Knowledge Application					
			CE101.5	Able to acquire knowledge about creating orthographic, isometric, multi-view drawing, and sectional views of objects and it's application.						Knowledge Application					
			CE101.6	Able to acquire knowledge about the development process of surfaces of various objects and it's application.						Knowledge Application					
COs	Mapping with Program Outcomes (POs)											Mapping with PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CE101.1	2	2	2		2				1	3		1	3		
CE101.2	2	2	2		2				1	3		1	3		
CE101.3	2	2	2		2				1	3		1	3		
CE101.4	2	2	2		2				1	3		1	3		
CE101.5	2	2	2		2				1	3		1	3		
CE101.6	2	2	2		2				1	3		1	3		
CE101	2	2	2		2				1	3		1	3		
SYLLABUS															
No.	Content											Hours	COs		
I	Introduction: Importance of Engineering Drawing, drawing Instruments and materials, B.I.S. and ISO conventions, Lines, Lettering, and Dimensioning											02	CE101.1		
II	Scales: Construction of scales – plane scale, diagonal scale, Vernier scale, functional scale; concept of conversion scale and nomogram											02	CE101.2		
III	Plane Geometry: Geometrical Construction: line, arc, and angle, divisions of straight line and circumference, construction of polygon											02	CE101.3		
IV	Conic Sections and other Curves: Construction of Ellipse, Parabola, Hyperbola, Rectangular Hyperbola, Cycloidal Curves: Cycloid, Involute											02	CE101.3		
V	Projection: Principle of Projection and Orthographic Projection, Projection of points and lines, Projection of Planes.											03	CE101.4		
VI	Solid Geometry: Types of Solids: polyhedral, prisms, pyramids, cylinder, cone, sphere, auxiliary projection method, Orthographic projection of solids: one view, two view and three view drawings, Missing view, rules for selection of views.											03	CE101.4		
VII	Sectional view, section plane perpendicular to the HP & VP and other Various positions, true shape of sections.											03	CE101.4		

VIII	Classification, line of intersection, line/generator method and section plane method: intersection of two prisms, two cylinders, intersection of cone and cylinder	03	CE101.4
IX	Terminology, isometric scale, isometric view and isometric projection, isometric axes, and lines, missing view	02	CE101.5
X	Method of development, parallel line development, radial line development, developments of cylinder, cone, prism, pyramid, true length of edges – oblique surface.	02	CE101.6
XI	Introduction to CAD software	04	All COs
Total Hours		28	

Essential Readings

1. N.D. Bhatt, Engineering Drawing, Chrotar Publishing House, 2011.
2. Dhananjay A Jolhe, Engineering drawing, TMH, 2008
3. M.B. Shah and B.C. Rana, Engineering Drawing, Pearson, 2009.

Supplementary Readings

1. T E French, C J Vierck and R J Foster, Graphic Science and Design, 4th edition, McGraw Hill, 1984
2. W J Luzadder and J M Duff, Fundamentals of Engineering Drawing, 11th edition, Prentice-Hall of India, 1995.
3. K Venugopal, Engineering Drawing and Graphics, 3rd edition, New Age International, 1998.
4. Gary R. Bertoline, Eric N. Wiebe, Nathan W. Hartman, William A. Ross, Technical graphics Communication, 4th Edition, McGraw Hill Higher Education, 2009
5. Frederick E. Giesecke, Shawna Lockhart, Marla Goodman, Cindy M. Johnson Technical Drawing With Engineering Graphics, 15th Edition, Prentice Hall, 2016
6. SP 46: 2003, Engineering Drawing Practice for schools and colleges.



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CURRICULUM

Programme	Bachelor of Technology							Year of Implementation				2024-25			
Department	Humanities and Social Sciences							Semester				I			
Course Code	Course Name						Pre-Requisite	Credit Structure				Marks Distribution			
								L	T	P	C	Continuous Assessment		Total	
HS151	Communication Skills						Nil	0	1	2	2	01 Experiment X 10		100	
Course Objectives	To introduce the basic concepts of communication To improve English communication skills of students which are essential to succeed in today's business environment. To improve oratory skills and body language To develop the ability to critically analyze topics and contexts independently or in groups						Course Outcomes	COs		Statement				Bloom's Taxonomy	
								HS151.1	Describe and apply the skill of listening in Communicative English				Apply		
								HS151.2	Demonstrate good reading skills in English				Apply		
								HS151.3	Demonstrate good writing skills in English				Apply		
HS151.4	Demonstrate good oratory skills in English				Apply										
Mapping with Program Outcomes (POs)															
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
HS151.1	-	-	-	-	-	-	-	-	1	3	-	3			
HS151.2	-	-	-	-	-	-	-	-	1	3	-	3			
HS151.3	-	-	-	-	-	-	-	-	1	3	-	3			
HS151.4	-	-	-	-	-	-	-	-	1	3	-	3			
HS151	-	-	-	-	-	-	-	-	1.0	3.0	-	3.0			
SYLLABUS															
No.	Activities/Experiments											Hours		COs	
I	Short speeches or other audio files: Listening; Conversing with the teacher or other students; Writing a summary; Speaking and recording of important points											6		HS151.1	
II	Short movies or other video files: Watching; Conversing with the teacher or other students; Writing a summary; Speaking and recording of important points											6		HS151.1	
III	Unseen comprehension: Reading passages or essays; Conversing with the teacher or other students; Writing a summary or answering questions											6		HS151.2	
IV	Written composition: Writing paragraphs and argumentative and narrative essays; Letter writing—official, personal, job application; Notice writing; Reports											12		HS151.3	
V	Oratory: Greetings & introductions; Extempore; Debate; Group discussion; Individual/group seminar presentations; Vocabulary building; Taking and giving interviews; pronunciation skills exercises											12		HS151.4	
Total Hours											42				
Essential Readings															
1. C. Muralikrishna and Sunita Mishra, <i>Communication Skills for Engineers</i> , Pearson, 2 nd Edition, 2011.															
2. Nitin Bhatnagar and Mamta Bhatnagar, <i>Communicative English for Engineers and Professionals</i> , Pearson, 2010.															
Supplementary Readings															
1. J. K. Gangal, <i>A Practical Course for Developing Writing Skills in English</i> , PHI, 2011.															
2. John Seely, <i>Oxford Guide to Effective Writing and Speaking</i> , Oxford University Press, 3 rd Edition, 2013.															
3. Sanjay Kumar and Pushp Lata, <i>Communication Skills</i> , Oxford University Press, 2 nd Edition, 2015.															

Second Semester Courses

		National Institute of Technology Meghalaya An Institute of National Importance										CURRICULUM			
Programme		Bachelor of Technology								Year of Regulation			2024-25		
Department		Mathematics								Semester			II		
Course Code	Course Name	Pre-requisite	Credit Structure				Marks Distribution				Total	Bloom's Taxonomy			
			L	T	P	C	INT	MID	END						
MA 102	Engineering Mathematics-II	NIL	3	1	0	4	50	50	100	200					
			CO's	Statement								200	Understand		
Course Objectives	1. To introduce the fundamental concepts of various engineering mathematics tools involving integral transforms, differential equations and complex variables.	Course Outcomes	MA102.1	Able to describe the basic concepts of Fourier series, Fourier transform, Laplace transform and their applications.								Understand			
			MA102.2	Able to solve ordinary differential equations analytically and implement the ODEs to model real world problems.								Apply			
	MA102.3		Able to compare second order PDEs and solve Laplace, heat and wave equations using Fourier series.								Analyze Apply				
	MA102.4		Able to recognize analytic functions, solve contour integrals and determine the Taylor and Laurent series expansions.								Understand Apply				
	MA102.5		Able to use the basic knowledge of engineering Mathematics in solving real-world problems .								Apply				
	MA102.6		Able to apply Gauss' divergence theorem, Stokes' theorem and Green's theorem to evaluate double and triple integrals								Apply				
COs	Mapping with Program Outcomes (POs)												Mapping with PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
MA102.1	3														
MA102.2	3														
MA102.3	3														
MA102.4	3														
MA102.5	3														
MA102.6	3														
MA102	3														
SYLLABUS															
No.	Content												Hours	COs	
I	Integral Transforms: Fourier series of a function with arbitrary period, Fourier series of even and odd functions, half-range Fourier series, Fourier Transform: Fourier integral theorem, Fourier sine and cosine integrals, complex form of Fourier integral, Fourier transform of derivative of a function, applications of Fourier transform in boundary value problems; Laplace Transform: Laplace transform of a function, existence theorem, Laplace transform of derivatives and integrals, inverse Laplace transform, convolution theorem.												13	MA102.1 MA102.5	
II	Ordinary Differential Equations: First order ordinary differential equations: exact, integrating factors, linear and Bernoulli's equations, Higher order differential equations with constant coefficients, Cauchy-Euler equations, method of variation of parameters, system of differential equations. Use of Laplace and Fourier transform in solving ordinary differential equations.												12	MA102.2 MA102.5	
III	Partial Differential Equations: First order partial differential equation: linear, semi-linear, quasi-linear, and non-linear types. Classification of integrals. Lagrange's method of solution and its geometrical interpretation, compatibility condition, Charpit's method, special types of first order equations. Method of separation of variables to solve Wave equation, Laplace equation, Heat equation. Use of Laplace and Fourier transform in solving partial differential equations.												13	MA102.2 MA102.5	
IV	Complex Analysis: Basic concept of complex numbers, limits, continuity and differentiability of a complex valued function of a complex variable, analytic functions, Cauchy-Riemann Equations, harmonic functions, complex exponential, trigonometric, hyperbolic and logarithmic functions, line integral in complex plane, Cauchy's Integral Theorem, Cauchy's Integral Formula, Taylor and Laurent series, singularities.												12	MA102.4 MA102.5	
V	Vector Calculus: Gradient, divergence, curl; Green's theorem; Gauss' divergence theorem; Stokes' theorem.												06	MA102.6	
Total Hours (5 Modules)												56			
Essential Readings															
1. E. Kreyszig, "Advanced Engineering Mathematics", John Wiley & Sons, 10 th edition 2023.															
2. R. K. Jain and S. R. K. Iyengar, "Advanced Engineering Mathematics", Narosa Publishing House, 5 th edition, 2019.															

Supplementary Readings

1. P. Dyke, "An Introduction to Laplace Transforms and Fourier Series", Springer Nature; 2nd edition, 2014.
2. Shepley L. Ross, "Differential Equations", John Wiley & Sons, Inc, 3rd edition 2007.
3. S. J. Farlow, "Partial Differential Equations for Scientist and Engineers", Dover Publications, 2003.
4. J. W. Brown and R. V. Churchill, "Complex Variables and Applications", McGraw Hill; 9th edition, 2021.



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CURRICULUM

Programme	Bachelor of Technology (All Branches)							Year of Regulation	2024-25						
Department	Chemical and Biological Sciences							Semester	I/II						
Course Code	Course Name	Pre requisite	Credit Structure				Marks Distribution								
			L	T	P	C	INT	MID	END	Total					
CB 101	Engineering Chemistry	NIL	3	0	0	3	50	50	100	200					
Course Objectives	To introduce the students to the concept, classifications, and industrial applications of polymers	NIL	CO's		Statement				Bloom's Taxonomy						
			CB101.1	The students will be apply the knowledge about polymers, polymerization processes, and their industrial applications.				Apply							
			CB101.2	Able to describe different types of fuels and their analysis, petroleum technology				Understand							
			CB101.3	Able to explain the process of metal extraction from ores and discuss the properties of alloys and composition				Analyze							
	CB101.4	Able to analyze the properties of different materials and apply the knowledge of nanotechnology for various practical applications.				Analyze									
COs	Mapping with Program Outcomes (POs)												Mapping with PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CB101.1	2	2	3	-	-	-	-	-	-	-	-	-	-	-	-
CB101.2	2	2	3	-	-	-	-	-	-	-	-	-	-	-	-
CB101.3	2	2	3	-	-	-	-	-	-	-	-	-	-	-	-
CB101.4	2	2	3	-	-	-	-	-	-	-	-	-	-	-	-
CB101	2	2	3												

SYLLABUS

No.	Content	Hours	COs
I	Polymer Chemistry: Concepts, classification, structures, and molecular weights of polymers, mechanism and kinetics of various polymerization processes, natural rubber and its properties, vulcanization of rubber, synthesis and applications of various industrial polymers, adhesives, paints, conducting polymers and their applications in electronic devices, biodegradable polymers.	10	CB101.1
II	Petroleum Chemistry: Composition, characteristics of crude oil, cracking. Solid, liquid and gaseous fuels, coal analysis; classification of coal; anti-knocking agents, octane number and cetane number, aviation fuel and biofuels, lubricants.	08	CB101.2
III	Metallurgy: Minerals, ores, and general methods of extraction and purification of metals (Fe, Al, Cu, Zn). Alloys: Definition of alloy, types of alloys (ferro, non-ferro & amalgam), composition, properties, and uses of brass, bronze, and steel.	08	CB101.3
IV	Material Chemistry: Introduction and properties of glass, ceramics and their composites, magnetic materials, and smart materials. Piezoceramic materials, electro-active materials, shape-memory materials, energy harvesting materials, self-healing materials, semiconducting materials, and liquid crystals. Nanomaterials Introduction, classification, properties of nanomaterials, carbon-based nanomaterials, synthesis of nanomaterials, top-down and bottom-up approaches, characterization of nanomaterials, applications of nanomaterials - materials for light emitting diodes, batteries, and fuel cells, memory devices and sensors, nanotechnology for pharmaceutical applications, nanomaterials for tissue engineering, carbon nanotubes and nanocomposites in textiles.	16	CB101.4
Total Hours		42	

Essential Readings

1. P. C. Jain and M. Jain, "Engineering Chemistry", 17th Edition", Dhanpat Rai Publication Co., 2019.
2. S. Chawla, "A Text Book of Engineering Chemistry", 1st Edition, Dhanpat Rai & Co. (P) Limited, 2017

Supplementary Readings

1. M. G. Fontana, "Corrosion Engineering", Third Edition, McGraw-Hill Book Company, 2017
2. R. Gopalan, D. Venkappayya, S. Nagarajan, "A textbook of Engineering Chemistry" 4th Edition, Vikas Publishing House Pvt. Ltd.
3. S. Agarwal, "Engineering Chemistry: Fundamentals and Applications", 2nd edition, Cambridge University Press, 2019



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CURRICULUM

Programme	Bachelor of Technology (All branches)	Year of Regulation	2024-2025
Department	Chemical and Biological Sciences	Semester	I/II

Course Code	Course Name	Credit Structure				Marks Distribution		
		L	T	P	C	Continuous Evaluation	Total	
CB 151	Chemistry Laboratory	0	0	2	1	01 Expt.	10	100

Course Objectives	Course Outcomes	COs	Statement	Bloom's Taxonomy
To provide the students with knowledge of various titration-based techniques for chemical analysis.	Course Outcomes	CB151.1	Able to explain the concepts of acid-base, redox, potentiometric and pH metric titration for quantitative analysis	Understand
To teach the fundamentals of basic chemistry-related aspects for practical applications and sample analysis.		CB151.2	Able to prepare standard solutions for various quantitative analysis	Apply
To develop the student's ability to use different instrumental methods for chemical analysis and testing of various samples.		CB151.3	Able to analyze water sample, alloy samples by complexometric iodometric and spectrophotometric analysis	Analyse
		CB151.4	Able to apply the concepts of partition coefficient, viscosity in analysis	Apply

No.	COs	Mapping with Program Outcomes (POs)												Mapping with PSOs		
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	CB151.1	2	2	-	-	-	-	-	-	-	-	-	-	-	-	-
2	CB151.2	2	2	-	-	-	-	-	-	-	-	-	-	-	-	-
3	CB151.3	2	2	-	-	-	-	-	-	-	-	-	-	-	-	-
4	CB151.4	2	2													
	CB151	2	2													

SYLLABUS

No.	Content	Hours	COs
1	To determine the alkalinity of a given water sample	2	CB151.1 CH151.2
2	Estimation of Fe(II) in Mohr's salt solution using standard KMnO ₄ solution via Redox titration	2	CB151.1 CB151.2
3	Conductometric titration of an unknown acid solution using a standard base solution	2	CB151.1 CB151.2
4	pH-metric titration of an unknown acid solution using a standard base solution	2	CB151.1 CB151.2
5	Complexometric determination of hardness of water	2	CB151.3
6	Iodometric determination of copper in brass alloy	2	CB151.3
7	Spectrophotometry on copper sulphate solution	2	CB151.3
8	Determination of partition coefficient of acetic acid between <i>n</i> -butanol and water	2	CB151.4
9	Determination of percentage composition of sugar solution from viscosity	2	CB151.4
10	Estimation of Fe(II) in a solution using standard K ₂ Cr ₂ O ₇ solution via potentiometric titration	2	CB151.1
Total Hours		20	

Essential Readings

1. J. Mendham, R. Denney, J. Barnes, M. Thomas, "Vogel's Quantitative Chemical Analysis", 6th Edition, Pearson.

Supplementary Readings

1. V. D. Athawale, P. Mathur, "Experimental Physical Chemistry", 1st Edition, New Age International (P) Limited Publishers, 2001.
2. Departmental laboratory manual



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CURRICULUM

Programme	Bachelor of Technology (All branches)	Year of Regulation	2024-2025
Department	Chemical and Biological Sciences	Semester	II

Course Code	Course Name	Credit Structure				Marks Distribution			
		L	T	P	C	INT	MID	END	Total

CB 102	Environmental Science	2	0	0	2	50	50	100	200
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Course Objectives	Course Outcomes	COs		Bloom's taxonomy
		COs		
To introduce students to natural resources and the impact of various human activities on natural resources and the environment.	Course Outcomes	CB102.1	The students will be able to discuss various types of natural resources, their proper utilization, and conservation for maintaining ecological balance.	Understand
To provide basic knowledge about the environment and its related socio-economic problems, environment protection, and environment improvement programs.		CB102.2	Able to analyze the impacts of various types of pollutants on the environment and provide a proper scientific and technical solutions to control them.	Analyze
To study the causes and effects of air, and water pollution and the techniques for monitoring air and water quality in the environment.		CB102.3	Able to apply different techniques to manage solid wastes and recovery of useful materials from wastes.	Apply
To provide basic knowledge and overview of solid waste management and its impact on human health and surrounding environments.		CB102.4	Able to understand the features of renewable energy resources and their importance for sustainable development.	Understand

No.	COs	Mapping with Program Outcomes (POs)												Mapping with PSOs		
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	CB102.1	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-
2	CB102.2	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-
3	CB102.3	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-
4	CB102.4	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-
	CB102							2								

SYLLABUS

No.	Content	Hours	COs
I	Natural resources: Scope and importance, concept of sustainability and sustainable development. Land resources- Land degradation, soil erosion and desertification. Deforestation; impacts due to mining, dam building on environment, forests, biodiversity and tribal populations. Water- Surface and ground water, floods, droughts, population growth, and associated problems.	05	CB102.1 CB102.2
II	Human communities and the Environment: Demography, population, population explosion and population control, family welfare programs, resettlement and rehabilitation of affected persons, case studies. Disaster management- flood, earthquake, cyclones and landslides. Environmental movements – Chipko, Silent valley and Bishnois of Rajasthan. Environmental ethics, environmental conservations, public awareness. Environmental Protection Acts.	04	CB102.1
III	Air pollution: Source and effect of pollutants, primary and secondary pollutants, control measures. Acid rain and its impacts. Green-house effects and their impact on global climate change. Depletion of the ozone layer and its effects. Air pollution monitoring techniques. Water pollution: Natural water, pollutants- their origin and effects, oxygen demanding wastes, pathogens, nutrients, salts, heavy metals, pesticides, volatile organic compounds. River/ lake/ ground water pollution. Water pollution monitoring techniques	08	CB102.2
IV	Solid Waste Management: Municipal, industrial, commercial, agricultural, hazardous solid wastes, recovery and conversion method of waste and waste management, land filling/disposal, incineration, composting. Environment management and sustainability tools (material management and recovery planning) for sustainable management including ISO, RIOS & R2 certifications, environment audit. E-waste- composition and generation, global context in e- waste, effects of pollutant (E- waste) on human health and surrounding environment, e-waste control measures, steps in recycling and recovery of materials from e-waste.	07	CB102.3
V	Energy Resources: Renewable and non-renewable energy sources, use of alternate energy sources [solar energy, hydro (tidal) energy, wind energy, geothermal, biomass, nuclear energy].	04	CB102.4
Total Hours		28	

Essential Readings

1. A. Basak, "Environmental Studies", 2nd Edition, Pearson, 2015.
2. D. Dave and S.S. Katewa, "Text Book of Environmental Studies", Cenage Learning, 2nd Edition, 2012.

Supplementary Readings

1. R. Daniels and J. Khirshnaswamy, "Environmental Studies", 1st Edition, Wiley, 2009.
2. A. Khan, Inamuddin, A. M. Asiri "E-waste Recycling and Management", Springer Nature Switzerland AG, 2020



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CURRICULUM

Programme		Bachelor of Technology in Electronics Engineering					Year of Regulation					2024-25			
Department		Electrical Engineering & Electronics and Communication Engineering					Semester					II			
Course Code	Course Name	Pre-Requisite	Credit Structure				Marks Distribution								
			L	T	P	C	INT	MID	END	Total					
EE102	Basic Electrical & Electronics Engineering	No	3	0	0	3	50	50	100	200					
Course Objectives	To understand basic circuit theorems and laws To develop the skills to analyze the basic DC/AC system To introduce the principle of semiconductor physics To understand the concept of diode and its applications To understand the fundamentals of Bipolar Junction Transistors	Course Outcomes	CO's		Statement				Bloom's Taxonomy						
			EE102.1	Acquire knowledge of circuit theorems, understand and apply circuit theorems to DC circuits				Knowledge Application							
			EE102.2	Understand the laws of electricity and magnetism and apply them in simple circuits				Knowledge Synthesis							
			EE102.3	Analyze single phase AC circuits for voltage and circuit and calculate complex power				Comprehension Application							
			EE102.4	Able to acquire knowledge about the fundamentals of semiconductor physics.				Knowledge Synthesis							
			EE102.5	Able to gather knowledge about diode and its applications.				Knowledge Application							
			EE102.6	Able to understand the Bipolar Junction Transistors				Knowledge Application							
COs	Mapping with Program Outcomes (POs)											Mapping with PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
EE102.1	3	3	1	1	1	2	1					2		2	3
EE102.2	3	2	2	1	1	2	2					2		2	3
EE102.3	3	3	1	2	2	2	1					2		2	3
EE102.4	3	2	2	1	1	1	1					2	2	2	3
EE102.5	3	2	2	1	1	1	1					2	2	2	3
EE102.6	3	2	2	1	1	1	1					2	2	2	3
EE102	3.00	2.33	1.67	1.17	1.17	1.50	1.17					2.00	2.00	2.00	2.40

SYLLABUS

No.	Content	Hours	COs
I	Analysis of DC circuits Mesh, node, branch, Ohm's law, series and parallel circuit, basic devices: resistors, capacitors, inductors, dependent and independent sources, Kirchhoff's Laws, Mesh and Node Analysis, Star-Delta conversion, Superposition theorem, Source conversion, Thevenin theorem, Norton theorem, Maximum power transfer theorem.	07	CO1
II	Electromagnetic Induction & Magnetic Circuit Magnetic field, Right hand rule, Left hand rule, Electromechanical laws, relation between electricity and magnetism, production of emfs (ac & dc), Faraday's law of electromagnetic induction, direction of induced emf, Lenz law, dynamically and statically induced emfs, self-inductances, and mutual inductances, coefficient of coupling, Inductance in series and parallel, energy stored in a magnetic field.	07	CO2
III	A.C Fundamentals and R.L.C circuits Phasors, Complex quantities, Application of complex algebra to A.C circuit, series and parallel RL, RC, RLC circuit, concept of impedance triangle, complex power: active, reactive and apparent power, power triangle, admittance triangle, series parallel circuit. Balanced two phase and three phase systems, Balanced Star-Delta connections, phase and line currents and voltages and their relations, Measurement of three phase power.	07	CO3
IV	Introduction to Semiconductors: Fundamentals of semiconductor, Energy Bandgap, intrinsic and extrinsic semiconductors, Mobility, Conductivity & Resistivity.	05	CO4
V	Diodes & applications: Physical structure and working mechanism of the p-n junction, p-n junction under forward & reverse bias, I/V characteristics, Half wave & full-wave, bridge rectifiers.	08	CO5
VI	Bipolar Junction Transistors: Physical structure and working mechanism of BJT transistors, Input Output characteristics, Regions of operation, Transistor configurations: CB, CE, CC.	08	CO6
Total Hours		42	

Essential Readings

- A. Hussain, Fundamental of Electrical Engineering, Dhanpat Rai & Co. Ltd., 3rd edition, 2007.
- W.H. Hayt, J.E. Kemmerley, Engineering circuit analysis, Int. St. Ed. McGraw Hill, 8th edition 2013

3. D. Chattopadhyay, P.C. Rakshit, Electronics Fundamentals and Applications, New Age International Publisher, 7th Edition 2006

Supplementary Readings

1. A. Chakroborty, S. Nath and C.K. Chanda, "Basic Electrical Engineering", McGraw Hill Education Pvt. Ltd., 1st Edition, 2009.

2. V.N Mittle, Basic Electrical Engineering, Tata McGraw Hill, 2nd edition 2017.

3. A. Malvino, Electronics Principles, Tata McGraw-Hill, 7th Edition, 2017.

4. T.L. Floyd, Electronics Devices, Publisher: Pearson Education, 9th Edition, 2017.

5. https://onlinecourses.nptel.ac.in/noc21_ee55/preview



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CURRICULUM

Programme	Bachelor of Technology in Electrical and Electronics Engineering	Year of Regulation	2024-25
Department	Electrical Engineering & Electronics and Communication Engineering	Semester	II

Course Code	Course Name	Pre-Requisite	Credit Structure				Marks Distribution		
			L	T	P	C	Continuous	Exam	Total
EE152	Basic Electrical and Electronics Engineering Lab	EE	0	0	2	1	70	30	100
			CO's	Statement				Bloom's Taxonomy	

Course Objectives	Course Outcomes	EE152.1	EE152.2	EE152.3	EE152.4	EE152.5	EE152.6	Bloom's Taxonomy		
								Knowledge	Application	Synthesis
To understand basic circuit theorems and laws		Acquire knowledge of circuit theorems, understand and apply circuit theorems to DC circuits						Knowledge	Application	
To develop the skills to analyze the basic DC/AC system		Understand the laws of electricity and magnetism and apply them in simple circuits						Knowledge	Synthesis	
To develop the student's ability to apply the basic principles of electronics in circuit designing		Analyze single phase AC circuits for voltage and circuit and calculate complex power						Comprehension	Application	
To develop the student's ability to design circuits based on diode		Verify the V-I characteristics of the basic diodes						Knowledge	Application	
To develop the student's ability to study characteristics of BJT		Study the operational mechanism of diode circuits as a rectifier						Knowledge	Application	
		Study the characterises of BJT						Knowledge	Application	

COs	Mapping with Program Outcomes (POs)												Mapping with PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
EE102.1	3	3	1	1	1	2	1	0	0	0	0	2	0	2	3	0
EE102.2	3	2	2	1	1	2	2	0	0	0	0	2	0	2	3	0
EE102.3	3	3	1	2	2	2	1	0	0	0	0	2	0	2	3	0
EE102.4	3	2	1	1	1	1	0	0	0	0	0	2	3	2	2	0
EE102.5	3	2	1	1	1	1	0	0	0	0	0	2	3	2	2	0
EE102.6	3	2	1	1	1	1	0	0	0	0	0	2	3	2	2	0
EE102	3.00	2.33	1.67	1.17	1.17	1.50	1.17					2.00	1.00	2.00	2.40	

SYLLABUS

No.	Content	Hours	COs
1	Study and verification of Kirchhoff's Current Law & Kirchhoff's voltage law applied to D.C. circuit.	02	CO1
2	To Study & Verify the Maximum Power Transfer theorem.	02	CO1
3	To find the inductance of the choke coil.	02	CO2
4	To study the R-L-C series circuit.	02	CO3
5	To study three-phase power measurement using The two-wattmeter method.	02	CO3
6	I-V characteristics of forward biased P-N junction Diode.	02	CO4
7	Reverse characteristics of Zener Diode.	02	CO4
8	Half-wave rectifier using diode.	02	CO5
9	Full-wave rectifier using diode.	02	CO5
10	Input & output characteristics of BJT in CE mode.	02	CO6
Total Hours		20	

Essential Readings

1. A. Hussain, Fundamental of Electrical Engineering, Dhanpat Rai & Co. Ltd., 3rd edition, 2007.
2. W.H. Hayt, J.E. Kemmerley, Engineering circuit analysis, Int. St. Ed. McGraw Hill, 8th edition 2013
3. D. Chattopadhyay, P.C. Rakshit, Electronics Fundamentals and Applications, New Age International Publisher, 7th Edition 2006

Supplementary Readings

4. A. Chakroborty, S. Nath and C.K. Chanda, "Basic Electrical Engineering", McGraw Hill Education Pvt. Ltd., 1st Edition, 2009.
5. V.N Mittle, Basic Electrical Engineering, Tata McGraw Hill, 2nd edition 2017.
6. A. Malvino, Electronics Principles, Tata McGraw-Hill, 7th Edition, 2017.
7. T.L. Floyd, Electronics Devices, Publisher: Pearson Education, 9th Edition, 2017.



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CURRICULUM

	National Institute of Technology Meghalaya An Institute of National Importance											CURRICULUM			
Programme	Bachelor of Technology in Mechanical Engineering											Year of Regulation		2024-25	
Department	Mechanical Engineering											Semester		II	
Course Code	Course Name	Pre-Requisites	Credit Structure										Marks Distribution		
			L	T	P	C	Continuous Evaluation	Total							
ME 152	Workshop practice	--	0	0	2	1						100	100		
				CO's		Statement						Bloom's Taxonomy			
Course Objectives	Explain the tools, equipment and safety procedures of carpentry, fitting, welding and foundry shops. (Understanding).	Course Outcomes	ME152.1	Utilize the tools and equipment to perform specified jobs in fitting shop and compare with prescribed dimensions.						Applying					
			ME152.2	Utilize the tools and equipment to perform specified jobs in carpentry shop and compare with prescribed dimensions.						Applying					
			ME152.3	Utilize the tools and equipment to perform specified jobs in welding shop and compare with prescribed dimensions.						Applying					
			ME152.4	Utilize the casting process to develop the prescribed job						Application					
COs	Mapping with Program Outcomes (POs)												Mapping with PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ME152.1	2	1				2			2				2	1	
ME152.2	2	1				2			2				2	1	
ME152.3	2	1				2			2				2	1	
ME152.4	2	1				2			2				2	1	
ME152	2	1				2			2				2	1	
SYLLABUS															
No.	Content												Hours	COs	
I	To perform T-joint with drilling in the centre in the fitting with the use of specific tools												07	ME152.1	
II	To develop cross joint/dovetail joint/ bridle joint in carpentry shop with the use of specific tools												07	ME152.2	
III	To develop T-joint Oxy-acetylene gas welding												07	ME152.3	
IV	To make specific job using casting process												07	ME152.4	
Total Hours												28			
Essential Readings															
1. S.K. Hajra Chaudhary, Elements of Workshop Technology Vol-I and II, Asia Publishing House, 2008															
Supplementary Readings															
1. K.N. Gupta, J. P. Kaushish, Workshop Technology, New Delhi Heights Publications, 1992															
2. H.S. Bava, Workshop Technology, Tata McGraw Hill Publishing Co. Ltd., 2nd Edition, 2009															
3. W.A.J. Chapman, Workshop Technology, ELBS Low Price Text, Edward Donald Pub. Ltd., 5th Edition, 1972															



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CURRICULUM

Programme	Bachelor of Technology					Year of Implementation			2024-25						
Department	Humanities and Social Sciences					Semester			II						
Course Code	Course Name	Prerequisite	Credit Structure				Marks Distribution								
			L	T	P	C	INT	MID	END	Total					
			2	0	0	2	50	50	100	200					
HS102	Creativity, Innovation and Entrepreneurship	Nil	COs				Statement				Bloom's Taxonomy				
Course Objectives	To introduce the basic aspects of creativity, innovation and entrepreneurship	Course Outcomes	HS102.1	Describe the basic concepts of creativity, innovation and entrepreneurship				Understand							
	To familiarize the importance of creativity, innovation, and entrepreneurship		HS102.2	Describe and illustrate the importance of creativity				Apply							
	To discuss the role and importance of creativity, innovation, and entrepreneurship for social development		HS102.3	Describe and illustrate the importance of innovation				Apply							
	To discuss the stages of the entrepreneurial process for the successful development of entrepreneurial projects		HS102.4	Describe and illustrate the importance of entrepreneurship				Apply							
COs	Mapping with Program Outcomes (POs)												Mapping with PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO2	PSO3
HS102.1	-	-	1	-	1	2	2	-	3	2	3	2			
HS102.2	-	-	1	-	1	2	2	-	3	2	3	2			
HS102.3	-	-	3	-	1	2	2	-	3	2	3	2			
HS102.4	-	-	3	-	1	2	2	-	3	2	3	2			
HS102	-	-	2.0	-	1.0	2.0	2.0	-	3.0	2.0	3.0	2.0			
SYLLABUS															
No.	Content											Hours	COs		
I	Meaning and definition of creativity, innovation, and entrepreneurship; Relation between creativity, innovation, and entrepreneurship; Differences between creativity and innovation; Differences between creativity and entrepreneurship; Differences between innovation and entrepreneurship; Event funding											06	HS102.1		
II	Individual creativity, behaviour and psychological aspects of creativity; Idea generation; Creativity tools and techniques; Creativity in groups											06	HS102.2		
III	Innovation and competitive advantage; Framework of innovative strategies; Organizational issues of innovation; Innovation in a competitive environment; Sources of innovation; Innovation selection; Effective implementation of innovative ideas											08	HS102.3		
IV	Historical development of entrepreneurship; Types of entrepreneurship; Entrepreneurial opportunities; Entrepreneurial processes; Entrepreneurial strategies; Entrepreneurial practice; Sources of entrepreneurial ideas; Entrepreneurial project; Start-up; Contributions of entrepreneurs in society											08	HS102.4		
Total Hours											28				
Essential Readings															
1. Pradip N. Khandwalla, <i>Lifelong Creativity: An Unending Quest</i> , Tata McGraw Hill, 2004.															
2. Vinnie Jauhari and Sudanshu Bhushan, <i>Innovation Management</i> , Oxford Higher Education, 2014.															
3. Robert D. Hisrich et. al. <i>Entrepreneurship</i> , McGraw Hill Higher Education, 6 th Edition, 2004.															
Supplementary Readings															
1. D. H. Holt, <i>Entrepreneurship: New Venture Creation</i> , Prentice Hall, 1992.															
2. Lewrick, M., Link, P., and Leifer, L., <i>The Design Thinking Toolbox: A Guide to Mastering the Most Popular and Valuable Innovation Methods</i> , John Wiley & Sons, 2020.															
3. Hisrich, R. D., Peters, M. P., and Shepherd, D. A., <i>Entrepreneurship</i> , New York: McGraw-Hill, 2020.															



National Institute of Technology Meghalaya

An Institute of National Importance

CURRICULUM

Programme	Bachelor of Technology in Computer Science and Engineering	Year of Regulation	2024-25													
Department	Computer Science and Engineering	Semester	II													
Course Code	Course Name	Pre-Requisite	Credit Structure				Marks Distribution									
			L	T	P	C	Continuous Evaluation	Quiz/ Viva	Total							
CS152	Python Programming		0	1	2	2	70	30	100							
			CO's		Statement				Bloom's Taxonomy							
Course Objectives	To introduce programming using Python and to write programs in python on a computer, and to edit, compile, debug, correct, recompile and run those.	Course Outcomes	CS152.1	Able to understand the basic concepts of scripting and the contributions of scripting language.				Understand								
	To inculcate the ability to do algorithmic thinking to analyze real-world problems and develop algorithms to solve those.		CS152.2	Able to develop Python programs with conditionals and loops, functions and calling them.				Create								
	To train the students in choosing right data representation formats based on a problem specification.		CS152.3	Able to analyse and explore python data structures like Lists, Tuples, Sets and dictionaries.				Analyze								
			CS152.4	Able to develop Python program to read and write data from/to files				Create								
COs		Mapping with Program Outcomes (POs)										Mapping with PSOs				
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CS152.1		3		1		1					1	1	1			
CS152.2		2	3	3	2	1				1					1	
CS152.3		3	3	3	2	1				1					3	
CS152.4		3	2	1	2										1	
CS152		2.75	2.67	2.00	2.00	1.00				1.00	1.00	1.00	1.00		1.67	

SYLLABUS

No.	Content	Hours	COs
I	1. Python program to print the paragraph as shown below: " Hello World " <pre style="margin: 0;">% Hello World % \\ Hello World \\</pre> 2. Python program to print the result of the following arithmetic expression where a=4, b= 5. $\frac{5a + ab^2}{\sqrt{a^2+9}}$	02	CS152.1 CS152.2 CS152.3 CS152.4
II	3. Python program to check a given number is odd or even and positive or negative. 4. Python program to read three numbers and find the greatest one.	02	
III	5. Python program to read five numbers and find the second smallest number. 6. Python program to find GCD and LCM of two numbers.	02	
IV	7. Python program to store ten numbers in a list and find the largest and smallest. 8. Python program to store N numbers in a list and count the total positive, negative, odd and even numbers [0 < N < 11].	02	
V	9. Python program to check whether a given number is prime or not. 10. Python program to print first N numbers of Fibonacci series.	02	
VI	11. Python program to create a menu with the following options 1. TO PERFORM ADDITION 2. TO PERFORM SUBTRACTION 3. TO PERFORM MULTIPLICATION 4. TO PERFORM DIVISION Accepts users input and perform the operation accordingly. Use functions with arguments. 12. Python program to check whether the given string is palindrome or not.	02	
VII	13. Python program to find factorial of a given number using functions. 14. Python function that takes two lists and returns True if they are equal otherwise false	04	
VIII	15. Python program to open and write "hello world" into a file. 16. Python program to read a csv file using pandas module and print the first and last five lines of a file.	04	
IX	17. Python program to open a file and check what are the access permissions acquired by that file using os module. 18. Python program to copy the contents of a file to another file.	04	
X	19. Python program to count frequency of characters in a given file. 20. Python program to print each line of a file in reverse order.	04	
Total Hours		28	

Essential Readings

1. Mark Lutz, " Programming Python", Prentice Hall India, 7th Edition, 2017
2. Mark Lutz, "Learning Python", McGraw-Hill publication, 6th Edition, 2021
3. Luciano Ramalho, "Fluent Python", O'Reilly Media, 2nd Edition, 2021

Supplementary Readings

1. Allen Downey, "Think Python", O'Reilly Media, 2nd Edition, 2015
2. Marj Pilgrim, "Dive into Python", APress Media LLC, 1st Edition, 2005
3. Brett Slatkin, "Effective Python: 59 Specific Ways to Write Better Python", Pearson Education, Inc, 2nd Edition 2019



National Institute of Technology Meghalaya
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CURRICULUM

Programme	Bachelor of Technology					Year of Implementation					2024-25								
Department	Humanities and Social Sciences					Semester					II								
Course Code	Course Name					Prerequisite					Credit Structure				Marks Distribution				
											L	T	P	C	INT	MID	END	Total	
											2	0	0	2	50	50	100	200	
HS104	Ethics and Morals					Nil					COs				Statement				Bloom's Taxonomy
Course Objectives	To introduce the basic aspects of human values and ethics					Course Outcomes					HS104.1	Explain the basic aspects of ethics, values, and morals				Understand			
	To familiarize a few ethical theories that guide human values and principles										HS104.2	Explain a few theories that guide ethics, values, and morals				Understand			
	To discuss a multi-dimensional perspective of human values and ethics										HS104.3	Demonstrate a multi-dimensional perspective of human values and ethics				Apply			
	To help in applying the concepts of ethics to personal ethical lifestyle choices and for community well-being										HS104.4	Apply the concepts of ethics to personal ethical lifestyle choices and decision making				Apply			
COs	Mapping with Program Outcomes (POs)												Mapping with PSOs						
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3				
HS104.1	-	-	2	-	-	3	2	3	1	1	1	-							
HS104.2	-	-	2	-	-	3	2	3	1	1	1	-							
HS104.3	-	-	2	-	-	3	2	3	1	1	1	-							
HS104.4	-	-	2	-	-	3	2	3	1	1	1	-							
HS104	-	-	2.0	-	-	3.0	2.0	3.0	1.0	1.0	1.0	-							
SYLLABUS																			
No.	Content											Hours		COs					
I	Meaning and definition of ethics, morals, and values; Differences between ethics, morals, and values; Types of ethics; Dimensions of ethics; Ethics in human actions; Role of family, society, and educational institutions in inculcating values											06		HS104.1					
II	Theories on ethics; Egoism; Ethical ideologies; Moral development; Moral thinking; Values; Transparent standards; Fair competition; Equal opportunity; Conflict of interest; Code of conduct											08		HS104.2					
III	Emotional intelligence and ethics; Corporate social responsibility and consumer protection; Environment ethics; Industry and environment management; Discrimination; Privacy; Surveillance; Coping with failures; Performance appraisals											07		HS104.3					
IV	Relationship between attitude, thought and behaviour; Ethics and attitude; Social influence and persuasion; Ethical decision making; Personal values and ethical decision making; Trustworthiness; Respect; Responsibility; Fairness; Integrity											07		HS104.4					
Total Hours											28								
Essential Readings																			
1. R. R. Gaur, R. Sangal and G. P. Bagaria, <i>A Foundation Course in Human Values and Professional Ethics</i> , Excel Books, 2010.																			
2. R. Subramanian, <i>Professional Ethics</i> , Oxford University Press, 2 nd Edition, 2017.																			
Supplementary Readings																			
1. A. Carr, <i>Positive Psychology: The Science of Happiness and Human Strength</i> , Brunner-Routledge, 2004.																			
2. Charles E. Harris et.al. <i>Engineering Ethics: Concepts and Cases</i> , Wadsworth Publishing Co. Inc., 5 th Edition, 2013.																			



National Institute of Technology Meghalaya
An Institute of National Importance

CURRICULUM

Programme	Bachelor of Technology in Mechanical Engineering	Year of Regulation	2024-25
Department	Mechanical Engineering	Semester	II

Course Code	Course Name	Pre-Requisite	Credit Structure				Marks Distribution								
			L	T	P	C	Continuous Evaluation		Total						
VA 102	Skill Development and Prototyping	-----	0	0	2	1	100		100						
Course Objectives	To develop basic skills in the field of Electrical and Mechanical Engineering. To make students familiar with different electrical, automobile, and plumbing instruments, setups, assembly, and tools. To develop basic skills and understanding in 3-D printing technology	Course Outcomes	CO's	Statement				Bloom's Taxonomy							
			VA102.1	Students will be able to design domestic electric circuits and other basic circuits and function of different measuring instruments.				design							
			VA102.2	Students will be able to understand the concept of battery charging/discharging systems and construction of machines, its starting, and fabrication of armature coil.				understand							
			VA102.3	Students will be able to understand the functioning of different automobile parts and assemblies.				understand							
			VA102.4	Students will be able to understand the functioning of different plumbing parts, tools, and assemblies.				understand							
			VA102.5	Students will be able to understand the concepts of 3-D printing and its superiority over conventional manufacturing.				understand							
COs	Mapping with Program Outcomes (POs)												Mapping with PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
VA102.1	3	3	3	2	1	3	3		1		1	1	3	3	2
VA102.2	3	3	3	2	1	1			1		1	1	3	3	3
VA102.3	3	3	2	3	3	3	3		1		1	1	3	3	3
VA102.4	3	3	3	3	3	2	1		1		1	1	3	3	3
VA102.5	3	3	3	2	1	3	3		1		1	1	3	3	2
VA102	3	3	2.75	2.5	2	2.25	2.33		1		1	1	3	3	2.75

SYLLABUS

No.	Content	Hours	COs
I	Electrical Shop: Study and design different types of electrical wiring with loads, Study the cut-section of different types of AC/DC machines, Design and fabricate an armature coil using a handy coil winding machine, Assembling different parts of the electrical machine and testing its operation, Charging and discharging circuit of Batteries, Familiarization with analog /digital universal IC tester and advanced digital measuring instruments, To study the measurement of earth resistance using an earth tester, Energy measurement using a smart energy meter, Measurement of insulation resistance of cable/machine using insulation tester/megger, Starting of machine using various starters.	6	VA102.1 VA102.2
II	Automobile Shop: Demonstration on the cut section of the single and multicylinder engine (diesel and petrol), anti-lock braking system, constructional view and internal details of common automobile parts, fuel supply system of petrol and diesel engine, and coil ignition and electrical ignition system of an automobile.	5	VA102.3
III	Plumbing Shop: Demonstration on full-scale sewerage system, assembly station pipes, valves and fittings, tools for plumbing (plumbing wrenches, drain tools, and tools and supports for PVC pipes), cut away models of straightway valve, corner valve, angle seat valve, nonreturn valve, pressure reducing valve, strainer, gate valve, straightway plug valve, three ways plug valve, safety valve, screwed pipe connections, changeover valve, nonreturn butterfly valve, and strainer.	4	VA102.4
IV	Additive Manufacturing Lab: Introduction to 3-d printing, additive v/s conventional manufacturing, Engineering graphics, coordinate systems and their transformation, CAD, product design and prototyping, solid modeling and slicing software, STL files, additive manufacturing techniques, FDM printing, printing materials, support materials.	5	VA102.5
V	Prototyping: Circuit designing based on Electrical Shop, prototyping of automobile parts, plumbing tools, and parts, 3-D printing, etc.	8	All COs
Total Hours		28	

Essential Readings

- R.P. Singh, 'Electrical Workshop, Dreamtech Press, 3rd Edition, 2019
- S.L. Uppal, "Electrical Wiring Estimating and Costing", Khanna Publishers, 6th Edition, 2015
- K. Singh, "Automobile Engineering", Standard Publishers, 2020.
- U. Rathore, N. K. Sharma, "A Textbook of Electrical Workshop Practices", S.K. Kataria & Sons, 1st Edition 2019
- C.K. Chua, K. F. Leong, "3D Printing and Rapid Prototyping- Principles and Applications", World Scientific, 2017.

Supplementary Readings

- R.C. Mullin, P. Simmons, "Electrical Wiring Residential", Cengage Learning, 17th Edition, 2011.

Third Semester Courses

		National Institute of Technology Meghalaya An Institute of National Importance										CURRICULUM				
Programme		Bachelor of Technology in Mechanical Engineering						Year of Regulation				2024-25				
Department		Mechanical Engineering						Semester				III				
Course Code	Course Name	Pre-Requisite	Credit Structure										Marks Distribution			
			L	T	P	C	IN	T	MID	END	Total					
ME201	Strength of Materials	-----	3	0	0	3	50	50	100	200						
				COs	Statement								Bloom's Taxonomy			
Course Objectives			Course Outcomes	ME201.1	Able to understand the concepts of stress and strain as well as the stress-strain relationships for different materials.								Understanding			
				ME201.2	Able to analyse the stresses and strains in axially-loaded members, circular torsion members, stress concentration in circular shafts.								Analysing			
				ME201.3	Able to solve complex engineering problems related to shear force and bending moment in beams and deflection of beams under various loading conditions.								Applying			
				ME201.4	Able to analyse the principal stresses & strains, maximum shearing stress, Mohr's circle for plane stress & plane strain in structure, thin and thick walled pressure vessel etc.								Analysing			
				ME201.5	Able to solve engineering problems related to deformation of columns under various loading condition, strain energy due to various stresses etc.								Applying			
COs		Mapping with Program Outcomes (POs)										Mapping with PSOs				
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ME201.1		3	3		1									3		
ME201.2		3	3		1									3		
ME201.3		2	3	3	1	2								3	3	
ME201.4		2	2	3		2	2	3						3	3	
ME201.5		2	2	3		2	2	3						3	3	
ME201		2.4	2.6	3	1	2	2	3						3	3	
SYLLABUS																
No.	Content												Hours	COs		
I	Introduction to Stress and Strain: Introduction of Stress, Strain, Normal Stress, Stress-Strain Diagrams, True Stress and True Strain, Hooke's Law, Young Modulus, Compression and Shear Stress, Thermal Stresses etc.												07	ME201.1		
II	Torsion: Introduction, Stresses in a Shaft, Deformation in Circular Shafts, Angle of Twist & Design of Transmission Shafts 3 Stress Concentration in Circular Shafts												07	ME201.2		
III	Design of Beams for Bending: Introduction of Pure Bending, Bending of Members, Stress Concentrations 3 Shear and Bending Stresses in Beams, Shear Force and Bending Moment Diagram												07	ME201.1 ME201.3		
IV	Transformation of Stress and Strain: Introduction, Principal Stresses and Strains, Mohr's Circle for Plane Stress and Plane Strain, Thin and Thick Walled Pressure Vessel												07	ME201.1 ME201.4		
V	Deflection of Beams: Introduction, Beam Deformation under Transverse Loading, Statically Indeterminate Beam etc.												06	ME207.1 ME207.3		
VI	Columns: Introduction, Buckling of Columns, Euler's Formula etc.												04	ME201.3 ME201.5		
VII	Energy Methods: Introduction, Strain Energy, Castigliano's Theorem etc.												04	ME201.1 ME201.5		
Total Hours												42				
Essential Readings																
1. E.P. Popov, "Engineering Mechanics of Solids", Prentice Hall.																
2. F.P. Beer, E.R. Johnston (Jr.) and J.T. DeWolf, "Mechanics of Materials", Tata McGraw Hill																
Supplementary Readings																
1. S.P. Timoshenko, "Strength of Materials, Vols. 1 & 2", CBS Publishers.																
2. H. Shames and J.M. Pitarresi, "Introduction to Solid Mechanics", Prentice Hall of India																
3. R. Subramanian, "Strength of Materials", Oxford University Press.																

		National Institute of Technology Meghalaya An Institute of National Importance										CURRICULUM				
Programme		Bachelor of Technology in Mechanical Engineering					Year of implementation					2024-25				
Department		Mechanical Engineering					Semester					III				
Course Code	Course Name	Prerequisite	Credit Structure				Marks Distribution									
			L	T	P	C	INT	MID	END	Total						
ME203	Engineering Thermodynamics	-----	3	0	0	3	50	50	100	200						
Course Objectives	Course Outcomes	To understand and apply basic thermodynamic principles and laws	COs		Statement				Bloom's Taxonomy							
			ME203.1	Able to understand the basic concepts of thermodynamics such as system, surrounding, state, process, cycle, thermodynamic equilibrium, property diagrams and application of knowledge in the measurement of temperature and solve engineering problems.				Apply								
		ME203.2	Able to interpret the properties of pure substances using property table, p-v-t relations and apply the knowledge in formulation and solution of problem-related to energy transfer.				Apply									
		ME203.3	Able to apply the first law of thermodynamics to cyclic process and non-flow process undergone by closed systems.				Apply									
		ME203.4	Able to apply the first law of thermodynamics to the open system using the control volume technique.				Apply									
		ME203.5	Able to apply the second law of thermodynamics in analysing the thermal efficiencies of heat engines and cop of refrigerator and heat pumps with reference to the reversible systems.				Apply									
		ME203.6	Able to calculate the entropy change in a wide range of processes and to analyse the extent of irreversibility of processes including the thermodynamic relations.				Analyse									
COs		Mapping with Program Outcomes (POs)										Mapping with PSOs				
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ME203.1		3	3											3		
ME203.2		3	3											2		
ME203.3		3	3											2		
ME203.4		3	3											2		
ME203.5		3	3											3		
ME203.6		3	3													
ME203		3	3											2.4		
SYLLABUS																
No.	Content												Hours	COs		
I	Fundamental Concepts & Definitions: Thermodynamic definition and scope, Microscopic and Macroscopic approaches, Concept of Continuum, Thermodynamic System and Control Volume, Surrounding, Boundaries, Types of Systems, Universe, Thermodynamic properties, Thermodynamic Process, Cycle, intensive & extensive properties, specific properties, Thermodynamic state, path and process, Thermodynamic Equilibrium, quasi- static process, cyclic and non-cyclic; processes, Property diagram, Point and Path function, Exact and inexact differential, Zeroth Law of Thermodynamics, Measurement of Temperature, Thermometry, reference Points, Temperature Scales, Ideal gas temperature scale, Comparison of thermometers- Gas Thermometers, Thermocouple, Resistance thermometer												08	ME203.1		
II	Pure Substances: Phase Transformations, T-v, P-v and P-T diagrams, Sub-cooled liquid, saturated liquid, mixture of saturated liquid and vapor, saturated vapour and superheated vapour states of pure substance with water as example, triple point and critical points. Enthalpy of change of phase (Latent heat), Dryness fraction (quality), Property and steam tables. Property calculations using steam tables, representation of various processes on T-v , P-v diagrams .Steam tables Ideal and Real gases: The ideal Gas Equation, Characteristic and Universal Gas constants, Mixtures of ideal Gases – Mole Fraction, Mass fraction, Gravimetric and volumetric Analysis, Dalton's Law of partial pressure, Amagat's Laws of additive volumes, Deviations from ideal Gas Model: Equation of state of real substances, Vander Waals Equation of State, Law of corresponding states, compressibility factor, compressibility chart. Difference between Ideal and real gases. Work and Heat: Thermodynamic definition of work; examples, sign convention. Displacement work, expressions for displacement work in various processes through p-v diagrams. Shaft work; Electrical work, free expansion work, Heat; definition, units and sign convention												10	ME203.2		
III	The first law of Thermodynamics: Joule's experiments, equivalence of heat and work. Statement of the First law of thermodynamics, PMM1, Application of the First law to non-flow processes, internal energy, enthalpy, Application of first law to control volume; steady flow energy equation (SFEE), Important applications (nozzles, diffuser, turbine, compressor, pump, heat exchanger). Transient flow – Filling and Emptying Process.												09	ME203.3 ME203.4		

IV	Second Law of Thermodynamics: Limitations of first law of thermodynamics, Necessity of 2nd law of thermodynamics, Thermal Reservoir, Heat Engine, Heat pump, Refrigerator ,schematic representation, Kelvin-Planck and Clausius Statements, Performance factors(efficiency , coefficients of performance),Reversible Process, Irreversible Process, Reversibility, Cause of irreversibility, internal and external irreversibility reversible/ Carnot heat engines/ refrigerators/heat pump, Corollaries of second law, PMM2,Absolute Thermodynamic Temperature scale.	09	ME203.5
V	Entropy: Clausius Inequality, Entropy- Causes of Entropy Change, Entropy changes in various thermodynamic processes, the principle of increase of entropy and its applications, Entropy generation in open and closed system, Entropy and Disorder, Reversible adiabatic process- isentropic process, T-s, H-s diagram of pure substance General Thermodynamic Relations Combined First and Second law equations – Helmholtz and Gibb's functions - Maxwell's Relations, Tds Equations. The Clapeyron equation, Equations for internal energy, enthalpy and entropy, specific heats, Throttling process, Joule Thomson Coefficient, inversion curve.	10	ME203.6
Total Hours		42	
Essential Readings			
1. Y. Cengel and M. Boles, "Thermodynamics- An Engineering Approach", McGraw Hill Education; Eighth Edition, 2017			
2. R. E. Sonntag and C. Borgnakke, "Introduction to Engineering Thermodynamics", John Wiley & Sons, Second Edition, 2006.			
Supplementary Readings			
1. Moran, Shapiro, Boettner and Bailey "Principles of Engineering Thermodynamics", Wiley, Eighth Edition, 2015.			
Property Tables/ Databook			
1. K K Ramalingam "Steam Tables & Mollier Diagram (SI units)" SciTech publications (India) Pvt.Ltd.(2013)			
2. C.P. Kothandarman, "Refrigerant Tables and Charts including Air Conditioning Data" New Age International; Fifth edition (2018)			

		National Institute of Technology Meghalaya An Institute of National Importance										CURRICULUM						
Programme		Bachelor of Technology in Mechanical Engineering					Year of Regulation					2024-25						
Department		Mechanical Engineering					Semester					III						
Course Code	Course Name	Pre-Requisite	Credit Structure										Marks Distribution					
			L	T	P	C	INT	MID	END	Total								
ME205	Fluid Mechanics	----	3	0	0	3	50	50	100	200								
			COs		Statement						Bloom's Taxonomy							
Course Objectives	To understand the various types and properties of fluids and flows and the various forces on fluid elements as well as on submerged bodies.		Course Outcomes	ME205.1	a) Explain fluid properties and rheology of fluids b) Explain and solve problems on hydrostatic pressure and buoyancy						Understanding and applying							
				ME205.2	Explain different terminologies of fluid kinematics. Solving fluid kinematics problem in different types of flow domain.						Understanding and applying							
				ME205.3	Formulate and make use of conservation equations to solve incompressible and compressible fluid flow problems						Applying							
	ME205.4			a) Explain the basic theories of dimensional analysis b) Illustrate and analyzed the use of dimensional analysis tool in constructing nondimensional numbers associated with fluid flows.						Understanding and applying								
	ME205.5			a) Explain and apply the N-S equations in various problems along with the pipe friction and various losses. b) Explain the basic theories of compressible flows c) Formulate and solve the compressible flows problem						Understanding and applying								
	ME205.6			a) Formulate and solve boundary layer flows b) Understand flow separation and control methodologies						Understanding, analysing and applying								
			Mapping with Program Outcomes (POs)										Mapping with PSOs					
COs			PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO2	PSO3	
ME205.1			3	2					2					2	3	2		
ME205.2			3	2	2	2			2					2	3	2		
ME205.3			3	2	2				2					2	3	2		
ME205.4			3	2	2	2			2					2	3	2		
ME205.5			3	2	2	2			2					2	3	2		
ME205.6			3	2	2	2			2					2	3	2		
ME205			3	2	2	2			2					2	3	2		
SYLLABUS																		
No.	Content														Hours	COs		
I	Fundamental Concepts: Fluid properties, Ideal and real fluids, Concept of shear stress, Newtonian and non-Newtonian fluids														04	ME205.1		
II	Fluid Statics: Forces on fluid elements, Normal stresses in stationary fluid, Pressure measurements, Thrusts on submerged bodies, Buoyancy, Stability														06	ME205.1		
III	Fluid Kinematics: Description of flow fields, Steady and unsteady flow, Uniform and non-uniform, Laminar and turbulent flow, Stream lines, Streak lines, Path lines, Stream tubes, Stream function and velocity potential, Vorticity														06	ME205.2		
IV	Fluid Dynamics: Continuity equation, Euler's equation of motion, Momentum equation, Energy equation														06	ME205.3		
V	Dimensional Analysis: Types of physical similarity, Dynamic similitude, Buckingham's theorem														03	ME205.4		
VI	Incompressible Flows: Couette flow, Hagen Poiseuille flow, Losses in pipes, Darcy-Weisbach equation, Hydraulic mean radius, Pipes in series and parallel, Water hammer in pipes, Flow measuring devices														06	ME205.5		
VII	Compressible Flows: Laws for perfect gases, Thermodynamic relations, Pressure field, Flow through nozzles, Stagnation pressure, Sonic properties, Shock waves														06	ME205.5		
VIII	Boundary Layer Flows: Boundary layer parameters and equations, Blasius solution, Momentum integral equations, turbulent boundary layer, Boundary layer separation and control														05	ME205.6		
Total Hours															42			
Essential Readings																		
1. S. K. Som, G. Biswas and S. Chakraborty, "Introduction to Fluid Mechanics and Fluid Machines", TMH, 3 rd Edition, 2012.																		
2. Y. A. Cengel and J. M. Cimbala, "Fluid Mechanics – Fundamentals and Applications", McGraw Hill, 4 th Edition, 2017.																		
Supplementary Readings																		
1. F. M. White and H. Xue, "Fluid Mechanics", McGraw Hill, 9 th Edition, 2022.																		
2. V. Streeter, E. B. Wylie and K. W. Bedford, "Fluid Mechanics", McGraw Hill, 9 th Edition, 2017.																		
3. B. S. Massey, "Mechanics of Fluids", Revised by J. Ward-Smith, CRC Press, 9 th Edition, 2011.																		

		National Institute of Technology Meghalaya An Institute of National Importance										CURRICULUM					
Programme		Bachelor of Technology in Mechanical Engineering						Year of Regulation				2024-25					
Department		Mechanical Engineering						Semester				III					
Course Code	Course Name	Pre-Requisite	Credit Structure				Marks Distribution										
			L	T	P	C	INT	MID	END	Total							
ME207	Engineering Materials	----	3	0	0	3	50	50	100	200							
Course Objectives Familiarisation with the basic understanding of Engineering Materials. Elaborates the atomic structures, crystal theory & imperfections, deformation & strengthening of materials, phase diagrams, heat treatment & transformation of ferrous alloys. Application and processing of metal alloys and non-ferrous metal.	Course Outcomes ME207.1 Compare between the behaviours of different types of engineering materials. ME207.2 Analyse the crystal structure of different class of engineering materials. ME207.3 Analyse the phase diagram for different types of alloying systems. ME207.4 Apply the concept of heat treatment process to improve the properties of engineering materials. ME207.5 Select the suitable application areas of different class of engineering materials.	COs		Statement				Bloom's Taxonomy									
								Understanding									
								Analysing									
								Analysing									
								Applying									
						Applying											
COs		Mapping with Program Outcomes (POs)										Mapping with PSOs					
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	
ME207.1		3												3			
ME207.2		3												3			
ME207.3			2											3			
ME207.4					3									3			
ME207.5		2												3			
ME207		2.6	2.0			3.0								3.0			
SYLLABUS																	
No.	Content													Hours	COs		
I	Atomic structure and interatomic bonding: Fundamental concepts, electrons in atoms, periodic table, bonding forces and energies, primary interatomic bonds, secondary bonding or Van der Waals Bonding.													04	ME207.1 ME207.2		
II	Structure of crystalline solids: Metallic crystal structures, polymorphism and allotropy, crystal systems, point coordinates, crystallographic directions, crystallographic planes, linear and planar densities, close-packed crystal structures, single crystals, polycrystalline materials, X-ray diffraction: determination of crystal structures, noncrystalline solids.													08	ME207.2		
III	Imperfections in solids: Vacancies and self-interstitials, impurities in solids, dislocations–linear Defects, interfacial defects, bulk or volume defects.													08	ME207.1 ME207.2		
IV	Dislocations and strengthening mechanisms: Characteristics of dislocations slip systems, plastic deformation of polycrystalline materials, deformation by twinning, strengthening by grain size reduction, solid-solution strengthening, strain hardening, mechanical working, recrystallization, grain growth.													07	ME207.1 ME207.3		
V	Phase diagrams and phase transformation: Phases, microstructure, phase equilibrium, one-component (or unary) phase diagrams, binary eutectic systems, ternary phase diagrams, Gibbs phase rule, iron carbon equilibrium phase diagrams, TTT and CCT diagrams, pearlitic, martensitic and bainitic transformations.													09	ME207.3 ME207.4		
VI	Applications and processing of metal alloys, ceramics, polymer and composites: Properties and applications of ferrous alloy, tool steels, stainless steels, cast irons, copper base alloys, aluminium base alloys, nickel base alloys, ceramics, polymers and composites.													06	ME207.4 ME207.5		
Total Hours													42				
Essential Readings																	
1. G.E. Dieter, "Mechanical Metallurgy", McGraw Hill, 3rd Edition, 2013.																	
2. W. D. Callister, "Material Science and Engineering and Introduction", Wiley, 10th Edition, 2018.																	
Supplementary Readings																	
1. S.R. Askland, P.P. Phule and W.J. Wright, The Science And Engineering of Materials, CL Engineering; 7th Edition, 2016.																	
2. V. Singh, Physical Metallurgy, Standard Publishers Distributors, 2010.																	
3. W.F. Smith, Principles of Materials Science & Engineering, McGraw Hill, 3rd Edition, 1995.																	
4. T.V. Rajan, C.P. Sharma and A. Sharma, Heat Treatments: Principles and Techniques, Prentice Hall, 2nd Edition, 2012.																	
5. E.C. Rollason, Metallurgy for Engineers, Edward Arnold Publishers Limited, 2nd Edition 1948.																	

		National Institute of Technology Meghalaya An Institute of National Importance										CURRICULUM			
Programme		Bachelor of Technology in Mechanical Engineering					Year of Regulation					2024-25			
Department		Mechanical Engineering					Semester					III			
Course Code	Course Name	Pre-Requisite	Credit Structure					Marks Distribution							
			L	T	P	C	INT	MID	END	Total					
ME209	Introduction to Renewable Energy	-----	3	0	0	3	50	50	100	200					
Course Objectives To provide knowledge about various renewable energy resources and technologies To understand the basics of aerodynamics, design methodology, and applications of renewable energy	Course Outcomes ME209.1 Ability to understand the basic concept of present global energy scenario, global warming and climate change. ME209.2 Ability to understand the basics of solar energy, collection and solar thermal storage. ME209.3 Ability to understand the wind energy conversion systems, hydro energy conversion systems, its aerodynamics and applications. ME209.4 Ability to understand the biomass and its sources, bio-conversion processes, biomass gasification and utilization of producer gas for thermal ME209.5 Ability to understand the basics of tidal energy, hydro energy, ocean and geothermal energy, hydrogen energy, alternate fuels for surface transportation.	COs	Statement								Bloom's Taxonomy				
		ME209.1	Ability to understand the basic concept of present global energy scenario, global warming and climate change.								Knowledge Identification				
		ME209.2	Ability to understand the basics of solar energy, collection and solar thermal storage.								Knowledge Identification and Application				
		ME209.3	Ability to understand the wind energy conversion systems, hydro energy conversion systems, its aerodynamics and applications.								Knowledge Identification and Application				
		ME209.4	Ability to understand the biomass and its sources, bio-conversion processes, biomass gasification and utilization of producer gas for thermal								Knowledge Identification and Application				
		ME209.5	Ability to understand the basics of tidal energy, hydro energy, ocean and geothermal energy, hydrogen energy, alternate fuels for surface transportation.								Knowledge Identification and analysing				
COs	Mapping with Program Outcomes (POs)											Mapping with PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ME 209.1	3	2		0			2	2				2	2	1	
ME 209.2	3	3		2			2	2				2	3	1	
ME 209.3	3	3		2			2	2				2	2	1	
ME 209.4	3	2		2			2	2				2	2	1	
ME 209.5	3	2		2			2	2				2	2	1	
ME 209	3	2.4		1.6			2	2				2	2.2	1	
SYLLABUS															
No.	Content												Hours	COs	
I	Introduction: Introduction to energy sources, reserves and estimates, global energy scenario, renewable energy vis-à-vis environment implications, global warming and climate change.												04	ME 209.1	
II	Solar Energy: Solar energy and its application, availability of solar radiation energy, collection and solar thermal storage, photovoltaic and thermal power generation, Solar energy mission, Fundamentals of semiconductors; Structure and working of solar cells, operation and maintenance of Solar PV systems.												06	ME 209.2	
III	Wind Energy: Wind energy and its application, Classification and Wind Turbine Design and their characteristics, elementary design principles, Aerodynamic models, Lift and drag based wind turbines, horizontal-axis and vertical-axis wind turbines–Savonius and Darrieus turbines, Geometric and aerodynamic parameters, Wind energy applications and system economics.												09	ME 209.3	
IV	Hydro Electric Power Plants: Turbines and other equipment, classification of plants and turbines, velocity triangle, cavitation, governing, performance												06	ME 209.3	
V	Introduction to Biomass Energy: Biomass and its sources, energy plantation, production of fuel wood, Bio-conversion processes, bio-gas, bio-diesel and ethanol production and utilization, Thermo-chemical processes, biomass gasification, process, types of reactors												06	ME 209.4	
VI	Tidal Energy: Introduction to Tidal Energy, Tidal theory and mechanisms, Tidal Energy Technologies, Wave and tidal hybrid systems												05	ME 209.5	
VII	Miscellaneous: New energy technology, ocean and geothermal energy, hydrogen energy, alternate fuels for surface transportation.												06	ME 209.5	
Total Hours												42			
Essential Readings															
1. Duffie, J.A. and Beckman, W.A., "Solar Engineering of Thermal Process", 4 th Edition, 2016, John Wiley.															
2. Charles, Y. W.-B. and Essel, B. H., "Biomass Conversion and Technology", 1 st Edition, 1996, John Wiley.															
3. J.F. Manwell, J.G.MC Gowan, A.L.Rogers, "Wind Energy Explained-Theory, Design and Application" 2 nd Edition, 2009, Wiley															
Supplementary Readings															
1. Burton, T. et al, "Wind Energy Handbook", 3 rd Edition, 2021, John Wiley and Sons Ltd.															

	National Institute of Technology Meghalaya An Institute of National Importance	CURRICULUM
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Programme	Bachelor of Technology in Mechanical Engineering	Year of Regulation	2024-25
Department	Mechanical Engineering	Semester	III

Course Code	Course Name	Pre-Requisite	Credit Structure				Marks Distribution			
			L	T	P	C	INT	MID	END	Total
ME211	Welding Technology	-----	3	0	0	3	50	50	100	200
				COs		Statement			Bloom's Taxonomy	

Course Objectives	Course Outcomes	Statement	Bloom's Taxonomy
To familiarize the students with the working principles of resistance welding process and Solid-state welding process.	ME211.2	Explain the different types of working principles of resistance welding process and its advantages, limitations and applications.	Understanding
To familiarize the students with the working principles of non-arc welding process.	ME211.3	Explain the different types of working principles of Solid-state welding process and its advantages, limitations and applications.	Understanding
To understand the concepts on weld joint design, defects, weldability and testing of weldments.	ME211.4	Explain the working principle of various non-arc welding techniques.	Understanding
	ME211.5	Apply the concept of weld joint design, defects, weldability and testing of weldments.	Applying

COs	Mapping with Program Outcomes (POs)												Mapping with PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS O1	PSO2	PSO3
ME211.1	2	2	3	2	2		2						2		
ME211.2	3	2	2	2			2						3	1	
ME211.3	3	2	2	2			2						2	1	
ME211.4	3	2	2	2	2		2						3	1	
ME211.5	3	2	3	3	2		2						3	1	
ME211	2.8	2.0	2.4	2.2	2.0		2.0						2.6	1.0	

SYLLABUS

No.	Content	Hours	COs
I	GAS AND ARC WELDING PROCESSES Fundamental principles – Oxy-acetylene welding, Carbon arc welding, Shielded metal arc welding, Submerged arc welding, TIG & MIG welding, Plasma arc welding and Electroslag welding processes.	07	ME211.1
II	RESISTANCE WELDING PROCESSES Spot welding, Seam welding, Projection welding, Resistance Butt welding, Flash Butt welding, Percussion welding and High frequency resistance welding processes.	09	ME211.2
III	SOLID STATE WELDING PROCESSES Cold welding, Diffusion bonding, Explosive welding, Ultrasonic welding, Friction welding, Forge welding, Roll welding and Hot pressure welding processes.	09	ME211.3
IV	NON-ARC WELDING PROCESSES Thermit welding, Atomic hydrogen welding, Electron beam welding, Laser Beam welding, Friction stir welding, Under Water welding. Introduction to different brazing and soldering Process. Methods of brazing such as torch & furnace; brazing and soldering consumables, application of brazing and soldering. Braze welding Process.	10	ME211.4
V	DESIGN OF WELD JOINTS, DEFECTS, WELDABILITY AND TESTING OF WELDMENTS Various weld joint designs, welding defects – causes and remedies, Weldability of Aluminium, Copper, and Stainless steels. Destructive and non-destructive testing of weldments.	07	ME211.5
Total Hours		42	

Essential Readings

1. Little R.L., "Welding and welding Technology", Tata McGraw Hill Publishing Co., Ltd., New Delhi, 47th reprint, 2015.
2. Parmer R.S., "Welding Engineering and Technology", 3rd Edition, Khanna Publishers, New Delhi, 2022.

Supplementary Readings

1. Nadkarni S.V., 'Modern Arc Welding Technology', Oxford IBH Publishers, 2014
2. Christopher Davis, 'Laser Welding - A Practical Guide', Jaico Publishing House, 1994
3. Mishra. R.S and Mahoney. M.W, Friction Stir Welding and Processing, ASM,2007

		National Institute of Technology Meghalaya An Institute of National Importance										CURRICULUM				
Programme		Bachelor of Technology in Mechanical Engineering						Year of Regulation				2024-25				
Department		Mechanical Engineering						Semester				III				
Course Code	Course Name	Pre-Requisite	Credit Structure										Marks Distribution			
			L	T	P	C	Continuous Evaluation		Total							
ME213	3D Printing Technologies	-----	0	1	2	2	100		100							
			COs		Statement							Bloom's Taxonomy				
Course Objectives	To make the students aware of rapidly evolving and widely used fabrication technology of 3D Printing by providing idea conceptual modelling, prototyping and rapid manufacturing along with reverse engineering, knowledge of Additive Manufacturing in industry and society.	Course Outcomes	ME213.1	Students will be able to explain the basics of additive manufacturing and its superiority over conventional manufacturing.	Understanding											
			ME213.2	Students will be able to explain the basics of computer graphics, coordinate systems and its transformations.	Understanding											
			ME213.3	Students will be able to apply the concept of 3D modeling and its data formats for slicing in 3D printing technology.	Applying											
			ME213.4	Students will be able to use the concept of various 3D printing technology for additive manufacturing.	Applying											
			ME213.5	Students will be able to select the proper material for 3D printing with respect to the desired application.	Analyze											
			ME213.6	Students will be able to test with polymer, composite and metal 3D printers.	Evaluate											
COs		Mapping with Program Outcomes (POs)										Mapping with PSOs				
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ME213.1		3	3	2		3						3	3	3		
ME213.2		3	3	3	2	3						3	3	2		
ME213.3		3	3	3	3							3	3	2		
ME213.4		3	3	3	3							3	3	3		
ME213.5		3	3	3	3	3		3				3	3	3		
ME213.6		3	3	3	3	3	3	3		3		3	3	3		
ME213		3	3	2.84	2.8	3	3	3		3		3	3	2.67		
SYLLABUS																
No.	Content												Hours	COs		
I	INTRODUCTION: Design conceptualization, basics of additive manufacturing, additive v/s conventional manufacturing.												01	ME 213.1		
II	FUNDAMENTALS OF COMPUTER GRAPHICS: Engineering graphics, two-dimensional and three-dimensional – coordinate systems and their transformation, homogeneous coordinates: line drawing, clipping, viewing transformation.												03	ME 213.2		
III	CAD: Definitions, evolution, product design and rapid product development, prototyping, 3D solid modeling and slicing software for 3D printing, CAD data formats, data translation, data loss, STL format, and creation of STL file.												03	ME 213.3		
IV	ADDITIVE MANUFACTURING TECHNIQUES: Vat photo-polymerization, material extrusion, material jetting, binder jetting, powder bed fusion, direct energy deposition and sheet lamination., selective laser sintering, direct metal selective laser sintering. Principle of FDM printing, steps of FDM, process parameters of FDM, layer height, angle, width, build temperature, nozzle temperature, orientation, printing speed etc. Types of FDM printers.												04	ME 213.4		
V	PRINTING MATERIALS: Plastics, metals, ceramics, carbon fiber, nitinol, hydrogels, graphene; material selection, liquid, solid, wire, powder; polymers, support materials.												03	ME 213.5		
VI	EXPERIMENTATION: Practice of 3D printing with polymer, composite and metal.												28	ME213.6		
Total Hours												42				
Essential Readings																
1. G.E. Dieter, "Mechanical Metallurgy", McGraw Hill, 3rd Edition, 1986.																
2. W. D. Callister, "Material Science and Engineering and Introduction", Wiley, 5th Edition, 1999.																
Supplementary Readings																
1. S.R. Asklund, P.P. Phule and W.J. Wright, The Science And Engineering of Materials, CL Engineering; 6th Edition, 2010.																
2. V. Singh, Physical Metallurgy, Standard Publishers Distributors, 2010.																
3. W.F. Smith, Principles of Materials Science & Engineering, McGraw Hill, 2nd Edition, 1990.																
4. T.V. Rajan, C.P. Sharma and A. Sharma, Heat Treatments: Principles and Techniques, Prentice Hall, 2nd Edition, 2012.																
5. E.C. Rollason, Metallurgy for Engineers, Edward Arnold Publishers Limited, 2nd Edition 1948.																

		National Institute of Technology Meghalaya An Institute of National Importance										CURRICULUM				
Programme		Bachelor of Technology in Mechanical Engineering					Year of Regulation					2024-25				
Department		Mechanical Engineering					Semester					III				
Course Code	Course Name	Pre-Requisite	Credit Structure										Marks Distribution			
			L	T	P	C	INT	MID	END	Total						
ME271	Safety Engineering	----	2	0	0	2	50	50	100	200						
				COs	Statement								Bloom's Taxonomy			
Course Objectives	To explain the basic concept of safety, Philosophy of safety, accidents in industries and their prevention.	Course Outcomes	ME271.1	Students will be able to outline of safety, accidents in industry and the preventive measures.								Knowledge				
	To explain the implication of safety engineering in industries, associated hazards, risk involved and the mitigation methods and to understand different types of machines guarding, manual and mechanical material handling		ME271.2	Students will understand the necessity of safety engineering in by way of identifying the hazards, assessing the risk involved and the mitigation measures like machine guarding and safe material handling techniques etc to ensure safety at work.								Comprehension				
	To explain the use of hand tools & portable power tools and to understand the electrical safety, fires, explosions and toxic releases in the industry.		ME271.3	Students will be able to Illustrate different safety tools to deal with electrical safety, fires, explosion and toxic release in industries.								Comprehension				
	To explain the safety in construction industries and to understand the use of personal protective equipment.		ME271.4	Students will be able to describe the personal protective equipment and safety measures in construction sites.								Comprehension				
	To explain the process of First Aid for the workers and safety management in the industries		ME271.5	Students will be able to Illustrate the First Aid process. To demonstrate the cyber security tools.								Knowledge				
COs	Mapping with Program Outcomes (POs)												Mapping with PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	
ME271.1	3	2	3			3	2	3				2	2	2		
ME271.2	3	2	3			3	2	3				2	2	2		
ME271.3	3	2	3			3	2	3				2	2	2		
ME271.4	3	2	3			3	2	3				2	2	2		
ME271.5	3	2	3		3	3	2	3				2	2	2		
ME271	3	2	3		3	3	2	3				2	2	2		
SYLLABUS																
No.	Content											Hours	COs			
I	Concept of safety, Philosophy of safety, safety terminology, behaviour-based safety, Accident - cause and prevention.											05	ME271.1			
II	Safety engineering in industry, statutory provisions, Principles of Machine guarding, types and selection of guards, ergonomics of machine guarding, mechanical and manual material handling, hand tools and portable power tools.											05	ME271.2			
III	Electrical safety, safety measures for electric work, fires and explosion, classification fires and fire extinguishers, toxic gas release and preventive measures thereof.											05	ME271.3			
IV	Safety in construction industry, underground works, above ground works, underwater works, movement of men and materials, Personal protective equipment, selection and classification of PPE, statutory provisions to ensure safety at work.											05	ME271.4			
V	Need of First Aid, Electrical injuries, artificial respiration, poisoning, first aid and antidotes, Industrial safety management, Safety Audit, Job safety analysis, Safety motivation.											04	ME271.5			
VI	Introduction to cyber security, internet, network mobile and cloud security, identity theft, encryption, security tools, cyber security metrics, antiviruses											04	ME271.5			
Total Hours												28				
Essential Readings																
1. Dr. K.U. Mistry, 'Fundamentals of industrial safety and health, 1 st edition, 2008, Siddharth Prakashan																
2. Akhil Kumar Das, Principles of Industrial Safety Management Understanding the Ws of Safety at Work, 1 st edition, 2020, PHI Learning Pvt. Ltd.																
3. Akhil Kumar Das, Principles of Fire Safety Engineering: Understanding Fire and Fire Protection, 2 nd edition, 2020, PHI Learning Pvt. Ltd.																
Supplementary Readings																
1. Charles D. Reese, Industrial Safety and Health for People-Oriented Services, 1 st edition, 2009, CRC Press																
2. C. Ray Asfahl, David Rieske, Industrial Safety and Health Management, 7 th edition, 2021, Pearson																
3. N. Godbole, Information Systems Security: Security Management, Metrics, Frameworks and Best Practices, 2 nd edition, 2017, Wiley																

		National Institute of Technology Meghalaya An Institute of National Importance										CURRICULUM				
Programme		Bachelor of Technology in Mechanical Engineering					Year of Regulation					2024-25				
Department		Mechanical Engineering					Semester					III				
Course Code	Course Name	Pre-Requisite	Credit Structure				Marks Distribution									
			L	T	P	C	Continuous evaluation	Quiz/Viva	Total							
ME251	Materials Testing Laboratory	-----	0	0	2	1	70	30	100							
			COs		Statement					Bloom's Taxonomy						
Course Objectives	Understand the behaviour of ductile materials under different loading conditions	Course Outcomes	ME251.1	Able to understand the behaviour of ductile materials under different loading conditions.					Understanding							
	To understand the behaviour of brittle materials under different loading conditions		ME251.2	Get ability understand the behaviour of brittle materials under different loading conditions.					Understanding							
	To conduct experiments with UTM, Impact and Torsion Testing Machines to evaluate mechanical properties of material.		ME251.3	Able to perform the experiments with Brinell, Rockwell and Vickers hardness tester to determine the hardness of different materials and to analyse them.					Applying							
	To perform experiments with Brinell, Rockwell and Vickers hardness tester to determine the hardness of different materials.		ME251.4	Able to apply the principles to perform experiments with Torsion Testing Machine to evaluate mechanical properties of material.					Applying							
			ME251.5	Able to apply the principles to perform experiments with Impact Testing to evaluate impact strength of the material.					Applying							
COs		Mapping with Program Outcomes (POs)										Mapping with PSOs				
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO ₁	PSO2	PSO3
ME251.1		2	2	2						2				2	1	
ME251.2		2	2	2						2				2	1	
ME251.3		2	2	2						2				2	1	
ME251.4		2	2	2						2				2	1	
ME251.5		2	2	2						2				2	1	
ME205		2	2	2						2				2	1	
SYLLABUS																
No.	Content												Hours	COs		
I	Demonstrate and explain working principle of UTM, Hardness testing machine (Brinell's, Vicker's, Rockwell's), Torsion testing and Impact testing machine												03	All COs		
II	Uniaxial tension test: To obtain the stress-strain relation of mild steel using a circular cylindrical specimen and determine Young's modulus (E), proportional limit (p), yield stress (y), ultimate tensile stress (u) and percentage elongation (SOM 1)												03	ME251.1		
III	Compression test: To study the stress-strain relation of cast iron using a cylindrical specimen (SOM 2)												03	ME251.2		
IV	Hardness test: To determine the hardness of a given set of specimens by Brinell (SOM3)												03	ME251.3		
V	Hardness test: Vickers hardness testing machines. (SOM 4)												04	ME251.3		
VI	Hardness test: Rockwell hardness testing machines. (SOM 5)												04	ME251.3		
VII	Torsion test: To obtain twisting moment - twist relationship of a mild steel specimen. To determine shear modulus G, yield stress y in pure shear, theoretical and experimental ultimate torque based on elastic - perfectly plastic model of material. (SOM 6)												04	ME251.4		
VIII	Impact Test: To obtain mechanical properties against impact load using Izod and Charpy test (SOM 7)												04	ME251.5		
Total Hours												28				
Essential Readings																
1. E. P. Popov, "Engineering Mechanics of Solids", Prentice Hall.																
2. F. P. Beer, E. R. Johnston (Jr.) and J.T. DeWolf, "Mechanics of Materials", Tata McGraw Hill																
Supplementary Readings																
1. S. P. Timoshenko, "Strength of Materials", Vols. 1 & 2, CBS Publishers.																
2. H. Shames and J. M. Pitarresi, "Introduction to Solid Mechanics", Prentice Hall of India																
3. R. Subramanian, "Strength of Materials", Oxford University Press																

	National Institute of Technology Meghalaya An Institute of National Importance											CURRICULUM				
	Programme	Bachelor of Technology in Mechanical Engineering					Year of Regulation					2024-25				
Department	Mechanical Engineering					Semester					III					
Course Code	Course Name		Pre-Requisites		Credit Structure				Marks Distribution							
					L	T	P	C	Continuous valuation		Total					
ME253	Advanced Workshop Practice		---		0	0	2	1	100		100					
Course Objectives	To understand the basic working principles of various Conventional Machine Tools such as Lathe, Shaper, and Milling machines To understand the operation of CNC Lathe and CNC Milling machines and be able to write CNC codes using the CNC coding.		Course Outcomes	COs		Statement						Bloom's Taxonomy				
				ME253.1	Explain the fundamental of lathe, shaper, milling, and CNC machine with safety procedure						Understanding					
				ME253.2	Utilize different machining operations in lathe to perform specified jobs.						Application					
				ME253.3	Utilize machining operation in shaper to perform specified jobs.						Applying					
				ME253.4	Utilize machining operations in milling machine to perform specified jobs.						Applying					
				ME253.5	Develop specified jobs using CNC lathe and CNC milling Machine.						Applying					
COs	Mapping with Program Outcomes (POs)												Mapping with PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	
ME253.1	2	2	2		2				2				2	1		
ME253.2	2	2	2		2				2				2	1		
ME253.3	2	2	2		2				2				2	1		
ME253.4	2	2	2		2				2				2	1		
ME253.5	2	2	2		2				2				2	1		
ME253	2	2	2		2				2				2	1		
SYLLABUS																
No.	Content												Hours		COs	
I	Introduction to machine tools, speed, feed rate, depth of cut and operations of various machine tools, types of cutting tools and geometry.												03		ME253.1	
II	To perform different machining operations in lathe to create specified jobs.												05		ME253.2	
III	To perform machining operation in shaper to create specified jobs.												05		ME253.3	
IV	To perform machining operations in milling machine to create specified jobs.												07		ME253.4	
V	Develop specified jobs using CNC lathe and CNC milling machine.												08		ME253.5	
Total Hours												28				
Essential Readings																
1. S.K.H. Choudhury, A.K.H. Choudhary and N. Roy, Elements of Workshop Technology, Media Promoters and Publishers Pvt. Ltd., 15th Edition, 2018																
Supplementary Readings																
1. W. A. J. Chapman, Workshop Technology, CBS Publishers, 5th Edition, 1972																
2. H. Gerling, All About Machine Tools, New Age International, 2006																



National Institute of Technology Meghalaya
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CURRICULUM

Programme	Bachelor of Technology in Mechanical Engineering					Year of Regulation	2024-25								
Department	Mechanical Engineering					Semester	III								
Course Code	Course Name	Pre-Requisite	Credit Structure				Marks Distribution								
			L	T	P	C	Continuous Evaluation	Total							
ME255	Fluid Mechanics Laboratory	-----	0	0	2	1	100	100							
				COs		Statement		Bloom's Taxonomy							
Course Objectives	To develop students' ability to measure various pressure heads and visualize different types of flow		Course Outcomes	ME255.1	Explain flow regimes, floating and submerged bodies, Bernoulli's theorem, pipe friction and flow measuring devices.	Knowledge, Comprehension									
	To develop students' ability to understand characteristics of floating bodies and frictional losses in pipes.			ME255.2	Experiment with Reynolds apparatus, Bernoulli's apparatus, stability apparatus, flow visualization apparatus and pipe friction apparatus to estimate Reynolds number, demonstrate Bernoulli's principle, demonstrate stability of the floating bodies, visualize flow past immersed bodies and estimate frictional coefficient.	Application, Analysis									
	To develop students' ability to measure flow rate using flow measuring devices.			ME255.3	Experiment with venturi, nozzle and orifice meters to estimate discharge coefficient.	Application, Analysis									
				ME255.4	Apply the knowledge of fluid mechanics to make a project that is innovative or have applications of fluid mechanics concepts.	Create									
COs	Mapping with Program Outcomes (POs)											Mapping with PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ME255.1	3							2	3	2			3	2	
ME255.2	3							2	3	2			3	2	
ME255.3	3							2	3	2			3	2	
ME255.4	3	3	3				2	3	3	3	2	2	3	2	
ME255	3	3	3				2	2.25	3	2.25	2	2	3	2	

SYLLABUS

No.	Content	Hours	COs
I	Introduction Fundamentals of Flow visualization, flow measuring devices, Bernoulli's principle, stability of floating bodies and frictional losses in pipes	02	ME255.1 ME255.2 ME255.3
II	Flow Visualization Laminar, Transition, Turbulent flow visualization & finding the critical Reynolds Number	04	ME255.1 ME255.2
III	Verify Bernoulli's principle Verification of the Bernoulli's Principle, Recording pressure and velocity curves in a Venturi nozzle, Determination of flow coefficient at different flow rate, Friction effects recognition.	04	ME255.1 ME255.2
IV	Stability of floating bodies Study the Stability of floating bodies & finding the metacentre, determination of buoyancy	04	ME255.1 ME255.2
V	Flow Measuring devices Measurement of flow rates with Venturi, Nozzle, Orifice meter and determination of corresponding flow rate coefficients, Calibration of the flow measuring devices.	06	ME255.1 ME255.3
VI	Friction losses in pipes Determination of the losses in pipe due to different pipe diameter, different material and different surface roughness and different flow rate	04	ME255.1 ME255.2 ME255.3
VII	Flow Visualization past bluff bodies Flow Visualization of Streamlines Past Bluff Body with the Help of an Aerodynamic Trainer	04	ME255.1 ME255.2
VIII	Mini Project Mini Project on Creating Models/Experimental Setups for Demonstrating Applications of Fluid Mechanics		ME255.4
Total Hours		28	

Essential Readings

1. S. K. Som, G. Biswas and S. Chakraborty, "Introduction to Fluid Mechanics and Fluid Machines", TMH, 3rd Edition, 2012.

Supplementary Readings

1. F. M. White and H. Xue, "Fluid Mechanics", McGraw Hill, 9th Edition, 2022.

2. V. Streeter, E. B. Wylie and K. W. Bedford, "Fluid Mechanics", McGraw Hill, 9th Edition, 2017.

3. B. S. Massey, "Mechanics of Fluids", Revised by J. Ward-Smith, CRC Press, 9th Edition, 2011.

4. R. W. Fox, A. T. McDonald and P. J. Pritchard, "Introduction to Fluid Mechanics", 6th edition, John Wiley & Sons, India edition, 2003.



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CURRICULUM

Programme	Bachelor of Technology in Mechanical Engineering	Year of Regulation	2024-25
Department	Mechanical Engineering	Semester	III

Course Code	Course Name	Pre-Requisite	Credit Structure				Marks Distribution	
			L	T	P	C	Continuous Evaluation	Total
ME 257	Material Science Lab.	-----	0	0	2	1	100	100

Course Objectives	Course Outcomes	COs	Statement	Bloom's Taxonomy
		To understand the basics of the microstructure of materials and their hardness under different conditions. To understand the basics of the heat-affected zone of materials and detection of flaws of materials.	ME257.1 ME257.2 ME257.3 ME257.4	Demonstrate the different heat treatment processes and their effect on a given work specimen. Demonstrate the effect of quenching on the microstructure and hardness of the steel. Ability to examine the microstructure of different types of materials. Study of hardness and microstructure changes in the heat-affected zone in a welded specimen.

COs	Mapping with Program Outcomes (POs)												Mapping with PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ME257.1	3	1		1	1			2				2	3	2	
ME257.2	3	2		2	2			2				2	2	2	
ME257.3	3	2		2	2			2				2	2	2	
ME257.4	3	2		2	2			2				2	2	2	
ME257	3	1.75		1.75	1.75			2				2	2.25	2	

SYLLABUS

No.	Content	Hours	COs
I	Study of the microstructure and hardness of a given mild steel specimen after annealing.	04	ME257.1 ME257.2
II	Study of the microstructure and hardness of a given mild steel specimen after air quenching.	04	ME257.1 ME257.2
III	Study of the microstructure and hardness of a given mild steel specimen after water quenching.	04	ME257.1 ME257.2
IV	Study of the microstructure and hardness effect of a given mild steel specimen after oil quenching.	04	ME257.1 ME257.2
V	Study of the microstructure of cast iron.	04	ME257.3
VI	Study of the microstructure of non-ferrous metal/alloy.	04	ME257.3
VII	Study of the heat-affected zone (HAZ) in a welded sample of low-carbon steel.	04	ME257.4
VIII	Study of the microstructure and hardness of a given mild steel specimen after annealing.	04	ME257.1 ME257.2
Total Hours		28	

Essential Readings

- G.E. Dieter, "Mechanical Metallurgy", McGraw Hill, 3rd Edition, 2017.
- W. D. Callister, "Material Science and Engineering: An Introduction", Wiley, 6th Edition, 2006.
- W.F. Smith, "Principles of Materials Science", McGraw Hill, 3rd Revised Edition, 1990.
- T.V. Rajan, C.P. Sharma, and A. Sharma, "Heat Treatments: Principles and Techniques", Prentice Hall, 2nd Edition, 2010.

Fourth Semester Courses

		National Institute of Technology Meghalaya An Institute of National Importance										CURRICULUM				
Programme		Bachelor of Technology in Mechanical Engineering								Year of Regulation			2024			
Department		Department Mechanical Engineering								Semester			IV			
Course Code	Course Name	Pre-Requisite	Credit Structure										Marks Distribution			
			L	T	P	C	INT	MID	END	Total						
ME 202	Kinematics of Machines	---	3	0	0	3	50	50	100	200						
Course Objectives	To introduce different approaches and mathematical models used in kinematic analysis of machineries.	---	COs				Statement						Bloom's Taxonomy			
			Course Outcomes	ME 202.1	Students will be able to illustrate various types of mechanism.						Understanding					
				ME 202.2	Students will be able to analyze position, velocity, and acceleration of the planner kinematic chain.						Analyze					
				ME 202.3	Students will be able to design profile of cm and follower through its motion simulation and analyze the motion condition through given cam shape						Analyze					
				ME 202.4	Students will be able to evaluate problems associated to the gear and gear mechanism.						Evaluate					
COs		Mapping with Program Outcomes (POs)										Mapping with PSOs				
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ME 202.1		3	2	3										3	2	
ME 202.2		3	2	3										3	2	
ME 202.3		3	2	3										3	2	
ME 202.4		3	2	3										3	2	
ME202		3	2	3										3	2	
SYLLABUS																
No.	Content												Hours	COs		
I	Analysis of Kinematic Chain: Links-types, Kinematics pairs-classification, Constraints-types, Degrees of freedom of planar mechanism, Grubler's equation, Linkage mechanisms, Inversions of four bar chain, Slider crank chain and double slider crank chain, Displacement analysis, Transmission angle. Miscellaneous mechanisms: approximate and exact straight line generating mechanisms, intermittent motion mechanism.												05	ME 202.1		
II	Velocity Analysis: Velocity of point in mechanism, Relative velocity method, Velocities in four bar mechanism, Slider crank mechanism and quick return motion mechanism, Rubbing velocity at a pin joint, Instantaneous center method, Types & location of instantaneous centers, Kennedy's theorem, Velocities in four bar mechanism & slider crank mechanism.												07	ME 202.2		
III	Acceleration Analysis: Acceleration of a point on a link, Acceleration diagram, Coriolis component of acceleration, Crank and slotted lever mechanism, Klein's construction for slider crank mechanism and four bar mechanism, Analytical method for slider crank mechanism. Mechanisms with Lower Pairs: Pantograph, Exact straight line motion mechanisms-Peaucellier's, Hart and Scott Russell mechanisms, Approximate straight line motion mechanisms-Grass-Hopper, Watt and Tchebicheff mechanisms, Analysis of Hooke's joint, Davis and Ackermann steering gear mechanisms.												07	ME 202.2		
IV	Cams: Cams and followers – classification & terminology, Cam profile by graphical methods with knife edge and radial roller follower for uniform velocity, Simple harmonic and parabolic motion of followers, Analytical methods of cam design – tangent cam with roller follower and circular cams with flat faced follower.												11	ME 202.3		
V	Gears and Gear Trains: Classification & terminology, law of gearing, Tooth forms & comparisons, Systems of gear teeth, Length of path of contact, contact ratio, Interference & under cutting in involute gear teeth, Minimum number of teeth on gear and pinion to avoid interference Simple, Compound, Reverted and Planetary gear trains, Sun and planet gear.												12	ME 202.4		
Total Hours												42				
Essential Readings																
1. S. S. Rattan, "Theory of Machines", McGraw Hill, Second Edition, 2014.																
2. J. J. Uicker, G. R. Pennock, J. E. Shigley, "Theory of Machines and Mechanisms", Oxford Education, Fourth Edition, 2011.																
Supplementary Readings																
1. A. Ghosh and A. K. Mallick, "Theory of Mechanisms and Machines", Ease-West Press, Third Edition, 1998.																
2. T. Bevan, "Theory of Machines", Pearson Publication, Third Edition, 1996.																
3. J. L. Meriam, L. G. Kraige, "Engineering Mechanics – Dynamics", Wiley, Seventh Edition, 2013.																



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CURRICULUM

Programme	Bachelor of Technology in Mechanical Engineering	Year of Regulation	2024-25
Department	Mechanical Engineering	Semester	IV

Course Code	Course name	Pre-Requisite	Credit Structure				Marks Distribution			
			L	T	P	C	INT	MID	END	Total
ME 204	Manufacturing Technology-I	----	3	0	0	3	50	50	100	200
Course Objectives	To develop the student's ability to understand the basic concept of manufacturing processes, structure and properties of materials, and different heat treatment processes.	Course Outcomes	ME204.1	Summarize the various manufacturing processes and properties of materials.	Understanding					
	To develop the student's ability to understand the working principle of different types of casting processes along with the casting defects and their remedies.		ME204.2	Explain the different types of metal casting processes, their advantages and disadvantages, casting defects, and remedies.	Understanding					
	To familiarize the students with the working of different metal forming processes like, rolling, extrusion, wire drawing, sheet metal working, spinning, swaging, thread rolling, metal forming defects, powder metallurgy and its applications.		ME204.3	Explain the concept of various metal joining techniques, the effect of various input parameters on joining behavior, joining defects, etc.	Understanding					
	To develop the student's ability to understand the concept of different joining processes such as brazing, soldering, welding, solid state welding methods, resistance welding, arc welding, submerged arc welding, inert gas welding, welding defects, and inspection.		ME204.4	Explain the working principle of various metal forming techniques.	Understanding					
			ME204.5	Apply the concept of powder metallurgy to manufacture ceramic-based products.	Applying					

COs	Mapping with Program Outcomes (POs)												Mapping with PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ME204.1	2														
ME204.2	3	3	2										3	2	
ME204.3	3	3	2										2	2	
ME204.4	3	3	2										3	2	
ME204.5	3						2						3	2	
ME204	2.8	3	2				2						2.75	2	

SYLLABUS

No.	Content	Hours	COs
I	Manufacturing Process and Properties of Materials: Introduction to Manufacturing Processes, Structure of Matter, Metals and Alloys, Deformation and Mechanical Properties of Materials, Heat Treatment, etc.	6	ME204.1
II	Casting Processes: Introduction, pattern and mould, mould design, types and various pattern materials, various casting methods such as sand-casting investment casting, pressure die casting, centrifugal casting, continuous casting, thin roll casting, casting defects, and their remedies, etc.	12	ME204.2
III	Metal Joining Processes: Brazing, soldering, welding, solid state welding methods; resistance welding; arc welding; submerged arc welding; inert gas welding; welding defects, inspection, etc.	12	ME204.3
IV	Metal forming Processes: Various metal forming operations and their analysis such as forging, rolling, extrusion, wire drawing, sheet metal working, spinning, swaging, thread rolling, metal forming defects, etc., powder metallurgy and its applications.	12	ME204.4 ME204.5
Total Hours		42	

Essential Readings

1. A. Ghosh and A.K. Mallik, "Manufacturing Science", Wiley Eastern.
2. P.N. Rao, "Manufacturing Technology: Foundry, Forming and Welding", McGraw Hill.

Supplementary Readings

1. R.W. Heine, C.R. Loper, and P.C. Rosenthal, "Principles of Metal Casting", McGraw Hill.
2. G.E. Dieter, "Mechanical Metallurgy", McGraw Hill.
3. J.S. Campbell, "Principles of Manufacturing Materials and Processes", McGraw Hill.
4. F.C. Flemmings, "Solidification Processing", McGraw Hill.
5. P.C. Pandey and C.K. Singh, "Production Engineering Sciences", Standard Publishers Ltd.
6. S. Kalpakjian and S.R. Schmid, "Manufacturing Processes for Engineering Materials", Pearson Education

		National Institute of Technology Meghalaya An Institute of National Importance										CURRICULUM				
Programme		Bachelor of Technology in Mechanical Engineering						Year of Regulation				2024-25				
Department		Mechanical Engineering						Semester				IV				
Course Code	Course Name	Pre-Requisite	Credit Structure				Marks Distribution									
			L	T	P	C	INT	MID	END	Total						
ME206	Fluid Machines	-----	3	0	0	3	50	50	100	200						
			CO's		Statement				Bloom's Taxonomy							
Course Objectives	To understand basic principles of fluid machines and apply relevant flow equations.		Course Outcomes	ME206.1	The student will be able to explain the basic concepts of fluid machines and apply dimensional analysis to generate suitable non-dimensional parameters.				Understand							
	To develop the skills to compare various fluid machines and select a suitable one for a particular operation.			ME206.2	The student will be able to describe the working principle of hydraulic turbines (Pelton, Francis and Kaplan) and solve problems to calculate different performance parameters.				Apply							
				ME206.3	The student will be able to interpret the working principle of hydraulic pumps (centrifugal and reciprocating) and solve problems to calculate different performance parameters.				Apply							
				ME206.4	The student will be able to determine the effect of cavitation in turbines and pumps				Apply							
				ME206.5	The student will be able to illustrate the operation of compressors (centrifugal and axial), fans and blowers.				Apply							
COs		Mapping with Program Outcomes (POs)										Mapping with PSOs				
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ME206.1		2												1		
ME206.2		3	2											2		
ME206.3		3	2											2		
ME206.4		2	1											2		
ME206.5		1	1											2		
ME206		2.2	1.5											1.8		
SYLLABUS																
No.	Content												Hours	COs		
I	Principles of Fluid Machines: Classification of Fluid Machines, Rotodynamic Machines, Basic Equation of Energy Transfer in Rotodynamic Machines, Principle of Similarity and Dimensional Analysis in Rotodynamic Machines												07	ME206.1		
II	Hydraulic Turbines: Application and Classification, Heads and Efficiencies, Pelton Wheel, Reaction Turbine, Francis Turbine, Kaplan Turbine, Draft Tube, Runaway Speed, Surge Tanks, Performance Characteristics, Governing												08	ME206.1, ME206.2, ME206.4		
III	Centrifugal Pumps: Applications and Classification, Priming of Pumps, Components, Pressure Changes, Heads and Efficiencies, Characteristic Curves, Multi-Stage Pumps, Net Positive Suction Head, Cavitation												08	ME206.1, ME206.3, ME206.4		
IV	Reciprocating Pumps: Classification, Components, Working Principle, Indicator Diagram, Effect of Acceleration, Effect of Air Vessel, Multiple Cylinder Pumps												06	ME206.1, ME206.3, ME206.4		
V	Compressors, Fans and Blowers: Centrifugal and Reciprocating Compressors, Axial Flow Compressors, Fans and Blowers												07	ME206.5		
VI	Miscellaneous Hydraulic Machines Hydraulic Ram, Air Lift Pump, Hydraulic Accumulator, Hydraulic Intensifier, Hydraulic Crane, Hydraulic Coupling												06	ME206.2, ME206.3		
Total Hours												42				
Essential Readings																
1. J. Lal, "Hydraulic Machines including Fluidics", Metropolitan Book, 1994																
2. Ojha, Berndtsson and Chandramouli, "Fluid Mechanics and Machinery", Oxford University Press, 2010																
3. P.N. Modi and S.M. Seth, "Hydraulics and Fluid Mechanics Including Hydraulics Machines", Rajsons Publications Pvt. Ltd., Standard Book House, 22 nd Edition, 2019																
Supplementary Readings																
1. Som, Biswas and Chakraborty, "Introduction to Fluid Mechanics and Fluid Machines", TMH, 3rd Edition, 2011																
2. D. S. Kumar, "Fluid Mechanics and Fluid Power Engineering", Kataria and Sons, 2012 Edition																
3. Cengel and Cimbala, "Essentials of Fluid Mechanics: Fundamentals and Applications", McGraw Hill, 4th Edition, 2017																

		National Institute of Technology Meghalaya An Institute of National Importance				CURRICULUM									
Programme		Bachelor of Technology in Mechanical Engineering				Year of Regulation		2024-25							
Department		Mechanical I Engineering				Semester		IV							
Course Code	Course Name	Pre-Requisite	Credit Structure				Marks Distribution								
			L	T	P	C	INT	MID	END	Total					
ME208	Applied Thermodynamics	ME203	3	0	0	3	50	50	100	200					
			COs	Statement						Bloom's Taxonomy					
Course Objectives	To develop the student's ability to apply the first and the second laws of thermodynamics for the exergy and energy analysis of the basic energy conversion systems.	Course Outcomes	ME208.1	Demonstrate the ability to perform the exergy analysis and irreversibility of thermodynamic system.						Application					
			ME208.2	Demonstrate the ability to perform the thermal analysis of vapour power cycle						Application					
	ME208.3		Demonstrate the ability to perform the thermal analysis of gas power cycle						Application						
	ME208.4		Demonstrate the ability to perform analysis of refrigeration cycles using various working fluids.						Application						
	ME208.5		Demonstrate the ability to apply psychrometrics for analysis of different air conditioning process.						Application						
	ME208.6		Demonstrate the ability apply the first and second laws to combustion processes						Application						
COs		Mapping with Program Outcomes (POs)										Mapping with PSOs			
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
	ME208.1	3	3											3	2
	ME208.2	3	3										2	2	2
	ME208.3	3	3										2	2	2
	ME208.4	3	3										2	2	2
	ME208.5	3	3										2	3	2
	ME208.6	3	3										2	3	2
	ME208	3.0	3.0										2.0	2.5	2.0
SYLLABUS															
No.	Content													Hours	CO
I	Availability, Irreversibility: Introduction, Available and Non-Available Energy of a Source and Finite Body, Relation between Increase in Unavailable Energy and Entropy Generation. Maximum Work, Maximum Useful Work for a Control System and Control Volume, Irreversibility, Second Law Efficiency (Effectiveness).													06	ME208.1
II	Vapour Power Cycles: Simple Steam Power Plant, Carnot Vapours Power Cycle and its Drawbacks. Description and Thermodynamic Analysis Simple Rankine Cycle with T-s Diagram, Different Losses in Rankine Cycle and Thermodynamic Analysis of Actual Rankine Cycle. Comparison of Carnot and Rankine Cycle. Methods to Improve Rankine Cycle Performance. Reheat Cycle and its Thermodynamic Analysis, Regeneration, Practical Regenerative Rankine Cycles, Open and Closed Feed Water Heaters. Reheat- Regenerative Cycle. Co-Generation Cycle and its Thermodynamic Analysis, Binary Vapour Cycles, Combined Power Cycles													08	ME208.2
III	Gas Power Cycles : Air Standard Cycles; Otto, Diesel, Dual Cycles, P-v and T-s Diagrams, Description and Thermodynamic Analysis, Efficiencies and Mean Effective Pressures. Comparison of Otto and Diesel Cycles. Gas Turbine (Brayton) Cycle; Description and Analysis. Regenerative Gas Turbine Cycle. Inter-Cooling and Reheating in Gas Turbine Cycles. Jet propulsion: Introduction to the Principles of Jet Propulsion, Turbojet, Turboprop, Ramjet and Turbofan Engines and their Processes . Principles of Rocket Propulsion.													08	ME208.3
IV	Refrigeration: Mechanical Refrigeration and Types, Units of Refrigeration, Air Refrigeration System, Details and Principle of Operation, Applications of Air Refrigeration, Vapour Compression Refrigeration Systems, Calculation of COP, Effect of Superheating and Sub Cooling, Desired Properties of Refrigerants and Common Refrigerants, Vapour Absorption System, Mechanical Details, Working Principle, Use of P-H Charts for Calculations													07	ME208.4
V	Psychrometrics and Air-conditioning : Properties of Atmospheric Air, Psychometric Properties(Dry Bulb, Wet Bulb and Dew Point Temperature, Specific & Relative Humidity) of Air, Enthalpy of Moist Air, Psychometric Chart, Psychrometric and Air-Conditioning Processes; Heating, Cooling, Dehumidification and Humidification, Evaporative Cooling. Adiabatic Mixing of Two Moist Air Streams.													07	ME208.5
VI	Chemical Reactions: Fuels and Combustion, Theoretical and Actual Combustion Processes, Enthalpy of Formation and Enthalpy of Combustion, First-Law Analysis of Reacting Systems (Steady-Flow Systems, Closed Systems), Adiabatic Flame Temperature, Entropy Change of Reacting Systems, Second-Law Analysis of Reacting Systems													06	ME208.6
Total Hours													42		

Essential Readings

1. Y. Cengel, M. Boles, M. Kanoglu, "Thermodynamics- An Engineering Approach", McGraw Hill India, 9th Edition, 2019
2. C. Borgnakke and R. E. Sonntag, "Fundamentals of Thermodynamics", Wiley, 10th Edition, 2022.

Supplementary Readings

1. M. B. Bailey, M. J. Moran, D. D. Boettner, H. N. Shapiro "Principles of Engineering Thermodynamics", Wiley, 9th Edition, 2018.
2. T.D. Eastop, A.McConkey, "Applied Thermodynamics for Engineering Technologists", Longman, 5th Edition, 1993

Property Tables/ Databook

1. K. K. Ramalingam "Steam Tables & Mollier Diagram (SI units)" SciTech publications (India) Pvt.Ltd., 2013
2. C.P. Kothandarman, "Refrigerant Tables and Charts including Air Conditioning Data" New Age International, Fifth edition, 2018

		National Institute of Technology Meghalaya An Institute of National Importance										CURRICULUM			
Programme		Bachelor of Technology in Mechanical Engineering								Year of Regulation			2024-25		
Department		Mechanical Engineering								Semester			IV		
Course Code	Course Name	Pre-Requisite	Credit Structure				Marks Distribution								
			L	T	P	C	INT	MID	END	Total					
ME210	Modelling and Simulation of Mechanical Systems	-----	2	0	2	3	50	50	100	200					
				COs	Statement				Bloom's Taxonomy						
Course Objectives	To introduce modelling and simulation in engineering applications	Course Outcomes	ME210.1	Able to know the basics of modelling and simulation, and its importance in engineering application.				Knowledge							
	To develop ability to model and simulate solar and HVAC systems		ME210.2	Able to demonstrate the modelling of solar and HVAC systems. To appraise and analyse the thermal characteristics of these systems.				Comprehension, Application, Analysis							
	To develop skill to model and analyze welding phenomena		ME210.3	Able to demonstrate the modelling and simulation of welding phenomena and analyse the thermal, stress and distortion of the system.				Comprehension, Application, Analysis							
	To develop ability to simulate and analyze beams and plates		ME210.4	Able to explain structural mechanics, demonstrate the modelling and simulation of beams and plates				Comprehension, Application							
	To develop skill to analyze aerodynamic characteristics		ME210.5	Able to analyze the aerodynamic characteristics during flow over an immersed body.				Analysis							
COs	Mapping with Program Outcomes (POs)											Mapping with PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ME210.1	3	2	3	2	2				1	-	1	3	3	1	
ME210.2	3	3	3	3	3				3	2	2	3	3	2	
ME210.3	3	3	3	3	3				3	2	2	3	3	2	
ME210.4	3	3	3	3	3				3	2	2	3	3	2	
ME210.5	3	3	3	3	3				3	2	2	3	3	2	
ME210	3	2.8	3	2.8	2.8				2.6	2	1.8	3	3	1.8	
SYLLABUS															
No.	Content											Hours	COs		
I	Introduction Overview of modelling and simulation, Importance in engineering applications, Types of mechanical systems, Mathematical modelling basics, Mechanical Components Modelling											05	ME210.1		
II	Solar, Air-Conditioning and Heating Systems Modelling of solar thermal and HVAC systems. Integration of photovoltaic and thermal storage systems. Overview of TRNSYS/Simulink, its applications and analysing the simulation results.											09	ME210.2		
III	Welding simulation Introduction to welding, fundamentals of modelling and simulation, thermal analysis of welding, stress and distortion analysis.											10	ME210.3		
IV	Structural Analysis Introduction to structural mechanics, modelling and meshing using ANSYS, material properties and load/boundary conditions, structural analysis of beams and plates											07	ME210.4		
V	Aerodynamic Analysis Introduction to aerodynamics, Aerodynamic analysis, Aerodynamic analysis of flow past over a body, numerical modelling and methodology, Lift and Drag analysis using ANSYS Fluent.											11	ME210.5		
Total Hours											42				
Essential Readings															
1. Esam M. Alawadhi, "Finite Element Simulations Using ANSYS", CRC Press, 2015.															
Supplementary Readings															
1. J.F. Manwell, J.G.MC Gowan, A.L.Rogers, "Wind Energy Explained-Theory, Design and Application" 2nd Edition, Wiley, 2010															
2. ASHRAE Handbook of Fundamentals, American Society of Heating, Refrigerating, and Air Conditioning Engineers, 1972.															
3. TESS Component Library Packages (www.trnsys.com/tess-libraries/GeneralDescriptions_TESSLibs18.pdf)															
4. D A Spera, (Ed.), "Wind Turbine Technology:Fundamental Concepts in Wind Turbine Engineering ", ASME Press, 2009															

		National Institute of Technology Meghalaya An Institute of National Importance										CURRICULUM				
Programme		Bachelor of Technology in Mechanical Engineering					Year of Regulation					2024-25				
Department		Mechanical Engineering					Semester					IV				
Course Code	Course Name	Pre-Requisite	Credit Structure				Marks Distribution									
			L	T	P	C	INT	MID	END	Total						
ME212	Metrology & Instrumentation	-----	3	0	0	3	50	50	100	200						
Course Objectives	To understand basic principles and laws of metrology and measurement.	-----	CO's		Statement				Bloom's Taxonomy							
			ME212.1	Able to understand the need for measurement and the working principles of various instruments used for linear and angular measurements				Understanding								
	ME212.2		Able to understand the standards of measurement and various tolerances and limits, Apply the principles of metrology for designing the limit gauges				Understanding									
	ME212.3		Able to apply the principle of operation of the optical instruments and usage of those instruments				Applying									
	ME212.4		Able to analyse the design principles to measure various parameters of gear and screw threads, surface roughness and gear thread measurements.				Analysing									
	ME212.5		Able to evaluate the functionality of different types of transducers and design various transducers for measuring the mechanical parameters.				Evaluating									
COs		Mapping with Program Outcomes (POs)										Mapping with PSOs				
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ME212.1		3	2	3										3	2	
ME212.2		3	2	3					2				2	2	2	
ME212.3		3	2	3					2				2	2	2	
ME212.4		3	2	3					2				2	2	2	
ME212.5		3	2	3					2				2	3	2	
ME212		3	2	3					2				2	2.4	2	
SYLLABUS																
No.	Content														Hours	COs
I	Engineering Metrology Introduction: Characteristics of measuring instruments, Functional elements of instruments, classification of methods of measurement; Standards for measurement and standardizing organizations; International system (SI) of units; Coordinate Measuring Machine; Measurement uncertainty/ error, types of error. Simple Measurement Tools: Rules, calipers, height gauges, micrometers, depth gauges, combination set, dial indicators, slip gauges, sine bars etc.														08	ME212.1
II	Limits, Fits and Tolerances, and Gauge Design: Basic concepts in limits, fits and tolerances; Selective assembly; Tolerance grades; ISO system of tolerance; Principles gauge design; Workshop and Inspection gauges; Gauge Design à Basic design rules for Plug and Ring gauges; Taper Plug Gauges, Taper Ring Gauges Bore gauge.														08	ME212.2
III	Interferometers: Types of light sources and Interferometers, Types of scales and gratings, Optical flats, Use of different interferometers for calibration of height standards etc.														06	ME212.3
IV	Screw Thread Measurement: Standard thread profiles, Different Thread Elements, Effective diameter, 2 wire and 3 wire methods as applied to standard and non-standard thread profiles, best wire size, Virtual Effective Diameter Surface Roughness: Sources of surface irregularities in manufacturing, Different elements of surface roughness, Definition of centre line and related roughness parameters, Measurement Instruments, Use of Talysurf, Profilometers, Analysis of roughness signal in frequency domain, auto-correlation of surface roughness signals, Use of such analysis in identification of state of health of the manufacturing process. Gear Metrology: Different types of gears, Basic elements of a gear, Involute function, Relations between different gear elements of spur and helical gears, Virtual number of teeth, Use of gear tooth vernier for chordal and constant chordal measurements, Span measurement using Base Tangent Micrometers														15	ME212.4
V	Measurement of Mechanical Parameters: Introduction; Active Passive transducers; Analog/digital mode of operation; Null/deflection methods of measurement; Generalized I/O configuration of measurement systems. Methods of correction of interfering and modifying inputs; Static and Dynamic characteristics of the measuring instruments. Force, Pressure, Torque, Temperature, Viscosity, Flow and Strain measurement														05	ME212.5
Total Hours														42		
Essential Readings																
1. N.V. Raghavendra & L. Krishnamurthy, "Engineering Metrology and Measurements", Oxford University Press, 1 st Edition, 2013																
2. E. O. Doebelin and D. N. Manik, "Measurement systems", Tata McGraw Hill Publishing Company Ltd, 7 th Edition, 2019																
Supplementary Readings																
1. B.C.Nakra, K.K.Chaudhary, "Instrument Measurement and Analysis", Tata McGraw Hill Publishers, 5 th Edition, 2016																
2. J. P.Holman, "Experimental Methods for Engineers", McGraw Hill Publishers, 7 th Edition, 2017																
3. J. W. Dailly, William F. Riley, G. Kenneth, "Instrumentation for Engineering Measurement", Wiley, 2 nd Edition, 2010																

	National Institute of Technology Meghalaya An Institute of National Importance	CURRICULUM
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Programme	Bachelor of Technology in Mechanical Engineering	Year of Regulation	2024-25
Department	Mechanical Engineering	Semester	IV

Course Code	Course Name	Pre-Requisite	Credit Structure				Marks Distribution			
			L	T	P	C	INT	MID	END	Total
ME214	Numerical Methods in Engineering	----	3	0	0	3	50	50	100	200
			COs	Statement						Bloom's Taxonomy
Course Objectives	To introduce numerical approximation methods.	Course Outcomes	ME214.1	Able to choose and apply different iterative methods to find solution of algebraic equations and compare in terms of error analysis and convergence.						Application, Analysis
	To develop an ability to choose and apply different numerical schemes to obtain solution of algebraic equations, numerical differentiation and integrations, ordinary and partial differential equations and obtain empirical correlations		ME214.2	Able to appraise empirical correlations using curve fitting methods.						Analysis
	To develop an ability to analyze numerical schemes in terms of error analysis, stability analysis and convergence.		ME214.3	Able to solve differentiation and integration using different numerical schemes.						Application
	To develop an ability to create computer program for mathematical models that solves real-life applications using the knowledge of numerical methods.		ME214.4	Able to choose and apply different numerical methods to find solution of ordinary and partial differential equations and compare in terms of accuracy, stability and convergence.						Application, Analysis, Evaluation
			ME214.5	Develop a computer code to solve prototypical mathematical problems which will have real-life applications and deliver presentation on outcome of the project.						Creation

COs	Mapping with Program Outcomes (POs)												Mapping with PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ME214.1	3	3	2										3	3	
ME214.2	3	3	2		2								3	3	
ME214.3	3	3	3	3	2								3	3	
ME214.4	3	3	3	-	2								3	3	
ME214.5	3	3	3	3	2				3	3		3	3	3	
ME214	3	3	2.6	3	2				3	3		3	3	3	

SYLLABUS

No.	Content	Hours	COs
I	Solution of Simultaneous Algebraic Equations Direct methods of solution, Pitfalls of elimination methods, Norm and condition number, Iterative methods for solution, Comparison and convergence of iterative methods, Ill conditioned equations	7	ME214.1
II	Empirical Correlations and Curve-Fitting Graphical method, Laws reducible to the linear law, Method of group averages, Method of least squares, Method of moments, Linear and non-linear regression analysis	7	ME214.2
III	Numerical Differentiation and Integration Numerical derivatives using forward, backward and central difference schemes, Maxima and minima, Numerical integration, Quadrature formulae, Errors in quadrature formulae	9	ME214.3
IV	Numerical Solution of Ordinary Differential Equations Taylor's series method, Euler's method, Runge-Kutta method, Adam's Bashforth method, Error analysis, Stability analysis, Convergence of a method	10	ME214.4
V	Numerical Solution of Partial Differential Equations Classification of partial differential equations, Solution of elliptic, parabolic and hyperbolic equations	9	ME214.4
VI	Term Project Write computer programs/codes for prototypical mathematical problems which will have real-life applications in the area of computational mechanics. Deliver short presentation on the project undertaken.		ME214.5
Total Hours		42	

Essential Readings

- 1.J. D. Hoffman, "Numerical Methods for Engineers and Scientists", Second Edition, 2001, CRC Press.
- 2.B. S. Grewal, "Numerical Methods in Engineering & Science with Programs in C, C++ & MATLAB" Eleventh Edition, 2013, Khanna Publishers

Supplementary Readings

1. E. Kreyszig, "Advanced Engineering Mathematics", Tenth Edition, 2020, Wiley.
2. R. W. Hamming, "Numerical Methods for Scientists and Engineers", Second Edition, 1987, Dover
3. K. E. Atkinson. An Introduction to Numerical Analysis, Second Edition, 1991, Wiley

		National Institute of Technology Meghalaya An Institute of National Importance										CURRICULUM			
Programme		Bachelor of Technology in Mechanical Engineering						Year of Regulation				2024-25			
Department		Mechanical Engineering						Semester				IV			
Course Code	Course Name	Pre-Requisite	Credit Structure				Marks Distribution								
			L	T	P	C	INT	MID	END	Total					
ME216	Dynamics of Rigid Bodies	-----	3	0	0	3	50	50	100	200					
Course Objectives	<p>To understand basic principles of kinetics of particles and rigid bodies.</p> <p>To develop the skills to analyze various problems related to velocity and acceleration analysis of rigid bodies.</p>	Course Outcomes	CO's		Statement				Bloom's Taxonomy						
			ME216.1	Illustrate kinematics and kinetics of particles, system of particles.				Understanding							
			ME216.2	Apply the Newton's laws of motion to particles, system of particle and rigid bodies				Applying							
			ME216.3	Apply the relation between force, mass and acceleration for System of particles and rigid bodies and solve related problems				Applying							
			ME216.4	Analyze the momentum and impulse principles for solving the kinetic and kinematic parameters of engineering systems				Analyzing							
			ME216.5	Analyze for the linear, angular momentum and acceleration of rigid bodies				Analyzing							
COs	Mapping with Program Outcomes (POs)											Mapping with PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ME216.1	3	2	3										3	3	
ME216.2	3	3	3									2	2	3	
ME216.3	3	2	3									2	2	3	
ME216.4	3	2	2									2	2	2	
ME216.5	3	2	2									2	3	2	
ME216	3	2.2	2.6									2	2.4	2.6	
SYLLABUS															
No.	Content												Hours	COs	
I	Particle Mechanics Rectilinear & curvilinear motion; Relative motion. Kinetics of the Particle: Inertial frame, Force, mass & acceleration; Work & energy; Impulse & momentum.												09	ME 216.1	
II	Mechanics of system of particles Kinetics of the system of particles: Introduction to system of particle; Work energy principle for the system of particle; Impulse & momentum principle for the system of particle; conservation of energy and momentum.												06	ME 216.2	
III	Mechanics of rigid bodies Kinematics of the rigid body Introduction to rigid body; rigid body motion-rotation, absolute motion, relative velocity, relative acceleration; Instantaneous centre of zero velocity; Motion relative to rotating axes.												06	ME 216.3	
IV	Kinetics of the rigid body Force, mass & acceleration of rigid body, translation, fixed axis rotation, general plane motion; Work & energy relation for the rigid body, virtual work; Impulse & momentum equation for the rigid body.												12	ME 216.4	
V	Euler's equation Lagrange's equation, Displacement, Velocity, Acceleration analysis, Graphical/Analytical												09	ME 216.5	
Total Hours												42			
Essential Readings															
1. J. L. Meriam, L. G. Kraige, "Engineering Mechanics–Dynamics", Wiley, 7 th Edition, 2013.															
2. Shames, ShamesIrving H., "Engineering Mechanics Statics And Dynamics", Pearson Education, 4thEdition, 2006.															
Supplementary Readings															
1. R.C.Hibbler,A.Gupta,"EngineeringMechanics:StaticsandDynamics",Pearson,11thEdition,2010.															
2. S.Timoshenko,DHYoung,JVRao,andS.Pati"EngineeringMechanics",McGrawHill,5thEdition,2013.															

		National Institute of Technology Meghalaya An Institute of National Importance										CURRICULUM				
Programme		Bachelor of Technology (All Branches)								Year of Regulation			2024-25			
Department		Mechanical Engineering								Semester			IV			
Course Code	Course Name	Pre-Requisite	Credit Structure					Marks Distribution								
			L	T	P	C	INT	MID	END	Total						
ME218	Indian Health, Wellness and Psychology	-----	2	0	0	2	50	50	100	200						
			COs		Statement					Bloom's Taxonomy						
Course Objectives	Understanding the fundamental principles of Indian health systems such as Ayurveda and yoga which are useful in maintaining the health of a healthy person		Course Outcomes	ME218.1	Students will be able to know about the IKS and its role in Indian as well as World history.					Knowledge						
	Practical implementation of health principles to correct the intake of our food, air, water and sunlight to achieve perfect health.			ME218.2	Students will be able to understand the contributions of IKS in health and the role of Ayurveda					Knowledge						
	Understanding unique Mind Body Constitution and choosing the right lifestyle suitable to maintain the internal balance.			ME218.3	Students will be able to understand the role of IKS in Wellness and learn the benefits of Yoga.					Knowledge						
				ME218.4	Students will be able to understand the role of IKS in Psychology and learn different aspects of the mind.					Knowledge						
				ME218.5	Students will be able to design and present cognitive problem-solving kits.					Analysis, Synthesis, Creation						
COs		Mapping with Program Outcomes (POs)										Mapping with PSOs				
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ME218.1			2						2				2	2		
ME218.2		3	3		2			2	2				2	2	2	
ME218.3		3	3		2			2	2				2	2	2	
ME218.4		3	2		2			2	2				2	2	2	
ME218.5		3	3	3	2	2	3	3	3	3	3	3	2	2		
ME218		3	2.6	3	2	2	3	2.25	2.2	3	3	3	2.2	2	2	
SYLLABUS																
No.	Content												Hours	COs		
I	Introduction to IKS: What is IKS? Why do we need IKS? Organization of IKS, Historical authenticity of IKS, some salient aspects of IKS												4	ME218.1		
II	Health: Introduction to health; Definition of health in Ayurveda; Introduction to Ayurveda, the Knowledge of Life, Health and treatment aspects in Ayurveda; Influence of Pancha maha bhuta or the five elements on Internal environment of Human being												6	ME218.2		
III	Wellness: Understanding Swastha vritta, the healthy regimen to maintain state of wellbeing; Dinacharya, the Daily regimen including Daily detoxification, exercise, Intake of Food, Water, Air and Sunlight, work and ergonomics, Rest and sleep hygiene; Meaning and objectives of Yoga, Introduction to hatha yoga and other forms of karma yoga, raja yoga, gnan yoga and bhakti yoga; Approaches to lead a healthy life;												7	ME218.3		
IV	Psychology: Indian approach to psychology; Concept of Manas in Ayurveda and understanding Mind Body harmony, Triguna based Psychology in Ayurveda and Yoga, Influence of Tri dosha on Mind, Mind body intellect and consciousness complex												7	ME218.4		
V	Minor project: Development of cognitive materials/kits for problem solving, creativity, intelligence; Presentation.												4	ME218.5		
Total Hours												28				
Essential Readings																
1. B. Mahadevan, V. R. Bhat, R. N. Nagendra Pavana, "Introduction to Indian Knowledge System: Concepts and Applications", PHI Learning Pvt. Ltd, 2022.																
2. K. Kapur and A. K. Singh (Eds), "Indian Knowledge Systems, Vol. 1", Indian Institute of Advanced Study, Shimla, 2005.																
3. D. Chopra, "Perfect Health--Revised and Updated: The Complete Mind Body Guide", Harmony Publications, 2001																
4. V. Lad, "Ayurveda, the Science of Self-healing: A Practical Guide", Lotus Press, 1984																
5. B.K.S. Iyengar, "Light on Yoga: The Classic Guide to Yoga by the World's Foremost Authority", Thorsons Publications, 2006.																
6. B. Avari, "India: The Ancient Past: A History of the Indian Subcontinent from c. 7000 BCE to CE 1200", 2 nd edition, London: Routledge, 2016.																
Supplementary Readings																
1. B. S. Sukumar and H. K. Shashirekha, "Charaka Samhita, General Principles (Volume I)", Chaukhambha Publications, 2017.																
2. "Tatvabodh of Sankaracharya", Central Chinmay Mission Trust, Bombay, 1995.																
3. B. Bhattacharya, "Everyday Ayurveda", Penguin Random House India, 2015.																
4. D. Vora, "Health in your Hands: Vol 1", Navneet Education Limited, 1989.																
5. "Healthy Mind, Healthy Body", Ramakrishna Math, Chennai, 2022																
6. S. Gokulananda, "How to overcome Mental Tension", RKMIC, Kolkata, 2019.																

		National Institute of Technology Meghalaya An Institute of National Importance											CURRICULUM			
Programme		Bachelor of Technology in Mechanical Engineering						Year of Regulation						2024-25		
Department		Mechanical Engineering						Semester						IV		
Course Code	Course Name	Pre-Requisite	Credit Structure										Marks Distribution			
			L	T	P	C	INT	MID	END	Total						
ME272	Product Design and Development	-----	2	0	0	2	50	50	100	200						
Course Objectives	To understand the basic structure of Product Design, Product Development Process and Explain the techniques uses in product design and development	-----	CO's		Statement								Bloom's Taxonomy			
			ME272.1	Able to interpret basic structure of product design, product development process and scope of product development.								Understanding				
	ME272.2		Able to explain the techniques of product function, product teardown and experimentation.								Understanding					
	ME272.3		Able to apply the knowledge of benchmarking, establishing engineering specifications and product architecture in product design.								Applying					
	ME272.4		Able to analyse the knowledge of Brainstorming, Directed Search, Morphological Analysis and Concept Variants for concept selection and embodiment.								Analysing					
	ME272.5		Able to evaluate the product metrics and life cycle assessment.								Evaluating					
COs		Mapping with Program Outcomes (POs)											Mapping with PSOs			
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ME272.1			1	1	1		2	2	1	2	2	2	1	3	2	
ME272.2				1	2			2		2	2	2	2	3	3	
ME272.3					2	2	3	3		3	3	3	3	3	3	
ME272.4						2	2			3	3	3	3	3	3	
ME272.5							2	3	3	3	3	3	3	3	2	
ME272			1	1	1.67	2	2.25	2.4	2	2.6	2.6	2.6	2	3	2.6	
SYLLABUS																
No.	Content														Hours	COs
I	Introduction to Product Design, Product Development Process Tools, Product Costing and Scope of Product Development: An introduction to Product Design, Modern Product Development, Example of Product Development Processes, Cost Estimation, Cost Optimization, Lifecycle Cost Analysis, Theories and Methodologies in Design, Product Development Teams, Product Development Planning, Determining What to Develop, Basic Method: Mission Statement and Technical questioning														06	ME272.1
II	Understanding Customer Needs, Establishing Product Function, Product Teardown and Experimentation: Customer Satisfaction, Gathering Customer Needs, Organizing and Prioritizing Customer Needs, Why Functional Decomposition? Modelling Process, A Simple Approach: Function Trees, Function Structure, Augmentation: From Simple Function Trees to Complete Models, Tear down Process, Tear down Methods.														08	ME272.2
III	Benchmarking, Establishing Engineering Specifications and Product Architecture: Background: Know Your Enemy to Know Yourself, A Bench-marking Approach, Support Tools for the Benchmarking Process, Setting Product Specification, Product Architectures.														05	ME272.3
IV	Generating Concepts, Concept Selection, Concept Embodiment: Concept Generating Process, Basic Methods: Information Gathering and Brainstorming, Estimating Technical Feasibility, A Concept Selection Process, Pugh Concept Selection Charts.														04	ME272.4
V	Modelling Of Product Metrics, Design for Manufacture and Assembled, Design for The Environment: Introduction: Model Selection by Performance Specification, Mathematical Modelling versus Physical Prototyping, Prototyping Essentials, Types of Prototypes, Uses of Prototypes, Rapid Prototyping Technique.														05	ME272.5
Total Hours															28	
Essential Readings																
1. Kevin N. Otto, Kristin L. Wood, "Product Design: Techniques in Reverse Engineering and New Product Development", Pearson Education India; 1 st Edition, 2003																
2. Karl Ulrich and Steven Eppinger, "Product Design and Development" 7 th Edition, 2020																
Supplementary Readings																
1. Steven Selikoff, "The COMPLETE BOOK of Product Design, Development, Manufacturing, and Sales", Amazon Digital Services LLC - Kdp, 1 st Edition, 2020																



National Institute of Technology Meghalaya
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CURRICULUM

Programme	Bachelor of Technology in Mechanical Engineering				Year of Regulation	2024-25								
Department	Mechanical Engineering				Semester	IV								
Course Code	Course Name	Pre-Requisite	Credit Structure				Marks Distribution							
			L	T	P	C	Continuous Evaluation	Total						
ME 252	Theory of Machines Lab	----	0	0	2	1	100	100						
Course Objectives	To understand the basics knowledge of steering mechanism, governor, gyroscope, moment balance, cams and whirling of shaft To perform the experiments using various setups to prove various principles of mechanics	Course Outcomes	COs		Statement			Bloom's Taxonomy						
			ME 252.1	To observe the static and dynamic balancing, Moment balance, dynamic friction			Understanding							
			ME 252.2	Observe the basic concepts of governor, gyroscope, and cams			Understanding							
			ME 252.3	To test Hooks law			Evaluate							
			ME 252.4	To test the whirling of shaft phenomenon and determining the critical speed in loaded condition			Evaluate							
COs	Mapping with Program Outcomes (POs)											Mapping with PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
ME 252.1	2	2	2						2				2	1
ME 252.2	2	2	2						2				2	1
ME 252.3	2	2	2						2				2	1
ME 252.4	2	2	2						2				2	1
ME252	2	2	2						2				2	1

SYLLABUS

Sl. No.	Content	Hours	COs
1	To study the fundamentals of the equilibrium of moments and application of the law of levers	02	ME 252.1
2	To verify the laws of statics (Force and Torque Balance)	02	ME 252.1
3	To determine mass moment of inertia of a flywheel.	02	ME 252.1
4	Demonstration of fundamental principles of belt drives, wheel and disc drives and investigation of transmission ratios on spur gear.	02	ME 252.1
5	To balance the masses statically and dynamically of a single reciprocating/rotating mass system.	02	ME 252.1
6	To demonstrate and measure displacement curves for cam mechanisms.	02	ME 252.2
7	To study the characteristic curves of different centrifugal force governors.	02	ME 252.2
8	Experimental verification of the laws of gyroscopes–gyroscopic couple	02	ME 252.2
9	To verify Hook's law using parallel-coupled loaded/gimbal spring.	02	ME 252.3
10	To study and conduct basic experiments on mechanical vibration, natural damped and forced vibrations (b)To understand the critical rotational speeds on simply loaded and continuous shafts – whirling of shaft	02	ME 252.4
11	Mini Project	08	ME 252.1, ME 252.2, ME 252.3, ME 252.4
Total Hours		28	

Essential Readings

1. Joseph E. Shigley, "Theory of Machines and Mechanisms", Oxford University Press, 4th Edition, 2014
2. Thomas Bevan, "Theory of Machines", Pearson, 3rd Edition, 2009

Supplementary Readings

1. Ghosh and Mallick, "Theory of Machines and Mechanisms", Ease-West Press, 3rd Edition, 2008



National Institute of Technology Meghalaya
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CURRICULUM

Programme	Bachelor of Technology in Mechanical Engineering	Year of Regulation	2024 -25
Department	Mechanical Engineering	Semester	IV

Course Code	Course Name	Pre-Requisite	Credit Structure				Marks Distribution	
			L	T	P	C	Continuous Evaluation	Total
ME 254	Manufacturing Technology Lab	-----	0	0	2	1	100	100

Course Objectives	Course Outcomes	CO's	Statement	Bloom's Taxonomy
		ME254.1	Explain about the drilling machine, tapping and reaming operation for various applications with safety procedure.	Understanding
<p>To understand the basic working principles of various manual Machines such as Drilling, Milling machines, and surface grinding process.</p> <p>To understand the process of gear manufacturing process for spur gear and helical gear.</p>	<p>Course Outcomes</p>	ME254.2	Utilize milling process in milling machine to perform surface preparation operations in specified jobs.	Application
		ME254.3	Utilize milling process to manufacture spur gear and its finishing operations.	Applying
		ME254.4	Utilize slotting machine for slot/groove cutting operations and sheet metal operation for contouring to perform specified jobs.	Applying
		ME254.5	Develop specified jobs using surface grinding machine to achieve high surface finish as desired in the process.	Applying

COs	Mapping with Program Outcomes (POs)												Mapping with PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ME254.1	2	2	2		2		2		2			2	2	2	
ME254.2	2	2	2		2		2		2			2	2	2	
ME254.3	2	2	2		2		2		2			2	2	2	
ME254.4	2	2	2		2		2		2			2	2	2	
ME254.5	3	3	3		3		3		2			3	2	2	
ME254	2.2	2.2	2.2		2.2		2.2		2.0			2.2	2.0	2.0	

SYLLABUS

No.	Content	Hours	COs
I	Drilling machine – Drilling, Boring, Trepanning, Reaming, Honing; Tapping.	04	ME254.1
II	Milling process – Face milling, Contour milling, Groove milling, Chamfer milling, Indexing for Gear cutting.	06	ME254.2
III	Hobbing process - Gear cutting, splines & Sprockets	06	ME254.3
IV	Slotting process- Slotting operations for Slot, groove, Keyway & Splines. Sheet metal operations- Bending, blanking, Piercing, Notching, Nibbling	06	ME254.4
V	Surface finishing process – Surface grinding, Cylindrical grinding, Centreless grinding, Lapping process.	06	ME254.5
Total Hours		28	

Essential Readings

- S.K.H. Choudhury, A.K.H. Choudhary and N. Roy, "Elements of Workshop Technology", Media Promoters and Publishers Pvt. Ltd., 2007
- HMT, "Production Technology" McGraw Hill, 2017

Supplementary Readings

- W. A. J. Chapman, "Workshop Technology", CBS Publishers, 5th Edition, 1972
- H. Gerling, "All About Machine Tools", New Age International.
- A. Ghosh and A.K. Malic, "Manufacturing Science", Second edition, East West Press, 2010

		<p align="center">National Institute of Technology Meghalaya An Institute of National Importance</p>										<p align="center">CURRICULUM</p>		
Programme		Bachelor of Technology in Mechanical Engineering								Year of Regulation		2024-25		
Department		Mechanical Engineering								Semester		IV		
Course Code	Course Name	Pre-Requisite	Credit Structure				Marks Distribution							
			L	T	P	C	Continuous evaluation	Quiz	Total					
ME256	Fluid Machines Lab	-----	0	0	2	1	70	30	100					
			COs		Statement					Bloom's Taxonomy				
Course Objectives	To understand the cavitation and water hammer		Course Outcomes	ME256.1	Explain various turbines and pumps, demonstrate, cavitation and water hammer phenomenon with the safety features					Understand				
	To understand the basic working principles of various turbines and pumps			ME256.2	Experiments with pumps to obtain various performance parameters					Applying				
				ME256.3	Experiment with Pelton turbine, Francis's turbine to obtain various performance parameters.					Applying				
COs	Mapping with Program Outcomes (POs)											Mapping with PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
ME256.1	3	2	2	2				2	2	3		2	3	2
ME256.2	3	2	2	2				2	2	3		2	3	2
ME256.3	3	2	2	2				2	2	3		2	3	2
ME256	3	2	2	2				2	2	3		2	3	2
SYLLABUS														
No.	Content											Hours	COs	
I	To study the functioning of a venture tube.											02	ME256.1	
II	To study and analyze the cavitation processes at various flow rates.											04	ME256.1	
III	Study of the water hammer and surge operation, determination of sound velocity in water and natural frequency in surge chamber.											04	ME256.1	
IV	Series operation of the pump, determination of head, recording of pump characteristics, hydraulic power.											04	ME256.2	
V	Parallel operation of the pump, determination of head, recording of pump characteristics, hydraulic power.											04	ME256.2	
VI	Performance analysis, finding the characteristic curve of the Pelton Turbine, and evaluating the influence of nozzle cross section on the characteristics.											05	ME256.3	
VII	Performance analysis & finding the characteristic curve of the Francis Turbine, influence of guide vane position on the characteristics.											05	ME256.3	
Total Hours											28			
Essential Readings														
1. F. P. Incropera, D.P. Dewitt, T.L. Bergman, A.S. Lavine, Principles of Heat and Mass Transfer, Wiley, 7th Edition, 2016.														
2. Y. A. Cengel, A. J. Ghajar, Heat and Mass Transfer: Fundamentals and Applications., McGraw Hill education, 7 th Edition, 2011.														
Supplementary Readings														
1. A. Bejan, "Convective Heat Transfer", John Wiley and Sons, 3 rd Edition, 2004.														

Fifth Semester Courses

		National Institute of Technology Meghalaya An Institute of National Importance										CURRICULUM				
Programme		Bachelor of Technology in Mechanical Engineering										Year of Regulation		2024-25		
Department		Mechanical Engineering										Semester		V		
Course Code	Course Name	Pre-Requisite	Credit Structure				Marks Distribution				Bloom's Taxonomy					
			L	T	P	C	INT	MID	END	Total						
ME301	Manufacturing Technology-II	-----	3	0	0	3	50	50	100	200						
				COs		Statement										
Course Objectives	To develop the student's ability to understand the metal cutting theory.	Course Outcomes	ME301.1	Interpret the basic concept of metal cutting, chip formation, cutting tools and tool materials, tool life, thermal aspect of machining, and machinability.	Understanding											
	To develop the student's ability to analyze the working of various machine tools.		ME301.2	Explain the working principle of various machine tools and machining operations.	Understanding											
	To familiarize the students with the jigs and fixtures, NC and CNC machine tools.		ME301.3	Explain the concept of jigs and fixtures, functional surfaces, location principles, locating, and clamping devices.	Understanding											
	To develop the student's ability to understand various nonconventional machining methods.		ME301.4	Explain the concept of NC and CNC machine tools.	Understanding											
			ME301.5	Apply the working principles and processing characteristics of various nonconventional machining methods to produce precision components.	Applying											
COs		Mapping with Program Outcomes (POs)										Mapping with PSOs				
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
	ME301.1	3	2											2		
	ME301.2	3	2											2		
	ME301.3	3	2	2		2								3		
	ME301.4	3												2		
	ME301.5	3	2	2				2						3	2	
	ME301	3	2	2		2		2						2.4	2	
SYLLABUS																
No.	Content												Hours	COs		
I	Metal Cutting Introduction to Meso, Micro, & Nano Machining, Chip Formation, Shear Zone, Orthogonal Cutting, Cutting Tools and Materials, Thermal Aspect, Tool Wear and Tool Life, Tool Geometry, Surface Finish and Machinability, Cutting Fluids,												10	ME301.1		
II	Machine Tool Generation of Surfaces and Machining Principles, Classification of Machine Tools: Lathe, Milling, Indexing in Milling, Shaping, Slotting, Planing, Drilling, Boring, Broaching, Grinding (Cylindrical, Surface, Centreless), Thread Rolling and Gear Cutting Machines, Basic Elements of Machine Tools												10	ME301.2		
III	Jigs and Fixtures Functional Surfaces, Location Principles, Locating Devices, Clamping Devices, Designing of Jig, Fixtures												06	ME301.3		
IV	Numerical Control Machine Tools Numerical Control, NC and CNC Machine Tools, Part Programming												06	ME301.4		
V	Nonconventional Methods Need of Nonconventional Machining, Electrochemical Machining, Electro-Discharge Machining, Ultrasonic Machining, LASER Machining, Plasma Machining, Electron Beam Machining, and Water Jet Machining.												10	ME301.5		
Total Hours												42				
Essential Readings																
1. P.N. Rao, "Manufacturing Technology: Metal Cutting and Machine Tools", McGraw Hill																
2. G.K. Lal, "Introduction to Machining Science", New Age International Pvt. Ltd.																
3. G.C. Sen and A. Bhattacharyya, "Principles of Metal Cutting", New Center Book Agency.																
Supplementary Readings																
1. A. Ghosh and A.K. Mallik, "Manufacturing Science", Wiley Eastern.																
2. "Production Technology", H.M.T. Publication, McGraw Hill.																
3. M.C. Shaw, "Metal Cutting Principles", MIT Press.																
4. P.K. Mishra, "Nonconventional Machining", Narosa Publishing House.																
5. S.A. Tobias, "Machine Tool Vibration", John Wiley & Sons Inc.																



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CURRICULUM

Programme	Bachelor of Technology in Mechanical Engineering	Year of Regulation	2024-25
Department	Mechanical Engineering	Semester	V

Course Code	Course Name	Pre-Requisite	Credit Structure				Marks Distribution			
			L	T	P	C	INT	MID	END	Total
ME303	Machine Design-I	-----	3	0	0	3	50	50	100	200
			COs		Statement				Bloom's Taxonomy	
Course Objectives	To introduce design of machine elements.	Course Outcomes	ME303.1	Demonstrate the basic knowledge of design methodologies, different considerations (aesthetic, ergonomic, manufacturing, safety etc.) and materials.				Understanding		
	To teach the different failure theories.		ME303.2	Demonstrate knowledge on basic machine elements.				Understanding		
	To develop an ability and skill to design against static and dynamic load.		ME303.3	Solve problems related to machine elements which withstand the loads and deformations (static and fluctuating), while considering constraints.				Applying		
	To develop an ability and skill to design various machine elements like spring, belt, chain, shafts and different joints like threaded, riveted, welded joints.		ME303.4	Analyze and quantify failure modes of mechanical parts applying different types of stress and strain analysis.				Analyzing		
			ME303.5	Evaluate a design problem successfully, taking decisions when there is no unique answer.				Evaluate		

COs	Mapping with Program Outcomes (POs)										Mapping with PSOs				
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ME303.1	2												3		
ME303.2	3												2		
ME303.3	3												3		
ME303.4			3										3	1	
ME303.5			3										3	1	
ME303	2.6		3.0										2.8	1.0	

SYLLABUS

No.	Content	Hours	COs
I	Introduction Engineering Design Process, Factors influencing Design, Engineering Materials, Manufacturing Considerations in Design – Limits, Fits and Tolerances	03	ME303.1
II	Design against Static Loading Stress Strains Relationship, Theories of Failure, Stress Concentration Factor, Concept of Factor of Safety	06	ME303.2 ME303.3 ME303.4
III	Design against Fatigue Loading Variable load - basic concept; load or stress variations- Cyclic stresses/strains - materials response and the origin of fatigue failure. Stress life relations; Factors influencing fatigue and endurance strength - Effect of stress concentration and fatigue stress concentration. Design approach to fatigue, design of members under combined loading conditions.	06	ME303.2 ME303.3 ME303.4
IV	Design of Shafts, Keys and Couplings Design of transmission shafts subjected to bending, twisting and combined bending twisting and axial loading for strength and rigidity. Design against fatigue loading. Design of Keys. Design of Couplings – Rigid and Flexible.	07	ME303.2 ME303.3 ME303.4 ME303.5
V	Design of Spring Mechanical Springs, Spring Materials, Design of Helical Springs against static and fluctuating loads. Design of Leaf Springs.	05	ME303.2 ME303.4
VI	Design of Belts and Chains Flat and V-belt, Construction, Analysis of Belt tensions, Selection of Flat and V-belts. Chain drives.	05	ME303.2 ME303.4
VII	Design of Joints Threaded Joints – types of screw threads. Design o Bolted Joints under static and fluctuating load. Eccentrically loaded bolted joints. Welded Joints -- type of welded joints, welding symbol and weld symbol and their representation, strength of welded joints subjected to static and fluctuating loads. Eccentrically loaded welded joints. Riveted joints – types of joints, design of riveted joints for structure. Design of Cotter and Knuckle joint.	10	ME303.2 ME303.3 ME303.4 ME303.5
Total Hours		42	

Essential Readings

1. J. E. Shigley, "Mechanical Engineering Design", McGraw Hill. 11th Edition 2020.
2. V B Bhandari, "Design of Machine Elements", Tata Mcgraw Hill. 5th Edition 2020.

Supplementary Readings

1. A. H. Burr and J. B. Cheatham, "Mechanical Analysis and Design", Prentice Hall.
2. M.F Spotts, T.E Shoup, L.E. Hornberger, S.R Jayram, and C. V. Venkatesh, "Design of Machine Elements", Person Education.
3. Faculty of Mechanical Engineering, PSG College of Technology, "Design Data Book".
4. J. D. Hoffman, L. A. Scipio, Elements of Machine Design, Literary Licensing, LLC, 2013



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CURRICULUM

Programme	Bachelor of Technology in Mechanical Engineering	Year of Regulation	2024-25
Department	Mechanical Engineering	Semester	V

Course Code	Course Name	Pre-Requisite	Credit Structure				Marks Distribution			
			L	T	P	C	INT	MID	END	Total
ME305	Heat Transfer	---	3	0	0	3	50	50	100	200

Course Objectives	COs	Statement	Bloom's taxonomy
To teach the mechanisms of heat transfer under various conditions	ME305.2	Analyze problems involving transient and steady state heat conduction in simple geometries.	Analyze
To develop an ability and skill to design a thermal system	ME305.3	Analyze and evaluate various extended surfaces (fins) for various applications.	Analyze
To develop an ability to analyse various industrial thermal heat exchangers, fins, etc.	ME305.4	Interpret and obtain solutions for conduction and radiation heat transfer problems.	Interpret
	ME305.5	Determine heat transfer parameters for natural and forced convection and in and over various geometries.	Determine
	ME305.6	Evaluate the performance parameters of different type of industrial heat exchangers.	Evaluate

COs	Mapping with Program Outcomes (POs)												Mapping with PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ME305.1	3												2		
ME305.2	3												2		
ME305.3		2											2		
ME305.4	3												2		
ME305.5		2											2		
ME305.6		3											2		
ME 305	3	2.34											2		

SYLLABUS

No.	Content	Hours	COs
I	Introduction: Application areas, Importance, Basic modes of heat transfer, Units and dimensions, Conduction vs. convection vs. radiation, Laws of Heat Transfer	07	ME305.1
II	Introduction to Conduction: Mechanism of conduction, Conduction rate equation, Thermal Properties of matter: thermal conductivity, Heat diffusion equation, Initial and Boundary, Conditions, 1-D steady state conduction, Conduction in slab, cylinder, sphere & composite system, 1-D transient problems, 2-D steady state systems, Lumped Capacitance Analysis, Critical thickness of insulations, Numerical methods for heat conduction	07	ME305.2
III	Convective Heat Transfer: Mechanism of convection, Advection vs. convection, Boundary layers, Local & average convection coefficients, Non-Dimensional Numbers, cases study of constant temperature and constant heat flux conditions, heat transfer in nano fluids, Reynolds analogy, Heat transfer in boiling and condensation	07	ME305.5
IV	Heat transfer in extended surfaces: Conduction analysis, Fins with uniform cross-sectional area, Fin performance	07	ME305.3
V	Heat Exchangers: Types of Heat exchangers, Overall heat transfer coefficient, LMTD and NTU method	07	ME305.6
VI	Thermal Radiation: Basic Laws: Planck's law, Lattice Boltzmann law, Wien's displacement law; Emissive power, Intensity, Black and Grey surfaces, View factor, numerical methods in thermal radiation: DTM, DOM, LBM, etc.	07	ME305.4
Total Hours		42	

Essential Readings

1. F. P. Incropera and D. P. Dewitt, "Fundamentals of Heat and Mass Transfer", John Wiley and Sons.
2. J. P. Holman, "Heat Transfer", McGraw Hill.
3. A. Bejan, "Convective Heat Transfer", John Wiley and Sons

Supplementary Readings

1. M. N. Ozisik, "Heat Transfer-A Basic Approach", McGraw Hill
2. Kays, "Convective Heat & Mass Transfer", McGraw-Hill Publishers
3. P. K. Nag, "Heat Mass Transfer", McGraw-Hill Publishers.



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CURRICULUM

Programme	Bachelor of Technology in Mechanical Engineering	Year of Regulation	2024
Department	Mechanical Engineering	Semester	V

Course Code	Course Name	Pre-Requisite	Credit Structure				Marks Distribution			
			L	T	P	C	INT	MID	END	Total
ME307	Dynamics of Machines	-----	3	0	0	3	50	50	100	200

Course Objectives	Course Outcomes	COs		Statement		Bloom's Taxonomy
		To introduce different approaches and mathematical models used in dynamic analysis of machineries.		ME307.1	Students will be able to solve problem associate to static and dynamic force in the kinematic chain.	Applying
ME307.2	Students will be able to solve problem associate to the balancing.			Applying		
ME307.3	Students will be able to solve problems associated to governor.			Applying		
ME307.4	Students will be able to analyze energy storage and turning moment diagram of flywheel.			Analyzing		
ME307.5	Students will be able to analyze effect of gyroscope on aeroplane, ship and vehicle.			Analyzing		
ME307.6	Students will be able to analyze the expiration of machinery components.			Analyzing		

COs	Mapping with Program Outcomes (POs)												Mapping with PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ME307.1	3	2	3										3	2	
ME307.2	3	2	3										3	2	
ME307.3	3	2	3										3	2	
ME307.4	3	2	3										3	2	
ME307.5	3	3	3										3	2	
ME307.6	3	3	3										3	2	

SYLLABUS

No.	Content	Hours	COs
I	Static and Dynamic Analysis of Linkages: Static analysis of four bar linkages, Dynamic analysis of slider crank mechanism, Dynamically equivalent systems, Turning moment diagram, Analysis of flywheel. Gyroscope: Euler's equation, Spin and precession, Gyroscopic effect in airplane, Ship and automobile.	08	ME307.1
II	Balancing: Balancing of reciprocating and rotary machines, Single and multi cylinder engine balancing, V and radial engine balancing, Balancing machines, Field balancing.	09	ME307.2
III	Governors: Classifications, Analysis of Watt, Porter, Proell, Hartnell and Wilson-Hartnell governors, Inertia governor, Sensitivity, Controlling force, Stability, Power and effort.	08	ME307.3
IV	Flywheel: Turning moment diagram of flywheel, fluctuation of energy, energy stored in flywheel	03	ME307.4
V	Gyroscope: Gyroscopic couple, gyroscopic effect on aeroplane, gyroscopic effect on naval ship, stability of vehcles.	04	ME307.5
VI	Vibration: Vibrations of one degree of freedom systems; Free and Force vibrations; Transverse and torsional vibrations of two and three rotor systems; critical speeds; Vibration isolation and measurements; two-degree of freedom systems	10	ME307.6
Total hours		42	

Essential Readings

- S. S. Rattan, "Theory of Machines", McGraw Hill, Second Edition, 2014.
- J. J. Uicker, G. R. Pennock, J. E. Shigley, "Theory of Machines and Mechanisms", Oxford Education, Fourth Edition, 2011.

Supplementary Readings

- A. Ghosh and A. K. Mallick, "Theory of Mechanisms and Machines", Ease-West Press, Third Edition, 1998.
- T. Bevan, "Theory of Machines", Pearson Publication, Third Edition, 1996.



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CURRICULUM

Programme	Bachelor of Technology in Mechanical Engineering	Year of Regulation	2024-25
Department	Mechanical Engineering	Semester	V

Course Code	Course Name	Pre-Requisite	Credit Structure					Marks Distribution			
			L	T	P	C	INT	MID	END	Total	

ME309	Non-Traditional Machining	-----	3	0	0	3	50	50	100	200
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Course Objectives	Course Outcomes	Statement		Bloom's Taxonomy
		COs	Statement	
To develop the student's ability to understand the material removal mechanisms in various non-traditional machining methods. To develop the student's ability to analyse the working principle of various non-traditional machining methods. To develop the student's ability to find the suitable non-traditional machining method for manufacturing of various engineering components.	ME309.1 ME309.2 ME309.3 ME309.4 ME309.5	Interpret the basic concept of material removal in various non-traditional machining methods.	Understanding	
		Explain the working principle of various mechanical machining methods.	Understanding	
		Explain the working principle of various electrochemical and chemical machining methods.	Understanding	
		Explain the working principle of various thermoelectric machining methods.	Understanding	
	ME309.5	Apply the working principle and processing characteristic of various non-traditional machining methods to produce precision components.	Applying	

COs	Mapping with Program Outcomes (POs)												Mapping with PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ME309.1	3	2											2		
ME309.2	3	2											2		
ME309.3	3	2											2		
ME309.4	3	2											2		
ME309.5	3	3	2				2						3	2	
ME309	3.0	2.2	2.0				2.0						2.2	2.0	

SYLLABUS

No.	Content	Hours	COs
I	Introduction: Need of Non-traditional Machining, Difference between Traditional and Non-traditional Machining, Classification and Application of Non-traditional Machining, Trends in Non-traditional Machining	05	ME309.1
II	Mechanical Processes: Ultrasonic Machining, Water Jet Machining, Abrasive Water Jet Machining, Abrasive Machining, Ice Jet Machining, Abrasive Flow Finishing, Magnetic Abrasive Finishing	12	ME309.2 ME309.5
III	Electrochemical and Chemical Processes: Electrochemical Machining, Electrochemical Grinding, Electrochemical Deburring, Electrochemical Honing, Electrostream Drilling, Shaped Tube Electrolytic Machining, Chemical Machining	12	ME309.3 ME309.5
IV	Thermoelectric Processes: Electric Discharge Machining, Wire Cut Electric Discharge Machining, Electric Discharge Grinding, Electric Discharge Diamond Grinding, Plasma Arc Machining, Laser Beam Machining, Electron Beam Machining, Focussed Ion Beam Machining, Hot Machining, Neutral Particle Etching,	13	ME309.4 ME309.5
Total Hours		42	

Essential Readings

- H.S. Shan and P.C. Pandey, "Modern Machining Processes", McGraw Hill 1st Edition 2015.
- V.K. Jain, "Advanced Machining Processes", Allied Publishers 1st Edition 2009.

Supplementary Readings

- A. Ghosh and A.K. Mallik, "Manufacturing Science", Wiley Eastern
- J.A. Mcgeough, "Advanced Methods of Machining", Springer
- P.K. Mishra, "Nonconventional Machining", Narosa Publishing House
- HMT, "Production Technology" McGraw Hill

		National Institute of Technology Meghalaya An Institute of National Importance										CURRICULUM				
Programme		Bachelor of Technology in Mechanical Engineering					Year of Regulation					2024-25				
Department		Mechanical Engineering					Semester					V				
Course Code	Course Name	Pre-Requisite	Credit Structure				Marks Distribution									
			L	T	P	C	INT	MID	END	Total						
ME311	Energy Conversion Systems	-----	3	0	0	3	50	50	100	200						
			COs		Statement					Bloom's Taxonomy						
Course Objectives	Students will able to learn the various energy resources and energy resources technology.	Course Outcomes	ME311.1	Ability to identify the various energy resources, energy management and energy conservation opportunities.					Knowledge Comprehension							
			ME311.2	Ability to understand the various heat exchanger design principles and apply the concept to solve the problems.					Knowledge Application							
			ME311.3	Ability to outline the basics Principle of operation for fuel cells and typical fuel cell systems					Knowledge Comprehension and application							
	ME311.4		Ability to understand the basics of energy conservation in industrial systems					Knowledge Comprehension and application								
	ME311.5		Ability to associate the details of hydrogen energy and waste energy utilization, its production processes and utilizations					Knowledge Comprehension and application								
	ME311.6		Ability to annotate the various energy storage systems for energy storage.					Knowledge Identification and application								
COs		Mapping with Program Outcomes (POs)										Mapping with PSOs				
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ME311.1		3	2		2			2	2				2	2	2	
ME311.2		3	3		2			2	2				2	2	2	
ME311.3		3	3		2			2	2				2	2	2	
ME311.4		3	2		2			2	2				2	2	2	
ME311.5		3	2		2			2	2				2	2	2	
ME311.6		3	2		2			2	2				2	2	2	
ME311		3.0	2.3		2			2	2.0				2.0	2.2	2.0	
SYLLABUS																
No.	Content												Hours	COs		
I	Energy Resources, definition of energy conservation, energy management, energy conservation opportunities, general principles, types, Energy resources and use, Potential for energy conservation, Optimal utilization of fossil fuels, Total energy approach												06	ME311.1		
II	Coupled cycles and combined plants, Cogeneration systems, Exergy analysis, Recuperators and regenerators, Shell and tube heat exchangers, Spiral tube and plate heat exchangers.												06	ME311.2		
III	Principle of operation for fuel cells, typical fuel cell systems, performance of fuel cells, fuel cell electrode processes, six major types of fuel cells, applications												06	ME311.3		
IV	Energy conservation in industrial systems: steam power plants, boilers, furnaces, pumps, fans and blowers, the mechanical system, gas turbines												06	ME311.4		
V	Introduction of Hydrogen Energy Systems: Hydrogen pathways introduction – current uses, General introduction to infrastructure requirement for hydrogen production, storage, dispensing and utilization, and Hydrogen production power plants. Hydrogen Production Processes and Hydrogen Utilization.												06	ME311.5		
VI	The Principles of Waste Management and Waste Utilization. Waste Management Hierarchy and 3R Principle of Reduce, Reuse and Recycle. Waste as a Resource and Alternate Energy source, Waste Sources & Characterization, Technologies for Waste to Energy.												06	ME311.5		
VII	Basics of energy storage, Need for energy storage: electrical, magnetic and chemical storage systems, details of PCM, Thermal energy storage systems: Sensible, Latent and Thermochemical energy storage, Thermo-economic optimization, Thermal and mechanical energy storage												06	ME311.6		
Total Hours												42				
Essential Readings																
1. D. Y. Goswami and F. Kreith, "Energy Conversion", 2 nd Editon, CRC Press, 2017.																
2. A. F. Zobaa, "Energy Storage –Technologies and Applications", Intech Publishers, 2013.																
3. J. H. Harlock, "Cogeneration: Combined Heat and Power", Pergamon Press, 1987																
Supplementary Readings																
1. A. A. Evers, "The Hydrogen Society", Hydrogeit Verlag, 2010.																



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CURRICULUM

Programme	Bachelor of Technology in Mechanical Engineering	Year of Regulation	2024-25
Department	Mechanical Engineering	Semester	V

Course Code	Course Name	Pre-Requisite	Credit Structure				Marks Distribution			
			L	T	P	C	INT	MID	END	Total
ME313	Tribology	---	3	0	0	3	50	50	100	200
			COs		Statement				Bloom's taxonomy	

Course Objectives	Course Outcomes	Statement	Bloom's taxonomy
To develop ability for analyzing the life cycle assessment and justify physical prototype in line with design for robustness.	ME313.2	Able to determine tribological performance parameters of sliding contact in different lubrication regimes.	Applying
	ME313.3	Able to design and select appropriate bearings for a given application.	Analyze
	ME313.4	Able to predict the type of wear and volume of wear in metallic and polymer surfaces.	Applying

COs	Mapping with Program Outcomes (POs)												Mapping with PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ME313.1	3	2			2	2	2					2	3		
ME313.2	3	2			2	2	2					2	3	2	
ME313.3	3		2		2	2	2					2	2	3	
ME313.4	2		2	2	2	2	2					2	2	3	
ME313	2.75	2	2	2	2	2	2					2	3	2.67	

SYLLABUS

No.	Content	Hours	COs
I	Introduction Overview of the course, history, Tribology definition, Tribology in design-bearing material, Tribology in industry (Maintenance), and basic concept of friction, wear, and Lubrication	08	ME313.1
II	Lubricants Lubrication-Definition, types of lubricants, objectives of lubricant, physical properties of lubricants, selection of lubricant, additives, EP lubricants, Recycling of used oil, Oil conservation, oil emulsion, Bearing Terminology-types of sliding contact, rolling contact bearings. Comparison between sliding and rolling contact bearing, Lubrication in rolling, forging, drawing and extrusion, Surface engineering for wear and corrosion resistance-diffusion.	12	ME313.2
III	Modes of Lubrication Hydrodynamic, Hydrostatic, Elasto-hydrodynamic, mixed and boundary lubrication, Reynolds' equation, Applications of hydrodynamic lubrication theory - Journal bearing and Inclined thrust pad bearing, Hydrodynamic lubrication of roughened surfaces, Theories of Externally pressurized lubrication, Squeeze-film lubrication, Elasto-hydrodynamic lubrication and gas (air), lubrication.	12	ME313.3
IV	Friction and Wear Origin of sliding friction, contact between two bodies in relative motion, Types of wear and their mechanisms - Adhesive wear, Abrasive wear, wear due to surface fatigue and wear due to chemical reactions, wear of metallic materials, Tribology of polymers.	10	ME313.4
Total Hours		42	

Essential Readings

- Stachowaik, G.W., Batchelor, A.W., Engineering Tribology, Elsevier, 4th Edition, 2013
- Majumdar B.C, Introduction to bearings, S. Chand & Co., Wheeler publishing, 23rd Edition 1999

Supplementary Readings

- Andras I. Szeri, Fluid film lubrication theory and design, Cambridge University press, 2nd Edition, 2010
- Davis J., Surface Engineering for Corrosion and Wear Resistance, Woodhead Publishing, 1st Edition, 2001
- Cameron A., Basic Lubrication Theory, Wiley Eastern Ltd., 3rd Edition, 1981



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CURRICULUM

Programme	Bachelor of Technology in Mechanical Engineering	Year of Regulation	2024-25
Department	Mechanical Engineering	Semester	V

Course Code	Course Name	Pre-Requisite	Credit Structure				Marks Distribution			
			L	T	P	C	INT	MID	END	Total
ME315	Design of Thermal systems	---	3	0	0	3	50	50	100	200
			COs		Statement				Bloom's taxonomy	
Course Objectives	To develop the student's ability to understand the engineering system and devices associated with fluid flow, heat transfer, thermodynamics Law. To develop the student's ability to understand the design and analysis of devices associated with fluid flow, heat transfer. To develop the student's ability to understand the design of thermal devices with the consideration of energy efficiency.	Course Outcomes	ME315.1	Able to acquire knowledge of thermal devices with the consideration law of fluid flow, heat transfer and thermal device project management.				Understand		
			ME315.2	Able to acquire knowledge pipe network in series and parallel.				Understand		
			ME315.3	Able to design and analyze pipe network with various losses.				Apply		
			ME315.4	Able to design shell and tube heat exchanger, plate and frame heat exchanger, parallel flow heat exchanger, cross flow heat exchanger.				Apply		
			ME315.5	Able to acquire knowledge of thermal devices with the consideration law of fluid flow, heat transfer and thermal device project management.				Apply		

COs	Mapping with Program Outcomes (POs)												Mapping with PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ME315.1	3	3	3	3							3		3	3	
ME315.2	3	3	3	3							2		3	3	
ME315.3	3	3	3	3							2		3	3	
ME315.4	3	3	3	3							3		3	3	
ME315.5	3												3	3	
ME315	3	3	3	3							2.5		3	3	

SYLLABUS

No.	Content	Hours	COs
I	Fundamental: The design process, bid process, engineering design approaches, project management, fluid properties and basic equations in fluid flow and heat transfer.	06	ME315.1
II	Piping System: Pipe and tubing standards, equivalent diameter of noncircular ducts, equation of motion for flow in duct, friction factor and pipe roughness, minor losses, series piping system, flow through non circular cross section, optimization process for economic pipe diameter, equivalent length of fittings, symbol of pipe system, support system for pipe, piping system design practices, pressure drop in two phase flow, support system design for low temperature application.	15	ME315.2, ME315.3, ME315.4
III	Design and analysis of heat exchanger: Shell and tube heat exchanger, plate and frame heat exchanger, cross flow heat exchanger, analysis of shell and tube heat exchanger, heat recovery, design of heat exchanger, extended or finned system heat exchanger	12	ME315.3, ME315.4
IV	Quality control of the design: Quality assurance, quality control, inspection and testing.	09	ME315.5
Total Hours		42	

Essential Readings

- W. S. Janna, "Design of Fluid Thermal System", PWS Publishing, 3rd Edition, 2011.
- A. G. McDonald, H. Magande, "Introduction to Thermo-Fluids Systems Design" Wiley, 1st Edition, 2012.

Supplementary Readings

- Y. A. Cengel, "Heat Transfer: A Practical Approach", McGraw-Hill, 2nd Edition, 2002.
- B.K. Taylor and R.P. Taylor, "Analysis and design of Energy Systems, Hodge", Prentice Hall, 3rd Edition, 1999.
- L. C. Burmeister, "Elements of Thermal-Fluid System Design", 1st Edition, Prentice Hall, 1998,



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CURRICULUM

Programme	Bachelor of Technology in Mechanical Engineering	Year of Regulation	2024-25
Department	Mechanical Engineering	Semester	V

Course Code	Course Name	Pre-Requisite	Credit Structure				Marks Distribution			
			L	T	P	C	INT	MID	END	Total
ME371	Power Plant Engineering and Energy Audit	---	2	0	0	2	50	50	100	200
			COs	Statement				Bloom's taxonomy		
Course Objectives	To introduce present energy scenario, source and energy storage along with the economics of power plant.	Course Outcomes	ME371.1	Students will be able to explain and classify working principles of different plant components of steam turbine power plant.				Understand		
			ME371.2	Students will be able to understand basic working principles and classify diesel and gas turbine plants. Compare with steam turbine power plant.				Apply		
	ME371.3		Students will be able to explain functioning of nuclear power plant and plant components. Recognize safety measures and disposal of nuclear waste.				Apply			
	ME371.4		Students will be able to explain working principles of power plants using renewable energy resources.				Design			
	ME371.5		Students will be able to explain and classify working principles of different plant components of steam turbine power plant.				Understand			
	To explain the working principles, plant layout, plant components of different power plants like steam turbine, diesel, gas turbine, nuclear, hydro-electric, solar thermal, wind turbine and fuel cell plants.									
	To explain the environment pollution during power generation and its control measures.									

COs	Mapping with Program Outcomes (POs)												Mapping with PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ME371.1	3	3	2	2		2	2						3	2	
ME371.2	3	3	2	2		2	2						3	2	
ME371.3	3	3	2	2		2	3						3	2	
ME371.4	3	3	2	2		2	3				1		3	2	
ME371.5	3	3	2	2		3	3						3	2	
ME371	3	3	2	2		2.2	2.6					1	3	2	

SYLLABUS

No.	Content	Hours	COs
I	Introduction Energy scenario, sources of energy, energy storage, pollution and its control.	03	ME371.1 ME371.2 ME371.3 ME371.4 ME371.5
II	Steam Turbine Power Plants Layout, site selection, major plant components: steam turbines, condensers, cooling tower, boilers, coal handling systems, feed water treatment. Operation and maintenance of steam power plant, safety measures.	06	ME371.1
III	Diesel and Gas Turbine Plant Layout, applications, types, plant components, gas turbine fuels, lubrication systems, operation and maintenance, comparison with steam turbine power plant, safety measures.	05	ME371.2
IV	Nuclear Power Plants Plant layout, applications, components of nuclear power plant, types of reactors, safety, disposal of nuclear waste, nuclear power plants in India and world.	05	ME371.3
V	Other Power Plants Plant layout, site selection, principles of working and plant components of- hydro-electric, solar thermal & wind turbine power plant and fuel cell power systems.	05	ME371.4
VI	Pollution and its Control Air and water pollution by power plants and its control, radioactive contamination, central and state pollution control rules and data, effects of pollutants on human health, acid rain	04	ME371.5
Total Hours		28	

Essential Readings

1. P.K. Nag, "Power Plant Engineering", 4th ed., 2017, McGraw Hill Education.
2. R.K. Hegde, "Power Plant Engineering", 1st ed., 2015, Pearson Education India.
3. S. Domkundwar, S. C. Arora, A. V. Domkundwar, "Power Plant Engineering", 8th ed., 2016, Dhanpat Rai and Co. (P) Limited.

Supplementary Readings

1. M. M. El Wakil, "Power plant technology", 1st ed. 2010, McGraw Hill Education.



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CURRICULUM

Programme	Bachelor of Technology in Mechanical Engineering	Year of Regulation	2024-25
Department	Mechanical Engineering	Semester	V

Course Code	Course Name	Pre-Requisite	Credit Structure				Marks Distribution		
			L	T	P	C	Continuous Evaluation	Quiz	Total
ME353	Non-Traditional Machining Lab	---	0	0	2	1	70	30	100
				COs	Statement				Bloom's taxonomy
Course Objectives	<p>This course familiarizes students with the use of various non-traditional machining processes that experienced during manufacturing processes</p> <p>To develop the student's ability to operate the advanced engineering equipment such as Die-sinking EDM, Wire- EDM, Micro-machining set up, surface roughness tester etc.</p>	Course Outcomes	ME353.1	Explain about traditional and non-traditional machining process. Demonstrate and explain the working principle of Die-sinking EDM, Powder material compact machine and surface roughness tester (Understanding). Design and fabrication of green compact tool using powder materials with compact machine for reverse-EDM process.	Apply				
			ME353.2	Application of Reverse-EDM process for surface modification by material deposition process using Die-sinking EDM.	Apply Apply				
			ME353.3	Demonstrate and explain the working principle of Wire-EDM process (Understanding). Analyze the surface roughness and burr formation of the machine product using single pass with WEDM process.	Apply				
			ME353.4	Apply the multi-pass process to analyze the surface roughness and burr formation of the machine product with WEDM process.	Understanding / Apply				
			ME353.5	Demonstrate and explain the working principle of micro-EDM process and analyze effect of different input parameters.	Apply				

COs	Mapping with Program Outcomes (POs)												Mapping with PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ME353.1	3												3		
ME353.2	3												3		
ME353.3	3												3		
ME353.4	3				2								3		
ME353.5	3	2											3		
ME353	3.0	2.0			2.0								3.0		

SYLLABUS

No.	Content	Hours	COs
I	Demonstrate and explain working principle of Die-sinking EDM, Wire-EDM process, Powder material compact machine and Micro-machining process. (NTM-1)	04	All COs
II	Design and fabrication of green compact tool using powder materials. (NTM-2)	02	ME353.1
III	Application of Reverse-EDM process for surface modification by material deposition process using Die-sinking EDM (Application). Analyze the surface pattern and finishing after material deposition. (NTM-3)	02	ME353.2
IV	Machining of cylindrical/rectangular block using single pass wire electro discharge machining (WEDM) process. Analyze the surface finish and burr formation of the machined product. Repeat the experiment at least for 3 times. (NTM-4)	04	ME353.1 ME353.3
V	Machining of cylindrical/rectangular block using multi-pass (2 pass) with WEDM process. Analyze the surface finish and burr formation of the machined product. Repeat the experiment at least for 3 times. (NTM-5)	06	ME353.4
VI	Machining of cylindrical/rectangular block using multi-pass (3 pass) with WEDM process. Analyze the surface finish and burr formation of the machined product. Repeat the experiment at least for 3 times. (NTM-6)	06	ME353.4
VII	Making of micro features using micro-EDM and investigating the effect of different input parameters on MRR. (NTM-7)	06	ME353.1 ME353.5
Total Hours		28	

Essential Readings

- H.S. Shan and P.C. Pandey, "Modern Machining Processes", McGraw Hill 1st Edition 2015.
- V.K. Jain, "Advanced Machining Processes", Allied Publishers 1st Edition 2009.

Supplementary Readings

- J. P. Holman, "Experimental Methods for Engineers", McGraw Hill.
- A. Ghosh and A.K. Mallik, "Manufacturing Science", Affiliated East-West Press Private Limited.
- P.C. Pandey and H.S. Shan, "Modern Machining Processes", TMH.



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CURRICULUM

Programme	Bachelor of Technology in Mechanical Engineering	Year of Regulation	2024-25
Department	Mechanical Engineering	Semester	V

Course Code	Course Name	Pre-Requisite	Credit Structure				Marks Distribution		
			L	T	P	C	Continuous Evaluation	Quiz	Total
ME355	Thermal Engineering Lab - 1	---	0	0	2	1	70	30	100
Course Objectives	Course Outcomes		COs		Statement				Bloom's taxonomy
			ME355.1	Able to apply Fourier's law of heat conduction to obtain thermal conductivity of different samples of solid, liquid and gas using heat conduction unit and illustrate temperature profiles in these experiments.				Comprehension, Application	
			ME355.2	Able to classify, compare and explain free and forced convection phenomena through flat plate, pipe bundles and fins; Calculate and compare heat transfer coefficients, efficiencies, Nusselt number and Reynolds number for free and forced convection.				Comprehension, Application	
			ME355.3	Able to explain different types of heat exchangers, while classifying different types of flow arrangements. Evaluate and analyze mean heat transfer coefficients, LMTD and illustrate temperature profiles in these experiments.				Comprehension, Application, Analysis	

COs	Mapping with Program Outcomes (POs)												Mapping with PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ME355.1	3	2	2	2				2	2	3		2	3	2	
ME355.2	3	2	2	2				2	2	3		2	3	2	
ME355.3	3	2	2	2				2	2	3		2	3	2	
ME355	3.0	2.0	2.0	2.0				2.0	2.0	3.0		2.0	3.0	2.0	

SYLLABUS

No.	Content	Hours	COs
I	Heat Conduction in Solids Determination of Thermal Conductivity and Temperature Profile during Linear and Radial Heat Conduction	04	ME355.1
II	Heat Conduction in Gases Determination of Thermal Conductivities of Various Gases at Different Temperatures during Steady-State Heat Conduction in Gases.	04	ME355.1
III	Heat Conduction in Liquids Determination of Thermal Conductivities of Various Liquids at Different Temperatures during Steady-State Heat Conduction in Liquids.	04	ME355.1
IV	Study of Free Convection Measuring the Heat Transfer Rates, Coefficients, Efficiencies, Reynolds and Nusselt Numbers for Free Convection through Flat Plate, Pipe Bundle and Fins.	04	ME355.2
V	Study of Forced Convection Measuring the Heat Transfer Rates, Coefficients, Efficiencies, Reynolds and Nusselt Numbers for Forced Convection through Flat Plate, Pipe Bundle and Fins.	04	ME355.2
VI	Tubular Heat Exchanger Measuring and Plotting the Temperature Curves in Parallel-Counter Flow, Cross Parallel-Cross Counter Flow Operation, Calculation of Mean Heat Transfer Coefficient and Effectiveness of the Heat Exchanger	04	ME355.3
VII	Shell and Tube Heat Exchanger Measuring and Plotting the Temperature Curves in Parallel-Counter Flow, Cross Parallel-Cross Counter Flow Operation, Calculation of Mean Heat Transfer Coefficient and Effectiveness of the Heat Exchanger	04	ME355.3
Total Hours		28	

Essential Readings

- A.S. Lavine, F. P. Incropera, D.P. Dewitt, T.L. Bergman, Principles of Heat and Mass Transfer, Wiley, 8th Edition, 2017.
- Y. A. Cengel, A. J. Ghajar, Heat and Mass Transfer: Fundamentals and Applications., McGraw Hill education, 6th Edition, 2021.

Supplementary Readings

- A. Bejan, "Convective Heat Transfer", John Wiley and Sons, 4th Edition, 2013.



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CURRICULUM

Programme	Bachelor of Technology in Mechanical Engineering	Year of Regulation	2024-25
Department	Mechanical Engineering	Semester	V

Course Code	Course Name	Pre-Requisite	Credit Structure				Marks Distribution		
			L	T	P	C	Continuous Evaluation	Quiz	Total
ME357	Machine Design and Drawing	---	0	0	2	1	70	30	100
Course Objectives	<p>To introduce limit, tolerance, fit, machining and surface finish symbols.</p> <p>To develop an ability to draw and interpret projection and section view.</p> <p>To develop an ability to develop CAD model of machine components and recreate a machine component in CAD software using reverse engineering.</p>	---	COs		Statement				Bloom's taxonomy
			ME357.1	Able to interpret limit, tolerance, fit, machining and surface finish symbols while designing machine elements.				Understanding	
			ME357.2	Able to classify, compare and explain free and forced convection phenomena through flat plate, pipe bundles and fins; Calculate and compare heat transfer coefficients, efficiencies, Nusselt number and Reynolds number for free and forced convection. Able to draw different machine components using projection and section views.				Comprehension, Application Applying	
			ME357.3	Able to utilize CAD modelling software to develop 3D models of machine components.				Applying	
			ME357.4	Able to build up assembly drawing making use of different component drawings.				Applying	
			ME357.5	Able to develop 3D model of a machine component using reverse engineering.				Analysing	

COs	Mapping with Program Outcomes (POs)												Mapping with PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ME357.1			3			3		3		3	1	2	1		
ME357.2			3		3	3		3		3	1	2	1		
ME357.3			3		3	3		3		3	1	2	1		
ME357.4			3		3	3		3		3	1	2	1		
ME357.5			3		3	3		3	2	3	1	2	1		
ME357			3		3	3		3	2	3	1	2	1		

SYLLABUS

No.	Content	Hours	COs
I	Limits, Tolerances and Fits, Surface Finish Fundamental deviations for holes and shafts. Types of fits, IS/ISO codes for limit and tolerances, Limits, tolerances and fits, Surface finish.	02	ME357.1
II	Orthographic Projection and Sectional View of Different types of Composite Bodies Bolts and nuts, Keys, Pins, Set screws, Riveted joints, Welded joints, Pipe joints, Flanged coupling, Flat and V-belt pulleys, Threads (internal and external), Plain journal bearing.	10	ME357.2 ME357.3
III	Symbols Symbols for surface roughness, Weldments, process flow, electrical and instrumentation units.	03	ME357.1
IV	Assembly and Part Drawings Couplings, bearings, I.C. Engine components etc.	04	ME357.3 ME357.4
V	Solid Modelling Introduction to solid modellers, solid modelling of various machine parts	05	ME357.2 ME357.3 ME357.4
VI	Project A drawing project on reverse engineering	04	ME357.5
Total Hours		28	

Essential Readings

- N. D. Bhatt, "Machine Drawing", Charotar Publishing House, 54th Edition, 2023
- N. Sidheswar, P. Kanniah and V.V.S. Sastry, "Machine Drawing", Tata McGraw Hill, 1st Edition, 2017

Supplementary Readings

- A. Singh, "Machine Drawing", Tata McGraw Hill Publishing, 2nd Edition, 2017
- K. L. Narayana, P. Kanniah & K. V. Reddy, "Production Drawing", New Age International Publisher, 3rd Edition, 2014
- R.K. Dhawan, "A Text Book of Machine Drawing", S. Chand & Company Publishing House, 5th Revised Edition, 2006

Sixth Semester Courses

		National Institute of Technology Meghalaya An Institute of National Importance										CURRICULUM			
Programme		Bachelor of Technology in Mechanical Engineering							Year of Regulation			2024-25			
Department		Mechanical Engineering							Semester			VI			
Course Code	Course Name	Pre-Requisite	Credit Structure				Marks Distribution								
			L	T	P	C	INT	MID	END	Total					
ME302	Machine Design-II	Machine Design-I	3	0	0	3	50	50	100	200					
				COs	Statement						Bloom's Taxonomy				
Course Objectives	To develop an ability and skill to design various machine elements like clutches, brakes and flywheels		Course Outcomes	ME302.1	Able to illustrate knowledge on basic machine elements used in machine design						Understanding				
	To teach rolling contact and journal bearing			ME302.2	Able to implement of basic machine elements design to the design of clutches, brakes and flywheels						Applying				
	To develop an ability and skill to design spur, helical, bevel and worm gears			ME302.3	Able to analyse the design of rolling contact and journal bearing						Applying				
	To provide a general idea of mechanical systems design			ME302.4	Able to analyse the design of spur, helical, bevel and worm gears						Analysing				
				ME302.5	Able to evaluate the part design of mechanical systems using codes and standards						Evaluate				
COs	Mapping with Program Outcomes (POs)											Mapping with PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ME302.1	2												3		
ME302.2	3												2		
ME302.3			3										3		
ME302.4			3										3	1	
ME302.5			3										3	1	
ME302	2.5		3										2.8	1	
SYLLABUS															
No.	Content												Hours	COs	
I	Design of Clutches Friction clutches, disc clutches – design for uniform pressure and wear, multi disc clutches, Cone clutch, Centrifugal clutch												05	ME302.1 ME302.2	
II	Design of Brakes Shoe brakes –short and long shoe analysis, disc and drum brake design												06	ME302.1 ME302.2	
III	Design of Flywheels Fly wheel – torque analysis, solid disc flywheel, stresses in flywheels, Design of flywheels												04	ME302.1 ME302.2	
IV	Design of Bearings Hydrodynamic lubrication theory, Hydrostatic and Hydrodynamic bearings – Bearing Design and selection of parameters, Rolling Element Bearings – dynamic load carrying capacity, selection and design.												08	ME302.1 ME302.3	
V	Design of Gears Gear Drives, Classifications, Selection of types of Gears, Law of Gearing; Spur Gears – terminology, force analysis, failure design of spur gear; Helical Gear – terminology, force analysis, design of helical gear; Bevel Gears – terminology, force analysis, design of bevel gear; Worm Gears – terminology, force analysis and design.												14	ME302.1 ME302.4	
VI	Systems Approach to Design Decision Making, Simulation of mechanical systems using CAD tools, Sensitivity analysis of design parameters, Value Analysis and Value Addition to designed components and systems; Exercises of mechanical systems design with examples.												05	ME302.2 ME302.3 ME302.4 ME302.5	
Total Hours												42			
Essential Readings															
1. J. E. Shigley, "Mechanical Engineering Design", McGraw Hill, 11 th Edition, 2020															
2. V B Bhandari, "Design of Machine Elements", Tata Mcgraw Hill, 5 th Edition, 2020															
Supplementary Readings															
1. A. H. Burr and J. B. Cheatham, "Mechanical Analysis and Design", Prentice Hall, 2 nd Edition, 1995															
2. M.F Spotts, T.E Shoup, L.E. Hornberger, S.R Jayram, and C. V. Venkatesh, "Design of Machine Elements", Person Education, 8 th Edition, 2006															
3. Faculty of Mechanical Engineering, PSG College of Technology, "Design Data Book", 4 th Edition, 2020															

		National Institute of Technology Meghalaya An Institute of National Importance										CURRICULUM				
Programme		Bachelor of Technology in Mechanical Engineering							Year of Regulation			2024-25				
Department		Mechanical Engineering							Semester			VI				
Course Code	Course Name	Pre-Requisite	Credit Structure				Marks Distribution									
			L	T	P	C	INT	MID	END	Total						
ME304	Industrial Engineering	-----	3	0	0	3	50	50	100	200						
			COs		Statement				Bloom's Taxonomy							
Course Objectives	To introduce the basics of Product Design and Development and Wok system design		Course Outcomes	ME304.1	Explain the concept of Product Design and Development and Wok system design.				Understanding							
	To Explain the facility design and Interpret the alternatives of Facility design			ME304.2	Interpret the alternatives in facility design.				Understanding							
	To develop an ability to use the different models in Forecasting, Aggregate production planning, MRP, scheduling and inventory control.			ME304.3	Make use of the different models in Forecasting, Aggregate production planning, MRP, scheduling and inventory control				Application							
	To develop an ability to analyse the optimization techniques in LPP, CPM and PERT			ME304.4	Analyse the different optimization techniques in LPP, CPM and PERT				Analysis							
	To Justify the SQC and Evaluate the different techniques in\ quality control, reliability and maintenance management			ME304.5	Evaluate the different techniques in quality control, reliability and maintenance management				Evaluation							
COs		Mapping with Program Outcomes (POs)										Mapping with PSOs				
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ME304.1		3	2	2	2									3	3	
ME304.2		3	2	2	1		1	1						1	2	
ME304.3		3	3	3	3	3								1	3	
ME304.4		3	3	3	3	3	3	2						3	3	
ME304.5		3	2	2	3	1		1		1	1			2	3	
ME304		3	2.4	2.4	2.4	2.33	2	1.33		1	1			2	2.8	
SYLLABUS																
No.	Content													Hours	COs	
I	Product Design and Development: Principles of good product design, tolerance design; quality and cost considerations; product life cycle; value engineering and analysis, concurrent engineering. Engineering Economy and Costing													03	ME304.1	
II	Work System Design: productivity – concepts and measurements; method study, micro-motion study, principles of motion economy; work measurement – stop watch time study, work sampling, standard data, PMTS; ergonomics; job evaluation, merit rating, incentive schemes, and wage administration.													05	ME304.1	
III	Facility Design: Facility location factors and evaluation of alternate locations; types of plant layout and their evaluation; computer aided layout design techniques; assembly line balancing; materials handling systems.													04	ME304.1 ME304.2	
IV	Production Planning and Inventory Control: Forecasting techniques, aggregate production planning; master production scheduling; order control and flow control; routing, scheduling and priority dispatching; push and pull production systems, concept of JIT manufacturing system; Inventory – functions, costs, classifications, deterministic and probabilistic inventory models, quantity discount; perpetual and periodic inventory control systems.													08	ME304.2 ME304.3	
V	Operation Research: Linear programming – problem formulation, simplex method, duality and sensitivity analysis; transportation and assignment models; network flow models, simple queuing models; dynamic programming; simulation – manufacturing applications; PERT and CPM, time-cost trade-off, resource levelling.													12	ME304.3 ME304.4	
VI	Quality, Reliability and Maintenance management: Quality – concept and costs, quality circles, quality assurance; statistical quality control, acceptance sampling, ISO 9000; design of experiments – Taguchi method, Reliability, availability and maintainability; distribution of failure and repair times; determination of MTBF and MTTR, reliability models; system reliability determination; preventive maintenance and replacement, total productive maintenance – concept and applications.													10	ME304.2 ME304.4 ME304.5	
Total Hours													42			
Essential Readings																
1. R. Panneerselvam., "Production and Operations Management, 3rd Edition, PHI, 2012																
2. Hamdy A. Taha, "Operations Research: An Introduction", 10th Edition, Pearson, 2017																
Supplementary Readings																
1. Chase, Jacobs, Aquilano and Agarwal, "Operations Management for Competitive Advantage ", 11th edition, Tata McGraw Hill Publications, 2008																
2. ILO, "Introduction to Work Study", 4th edition, International Labour Office, Geneva, 1992																

		National Institute of Technology Meghalaya An Institute of National Importance										CURRICULUM						
		Programme					Bachelor of Technology in Mechanical Engineering					Year of Regulation			2024-25			
Department					Mechanical Engineering					Semester			VI					
Course Code	Course Name	Pre-Requisite	Credit Structure				Marks Distribution				L	T	P	C	INT	MID	END	Total
			L	T	P	C	INT	MID	END	Total								
ME 306	Power Plant Engineering	-----	3	0	0	3	50	50	100	200	CO's		Statement				Bloom's Taxonomy	
Course Objectives	To teach the steam turbines and its performance and applications	Course Outcomes	ME306.1	Able to understand the basic working principle of steam power plant, methods to increase the performance of Rankine cycle, circulation, riser, down comer, economizer, superheater, air preheater and evaporator, steam turbines, nozzles and blades and solve related problems. (Applying)				Knowledge Identification										
	To teach the hydroelectric turbines and its performance and applications		ME306.2	Able to understand the hydro turbines, its performance parameters along with the velocity triangle, cavitation, governing and solve related problems (Applying).				Knowledge Application										
	To teach the diesel and nuclear power plant and its performance and applications		ME306.3	Able to explain the functioning of diesel power plant, types, layout and various components, details of combustion, turbocharging and supercharging and solve related problems (Applying).				Knowledge Identification and Application										
	To introduce present energy scenario, source and energy storage along with the economics and emissions of power plant.		ME306.4	Able to explain the functioning of nuclear power plant and solve related problem (Applying)				Knowledge Application and Analysing										
			ME306.5	Explain the economics of power plant based on load variation, solve related problems and describe the power plant emissions (Applying)				Knowledge Application and Analysing										
COs		Mapping with Program Outcomes (POs)											Mapping with PSOs					
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3		
ME 306.1	3	2	2	2		2	2					1	3	2				
ME 306.2	3	2	2	2		2	1					1	3	2				
ME 306.3	2	2	2	2		2	1					1	3	2				
ME 306.4	2	2	2	2		2	1					1	3	2				
ME 306.5	3	2	2	2		2	1					1	3	3				
ME 306	2.6	2.0	2.0	2.0		2	1.2					1.0	3.0	2.2				
SYLLABUS																		
No.	Content														Hours	COs		
I	Steam Turbine Power Plants: Rankine cycle, reheating of steam, feedwater heaters, boiler and types, circulation, riser, down comer, economizer, superheater, air preheater and evaporator, steam turbines, nozzles and blades.														12	ME 306.1		
II	Hydro Electric Power Plants: Turbines and other equipment, classification of plants and turbines, velocity triangle, cavitation, governing, performance.														08	ME 306.2		
III	Diesel Power Plants: Types, application, advantages and layout of diesel plants, components, combustion, performance, turbocharging and supercharging.														08	ME 306.3		
IV	Nuclear Power Plants Atomic structure, nuclear fission and nuclear fusion, nuclear fuel cycle, radioactive decay, nuclear reactors.														07	ME 306.4		
V	Power Plant Economics & Environmental Aspect: Energy scenario, sources of energy, energy storage, economics of power plant, plant investment costs, fixed charges, Operation cost, energy cost, depreciation, incremental cost, greenhouse effect, thermal pollution, other pollutants.														07	ME 306.5		
Total Hours															42			
Essential Readings																		
1. P.K. Nag, "Power Plant Engineering", Tata McGraw Hill.																		
2. R.K. Hegde, "Power Plant Engineering", Pearson Education India.																		
Supplementary Readings																		
1. AW Culp. Principles of Energy Conversion, Tata McGraw Hill.																		
2. Y.A. Çengel and M.A. Boles, "Thermodynamics - An Engineering Approach", McGraw Hill.																		
3. B.G.A. Skrotzki and W.A. Vopat, "Power Station Engineering and Economy", Tata McGraw Hill.																		

		National Institute of Technology Meghalaya An Institute of National Importance											CURRICULUM			
Programme		Bachelor of Technology in Mechanical Engineering						Year of Regulation						2024-25		
Department		Mechanical Engineering						Semester						VI		
Course Code	Course Name	Pre-Requisite	Credit Structure				Marks Distribution									
			L	T	P	C	INT	MID	END	Total						
ME308	CAD-CAM	-----	3	0	0	3	50	50	100	200						
Course Objectives	<p>To introduce the basic structure of CAD workstation and computer graphics and explain the techniques of geometric modelling to represent parametric curves.</p> <p>To develop an ability to use CAD software for developing 2D and 3D models and perform transformations, skill to use computer aided part programming to machine the parts with different geometrical dimensions using CNC machines and justify group technology, CAQC and CIM concepts</p>	-----	Course Outcomes	COs		Statement						Bloom's Taxonomy				
				ME308.1	Able to interpret basic structure of CAD workstation, Memory types, input/output devices and display devices and computer graphics						Understanding					
				ME308.2	Able to explain the techniques of geometric modelling to represent parametric curves.						Understanding					
				ME308.3	Able to apply the knowledge of geometric modelling and execute the steps required in CAD software for developing 2D and 3D models and perform transformations.						Applying					
				ME308.4	Able to analyse Group Technology, CAPP and CAQC						Analysing					
				ME308.5	Able to justify CIM concepts.						Evaluating					
COs		Mapping with Program Outcomes (POs)											Mapping with PSOs			
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ME308.1		3	1	2	2									3	1	
ME308.2		3	3	3	3	3								3	2	
ME308.3		3	3	3	3	3	3			1	1			3	3	
ME308.4		3	3	3	3	3	3	3	2	2	2	2	2	3	3	
ME308.5		3	3	3	3	3	3	3	3	3	3	3	3	3	3	
ME308		3	2.6	2.8	2.8	3	3	3	2.5	2	2	2.5	2.5	3	2.4	
SYLLABUS																
No.	Content														Hours	COs
I	Introduction & Elements of Interactive Computer Graphics The design process, the role of modelling & communication, modelling using CAD, Product life cycle & CAD/ CAM, Concurrent engineering in product design & development, Collaborative Engineering, computers for design Process, CAD system architecture. Operator input and output devices, 2-D and 3-D computer graphics, vector generation, windowing and viewing transformation, Homogeneous coordinates, Perspective projection, Visual realism.														08	ME308.1 ME308.2
II	Techniques for Geometric Modelling Graphic standards, parametric representation of geometry, Bezier curves, Cubic Spline curve, B-Spline curve, parametric representation of line, circle, ellipse & parabola constructive solid geometry (CSG), Boundary representation, wire frame, solid, surface and parametric modelling.														08	ME308.1 ME308.2 ME308.3
III	Transformation, Manipulation & Data Storage 2D & 3D Transformations (Translation, Rotation, and Scaling & Magnification), Concatenations, Matrix representation, Problems & object-oriented programming on Transformations. Object transformation, mirror transformation, Data Structures for interactive modelling, Bill of materials from attribute data, artificial intelligence in design & manufacturing, representation of knowledge and knowledge base engineering.														12	ME308.1 ME308.2 ME308.3
IV	Group Technology, CAPP, and CAQC Introduction to GT, Part Families, Part Classification & Coding, GT Machine cells, Benefits of GT, Computer Aided Process Planning (CAPP), Process Planning Systems, Benefits of CAPP, Artificial Intelligence in CAPP, Computer Aided Quality Control (CAQC), Computers in QC, Contact Inspection methods, Non-contact Inspection methods, Computer Aided Testing, Integration of CAQC with CAD/CAM.														08	ME308.4 ME308.5
V	Computer Integrated Manufacturing & Technology Driven Practices Introduction, CIM Hardware and Software, CIM Benefits, Nature and role of the elements of CIM, Identifying CIM needs, Data base requirements of CIM, Role of CAD/CAM in CIM, Obstacles to Computer Integrated Manufacturing, Concept of the future CIM systems, Socio -techno- economic aspects of CIM. Rapid and Virtual Prototyping, Design for Manufacturing, Reverse Engineering and Green Manufacturing.														06	ME308.2 ME308.4 ME308.5
Total Hours														42		
Essential Readings																
1. M. P. Groover and Emory W. Zimmers, Jr., "CAD/CAM Computer Aided and Manufacturing", Pearson Education India, 22 nd Impression, 2018																
2. P. Radhakrishnan, S. Subramanyan, V. Raju, "CAD/CAM/CIM", New Age International Publishers, 4 th Edition, 2018																
Supplementary Readings																
1. P.N. Rao, "CAD/CAM Principles and Applications", Tata McGraw Hill Publications, 3 rd Edition, 2017																
2. D. L. Goetsch, "Fundamental of CIM technology", Delmar publication, 1 st Edition, 1988																
3. B.S. Pabla and M. Adithan, "CNC Machines", New Age International Publishers., 3 rd Edition, 2018																

		National Institute of Technology Meghalaya An Institute of National Importance										CURRICULUM			
Programme		Bachelor of Technology in Mechanical Engineering					Year of Regulation					2024-25			
Department		Mechanical Engineering					Semester					VI			
Course Code	Course Name	Pre-Requisite	Credit Structure				Marks Distribution								
			L	T	P	C	INT	MID	END	Total					
ME 310	ROBOTICS	-----	3	0	0	3	50	50	100	200					
				CO's	Statement						Bloom's Taxonomy				
Course Objectives	To introduces different robots and its dynamic modelling and path planning and control technique	Course Outcomes	ME310.1	Able to explain the importance of robotics						Understanding					
			ME310.2	Able to illustrate robot configuration and its subsystems						Understanding					
			ME310.3	Able to solve problem of robot kinematics						Applying					
			ME310.4	Able to analyze the robot dynamics using Lagrangian and Eulerian approach						Analyzing					
			ME310.5	Able to predict the path planning and control						Evaluating					
COs	Mapping with Program Outcomes (POs)											Mapping with PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ME 310.1	3	3	3	2								2	3	2	
ME 310.2	3	3	3	3								2	3	2	
ME 310.3	3	3	3	3								3	3	2	
ME 310.4	3	3	3	3								3	3	2	
ME 310.5	3	3	3	3								3	3	2	
ME 310	3	3	3	2.8								2.6	3	2	
SYLLABUS															
No.	Content												Hours	COs	
I	Introduction History of robotics, classification and usages of robot workspace, specification, application-material handling, manufacturing and assembly.												03	ME310.1	
II	Components of Robots Links: Definition, classification and use, Joints: classification of the joints, operation. End effectors / grippers: Classification, force analysis and design, dexterous hand, Remote Centre Compliance (RCC) Actuators: Definition, classification, mechanical actuator, electrical actuator, hydraulic actuator, pneumatic actuator, linear and rotary actuator. Servo and non-servo drive Sensors: Purpose, characteristics and principle of operation of encoders, tachometers, 6 axis force-torque sensors, touch and slip sensor, robot vision-pre and post processing, feature extraction.												06	ME310.2	
III	Kinematics of Robots Position Analysis: Matrix transformation, representation of pure translation and pure rotation, combined translation and rotation, direct and inverse kinematics problems, examples of serial and parallel robots. Velocity Analysis: Differential analysis, Jacobian, homogenous transformation, DH parameters, solution of kinematics.												09	ME310.3	
IV	Dynamics of Robots Dynamic analysis of the manipulator robot, Lagrange-Euler dynamic formulation, static force analysis, transformation of force and moment.												10	ME310.4	
V	Motion Planning and Control Basics of trajectory planning, Multi - way point trajectory, Cartesian space trajectory, basics of control, block diagram, Laplace transform, PID control, trajectory planning – position, velocity and force control. Robot programming – Lead through and teach pendent method, VAL programming language and programming exercise.												06	ME310.5	
VI	Case Studies and Future Trend Mobile robots–navigation and guidance, tele-robotics, bio-robotics, social robotics and humanoid robots.												02	ME310.1 ME 310.2 ME 310.4	
Total Hours												42			
Essential Readings															
1. M.P.Groover, "Industrial Robotics – Technology, Programming and Applications", McGraw-Hill, 2 nd Edition, 2012.															
2. K.S.Fu,R.C.GonzalezandC.S.G.Lee,"RoboticsControl,Sensing,VisionandIntelligence", McGraw-Hill, 1 st Edition,1987.															
Supplementary Readings															
1. Y.Koren, "Robotics for Engineers", McGraw-Hill, 1 st Edition1985.															
2. J.J.Craig, "Introduction to Robotics: Mechanics and Control", Pearson Education International, 3 rd Edition, 2005.															
3. M.W.Spong and M.Vidyasagar, "Robot Dynamics and Control", Wiley,1 st Edition ,2008.															
4. R.J.Schilling,"FundamentalsofRoboticsAnalysisandControl",PrenticeHallofIndiaPvt.Ltd.,1 st Edition, 1996															



National Institute of Technology Meghalaya
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CURRICULUM

Programme	Bachelor of Technology in Mechanical Engineering						Year of Regulation	2024-25								
Department	Mechanical Engineering						Semester	VI								
Course Code	Course Name	Pre-Requisite	Credit Structure				Marks Distribution									
			L	T	P	C	INT	MID	END	Total						
ME 312	Machine Tool Technology	-----	3	0	0	3	50	50	100	200						
Course Objectives	To study and understand the various internal parts of machines.	Course Outcomes	CO's	Statement				Bloom's Taxonomy								
			ME312.1	Understand the kinematic motions of a machine tool.				Understanding								
			ME312.2	Explain the strategies for critical mechanical components of a machine tool based on design principles.				Understanding								
	ME312.3		Design and analyse the systems used for achieving required speeds and feeds.				Applying									
	ME312.4		Design and analyze of slide ways, spindles and lead screws for reducing friction and to achieve high accuracy of product.				Applying									
	ME312.5		Analysis of the reasons of chatter in machining and analyze vibrations to improve the performance of machine tool.				Analyzing									
	To understand the dynamics of machining parts by varying parameters		ME312.6	Evaluate the performance parameters of machine tools to enhance the quality assurance during machining.				Analyzing								
COs	Mapping with Program Outcomes (POs)										Mapping with PSOs					
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	
ME312.1	3	3	3		2			3	2			3	3	2		
ME312.2	3	3	3		2			3	2			3	2	2		
ME312.3	3	3	3		2			3	2			3	2	2		
ME312.4	3	3	3		3			3	2			3	2	2		
ME312.5	3	2	3		3			3	2			3	3	3		
ME312.6	3	3	3		3			3	2			3	3	3		
ME312	3.0	2.8	3.0		2.5			3.0	2.0			3.0	2.5	2.3		
SYLLABUS																
No.	Content											Hours	COs			
I	Introduction to Machine Tool Drives and Mechanisms: Introduction to the course, Working and Auxiliary Motions in Machine Tools, Hydraulics Transmission and its elements, Mechanical Transmission and its elements.											06	ME312.1			
II	Regulation of Speed and Feed Rates: Aim of Speed and Feed Regulation, Kinematics of Machine Tools – Stepped and step less drive, Stepped Regulation of Speeds, Multiple Speed Motors, Ray Diagrams and Design Considerations, Design of Speed Gear Boxes, Feed Drives, Feed Box Design, Step-Less Regulation of Speed and Feed Rates.											06	ME312.2			
III	Design of Machine Tool Structures: Functions of Machine Tool Structures and their requirements, Design for Strength Design for Rigidity, Materials for Machine Tool Structures, Machine Tool, Constructional Features, Beds and Housings, Columns and Tables, Saddles and Carriages.											05	ME312.3			
IV	Design of Guideways, Power Screws and Spindles: Functions and Types of Guide ways, Design of Guide ways, Design of Aerostatic, Slide ways, Design of Anti-Friction Guide ways, Combination Guide ways, Design of Power Screws, Recirculating power screws assemblies, Elimination of Backlash.											07	ME312.4			
V	Design of Spindles and Spindle Supports: Functions of Spindles and Requirements, Effect of Machine Tool Compliance on, Machining Accuracy, Design of Spindles, Antifriction and Sliding Bearings.											05	ME312.4			
VI	Dynamics of Machine Tools: Machine Tool Elastic System, Static and Dynamic Stiffness, Stability Analysis, Machine Tool Chatter, Damping Characteristics, Damping Methods.											05	ME312.6			
VII	Control Systems in Machine Tools: Machine tool control systems, Control Systems for Speed and Feed Changing, Adaptive Control Systems.											04	ME312.6			
VIII	Vibration in Machine Tools: Forced Vibration, self-excited vibration, stick-slip vibration and its minimization, vibration isolation.											04	ME312.5			
Total Hours											42					
Essential Readings																
N.K. Mehta, Machine Tool Design and Numerical Control, TMH, New Delhi, 3 rd Edition 2017.																
D. K Pal, S. K. Basu, "Design of Machine Tools", 5th Edition. Oxford IBH, 6 th Edition 2018.																
Supplementary Readings																
G.C. Sen and A. Bhattacharya, Principles of Machine Tools, New Central Book Agency, 2 nd Edition 2009.																
N. S. Acherkhan, "Machine Tool Design", Vol. I, II, III and IV, MIR publications, 1968.																

		National Institute of Technology Meghalaya An Institute of National Importance										CURRICULUM			
Programme		Bachelor of Technology in Mechanical Engineering							Year of Regulation			2024-25			
Department		Mechanical Engineering							Semester			VI			
Course Code	Course Name	Pre-Requisite	Credit Structure				Marks Distribution								
			L	T	P	C	INT	MID	END	Total					
ME 314	Aerodynamics	-----	3	0	0	3	50	50	100	200					
			CO's		Statement				Bloom's Taxonomy						
Course Objectives	To introduce the concept of aerodynamics		Course Outcomes	ME314.1	Illustrate the basics of aerodynamic parameters and forces				Illustrate						
	To understand the concept of potential flow and its application in aerodynamics			ME314.2	Analyse a system involving inviscid incompressible flow.				Analyse						
	To develop an ability and skill to design an aerodynamic system			ME314.3	Analyse a flow over aerofoil of various geometrical configurations				Analyse						
	To develop an ability to analyse flow over various shaped objects			ME314.4	Analyse a flow over a finite wing				Analyse						
	To introduce to the concept of compressible flow for aerodynamic applications			ME314.5	Illustrate the concept of inviscid compressible flow and its interaction with solid surfaces				Illustrate						
COs	Mapping with Program Outcomes (POs)												Mapping with PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ME314.1	3												2		
ME314.2		3											2		
ME314.3		2											2		
ME314.4	3												2		
ME314.5	3												2		
ME314	3	2.5											2		
SYLLABUS															
No.	Content												Hours	COs	
I	Introduction: Importance of aerodynamics, Aerodynamic forces and moments, Buoyancy force, Types of flow, Boundary layer, Aerodynamic coefficients, Fundamental equations in terms of substantial derivative.												08	ME314.1	
II	Potential flow: Introduction to vorticity and circulation, concept of velocity potential and stream function, Flow singularities and their superposition, lifting and non-lifting flows, Stokes Flow, Helmholtz's theorems, Blasius integral theorem, Kelvin's circulation theorem, Kutta-Joukowski theorem.												09	ME314.2	
III	Flow past airfoils: Kutta condition, standard airfoils and their nomenclature, thin airfoil theory for symmetrical airfoils: lifting and non-lifting cases, thin airfoil theory for cambered airfoils.												09	ME314.3	
IV	Flow past finite wings: Down wash and Induced drag, Horse-shoe vortex, Biot-Savart law, Elliptic and non-elliptic wings, 3D Ground effect, down wash on tail plane, Effect of Sweep back, Delta wings in incompressible flows.												08	ME314.4	
V	Inviscid compressible flow: Normal and oblique shocks, expansion waves, supersonic wind tunnels, elements of hypersonic flow, Newtonian theory, equation of viscous flow, laminar and turbulent boundary layers												08	ME314.5	
Total Hours												42			
Essential Readings															
1. J. D. Anderson Jr., "Fundamentals of Aerodynamics", McGraw Hill, Fifth edition, 2010															
2. J. J. Bertin, "Aerodynamics for Engineers", Pearson Education, Second edition, 1988															
3. L. J. Clancy, "Aerodynamics", Shroff, 2006															
Supplementary Readings															
1. E. L. Houghton, P. W. Carpenter, S. H. Collincott, and D. T. Valentine, "Aerodynamics for Engineering Students", Butterworth-Hienemann, Seventh edition, 2016															
2. A. M. Kuethe and C-Y Chow, "Foundations of Aerodynamics", Wiley, John Wiley & Sons, Fifth edition, 1997															



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CURRICULUM

Programme	Bachelor of Technology in Mechanical Engineering	Year of Regulation	2024-25
Department	Mechanical Engineering	Semester	VI

Course Code	Course Name	Pre-requisite	Credit Structure				Marks Distribution			
			L	T	P	C	INT	MID	END	Total
ME 316	REFRIGERATION AND AIR-CONDITIONING	--	3	0	0	3	50	50	100	200
			COs		Statement				Bloom's taxonomy	

Course Objectives	To develop the student's ability to understand vapor compression and absorption system along with analyzing the refrigeration cycles and techniques for performance improvement	Course Outcomes	ME316.1	Able to explain the concepts of refrigeration and air conditioning systems using various refrigerants.	Understand
			ME316.2	Able to explain vapor compression refrigeration systems with different refrigerants and infer the effect of different input parameters on the system performance and solve related problems.	Apply
	ME316.3		Able to describe the operating principle of different components of vapour compression, vapor absorption Refrigeration systems, aircraft refrigeration and PCM.	Understand	
	ME316.4		Able to explain and solve combined psychrometric process problem using analytical method and psychrometric chart.	Apply	
	ME316.5		Able to explain the air-conditioning process utilizing the inside and outside environment condition.	Apply	
	To familiarize the students with the components of refrigeration systems				
	To enable the students to solve problems on psychrometric process using psychrometric chart and design air-conditioning systems using cooling/heating load calculations.				

COs	Mapping with Program Outcomes (POs)												Mapping with PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ME316.1	2												2	1	
ME316.2	3												3	2	
ME316.3	3												3	1	
ME316.4	3												2	1	
ME316.5		3											2	2	
ME316	2.75	3											2.4	1.4	

SYLLABUS

No.	Content	Hours	COs
I	Introduction: Definition of Refrigeration and Air Conditioning and a brief history, Revisiting thermodynamics: system, state, properties, process, heat, work, first and second laws, saturation pressure-temperature relationship, Heat exchange processes, production of low temperature, Revisiting heat transfer: Temperature, modes and laws of heat transfer, electrical analogy, extended surfaces, Steady-State heat conduction, Refrigerating Machine and it's the Second Law Interpretation, Heat Engine, Heat Pump, Carnot Cycle and Reversed Carnot Cycle: it's Limitations	04	ME316.1
II	Vapour Compression Refrigeration Systems: Modifications in Reversed Carnot Cycle, Standard Vapour Compression Refrigeration Cycle, Super heat Horn and Throttling Loss for Various Refrigerants, Volumetric Efficiency of reciprocating compressor	06	ME316.1, ME316.2, ME316.3
III	Refrigerants: Designation and Trade Name, Physical, Chemical & Thermodynamic Properties of Principal Refrigerants, ODP and GWP of Refrigerants like CFC, HCFC, HFC, HC, HFO	05	ME316.1, ME316.2
IV	Multipressure Systems: Multistage Compression, Multi-Evaporator Systems, Cascade Systems	05	ME316.1, ME316.2, ME316.3
V	Refrigeration Components: Types of Compressors, Expansion Devices, Condensers & Evaporators.	05	ME316.2, ME316.3
VI	Absorption System of Refrigeration: Simple Vapor Absorption System, Maximum COP of a Heat Operated Refrigerating Machine, Common Refrigerant-Absorbent Systems, Modifications to Simple Vapor Absorption System, Electrolux Refrigerator. Phase Changing Materials (PCMs), Types and properties of PCMs, Applications, Integration of PCMs in Refrigeration Systems, PCM-based thermal energy storage systems, PCM-enhanced heat exchangers	05	ME316.3
VII	Psychrometry: Air properties and Psychrometric Chart, Sensible Heating / Cooling, Humidification / Dehumidification and their combinations, By-Pass Factor, Sensible Heat Ratio, Comfort, Psychrometric calculations for cooling, Evaporative Cooling.	05	ME316.4
VIII	Summer and Winter AC: Simple summer AC process, Room sensible heat factor, Coil sensible heat factor, ADP, Winter AC, Comfort Zone, Clothing.	03	ME316.4, ME316.5
IX	Load Calculations: Internal heat Gain, System Heat Gain, Break-up of Ventilation Load And Effective Sensible Heat Factor, Cooling / Heating Load Estimate.	04	ME316.5
Total Hours		42	

Essential Readings

1. C.P. Arora, "Refrigeration and Air Conditioning", Tata McGraw-Hill, 2000.
2. R.J. Dossat, "Principles of refrigeration", Pearson, 2001.

Supplementary Readings

1. W.F. Stoecker, "Refrigeration and Air conditioning", Tata McGraw-Hill, 2014.
2. P.N. Ananthanarayanan, "Basic Refrigeration and Air Conditioning", Tata McGraw-Hill, 2013.
3. M. Prasad, "Refrigeration and Air Conditioning", New Age International Pvt Ltd Publishers, 2015.

		<p align="center">National Institute of Technology Meghalaya An Institute of National Importance</p>										<p align="center">CURRICULUM</p>				
Programme		Bachelor of Technology in Mechanical Engineering						Year of Regulation				2024-25				
Department		Mechanical Engineering						Semester				VI				
Course Code	Course Name	Pre-Requisite	Credit Structure				Marks Distribution									
			L	T	P	C	INT	MID	END	Total						
ME 318	ADDITIVE MANUFACTURING	-----	3	0	0	3	50	50	100	200						
Course Objectives			Course Outcomes	CO's		Statement				Bloom's Taxonomy						
	To understand the importance of additive manufacturing and its technology used in modern manufacturing process.			ME318.1	Able to illustrate the various process used in Additive Manufacturing.				Understanding							
	To acquire knowledge of techniques and skills to select appropriate additive manufacturing process.			ME318.2	Able to analyse and select suitable process and materials used in Additive Manufacturing.				Analysing							
	To explore the potential of additive manufacturing in industrial sectors.			ME318.3	Able to solve problems related to Additive Manufacturing.				Applying							
	To develop an ability to analyse flow over various shaped objects			ME318.4	Able to apply knowledge of additive manufacturing for various real-life applications.				Applying							
			ME318.5	Able to apply technique of CAD and reverse engineering for geometry transformation in Additive Manufacturing.				Applying								
COs		Mapping with Program Outcomes (POs)										Mapping with PSOs				
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ME 318.1		3	2		3									3	2	
ME 318.2		3	3	3		3	1							3	2	
ME 318.3		3	3	2	3		2							3	2	
ME 318.4		3		3	3	2	3							3	2	
ME 318.5		3		3	2	3	3							3	2	
ME318		3	2.67	2.75	2.75	2.67	2.25							3	2	
SYLLABUS																
No.	Content													Hours	COs	
I	Introduction: Overview, Basic principles, applications, advantages and disadvantages of additive manufacturing, Process of product development, Classification of processes, Direct processes – Rapid Prototyping, Rapid Tooling, Rapid Manufacturing; Indirect Processes - Indirect Prototyping, Indirect Tooling, Indirect Manufacturing, Materials used in additive manufacturing, multifunctional and graded materials, Role of solidification rate, Evolution of non-equilibrium structure, Structural property relationship, Grain structure and microstructure, Challenges in Additive Manufacturing, Applications of Material Jetting Processes, Applications of Binder Jetting Processes.													08	ME 318.1	
II	Additive Manufacturing Processes: Stereolithography apparatus (SLA), Fused deposition modeling (FDM), Laminated Object Manufacturing (LOM), Selective deposition lamination (SDL), Ultrasonic consolidation, Selective laser sintering (SLS), Laser engineered net shaping (LENS), Electron beam free form fabrication (EBFFF), Electron beam melting (EBM), Plasma transferred arc additive manufacturing (PTAAM), Tungsten inert gas additive manufacturing (TIGAM), Metal inert gas additive manufacturing (MIGAM), Z-Corporation 3D-printing													07	ME 318.2	
III	Machines and Systems: Axes, Linear motion guide ways, Ball screws, Motors, Bearings, Encoders/ Glass scales, Process Chamber, Safety interlocks, Sensors. Introduction to NC/CNC/DNC machines, CNC programming, Hardware Interpolators, Software Interpolators, Recent developments of CNC systems for additive manufacturing.													07	ME 318.2	
IV	Pre-Processing: Preparation of 3D-CAD model, Reverse engineering, Reconstruction of 3D-CAD model using reverse engineering, Part orientation and support generation, STL Conversion, STL error diagnostics, Slicing and Generation of codes for tool path, Surface preparation of materials.													07	ME 318.3	
V	Post-Processing: Support material removal, surface texture improvement, accuracy improvement, preparation for pattern, property enhancements using non-thermal and thermal techniques, characterization techniques used in additive manufacturing, Applications in additive manufacturing for rapid prototyping and rapid manufacturing etc.													07	ME 318.4	
	Modelling and Simulation: Selection of AM technologies using decision methods, AM process plan, Monitoring and control of defects, transformation, Thermal model to predict size of deposition such as width and height of deposition, Finite element simulation of additive process.													06	ME 318.5	
Total Hours													42			
Essential Readings																
1. Gibson, I, Rosen, D W., and Stucker, B., Additive Manufacturing Methodologies: Rapid Prototyping to Direct Digital Manufacturing, Springer, 2010																
2. Chua C.K., Leong K.F., and Lim C.S., "Rapid prototyping: Principles and applications", Third Edition, World Scientific Publishers, 2010																
3. Chee Kai Chua, Kah Fai Leong, 3D Printing and Additive Manufacturing: Principles and Applications: Fourth Edition of Rapid Prototyping, World Scientific Publishers, 2014																
4. Gebhardt A., "Rapid prototyping", Hanser Gardener Publications, 2003																
Supplementary Readings																
1. Liou L.W. and Liou F.W., "Rapid Prototyping and Engineering applications: A tool box for prototype development", CRC Press, 2007																
2. Kamrani A.K. and Nasr E.A., "Rapid Prototyping: Theory and practice", Springer, 2006																
3. Mahamood R.M., Laser Metal Deposition Process of Metals, Alloys, and Composite Materials, Engineering Materials and Processes, Springer International Publishing AG 2018																
4. Ehsan Toyserkani, Amir Khajepour, Stephen F. Corbin, "Laser Cladding", CRC Press, 2004																

		National Institute of Technology Meghalaya An Institute of National Importance										CURRICULUM				
Programme		Bachelor of Technology in Mechanical Engineering						Year of Regulation				2024-25				
Department		Mechanical Engineering						Semester				VI				
Course Code	Course Name	Pre-Requisite	Credit Structure				Marks Distribution									
			L	T	P	C	INT	MID	END	Total						
ME320	Structural Health Monitoring	-----	3	0	0	3	50	50	100	200						
				COs	Statement					Bloom's Taxonomy						
Course Objectives	Define and explain the fundamental concepts of structural health monitoring (SHM).		Course Outcomes	ME320.1	Able to define and explain the basic principles of SHM.					Understanding						
				ME320.2	Able to describe various types of sensors and data acquisition systems used in SHM.					Understanding						
	ME320.3	Able to apply SHM techniques to identify and locate damage in structures.					Understanding									
	ME320.4	Able to analyse SHM data to evaluate the structural health of buildings and infrastructure.					Applying									
	ME320.5	Able to implement a basic SHM system for a designated structure.					Analysing									
COs		Mapping with Program Outcomes (POs)										Mapping with PSOs				
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
	ME320.1	2	1								1		1	1		
	ME320.2	2	1	1		2					1			1	1	
	ME320.3	3	2	2	1	2					1			1		
	ME320.4	3	3		2	2					1			1	1	
	ME320.5	2	2	2										2	2	
	ME320	2.4	1.8	1.67	1.5	2					1		1	1.2	1.33	
SYLLABUS																
No.	Content													Hours	COs	
I	Introduction to Structural Health Monitoring (SHM) Definition, objectives, applications, and benefits, overview of structural damage and deterioration mechanisms, non-destructive evaluation (NDE) techniques for structural assessment.													08	ME320.1	
II	Sensors and Data Acquisition Systems for SHM Types of sensors for SHM, data acquisition systems, signal conditioning and pre-processing techniques.													08	ME320.2	
III	SHM Techniques for Different Structures SHM of bridges, architectural structures, offshore platforms, marine structures, aircraft and aerospace structures.													08	ME320.3 ME320.4	
IV	Data Analysis and Interpretation for SHM Statistical analysis of SHM data, machine learning and artificial intelligence for SHM, damage detection and localization algorithms, structural health assessment and predicting future damage progression.													10	ME320.4 ME320.5	
V	Design and Implementation of SHM Systems System design considerations, case studies of implemented SHM systems, future trends and challenges in SHM.													08	ME320.5	
Total Hours													42			
Essential Readings																
1. Daniel Balageas, Peter Fritzen, Alfredo Guemes, "Structural Health Monitoring", John Wiley & Sons, 1 st Edition, 2006																
2. Douglas E, "Health Monitoring of Structural Materials and Components Methods with Applications", John Wiley & Sons, 1 st Edition, 2006																
3. Charles R. Farrar, Keith Worden, "Structural Health Monitoring: A Machine Learning Perspective", John Wiley & Sons, 1 st Edition, 2012																
Supplementary Readings																
1. Maguid H.M. Hassan, "Advances in Structural Health Monitoring", IntechOpen, 1 st Edition, 2019																

		National Institute of Technology Meghalaya An Institute of National Importance											CURRICULUM			
Programme		Bachelor of Technology in Mechanical Engineering							Year of Regulation				2024-25			
Department		Mechanical Engineering							Semester				VI			
Course Code	Course Name	Pre-Requisite	Credit Structure				Marks Distribution									
			L	T	P	C	INT	MID	END	Total						
ME372	Industry 4.0 and Six Sigma Engineering	-----	2	0	0	2	50	50	100	200						
Course Objectives	To introduce the basics of Industry 4.0 and Sustainability Assessment of Manufacturing Industry To Explain the Significance of Learn production system To apply the concepts of smart factories for industry 4.0 To develop an ability to analyse the different technique and models in six sigma	Course Outcomes	COs		Statement				Bloom's Taxonomy							
			ME372.1	Explain the Trends In Industry 4.0 and Sustainability Assessment of Manufacturing Industry				Understanding								
			ME372.2	Make use of lean Production system.				Understanding								
			ME372.3	Make use of the smart factories for industry 4.0				Application								
			ME372.4	Analyse the different techniques and models of six sigma				Analysis								
COs		Mapping with Program Outcomes (POs)											Mapping with PSOs			
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ME372.1						2	3	2	3	3	2	1	3	3		
ME372.2						2	3	3	3	2	3	3	3	3		
ME372.3						1	1	2	3	2	3	2	3	3		
ME372.4		3	2	2	3	1	2	2	2	3	2	3	3	3		
ME372		3	2	2	3	1	1.75	2.25	2.25	3	2.25	2.75	2.25	3	3	
SYLLABUS																
No.	Content													Hours	COs	
I	Overview History – Industrial Revolution - Introduction to Industry 4.0 - Profound and Systematic Change – Trends In Industry 4.0													04	ME372.1	
II	Industry 4.0: Sustainability Assessment of Manufacturing Industry Sustainability – Supply Chain Management- Information and Communication Technology- Introduction To Emerging Issues													04	ME372.1	
III	Industry 4.0: Lean Production System Lean Production System – Types of Waste- Significance of Learn production system													05	ME372.1 ME372.2	
IV	Industry 4.0: Smart Factories Introduction to Smart Factories – Need of Smart Factory- Component of Smart Factory.													05	ME372.1 ME372.3	
V	Six Sigma History of Six Sigma - Implementing Six Sigma, Customer Expectations and Needs, Linking Six Sigma Projects to Strategies, Attributes of Good Metrics, Using Resources Wisely, Project Management Using The Dmaic and Dmadv Models, The Define Phase, The Measure Phase, Measurement System Analysis, Analyzing Data: Value Streams and Dealing With Variations, Analyzing Data: Designed Experiments, The Improve Phase, The Control Phase.													10	ME372.4	
Total Hours													28			
Essential Readings																
1. Klaus Schwab, The Fourth Industrial Revolution, Portfolio Penguin																
2. Alasdair Gilchrist, Industry 4.0: The Industrial Internet of Things, Apress; 1st Ed. Edition																
3. N A Siddiqui, Introduction to Six Sigma, New Age International Private Limited; First edition.																
Supplementary Readings																
1. Elena G. Popkova, Yulia V. Ragulina, Aleksei V. Bogoviz, Industry 4.0: Industrial Revolution of the 21st Century, Springer, 1sted 2019 edition.																

 National Institute of Technology Meghalaya An Institute of National Importance													CURRICULUM		
Programme		Bachelor of Technology						Year of Implementation				2024-25			
Department		Humanities and Social Sciences						Semester				VI			
Course Code	Course Name	Prerequisite	Credit Structure				Marks Distribution								
			L	T	P	C	INT	MID	END	Total					
			2	0	0	2	50	50	100	200					
HS302	Indian Culture and Civilization	Nil	COs				Statement				Bloom's Taxonomy				
Course Objectives	To introduce the fundamentals of Ancient Indian Science to understand the Indian systems of Mathematics, Physics, Chemistry, Metallurgy and Town Planning	Course Outcomes	HS302.1	Explain the concepts of Indian knowledge system and Indian culture and civilization.				Understand							
	To help students to trace, identify, and develop knowledge in ancient knowledge systems		HS302.2	Explain the Fundamentals of Ancient Indian Science				Understand							
	To help to understand the rational, verifiable and universal solution from the ancient Indian knowledge system		HS302.3	Explain the Fundamentals of Ancient Indian Mathematics and Computation				Understand							
	To build in the learners a deep-rooted pride in Indian knowledge, committed to sustainable development		HS302.4	Explain the Fundamentals of Ancient Indian Metallurgy and Architecture				Understand							
			HS302.5	Explain the Fundamentals of Ancient Indian Philosophy, Literature, Culture, History and Governance				Understand							
COs	Mapping with Program Outcomes (POs)												Mapping with PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
HS302.1	3	2	1	1	1	3	2	1	1	2	1	3			
HS302.2	3	2	1	1	1	3	2	1	1	2	1	3			
HS302.3	3	2	1	1	1	3	2	1	1	2	1	3			
HS302.4	3	2	1	1	1	3	2	1	1	2	1	3			
HS302.5	3	2	1	1	1	33	2	1	1	2	1	3			
HS302	3.0	2.0	1.0	1.0	1.0	3.0	2.0	1.0	1.0	2.0	1.0	3.0			
SYLLABUS															
No.	Content													Hours	COs
I	Introduction: Introduction to Indian Knowledge System (IKS); Importance of Ancient Knowledge; Unique aspects of Indian Knowledge System; Wisdom through the ages; Indian Philosophers; Indian culture and Civilization; Ancient Indian Science and Technology													05	HS302.1
II	Sciences: Physics: Astronomy; Positional Astronomy, Mahayuga & Kalpa system, Yuga system, Ayanas, Months, tithis and seasons, Time units, sun and moon's motion, Planet position, Ayanachalana, Zero-precision year, Katapayaadi system, Indian nakshatra system Chemistry: Chemistry in India; Vatsyayana, Nagarjuna, Khanda, Al-Biruni, Vagbhata—Building of the Ras-shala (laboratory), Working arrangements of Ras-shala, Material and equipment, Yasodhara Bhatta—Process of distillation, Apparatus, Saranasamskara, Saranataila													06	HS302.2
III	Mathematics and Computation: Mathematics: Mathematics in India: Baudhayana's Sulbasutras, Aryabhata, Bhaskaracharya-I, Severas Sebokht, Syria, Brahmagupta, Bhaskaracharya-II, Jyesthadeva, Vedic Mathematics Computer Science: Brahmagupta (vargaprakrati, bhramasphuta siddhanta, bhavana), Ayatavftta, Ganitasarasamgraha, Lilavathi, Ganesadaivajna, Randavantika, Suryasidhanta, Grahalaghava, Sadratnamala, Mandavrtta, Sighrartta, Bijaganita, Bakshali manuscript													06	HS302.3
IV	Engineering: Mechanical: Metals and Metallurgy in India: Survarna (gold) and its different types, prosperities, Rajata (silver), Tamra (copper), Loha (iron), Vanga (tin), Naga /sisa (lead), Pittala (brass), Manufacturing process and ship building Civil: Architecture in India: Nagara (northern style), Vesara (mixed style), and Dravida (southern style), Indian vernacular architecture, Temple style, Cave architecture, Rock cut architecture, Kalinga architecture, Chandels architecture, Rajput architecture, Jain architecture, Sikh architecture, Maratha architecture, Indo-Islamic architectural, Indo-Saracenic revival architecture, Greco-Buddhist style													06	HS302.4
V	Humanities and Social Sciences: Ancient Indian Philosophy; Basic history of India, Literature and the Epics; Ancient Indian culture and civilization; Health, Wellness & Psychology; Yoga way of life; Governance, Public Administration & Management reference to Ramayana, Artha Sastra, Kauṭilyan State; History and culture of the Northeast; Indigenous system of forest management in Meghalaya													05	HS302.5
Total Hours													28		
Essential Readings															
1. B Mahadevan, V. R. Bhat, N. Pavana R. N., <i>Introduction to IKS: Concepts and Applications</i> , PHI, 2023.															
2. Kapur K. and A. K. Singh, <i>Indian Knowledge Systems, Vol. I</i> . Indian Institute of Advanced Study, Shimla, 2005.															
Supplementary Readings															
1. Sharma, A. K., <i>History of Science in India (Set)</i> , The Ramakrishna Mission Institute of Culture, 2012.															
2. Nair, Shantha N., <i>Echoes of Ancient Indian Wisdom</i> , Hindology Books, 2008.															

		National Institute of Technology Meghalaya An Institute of National Importance										CURRICULUM			
Programme		Bachelor of Technology in Mechanical Engineering						Year of Regulation				2024-25			
Department		Mechanical Engineering						Semester				VI			
Course Code	Course Name	Pre-Requisite	Credit Structure				Marks Distribution								
			L	T	P	C	Continuous Evaluation			Total					
ME352	AUTOMATION LABORATORY	-----	0	0	2	1	100			100					
Course Objectives	<p>To introduces various mechatronics components and illustrates their use for various applications.</p> <p>To familiarizes use of control module and mechatronics actuators.</p> <p>To familiarizes use of vision-based system for robotic application.</p>	Course Outcomes	COs		Statement				Bloom's Taxonomy						
			ME352.1	Able to identify and illustrate the use and application of different mechatronics components.				Understanding							
			ME352.2	Able to demonstrate the LabVIEW software for interfacing and application development.				Analysing							
			ME352.3	Able to operate different sensors for various applications.				Applying							
			ME352.4	Able to apply control modules and mechatronic system for Automation				Applying							
ME352.5	Able to analyze vision based robotic systems for different application				Applying										
COs	Mapping with Program Outcomes (POs)											Mapping with PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ME 352.1	3				3	3				1		2	1	2	
ME 352.2	3		3		3	3				1		2	1	2	
ME 352.3	3		3		3	3				1		2	1	2	
ME 352.4	3		3		3	3				1		2	1	2	
ME 352.5	3		3		3	3				1		2	1	2	
ME352	3		3		3	3				1		2	1	2	
SYLLABUS															
No.	Content												Hours	COs	
I	Introduction to LabVIEW software and interfacing with different sensor module.												04	ME 362.1	
II	Microcontroller I/O and inter-device communication using industry standards such as SPI, I2C, and CAN buses with different Mechatronics Sensors: Strain gauge, Pressure transducer, Ultrasonic and Infrared sensor, Reflective optical sensor, Potentiometer.												04	ME 362.2	
III	Experiment with Mechatronics Actuators: Brushed DC motor, Stepper motor, Servomotor.												04	ME 362.3	
IV	Experiment with Control Module & Mechatronics Systems.												04	ME 362.4	
V	Experiment with Smart Factory Automation System: Automatic Storage and Retrieval System, Automated Guided Vehicle.												04	ME 362.4	
VI	Experiment with Vision Based Mobile Robotic kit.												04	ME 362.5	
VII	Mini Project												04	ME 362.5	
Total Hours												28			
Essential Readings															
1. M.P.Groover, "Industrial Robotics – Technology, Programming and Applications", McGraw-Hill, 2 nd Edition, 2012.															
2. K.S.Fu, R.C.Gonzalez and C.S.G.Lee, "Robotics Control, Sensing, Vision and Intelligence", McGraw-Hill, 1 st Edition, 1987.															
Supplementary Readings															
1. Y.Koren, "Robotics for Engineers", McGraw-Hill, 1 st Edition 1985.															
2. J.J.Craig, "Introduction to Robotics: Mechanics and Control", Pearson Education International, 3 rd Edition, 2005.															
3. M.W.Spong and M.Vidyasagar, "Robot Dynamics and Control", Wiley, 1 st Edition, 2008.															
4. R.J.Schilling, "Fundamentals of Robotics Analysis and Control", Prentice Hall of India Pvt.Ltd., 1 st Edition, 1996															

		National Institute of Technology Meghalaya An Institute of National Importance										CURRICULUM			
		Programme		Bachelor of Technology in Mechanical Engineering					Year of Regulation			2024-25			
Department		Mechanical Engineering					Semester			VI					
Course Code	Course Name	Pre-Requisite	Credit Structure				Marks Distribution								
			L	T	P	C	Continuous evaluation	Quiz	Total						
ME354	Advanced Manufacturing Lab	-----	0	1	2	2	70		30	200					
Course Objectives	To develop the student's ability to measure and analyse the cutting forces during machining of mild steel. To develop the student's ability to understand the effect of various parameters during injection moulding of plastic. To develop student ability to perform 3D printing, scanning of object etc. To develop student ability to analysis factory automation		Course Outcomes	CO's		Statement				Bloom's Taxonomy					
				ME354.1	Analyze the cutting forces generated during machining of mild steel.				Analyse						
				ME354.2	Analyze the effect of various process parameters during injection molding of plastic.				Analyse						
				ME354.3	Development of the model and perform 3D printing.				Application						
				ME354.4	Scanning of an object and perform 3D printing				Application						
				ME354.5	Analysis of the factory automation for modern manufacturing.				Analyse						
COs		Mapping with Program Outcomes (POs)										Mapping with PSOs			
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
ME354.1	3												3		
ME354.2	3												3		
ME354.3	3												3		
ME354.4	3				2								3		
ME354.5	3	2										3	3	3	
ME354	3	2			2							3	3	3	
SYLLABUS															
No.	Content												Hours	COs	
I	To measure and analyse the cutting forces generate during machining of mild steel using a single point cutting tool.												04	ME354.1	
II	To fabricate the test specimen and investigate the effect of various process parameters during injection moulding of plastic.												04	ME354.2	
III	Development of the model in modeling software and performance of 3D printing.												08	ME354.3	
IV	Scanning of an object and print through 3D Pinter.												06	ME354.4	
V	Factory automation performance analysis.												06	ME354.5	
Total Hours												28			
Supplementary Readings															
1. A. Ghosh and A.K. Mallik, "Manufacturing Science", Wiley Eastern															
2. S.K. Mazumdar, "Composites Manufacturing: Materials, Product, and Process Engineering", CRC Press															

		National Institute of Technology Meghalaya An Institute of National Importance										CURRICULUM				
Programme		Bachelor of Technology in Mechanical Engineering										Year of Regulation		2024-25		
Department		Mechanical Engineering										Semester		VI		
Course Code	Course Name	Pre-Requisite	Credit Structure				Marks Distribution				Bloom's Taxonomy					
			L	T	P	C	Continuous evaluation		Quiz	Total						
ME356	Thermal Engineering Lab - 2	----	0	0	2	1	70		30		200					
Course Objectives	To provide student with the knowledge of radiation and enable them to analyse different types of refrigeration systems.	Course Outcomes	CO's		Statement				Bloom's Taxonomy							
			ME356.1	Able to demonstrate necessary skills to verify Lambert's cosine law and Kirchoff's Law on absorptivity, reflectivity and emissivity with thermal radiation unit				Application								
	ME356.2		Able to demonstrate necessary skills to illustrate different components in a refrigeration unit and compare and analyze performance of vapour compression and vapour absorption refrigeration units.				Application, Analysis									
	ME356.3		Able to operate temperature sensors and estimate meteorological parameters like solar irradiation, ambient air velocity and temperature				Comprehension, Application									
	ME356.4		Able to demonstrate the working principle of different types of solar thermal collectors				Application									
	To develop the student's ability to calibrate temperature sensors and measure meteorological parameters		ME356.5	Able to operate an IC engine at different loads at constant speed, while measuring the operating parameters and estimating the engine performance				Comprehension, Application								
	To develop students' ability to understand the working of solar thermal collectors and analyze the performance of internal combustion engine															
COs		Mapping with Program Outcomes (POs)										Mapping with PSOs				
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ME356.1		3	2	2	2				2	2	3		2	3	2	
ME356.2		3	2	2	2				2	2	3		2	3	2	
ME356.3		3	2	2	2				2	2	3		2	3	2	
ME356.4		3	2	2	2				2	2	3		2	3	2	
ME356.5		3	2	2	2				2	2	3		2	3	2	
ME356		3.0	2.0	2.0	2.0				2.0	2.0	3.0		2.0	3.0	2.0	
SYLLABUS																
No.	Content													Hours	COs	
I	Radiation unit Verifying the Lambert's Cosine Law; Kirchoff's Laws on Absorptivity, Reflectivity and Emissivity.													04	ME356.1	
II	Vapour Compression Refrigeration Unit Understanding the Operation of Key Components of a Vapour Compression Refrigeration System (Compressor, Evaporator, Condenser, and Expansion Element) and the Cycle, Performing the Energy Balance.													04	ME356.2	
III	Vapour Absorption Refrigeration Unit Studying the Basic Principle of an Absorption Refrigeration System under Various Loads.													04	ME356.2	
IV	Thermocouple Calibration Understanding different Types of Thermocouples, Preparation of Thermocouple Bids, Performing Calibration, Plotting Hysteresis Curves.													04	ME356.3	
V	Measurement of Solar Insolation and other Meteorological Parameters Measurement of Solar Radiation Along with Ambient Air Temperature and Velocity Using Different Equipment.													04	ME356.3	
VI	Solar Thermal Collectors Understanding the Working Principle and Applications of Different Types of Solar Thermal Collection Devices, viz. Solar Air Heater, Solar Water Heater, Solar Still etc.													04	ME356.4	
VII	Internal Combustion Engine Running of an Internal Combustion Engine at Different Loads at Constant Speed, Measurement of Engine Operating Parameters, Calculation of Performance and Combustion Parameters and Plotting in Graph.													04	ME356.5	
Total Hours													28			
Essential Readings																
1. A.S. Lavine, F. P. Incropera, D.P. Dewitt, T.L. Bergman, Principles of Heat and Mass Transfer, Wiley, 8 th Edition, 2017.																
2. C. P. Arora, Refrigeration and Air Conditioning, McGraw Hill India, 4 th Edition, 2020.																
3. S. P. Sukhatme, J. K. Nayak, Solar Energy, McGraw Hill India, 4 th Edition, 2017.																
4. V. Ganesan, Internal Combustion Engines, McGraw Hill India, 4 th Edition, 2012.																
Supplementary Readings																
1. A. Bejan, Convective Heat Transfer, John Wiley and Sons, 4 th Edition, 2013.																
2. J.A Duffie, and W.A. Beckman, Solar Engineering of Thermal Process, John Wiley and Sons, 3 rd Edition, 2013.																

Seventh Semester Courses



National Institute of Technology Meghalaya
An Institute of National Importance

CURRICULUM

Programme	Bachelor of Technology in Mechanical Engineering	Year of Regulation	2024-25
Department	Mechanical Engineering	Semester	VII

Course Code	Course Name	Pre-Requisite	Credit Structure				Marks Distribution			
			L	T	P	C	INT	MID	END	Total
ME411	I.C. Engine	ME203	3	0	0	3	50	50	100	200
			COs	Statement				Bloom's taxonomy		
Course Objectives	The fundamental of internal combustion engine in general	Course Outcomes	ME411.1	Recognize the types, constructions, terminologies and cycles associated with IC engines and solve related problems.				Knowledge, Application		
	The fuel and combustion in SI and CI Engine.		ME411.2	Identify the types of fuels, methods of fuel supply in SI and CI engines and solve related problems				Comprehension, Application		
	The cooling and lubrication in the engine.		ME411.3	Explain associated combustion in SI and CI engine and solve related problems.				Comprehension, Application		
	The measurement and control of emission.		ME411.4	Analyse different types of cooling and lubrication systems.				Analysis		
			ME411.5	Evaluate measurement and testing of engine performances and emissions.				Analysis		

COs	Mapping with Program Outcomes (POs)												Mapping with PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ME411.1	3	3										2	3	2	
ME411.2	3	2			2			2				2	3	2	
ME411.3	3	3	2									2	3	2	
ME411.4	3	2										2	3	2	
ME411.5	3	3	2	2	2	2	2			2		2	3	3	
ME411	3.0	2.6	2.0	2.0	2.0	2.0	2.0	2.0		2.0		2.0	3.0	2.2	

SYLLABUS

No.	Content	Hours	COs
I	Introduction of Engines: Engines & Their Type, Thermodynamic Principles, Classifications & Construction of IC Engines, Terminologies, Fuel Air Cycles, Actual Cycles.	07	ME411.1
II	Fuels: Types, SI Engine Fuels & Their Rating, CI Engine Fuels & Their Rating, Alternating Fuels and Types.	04	ME411.2
III	Carburettors: Carburetion, Simple Carburettor, Modern carburettors, Petrol Injection, Calculation of Air Fuel Ratio.	04	ME411.2
IV	Fuel Injection & Mixing: Air & Solid Injection, Injection Pumps, Types of Nozzles, Injection Timing, Mechanical and Pneumatic Governor, Spray, Swirl, Squish and Tumble.	04	ME411.2
V	Combustion in S.I. Engines: Stages of Combustion, Factors Influencing the Flame Speed, Rate of Pressure Rise, Rate of Heat Release, Knocking, Combustion Chamber Design.	05	ME411.3
VI	Combustion in C.I. Engines: Stages, Ignition Delay, Influencing Factors, Diesel Knock, Comparison of Knocking in SI and CI Engine, Combustion Chamber Design.	06	ME411.3
VII	Cooling & Lubrication System: (Flip Classroom/ Seminar/Mini Project) Types of Losses, Temperature Distribution Inside Cylinder, Air and Liquid Cooling and Types, Rating of Lubricants, Wet and Dry Sump Lubrication Systems.	03	ME411.4
VIII	Measurement & Testing: Frictional Power, Indicated Power, Brake Power, Measurement of Fuel and Air Supply, Heat Balance, Performance Maps.	05	ME411.5
IX	Engine Emission and Control: Air Pollution due to IC Engines, Euro I-VI Norms, HC, CO and NO _x Emission and Control, Catalytic Converter.	04	ME411.5
Total Hours		42	

Essential Readings

- V. Ganesan, Internal Combustion Engines, McGraw Hill India, 4th Edition, 2012.
- J.B. Heywood, Internal Combustion Engine Fundamentals, McGraw Hill, 2nd Edition, 2018.

Supplementary Readings

- R. Stone, Internal Combustion Engines, The Macmillan Press Limited, 4th Edition, 2012.
- C.R. Fergusan and A.T. Kirkpatrick, Internal Combustion Engines, John Wiley & Sons, 3rd Edition, 2015.
- V. Sajith and S. Thomas, Internal Combustion Engines, Oxford University Press, 1st Edition, 2017.



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CURRICULUM

Programme	Bachelor of Technology in Mechanical Engineering	Year of Regulation	2024-25
Department	Mechanical Engineering	Semester	VII

Course Code	Course Name	Pre-Requisite	Credit Structure				Marks Distribution			
			L	T	P	C	INT	MID	END	Total
ME 413	Optimization Techniques	---	3	0	0	3	50	50	100	200
			COs	Statement				Bloom's taxonomy		
Course Objectives	To provide the concept of various optimization techniques with the examples of engineering problem.	Course Outcomes	ME413.1	Students will be able to explain the basics of optimization, problem formulation, local and global optimization.				Understanding		
			ME413.2	Students will be able to apply the concept of linear programming method for optimization of Mechanical System.				Applying		
			ME413.3	Students will be able to solve unconstrained optimization problem through gradient-based: Cauchy's steepest descent, newton's, conjugate gradient method.				Applying		
			ME413.4	Students will be able to evaluate the unconstrained optimization method.				Analyze		
			ME413.5	Students will be able to reframe the optimization problem using Evolutionary and Nature inspired Optimization				Evaluate		

COs	Mapping with Program Outcomes (POs)												Mapping with PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ME 413.1	3	1	3	1		2							3	3	
ME 413.2	3	2	3	2									3	2	
ME 413.3	3	3	3	3	2	2	3	2					3	2	
ME 413.4	3	3	3	3	3		2						3	3	
ME 413.5	3	3	3	3	3	2	2	2					3	3	
ME411	3	2.4	3	2.4	2.67	2	2.34	2					3	2.6	

SYLLABUS

No.	Content	Hours	COs
I	Basics of Optimization – Optimal problem formulation, classification of optimization problem. optimum design concepts: definition of global and Local optima, optimality criteria global optimality.	05	ME 413.1
II	Linear programming for optimum: Review of linear programming methods for optimum design, post optimality analysis, application of LPP models in Mechanical system.	09	ME 413.2
III	Unconstrained optimization: Gradient-based method: Cauchy's steepest descent method, newton's method, conjugate gradient method.	09	ME 413.3
IV	Constrained optimization: Direct methods, penalty function methods, steepest descent method, engineering applications of constrained and unconstrained algorithms.	09	ME 413.4
V	Evolutionary and Nature inspired Optimization: Evolutionary computation, Genetic Algorithms – Simulated Annealing – Ant colony optimization – Tabu search – Neural-Network based Optimization – Fuzzy optimization techniques – Applications. Use of MATLAB to solve optimization problems.	10	ME 413.5
Total Hours		42	

Essential Readings

- X-S. Yang, Optimization Techniques and Application with Examples, First Edition, 2018.
- S.S. Rao, 'Engineering Optimization, Theory and Practice' – New Age International Publishers, 4th Edition, 2012

Supplementary Readings

- K. Deb, 'Optimization for Engineering Design Algorithms and Examples', PHI, 2000
- J. Arora, 'Introduction to Optimization Design', 2004, Elsevier Academic Press, 2004



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Programme	Bachelor of Technology in Mechanical Engineering	Year of Regulation	2024-25
Department	Mechanical Engineering	Semester	VII

Course Code	Course Name	Pre-Requisite	Credit Structure				Marks Distribution			
			L	T	P	C	INT	MID	END	Total

ME415	Experimental Stress Analysis	---	3	0	0	3	50	50	100	200
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Course Objectives	Course Outcomes	COs	Statement	Bloom's taxonomy
		To provide a comprehensive understanding of experimental stress analysis techniques To develop skills in using photoelasticity and strain gauges for stress measurement To familiarize with various experimental methods to determine stress, strain and deformation	ME415.1 ME415.2 ME415.3 ME415.4 ME415.5	Able to understand the fundamentals of experimental stress analysis and various techniques Able to apply principles of transmission photoelasticity for stress measurement Able to utilize advanced photoelasticity techniques including digital and 3D methods Able to implement brittle coating techniques for stress analysis Able to evaluate strain gauge methods for experimental stress measurement

COs	Mapping with Program Outcomes (POs)												Mapping with PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ME415.1	3	2	1		1					1			2		
ME415.2	3	3	2	1	2					1			3		
ME415.3	3	3	2	2	3					1			3		
ME415.4	3	3	2	1	2					1			2		
ME415.5	3	3	2	1	3					1			2		
ME415	3	2.8	1.8	1.25	2.2					1			2.4		

SYLLABUS

No.	Content	Hours	COs
I	Fundamentals of Experimental Stress Analysis Overview and approaches to stress analysis, Optical methods as optical computers, Stress, strain, and displacement fields, Physical principles of various techniques, Introduction to Moiré, Brittle Coatings, Holography, Overview of Shearography, TSA, DIC, and Caustics, Fringe patterns and qualitative information, multi-scale analysis in experimental mechanics	12	ME415.1
II	Transmission Photoelasticity Introduction and principles, Ordinary and extraordinary rays, Light ellipse and crystal plates, Retardation plates and stress-optic law, Plane and circular polariscopes, Jones calculus, Determination of photoelastic parameters, Tardy's method of compensation, Calibration of photoelastic materials, Fringe thinning and ordering methodologies	14	ME415.2
III	Advanced Photoelasticity Techniques Three-dimensional photoelasticity, Overview of digital photoelasticity, Photoelastic coatings: introduction and applications, Correction factors and calibration for photoelastic coatings	06	ME415.3
IV	Brittle Coatings Introduction to brittle coatings, Analysis of brittle coatings	04	ME415.4
V	Strain Gauges Introduction and principles, Strain sensitivity and bridge sensitivity, Strain gauge alloys, carriers, and adhesives, Performance of strain gauge systems, Temperature compensation and wiring techniques, Strain gauge selection and application	06	ME415.5
Total Hours		42	

Essential Readings

1. K. Ramesh, e-Book on Experimental Stress Analysis, IIT Madras, 1st Edition, 2009. URL: <https://home.iitm.ac.in/kramesh/ESA.html>
2. K. Ramesh, Digital Photoelasticity – Advanced Techniques and Applications, Springer, 1st Edition, 2000
3. W.N. Sharpe (Ed.), Springer Handbook of Experimental Solid Mechanics, Springer, 1st Edition, 2008

Supplementary Readings

1. J.W. Dally and W.F. Riley, Experimental Stress Analysis, McGraw-Hill, 3rd Edition, 1991
2. L.S. Srinath, M.R. Raghavan, K. Lingaiah, G. Gargesa, B. Pant, and K. Ramachandra, Experimental Stress Analysis, Tata Mc Graw Hill, 1st Edition, 1984

		National Institute of Technology Meghalaya An Institute of National Importance										CURRICULUM			
Programme		Bachelor of Technology in Mechanical Engineering						Year of Regulation				2024			
Department		Mechanical Engineering						Semester				VII			
Course Code	Course Name	Pre-Requisite	Credit Structure				Marks Distribution				Total				
			L	T	P	C	INT	MID	END						
ME417	Processing of Advanced Materials	---	3	0	0	3	50	50	100	200					
Course Objectives To familiarize the students with the functioning and processing of different types of advanced materials including functional alloys, shape memory alloys, superalloys, nanomaterials, and soft and hard magnetic materials.	Course Outcomes ME417.1 Interpret the basic functioning and processing of different types of advanced materials. ME417.2 Explain the processing of bulk metallic glass, glassy and amorphous materials, and shape memory alloys. ME417.3 Explain the characteristics of high-temperature materials and superalloys. ME417.4 Explain the properties, functioning, and processing of nanomaterials and magnetic materials. ME417.5 Explain the advanced processes and functional alloys.	COs	Statement				Bloom's Taxonomy								
		ME417.1	Interpret the basic functioning and processing of different types of advanced materials.				Understanding								
		ME417.2	Explain the processing of bulk metallic glass, glassy and amorphous materials, and shape memory alloys.				Understanding								
		ME417.3	Explain the characteristics of high-temperature materials and superalloys.				Understanding								
		ME417.4	Explain the properties, functioning, and processing of nanomaterials and magnetic materials.				Understanding								
		ME417.5	Explain the advanced processes and functional alloys.				Understanding								
COs	Mapping with Program Outcomes (POs)											Mapping with PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ME417.1	3												3		
ME417.2	3	3											3		
ME417.3	2	3											3		
ME417.4			3		3								3	2	
ME417.5	3		3		3							2	3	2	
ME417	2.75	3	3		3							2	3	2	
SYLLABUS															
No.	Content											Hours	COs		
I	Introduction to Metastable and Functional Alloys: Engineering Materials, Advanced Alloy, Metastable Alloys, Classification of Advanced Structural and Functional Materials, Biomaterials											03	ME417.1		
II	Bulk Metallic Glass, Glassy and Amorphous Materials: Glass, Glass Transformation, Thermodynamic Concepts, Structure Solids, Regular Solids, Symmetry in Solids, Glass Forming Ability (GFA), GFA and Phase Transformation, Deformation Mechanism, Mechanical Properties, Bulk Metallic Glass Composites											06	ME417.2		
III	Shape Memory Alloys and Pseudo Elasticity: Phase Transformation, Martensitic Transformation, Vector Analysis, Lattice Invariant Shear, Shape Memory Effect Mechanism, Two Way Shape Memory Effect, Pseudo-Elasticity, Ferrous Shape Memory Alloys, Non-Ferrous Shape Memory Alloys, Elaboration, Processing Heat Treatment Shaping of Shape Memory Alloys, Thermal and Deformation Fatigue, Application of SMA.											07	ME417.2		
IV	High-Temperature Materials and Superalloys: Characteristics of High-Temperature Materials, Improvement of High-Temperature Capability, High-Temperature Heat Resistant Steel, Ferritic, Martensitic, Austenitic Steels, Cermet, Ceramics, High-Temperature Composites, Coating for High Temperature, Fundamental of Superalloy, Role of Alloying Elements, Physical Metallurgy of Ni-base Superalloys, Applications of superalloys.											07	ME417.3		
VI	Nanomaterials: Introduction of Nanomaterial and Nanocomposite, Elementary Consequences and Size Effect, Thermodynamics and Phase Transformation in Nanomaterials, Graphene, Carbon Nanotube Fullerene, Mechanical Properties of Nanotube, Nanorod Platelet Filled Nanocomposite, Functional Properties of Nanomaterial.											07	ME417.4		
VII	Soft and Hard Magnetic Materials: Fundamentals of Magnetism, Hard Magnetic Materials Classification, Kerr Microscopy, Magnetic Force Microscopy, Hard Magnetic Material, Nano Crystallite Hard Magnet, Soft Magnetic Material, Nano Composite Exchange Coupling.											05	ME417.4		
VII	Advanced Processes and Functional Alloys: Inert Gas Condensation, CVD, PVD, Mechanical Alloying, SPS Sintering, Spark Plasma Sintering, Hot Isostatic Pressing, Rapid Solidification, Crystal Growth, Half Metallic Alloys, Heusler Alloys, Ferromagnetic Shape Memory Alloys, Magnetocaloric Alloys, Magnetic Refrigeration, Complex Metallic Alloys, High Entropy Alloys											07	ME417.5		
Total Hours											42				
Essential Readings															
1. M.V. Gandhi and B.D. Thompson, "Smart Materials and Structures", Chapman and Hall, 1992.															
2. K. Otsuka and C.M. Wayman, "Shape Memory Materials", Cambridge University Press, 1999.															
Supplementary Readings															
1. G.W. Taylor, "Piezoelectricity", Gordon and Breach Science Publisher, 1985.															
2. J. Arora, 'Introduction to Optimization Design', Elsevier Academic Press, 2004.															

		National Institute of Technology Meghalaya An Institute of National Importance										CURRICULUM				
Programme		Bachelor of Technology in Mechanical Engineering								Year of Regulation		2024-25				
Department		Mechanical Engineering								Semester		VII				
Course Code	Course Name	Pre-Requisite	Credit Structure				Marks Distribution									
			L	T	P	C	INT	MID	END	Total						
ME419	Mechanical Vibrations	---	3	0	0	3	50	50	100	200						
			CO's		Statement					Bloom's taxonomy						
Course Objectives	To understand the need and significance of vibration analysis in mechanical systems.	Course Outcomes	ME417.1	Able to understand fundamental concepts of vibration analysis to single and multi-degree freedom systems.					Understanding							
	To develop skills in modeling and analyzing vibrating systems with various degrees of freedom.		ME417.2	Able to analyze free and forced vibration responses of mechanical systems using various analytical methods.					Analyzing							
			ME417.3	Able to design vibration absorbers and isolation systems for practical applications					Applying							
			ME417.4	Able to model and analyse continuous systems and interpret results from transfer matrix methods.					Analyzing							
	To introduce concepts of continuous systems and vibration-based condition monitoring.		ME417.5	Able to comprehend the basics of vibration-based condition monitoring and random vibration.					Evaluate							
COs		Mapping with Program Outcomes (POs)										Mapping with PSOs				
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ME419.1		3	2	1		1							1	2		
ME419.2		3	3	2	1	2							1	3		
ME419.3		3	3	3	-	2							1	3		
ME419.4		3	3	2	2	2							1	3		
ME419.5		3	2	1	-	1							1	2		
ME419		3	2.6	1.8	1.5	1.6							1	2.6		
SYLLABUS																
No.	Content												Hours	COs		
I	Fundamentals of Vibration Analysis Need and significance of vibration analysis, Basic process and approaches for modeling mechanical systems, Single DOF system: Free vibration response, Newtonian and Energy approaches for governing equations of motion, Various damping mechanisms and ways to include them in mathematical models, Response to transient excitation, use of Convolution integral												10	ME419.1 ME419.2		
II	Forced Vibration and Two-DOF Systems Forced Vibration: harmonic and periodic excitation, Whirling of rotors, Campbell Diagram, Base excited system, Vibration Isolation and Transmissibility, Two DOF system: Natural frequencies, Concept of Mode shape, Response to initial conditions, Vibration response analysis (Free/forced), Design of vibration absorber and automotive torsional damper, Vibration isolation in 3 DOF system												12	ME419.2 ME419.3		
III	Multi-Degree of Freedom Systems MDOF system analysis, Eigenvalues and eigenvectors, Orthogonality of mode shapes, Modal analysis approach for vibration response (free/forced), Transfer Matrix methods for large DOF systems, Holzer and Myklestad-Prohl Methods												12	ME419.1 ME419.2 ME419.4		
IV	Continuous Systems and Condition Monitoring Modeling vibratory systems as continuous systems (distributed parameter model), Cases of string, bar, rod, and beam, Introduction to FEA approach for solving vibration problems, Introduction to vibration-based condition monitoring, Basics of Random vibration												08	ME419.4 ME419.5		
Total Hours												42				
Essential Readings																
1. Rao S.S., Mechanical Vibrations, 6 th Edition, Pearson, 2018																
2. Rao, J.S. and Gupta, K. Theory and Practice of Mechanical Vibrations, New Age International (Pvt) Ltd, New Delhi, 2 nd Edition, 1999																
Supplementary Readings																
1. Thomson W. T., Dahleh M. D., Padmanabhan C. Theory of Vibrations with Applications, Pearson Education, 5 th Edition, 2014																
2. Timoshenko, Stephen. Vibration Problems in Engineering, Wiley, 5 th Edition, 1937																



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CURRICULUM

Programme	Bachelor of Technology in Mechanical Engineering	Year of Regulation	2024-25
Department	Mechanical Engineering	Semester	VII

Course Code	Course Name	Pre-Requisite	Credit Structure				Marks Distribution			
			L	T	P	C	INT	MID	END	Total
ME421	Mechanical Micro-Machining	---	3	0	0	3	50	50	100	200
			COs		Statement				Bloom's taxonomy	
Course Objectives	To develop the student's ability to understand the issues and challenges in mechanical micro-machining.	Course Outcomes	ME421.1	Able to interpret the basic concept of mechanical micro-machining, the difference between macro- and micro-machining, mechanisms of material removal, etc.				Understanding		
	To develop the student's ability to understand the materials removal in mechanical micro-machining and fabrication process for the development of micro-tools.		ME421.2	Able to identify the various components of machine tools, errors in machine tools, etc.				Understanding		
	To develop the student's ability to identify the different components of machine tools, errors in machine tools, etc..		ME421.3	Able to develop different cutting tools for micro-machining of a wide range of materials.				Application		
	To develop the student's ability to understand the sensors used in the micro-machining process.		ME421.4	Able to explain the application, material removal mechanisms, etc. of the diamond turning process.				Understanding		
			ME421.5	Able to identify the different sensors and measurement techniques used in micro-machining.				Analysis		

COs	Mapping with Program Outcomes (POs)												Mapping with PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ME421.1	3	2											3	2	
ME421.2	3	1											2		
ME421.3	3	2	2		3								3	2	
ME421.4	3	1											2		
ME421.5	3	2			3								3	2	
ME421	3	1.6	2		3								2.6	2	

SYLLABUS

No.	Content	Hours	COs
I	Introduction Why Miniaturization? Micro-Machining vs. Nano-Machining, Applications of Mechanical Micro-Machining, Classifications of Micro Manufacturing Processes, Things to Remember while Operating Micro Machine, and Scaling Laws	04	ME421.1
II	Difference between Macro and Micromachining Size Effects, Effect of Cutting-Edge Radius and Uncut Chip Thickness, Different Mechanism of Material Removal, Influence of Size Effect on Material Removal, Effect of Depth of Cut and Blunt Tool, Effect of Material Anisotropy, Specific Cutting Energy, Burr Formation, Burr Formation and Reduction Strategies, Surface Roughness, and Surface Roughness Measurement Instruments	08	ME421.1
III	Components of Machine Tools Sub-systems of Machine Tool, Requirements of Machine Tool, Accuracy, Repeatability and Resolution, Structural Configuration of Machine Tool, Structural Loop Stiffness, Construction Material for Machine Tool, Material Selection Criteria, Use of Granite and Polymer Concrete for Machine Tool Structure, Linear Guideways, Hydrostatic Guideways, Aerostatic Guideways, Air Bearings, Linear Drive, Rotary Encoders, Linear Encoders, Belt Driven Spindle, Integral Motor Spindle, Angular Contact Ball Bearing, Preloading of Bearing, Aerostatic Spindles, Hybrid Ceramic Bearings, and Tool Holders	10	ME421.2
IV	Errors in Machine Tools Straightness, Flatness and Smoothness, Orthogonality in X, Y and Z Directions, Examples of Orthogonality Errors in X, Y, and Z Directions, and Motion Errors in Linear and Rotational Directions	05	ME421.2
V	Micro Cutting Tools and Micro Machines Micro Tool Fabrication Processes, Reasons for Tool Breakage, Advantages of Micro Machines, and Examples of Micro Machines	05	ME421.3
VI	Diamond Turning Introductions and Applications, Classifications, Material Removal Mechanisms and Cutting Tool, Slow Tool Servo and Fast Tool Servo Mechanism	05	ME421.4
VII	Sensors and Metrology for Micro Machining Introduction to Sensors, Dynamometer and Acoustic Emission Sensor, Use of Microscope, 3D Profilo meter, and SEM	05	ME421.5
Total Hours		42	

Essential Readings

- V.K. Jain, "Introduction to Micromachining", Narosa Publication, 2018.
- J.A. McGeough, "Micromachining of Engineering Materials", CRC Press, 2001.

Supplementary Readings

- K. Cheng and D. Huo, "Micro-Cutting: Fundamentals and Applications", Wiley, 2013.
- D. Dornfeld and D. Lee, "Precision Manufacturing", Springer, 2008.



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Programme	Bachelor of Technology in Mechanical Engineering	Year of Regulation	2024-25
Department	Mechanical Engineering	Semester	VII

Course Code	Course Name	Pre-Requisite	Credit Structure				Marks Distribution			
			L	T	P	C	INT	MID	END	Total
ME423	Wind and Solar Energy	---	3	0	0	3	50	50	100	200

Course Objectives	Course Outcomes	COs	Statement	Bloom's taxonomy
		ME423.1	Able to understand the solar energy, thermal application and solar radiation.	Knowledge Identification
To understand the details of wind energy conversion technologies. To understand the details of solar energy conversion systems.	ME423.2	Able to understand the non-concentrating solar collectors and able solve the related problems.	Knowledge Application	
	ME423.3	Ability to understand in details the parabolic solar collectors and thermal energy storage systems	Knowledge Identification and Application	
	ME423.4	Able to classifies the energy resources and compositional analysis.	Knowledge Identification, Application and analyzing	
	ME423.5	Ability to understand the basic concept of wind energy and wind turbines.	Knowledge Identification and Application	

COs	Mapping with Program Outcomes (POs)												Mapping with PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ME423.1	3	2	2	1	2	2	2						2	1	
ME423.2	3	3	2	1	2	2	2						3	1	
ME423.3	3	3	2	1	2	2	2						2	1	
ME423.4	3	2	2	1	2	2	2						2	1	
ME423.5	3	2	2	1	2	2	2						2	2	
ME423	3.0	2.4	2.0	1.0	2.0	2.0	2.0						2.2	1.2	

SYLLABUS

No.	Content	Hours	COs
I	Basics and Concepts, Solar Energy: An overview of thermal applications, Solar radiation, Practice problem	08	ME 423.1
II	Non-concentrating solar collectors: Part I, Non-concentrating solar collectors: Part II, Non-concentrating solar collectors: Part III, Practice problems	08	ME 423.2
III	Parabolic solar collectors, Thermal energy storage systems: Part I and Part II, Solar energy utilization methods	08	ME 423.3
IV	Classification of energy resources, Broad classification and compositional analysis, Characteristics and properties of biomass	08	ME 423.4
V	Wind Energy: Basics: Turbine terms, types and theories: Part I and Part II, Characteristics and Power Generation from Wind Energy: Part I, Characteristics and Power Generation from Wind Energy: Part II	10	ME 423.5
Total Hours		42	

Essential Readings

- J.F. Manwell, J.G. MC Gowan, A.L. Rogers, "Wind Energy Explained-Theory, Design and Application" 2nd Edition, Wiley
- H.P. Garg, J. Prakash, Solar Energy: Fundamentals and Applications, Tata McGraw-Hill, 1st Revised Edition, 2016.

Supplementary Readings

- D. A. Spera, "Wind Turbine Technology", ASME, 1994
- J. A. Duffie, W. A. Beckman, Solar Engineering of Thermal Processes, John Wiley and Sons, 4th edition, 2013
- K. Lovegrove, W. Stein, Concentrating Solar Power Technology: Principles, Developments and Applications, Woodhead Publishing, 2012



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CURRICULUM

Programme	Bachelor of Technology in Mechanical Engineering					Year of Regulation	2024-25									
Department	Mechanical Engineering					Semester	VII									
Course Code	Course Name	Pre-Requisite	Credit Structure				Marks Distribution									
			L	T	P	C	INT	MID	END	Total						
ME425	Mechatronics and Control	---	3	0	0	3	50	50	100	200						
Course Objectives	To provide the knowledge about mechatronics system, its components, design, control with respect to the engineering application.	---	Course Outcomes	COs	Statement				Bloom's taxonomy							
				ME425.1	Students will be able to illustrate the mechatronics system and its components construction, application.				Understanding							
				ME425.2	Student will be able to classify sensor application, construction operation.				Understanding							
				ME425.3	Student will be able to explain actuator system components like, hydraulic, pneumatic, electrical actuating system.				Applying							
				ME425.4	Student will be able to design and demonstrate hydraulic, pneumatic and electric circuit for mechatronic system.				Applying							
				ME425.5	Student will be able to solve problem associated to controller for mechatronics system.				Applying							
				ME425.6	Students will be able to predict the information from data acquisition system, microcontroller and system.				Understanding							
COs		Mapping with Program Outcomes (POs)										Mapping with PSOs				
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ME425.1		3												2	2	
ME425.2		3	2											2	2	
ME425.3		3	3											2	2	
ME425.4		3	3	3										3	3	
ME425.5		3	3	3										3	3	
ME425.6		2	3	3										3	3	
ME425		3	2.75	3										2.4	2.4	3
SYLLABUS																
No.	Content												Hours	COs		
I	Key element of the Mechatronics system, examples of the Mechatronics system, Electro Mechanical System, Micro electro Mechanical System												03	ME425.1		
II	Sensor and Transducer: characteristic of sensor, displacement sensor, proximity sensor, velocity sensor, pressure sensor, force sensor, temperature sensor, light sensor												08	ME425.2		
III	Hydraulic system: hydraulic pump, control valve, actuators and motors, hydraulic circuit design.												08	ME425.3		
IV	Pneumatic system: compressor, air treatment and pressure regulation, actuators, application of pneumatic system												04	ME425.3		
V	Electrical system: DC motor, AC motor, Stepper Motor												04	ME425.4		
VI	Control theory: Close loop and open loop control, transfer function representation, state space representation, Stability analysis, PID controller and its tuning.												07	ME425.5		
VII	Microprocessor and Microcontroller, programming in microcontroller.												04	ME425.5		
VIII	Data acquisition system: Analogue to digital conversion, digital to analogue conversion, USB communication, network connection.												04	ME425.6		
Total Hours												42				
Essential Readings																
1. J.F. Manwell, J.G.MC Gowan, A.L.Rogers, "Wind Energy Explained-Theory, Design and Application", Wiley, 2nd Edition, 2009																
2. Garg H.P., Prakash J., Solar Energy: Fundamentals and Applications, Tata McGraw-Hill, 1st Revised Edition, 2016.																
3. K. Ogata, Modern Control Engineering, fifth edition, Prentice Hall, 5th Edition, 2010.																
Supplementary Readings																
1. A. Esposito, "Fluid Power with Applications", Pearson Education, 7th Edition, 2014																
2. M. G.Rabie, "Fluid Power Engineering", McGraw Hill, 2nd Edition, 2024																



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CURRICULUM

Programme	Bachelor of Technology in Mechanical Engineering					Year of Regulation	2024-25								
Department	Mechanical Engineering					Semester	VII								
Course Code	Course Name	Pre-Requisite	Credit Structure				Marks Distribution								
			L	T	P	C	INT	MID	END	Total					
ME427	Fundamentals of Food Process Engineering	---	3	0	0	3	50	50	100	200					
			COs	Statement				Bloom's taxonomy							
Course Objectives	To understand the basics of food rheology and viscoelastic foods	Course Outcomes	ME427.1	Able to describe the fundamental concepts, classifications and terminologies of food rheology				Understand							
	To analyze the different thermal as well as non-thermal processing along with the kinetics of microbial death		ME427.2	Able to differentiate and evaluate different thermal processing and analyze the kinetics of microbial death				Apply							
			ME427.3	Able to compare different drying techniques applicable for food preservation				Apply							
			ME427.4	Able to evaluate and select proper separation and mixing mechanism for food processing.				Apply							
	To distinguish different drying, separation and mixing techniques commonly used for food preservation and processing		ME427.5	Able to analyze and evaluate different non-thermal processing				Analyze							
		Mapping with Program Outcomes (POs)										Mapping with PSOs			
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ME427.1	3	2	2			1			2	2	1		3	2	
ME427.2	3	3	2	2		1			2	2	1	2	3	2	
ME427.3	3	3	3	2		1			2	2	1	2	3	2	
ME427.4	3	3	3	2		1			2	2	1	2	3	2	
ME427.5	3	3	3	2		2	3		2	2	1	2	3	2	
ME427	3	2.8	2.6	2		1.2	3		2	2	1	2	3	2	
SYLLABUS															
No.	Content											Hours	COs		
I	Food Rheology, viscoelastic foods: Importance of rheology in food, classification of rheology, fluid behaviour, viscous properties, application of rheology in processing and handling, measurement of rheological properties, viscoelastic properties, viscoelastic behaviour.											08	ME427.1		
II	Thermal processing: Purpose of thermal processing, Thermal processing methods (Food preservation techniques like Blanching, Pasteurization and sterilization), Kinetics of microbial death											08	ME427.2		
III	Drying Technology: Objectives, Mechanism, psychrometry, moisture content and determination methods, equilibrium moisture content, drying rate and time, mass and energy balance, types of dryer, drying methods, freeze drying.											08	ME427.3		
IV	Separation and Mixing: Mechanical separation techniques, classification, screening, Screen effectiveness, Filtration, filtration mechanism, filter types, Flotation, Centrifugation, Cyclone separator, Mixing mechanisms and degree of mixing, Different types of mixers, Agitation systems											09	ME427.4		
V	Non-Thermal Processing: Fundamental concepts, high pressure processing techniques, Pulsed electric field technology, Pulse light technology, Irradiation, Ozone and cold plasma technology, Hurdle technology,											09	ME427.5		
Total Hours												42			
Essential Readings															
1. P. Fellows, "Food Processing Technology Principles and Practice", CRC Press, 2 nd Edition, 2000.															
Supplementary Readings															
1. J Mitra, "Fundamentals of Food Process Engineering", NPTEL course															



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CURRICULUM

Programme	Bachelor of Technology in Mechanical Engineering	Year of Regulation	2024-25
Department	Mechanical Engineering	Semester	VII

Course Code	Course Name	Pre-Requisite	Credit Structure				Marks Distribution				
			L	T	P	C	INT	MID	END	Total	
ME471	Hybrid and Electric Vehicles	---	2	0	0	2	50	50	100	200	
			COs	Statement				Bloom's taxonomy			
Course Objectives	To develop students' ability to classify hybrid and electric vehicles and gain knowledge on vehicle dynamics, controllers, battery management and current trends on hybridization of vehicles	Course Outcomes	ME471.1	To explain hybrid and electric vehicles. To explain and appraise the force and power required vehicle motion.				Understanding			
			ME471.2	To classify types of motors and determine motor efficiency, acceleration and controllers.				Understanding			
			ME471.3	To classify types of batteries and apply the concept of charging, discharging and thermal management of batteries.				Applying			
			ME471.4	To compare the conventional, non-conventional and renewable sources of energy and the current trends in hybridization of vehicles.				Evaluate			
			ME471.5	To manage the infrastructure for electric vehicles, including deployment and installation, operation and maintenance, and the management and integration of charging stations.				Applying			

COs	Mapping with Program Outcomes (POs)												Mapping with PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ME471.1	3	2		3									3	2	
ME471.2	3	3	3		3	1							3	2	
ME471.3	3	3	2	3		2							3	2	
ME471.4	3		3	3	2	3							3	2	
ME471.5	3		3	2	3	3							3	2	
ME471	3	2.67	2.75	2.75	2.67	2.25							3	2	

SYLLABUS			
No.	Content	Hours	COs
I	Overview of Electric Vehicles: Innovative EV program, Batteries, Charging and Swapping, Lithium for Batteries, Subsystems for EVs.	02	ME471.1
II	Vehicle Dynamics: Forces associated with vehicle, Rolling/Uphill resistance and Aerodynamics drag, Power and torque, Overall drive cycle concept.	04	ME471.2
III	Vehicle Subsystems: EV Power-train: Drive cycle concept, Drive cycle, EV drive train design	06	ME471.3
	Storage for EVs: Battery Parameters, Lithium-Ion batteries, EV battery future.		
	Fundamentals of EV Battery Pack Design: Fundamentals and Design of battery pack, Self-discharge and SoH/SoC estimation, Development of battery pack, Effective computation cost of battery Part, Battery charging.		
	EV Motors and Controllers: Mechanical design aspect, Thermal design aspect, Electrical design aspect, Motor Controllers, Power and efficiency, Torque measurement, Measurement of speed and back EMF, Equivalent d-q circuit, three phase AC supply, Engineering Design considerations.		
IV	Vehicle Accessories: Roof Racks and Cargo Carriers, Parking Sensors and Cameras, Advanced Driver Assistance Systems, Suspension Enhancements, High-Performance Tires.	04	ME471.4
V	Battery Charging and Swapping: Introduction to EV charges, Battery System Management design, Slow or fast charger, Battery swapping, Standardization of chargers, Public Chargers, Bulk chargers and swap stations, Economic aspect of public chargers, Future frontiers.	06	ME471.4
VI	Management of EV Infrastructure: Deployment and Installation, Operation and Maintenance, Management of charging stations and Integration.	06	ME471.5
Total Hours		28	

Essential Readings	
1.	P. Enge, N. Enge, S. Zoepf, "Electric Vehicle Engineering", Tata McGraw Hill, 1st Edition, 2021.
2.	A.K. Babu, "Electric & Hybrid Vehicles", Khanna Book Publishing, 2nd Edition, 2022
Supplementary Readings	
1.	S. R. Pawar, "Electrical Vehicle Technology: The Future Towards Eco-Friendly Technology", Notion Press, 2nd Edition, 2024.



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CURRICULUM

Programme	Bachelor of Technology in Mechanical Engineering	Year of Regulation	2024
Department	Mechanical Engineering	Semester	VII

Course Code	Course Name	Pre-Requisite	Credit Structure				Marks Distribution			
			L	T	P	C	INT	MID	END	Total
ME473	Optimization Techniques	---	2	0	0	2	50	50	100	200

Course Objectives	Course Outcomes	COs	Statement	Bloom's Taxonomy
		To provide the concept of various optimization techniques with the examples of engineering problem.	ME473.1 ME473.2 ME473.3 ME473.4	Students will be able to explain the basics of optimization, problem formulation, local and global optimization.
Students will be able to apply the genetic algorithm for optimization of Mechanical System.	Applying			
Students will be able to solve unconstrained optimization problem through various Differential Evolution optimization technique.	Applying			
Students will be able to evaluate the unconstrained optimization through multi objective optimization	Analyze			

COs	Mapping with Program Outcomes (POs)												Mapping with PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ME473.1	3	1	3	1		2							3	3	
ME473.2	3	2	3	2									3	2	
ME473.3	3	3	3	3	2	2	3	2					3	2	
ME473.4	3	3	3	3	3		2						3	3	
ME473.5	3	3	3	3	3	2	2	2					3	3	
ME473	3	2.4	3	2.4	2.67	2	2.34	2					3	2.6	

SYLLABUS

No.	Content	Hours	COs
I	Introduction and Principles of Evolutionary Computation (EC): Introduction to Optimization, Generalized Formulation, Scope of Optimization via Applications, Characteristic of Optimization Functions; Principles of EC: Natural Evolutional and Genetics, Generalized Framework, Behavior and Typical run of EC, Advantages and Limitations	04	ME473.1
II	Binary-Coded Genetic Algorithm (BGA): Introduction, Binary Representation and Decoding, Working Principle of binary coded GA (BGA), BGA on Generalized Framework, Operators, Hand Calculations, Graphical Examples; Real-Coded Genetic Algorithm (RGA): Concepts and Need of Real-Coded GA (RGA), Algorithm, RGA on Generalized Framework, Operators, Hand Calculations, Graphical Examples, Case studies;	06	ME473.2
III	Other EC Techniques: Differential Evolution (DE): Introduction, Concepts, Operators, Algorithm, DE on Generalized Framework, Graphical Examples, Case studies; Particle Swarm Optimization (PSO): Introduction, Concepts, Operators, PSO on Generalized Framework, Graphical Examples, Case studies; Constraint Handling Techniques: Generalized Constraint Formulation, Karush Kuhn Tucker (KKT) conditions, Penalty Function Method, Parameter-Less Deb's Method, Hand Calculations, Graphical Examples, Case studies	06	ME473.3
IV	Introduction to Multi-Objective Optimization: Introduction, Generalized Formulation, Concept of Dominance and Pareto-optimality, Graphical Examples, Terminologies, Difference with Single-objective optimization, Approaches to multi-objective optimization	04	ME473.4
VI	Classical Multi-Objective Optimization Methods: Classical Multi-Objective Optimization Methods: Weighted- Sum Method, ϵ -Constraint Method, Weighted Metric Methods, Hand Calculations, Difficulties with Classical approaches, Ideal Multi-Objective Optimization Approach	04	ME473.4
VII	Multi-Objective Evolutionary Algorithms (MOEAs): Introduction, MOEAs on generalized Framework, Algorithms: NSGA-II, SPEA2, Graphical Examples, Case Studies; Hypervolume Indicator (HV) for Performance Assessment	04	ME473.4
Total Hours		28	

Essential Readings

1. K. Deb, Multi-objective Optimization using Evolutionary Algorithms, Wiley, 1st Edition, 2001
2. S. S. Rao, Engineering Optimization, Theory and Practice, New Age International Publishers, 4th Edition, 2012

Supplementary Readings

1. K. Deb, Optimization for Engineering Design Algorithms and Examples, PHI, 2nd Edition, 2000
2. J. Arora, Introduction to Optimization Design, Elsevier Academic Press, 4th Edition, 2016



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CURRICULUM

Programme	Bachelor of Technology in Mechanical Engineering						Year of Regulation	2024-25							
Department	Mechanical Engineering						Semester	VII							
Course Code	Course Name	Pre-Requisite	Credit Structure				Marks Distribution								
			L	T	P	C	INT	MID	END	Total					
ME475	Electronic Packaging and Manufacturing	---	2	0	0	2	50	50	100	200					
			COs	Statement				Bloom's taxonomy							
Course Objectives	To provide students with basic knowledge of technologies and processes in electronic product packaging and manufacturing, focusing on often-neglected mechanical, materials, and manufacturing aspects. Students will gain essential scientific and technological knowledge to become proficient builders and users of electronic systems.	Course Outcomes	ME475.1	Identify the different levels of electronic packaging and their respective components and techniques.				Understanding							
			ME475.2	Apply knowledge of first and second level packaging to design and fabricate integrated circuits and printed wiring boards, including chip carriers, interconnection methods, and solder masks.				Applying							
			ME475.3	Analyse advanced packaging technologies, such as chip scale packaging, multi-chip modules, and system in packages, including specialized packages for RF, MEMS, and harsh environments.				Analyzing							
			ME475.4	Evaluate mechanical design considerations, including vibration, fatigue, and creep analysis, and apply theorems like Castigliano's to solve related problems.				Evaluating							
			ME475.5	Assess thermal management strategies, including the use of thermal interface materials, heat spreaders, and heat sinks, and perform reliability analysis to predict life cycle and failure modes in electronic systems.				Evaluating							
COs	Mapping with Program Outcomes (POs)										Mapping with PSOs				
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ME477.1	3	3											3	2	3
ME477.2	3	2			1								3	2	3
ME477.3	3	3	2										3	2	3
ME477.4	3	2											3	2	3
ME477.5	3	3	2	2	2	2							3	3	3
ME477	3	2.6	2	2	1.5	2							2	2.2	3
SYLLABUS															
No.	Content											Hours	COs		
I	Introduction: Electronic Packaging, Levels of Packaging, Wafer Fabrication, Recap of Basic Electronics											02	ME475.1		
II	First Level Packaging: Package Taxonomy, Chip and Chip Carrier, Lead Frame, Interconnection Types and Methods, Flip-Chip Bonding, Area Arrays											03	ME475.2		
III	Second Level packaging: Design and Manufacture of Printed Wiring Boards, Types of Circuit Boards, Component Placement, Routing, Lamination, Solder Masks											03	ME475.2		
IV	Third Level Packaging and System Level Integration: Cables, Connectors, Chassis, Display											04	ME475.2		
V	Advanced Packaging: Chip Scale Packaging, Multi-Chip Module, Stacked Package, System in Package (SIP), System on Chip (SOC), Specialized Packages (RF, MEMS, Sensors, Harsh Environments, Wearable/Flexible)											04	ME475.3		
VI	Mechanical Design: Vibration Analysis, Theorem of Castigliano, Fatigue and Creep Analysis											04	ME475.3		
VII	Thermal Design: Basics of Heat Transfer, Thermal Resistance, Thermal Interface Materials, Heat Spreaders and Heat Sinks, System Level Thermal Challenges, Modelling and Analysis											04	ME475.4		
VIII	Reliability: Design for Reliability, Life Cycle, Failure Modes and Mechanisms, Reliability Metrology and Analysis, Accelerated Degradation Modelling, Environmental Stress Screening											04	ME475.5		
Total Hours											28				
Essential Readings															
1. V. Ganesan, "Internal Combustion Engines", Tata McGraw Hill, 4 th Edition, 2012.															
2. J.B. Heywood, "Internal Combustion Engine Fundamentals", McGraw Hill, 1 st Edition, 2011.															
Supplementary Readings															
1. R. Stone, "Internal Combustion Engines", The Macmillan Press Limited, 4 th Edition, 2012.															
2. C.R. Ferguson and A.T. Kirkpatrick, "Internal Combustion Engines", John Wiley & Sons, 3 rd Edition, 2015.															
3. V. Sajith and S. Thomas, "Internal Combustion Engines", Oxford University Press, 1 st Edition, 2017.															



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CURRICULUM

Programme	Bachelor of Technology in Mechanical Engineering					Year of Regulation	2024-25								
Department	Mechanical Engineering					Semester	VII								
Course Code	Course Name	Pre-Requisite	Credit Structure				Marks Distribution								
			L	T	P	C	INT	MID	END	Total					
ME 477	Foundation of Computational Fluid Dynamics	---	2	0	0	2	50	50	100	200					
			COs	Statement				Bloom's taxonomy							
Course Objectives	To understand fundamental principles of fluid dynamics and governing equations.		Course Outcomes	ME477.1	Demonstrate understanding of fundamental principles and governing equations in fluid dynamics.				Demonstrate						
	To apply numerical methods effectively for solving fluid flow problems.			ME477.2	Apply numerical methods to accurately simulate and analyze fluid flow phenomena.				Apply						
	To understand solution techniques for both compressible and incompressible flows.			ME477.3	Solve Navier-Stokes equations for both compressible and incompressible flows using appropriate techniques.				Solve						
	To implement the Finite Volume Method and grid generation techniques.			ME477.4	Implement the Finite Volume Method and generate grids suitable for computational fluid dynamics simulations.				Implement						
	To explore advanced topics such as turbulent flows and turbulence modelling through practical applications.			ME477.5	Analyze and interpret results from advanced simulations, including turbulent flows and turbulence models, for practical engineering applications.				Analyze						
COs	Mapping with Program Outcomes (POs)												Mapping with PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ME477.1	3												2		
ME477.2	3	3											2		
ME477.3	3	2											2		
ME477.4	3		2										2		
ME477.5	3												2		
ME477	3	2.5	2										2		
SYLLABUS															
No.	Content											Hours	COs		
I	Introduction to Computational Fluid Dynamics: Rectangular duct flow, triangular duct flow, governing equations, numerical methods, boundary conditions.											06	ME477.1		
II	Governing Equations and Numerical Methods: Navier-Stokes equations, conservation laws, incompressible flow, continuity equation, momentum equation, finite difference methods, consistency, stability, convergence.											06	ME477.2		
III	Solution Techniques for Fluid Flow Equations: Navier-Stokes equations (compressible and incompressible), linear algebraic equations, direct methods, iterative methods.											06	ME477.3		
IV	Finite Volume Method and Grid Generation: Finite volume method, control volumes, discretization, structured grids, unstructured grids, grid generation, grid quality.											05	ME477.4		
V	Advanced Topics in Computational Fluid Dynamics: Turbulent flows, turbulence modeling, k-epsilon model, RNG k-epsilon model, Reynolds-averaged Navier-Stokes (RANS), computational challenges, case studies.											05	ME477.5		
Total Hours											28				
Essential Readings															
1. J. D. Anderson Jr., "Computational Fluid Dynamics: The Basics with Applications", McGraw-Hill Education, 1st Edition, 1995.															
2. J. H. Ferziger, M. Peric, "Computational Methods for Fluid Dynamics", Springer, 3rd Edition, 2002.															
3. H. K. Versteeg, W. Malalasekera, "An Introduction to Computational Fluid Dynamics: The Finite Volume Method", Pearson Education Limited, 2nd Edition, 2007.															
Supplementary Readings															
1. F. Moukalled, L. Mangani, M. Darwish, "The Finite Volume Method in Computational Fluid Dynamics: An Advanced Introduction with OpenFOAM and Matlab", Springer, 1st Edition, 2016.															
2. C. Hirsch, "Numerical Computation of Internal and External Flows: The Fundamentals of Computational Fluid Dynamics" Butterworth-Heinemann, 2nd Edition, 2007.															

Eighth Semester Courses

		National Institute of Technology Meghalaya An Institute of National Importance										CURRICULUM				
		Programme		Bachelor of Technology in Mechanical Engineering					Year of Regulation			2024-25				
Department		Mechanical Engineering					Semester			VIII						
Course Code	Course Name	Pre-Requisite	Credit Structure				Marks Distribution									
			L	T	P	C	INT	MID	END	Total						
ME412	Fracture Mechanics	-----	3	0	0	3	50	50	100	200						
			CO's		Statement				Bloom's Taxonomy							
Course Objectives	To introduce the concepts of Linear Elastic Fracture Mechanics (LEFM) and Elastic-Plastic Fracture Mechanics (EPFM)		Course Outcomes	ME412.1	Able to understand the fundamentals of fracture mechanics and identify spectacular failures.				Understanding							
	To develop understanding of crack growth mechanisms and fracture theories			ME412.2	Able to apply concepts of LEFM and EPFM to analyze crack growth and fracture mechanisms.				Applying							
	To teach methods for determining stress intensity factors and fracture toughness			ME412.3	Able to analyse stress intensity factors and energy release rates for various geometries.				Analysing							
	To introduce concepts of fatigue crack growth and failure assessment			ME412.4	Able to analyse plastic deformation models and conduct fracture toughness testing.				Analysing							
				ME412.5	Able to evaluate fatigue crack growth and apply concepts of failure assessment diagrams and crack arrest methodologies.				Evaluate							
COs		Mapping with Program Outcomes (POs)										Mapping with PSOs				
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ME412.1		3	2	1		1					2		1	2		
ME412.2		3	3	2	1	2					2		1	3		
ME412.3		3	3	2	2	2					2		1	3		
ME412.4		3	3	2	1	2					2		1	3		
ME412.5		3	3	2	2	2					2		1	3		
ME412		3	2.5	1.8	1.5	1.8					2		1	2.5		
SYLLABUS																
No.	Content													Hours	COs	
I	Introduction to Fracture Mechanics EFM Course outline and Spectacular Failures, Introduction to LEFM and EPFM, Crack Growth and Fracture Mechanisms, Griffith's Theory of Fracture, Energy Release Rate, Review of Theory of Elasticity													08	ME412.1 ME412.2	
II	Stress Intensity Factors and Elastic Solutions Westergaard Solution for Stress and Displacements for Mode I, Relationship between K and G, Introduction to multi-parameter stress field for Mode I, Mode II and Mixed Modes, SIF for Various Geometries													12	ME412.2 ME412.3	
III	Plastic Deformation and Fracture Toughness Modeling Plastic Deformation, Irwin's model, Dugdale Model, Fracture Toughness Testing, J-Integral													10	ME412.3 ME412.4	
IV	Fatigue Crack Growth and Failure Assessment Paris Law and Sigmoidal curve, Crack Closure, Crack Growth Models, Failure Assessment Diagram, Mixed Mode Fracture, Crack Arrest and Repair Methodologies													12	ME412.4 ME412.5	
Total Hours													42			
Essential Readings																
1. P. Kumar, "Elements of Fracture Mechanics", Tata McGraw Hill, 1 st Edition, 2017																
2. T. Kundu, "Fundamentals of Fracture Mechanics", CRC Press, 1 st Edition, 2008																
Supplementary Readings																
1. T. L. Anderson, "Fracture Mechanics – Fundamentals and Applications", CRC Press, 4 th Edition, 2017																
2. D. Broek, "Elementary Engineering Fracture Mechanics", Kluwer Academic Publishers, 4 th Edition, 1982																

		National Institute of Technology Meghalaya An Institute of National Importance										CURRICULUM				
Programme		Bachelor of Technology in Mechanical Engineering							Year of Regulation			2024-25				
Department		Mechanical Engineering							Semester			VIII				
Course Code	Course Name	Pre-Requisite	Credit Structure				Marks Distribution									
			L	T	P	C	INT	MID	END	Total						
ME 414	Heat Exchanger: Fundamental and Design Analysis	-----	3	0	0	3	50	50	100	200						
Course Objectives	To equip students with an understanding of fundamental concepts, classifications, and terminologies related to heat exchangers.	Course Outcomes	CO's		Statement				Bloom's Taxonomy							
	To enable students to analyze the thermal and hydraulic performance of various heat exchanger types		ME414.1	Illustrate the fundamental principles and classifications of heat exchangers				Illustrate								
	To apply the LMTD and Effectiveness-NTU methods for designing and rating heat exchangers		ME414.2	Analyze and evaluate the thermal and hydraulic performance of heat exchangers				Analyze								
	To evaluate and design specialized and compact heat exchangers.		ME414.3	Apply LMTD and Effectiveness-NTU methods in designing and rating heat exchangers				Apply								
	To conduct testing and performance analysis of heat exchangers using steady state and dynamic methods		ME414.4	Design and enhance the performance of various specialized and compact heat exchangers.				Design								
			ME414.5	Conduct and interpret testing and performance analyses of heat exchangers				Interpret								
COs		Mapping with Program Outcomes (POs)										Mapping with PSOs				
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ME414.1		3												2		
ME414.2			3											2		
ME414.3			2											2		
ME414.4		3												2		
ME414.5		3												2		
ME414		3	2.5											2		
SYLLABUS																
No.	Content													Hours	COs	
I	Introduction to Heat Exchangers: foundational aspects, background, application, classification, and common terminologies.													08	ME414.1	
II	Thermal and Hydraulic Aspects: pressure drop and heat transfer, sizing and rating, and finned surface heat exchangers, basics of extended surface heat transfer.													09	ME414.2	
III	Methods and Tubular Heat Exchangers: Log Mean Temperature Difference (LMTD) method, the Effectiveness-NTU method, tubular heat exchangers, shell and tube heat exchangers, and special types of tubular heat exchangers.													08	ME414.3	
IV	Compact Heat Exchangers and Fin Heat Exchangers: compact heat exchangers, enhancement of heat transfer, Plate Fin Heat Exchangers (PFHE), types, construction, fabrication, design, applications, and multi-stream PFHE.													08	ME414.4	
V	Specialized Heat Exchangers and Testing: direct contact heat exchangers, types, applications, simple analysis, regenerators, construction, applications, theory, Effectiveness-NTU method, heat pipes, construction, working principles, applications, special heat pipes, microscale heat exchangers, heat sinks, heat transfer, fluid flow through narrow conduits, special design considerations, phase change heat exchangers, evaporators, condensers, steady state methods, and dynamic methods.													09	ME414.5	
Total Hours													42			
Essential Readings																
1. S. Kakac, H. Liu, A. Pramuanjaroenkij, "Heat Exchangers: Selection, Rating, and Thermal Design", CRC Press, 3rd Edition, 2012.																
2. J.E. Hesselgreaves, R. Law, D. Reay, "Compact Heat Exchangers: Selection, Design and Operation", Butterworth-Heinemann, 2nd Edition, 2016.																
3. Ramesh K. Shah, Dusan P. Sekulic, "Fundamentals of Heat Exchanger Design", Wiley, 1st Edition, 2003.																
Supplementary Readings																
1. K. Thulukkanam, "Heat Exchanger Design Handbook", CRC Press, 2nd Edition, 2013																
2. A. Bejan, "Heat Transfer Handbook", John Wiley & Sons, 1st Edition, 2003																

		National Institute of Technology Meghalaya An Institute of National Importance										CURRICULUM						
Programme		Bachelor of Technology in Mechanical Engineering						Year of Regulation				2024-25						
Department		Mechanical Engineering						Semester				VIII						
Course Code	Course Name	Pre-Requisite	Credit Structure				Marks Distribution				L	T	P	C	INT	MID	END	Total
			L	T	P	C	INT	MID	END	Total								
ME 416	Fundamentals of Artificial Intelligence	-----	3	0	0	3	50	50	100	200								
Course Objectives The objective of this course is to present an overview of the principles and practices of AI to address such complex real-world problems. The course is designed to develop a basic understanding of problem solving, knowledge representation, reasoning and learning methods of AI.	Course Outcomes ME416.1 Students will be able to compare history, scope and future of AI. ME416.2 Students will be able to interpret through AI. ME416.3 Students will be able to apply game trees on for problem solving ME416.4 Students will be able to compute Calculus in AI ME416.5 Students will be able to analyze problem through Reasoning under uncertainty ME416.6 Students will be able to predict problem through Machine Learning	CO's	Statement											Bloom's Taxonomy				
		ME416.1	Students will be able to compare history, scope and future of AI.											Understanding				
		ME416.2	Students will be able to interpret through AI.											Understanding				
		ME416.3	Students will be able to apply game trees on for problem solving											Applying				
		ME416.4	Students will be able to compute Calculus in AI											Applying				
		ME416.5	Students will be able to analyze problem through Reasoning under uncertainty											Analyze				
ME416.6	Students will be able to predict problem through Machine Learning											Evaluate						
COs	Mapping with Program Outcomes (POs)												Mapping with PSOs					
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3			
ME 416.1	3	2	3										3	3				
ME 416.2	3	2	3										3	3				
ME 416.3	3	2	3										3	3				
ME 416.4	3	2	3										3	3				
ME 416.5	3	3	3										3	3				
ME 416.6	3	3	3										3	3				
ME416	3	2.33	3										3	3				
SYLLABUS																		
No.	Content													Hours	COs			
I	Introduction: Scope; History, Trends and Future Directions.													02	ME 416.1			
II	Problem Solving by Search: Production Systems and AI; Graph- Constraint Satisfaction Problems; Stochastic Search Methods; Searching													05	ME 416.2			
III	Game Trees: Minimax, Alpha-Beta Pruning. Knowledge Representation and Reasoning: Search Strategies: Uninformed Search, Heuristic Search Techniques;													05	ME 416.3			
IV	Predicate Calculus in AI: Syntax and Semantics, Expressivity, Unification, Resolution; Resolution Refutation Systems; Situation Calculus.													10	ME 416.4			
V	Reasoning under uncertainty: Notion of Uncertainty; Uncertain Knowledge and Reasoning, Probabilities; Bayesian Networks. Planning: Planning with State Space Search; Planning Graphs; Partial Order Planning. Decision Making: Sequential Decision Problems, Algorithms for optimal Policies.													10	ME 416.5			
VI	Machine Learning: Learning from Observations: Overview of different forms of Learning, Learning Decision Trees, Computational Learning Theory, Statistical Learning Methods, Neural Networks and Connectionist Learning													10	ME 416.6			
Total Hours													42					
Essential Readings																		
1. P H. Winston, Artificial Intelligence, Addison-Wesley Publishing Company, 3rd Edition, 2004.																		
2. N. J. Nilsson, Principles of Artificial Intelligence, Springer Heidelberg, Illustrated Reprint Edition, 2014																		
Supplementary Readings																		
1. S. Russell and P. Norvig, Artificial Intelligence: A Modern Approach, PHI, 3rd Edition, 2009.																		
2. N. J. Nilsson, Quest for Artificial Intelligence, Cambridge University Press, 1st Edition, 2010.																		

		National Institute of Technology Meghalaya An Institute of National Importance						CURRICULUM							
Programme		Bachelor of Technology in Mechanical Engineering				Year of Regulation				2024-25					
Department		Mechanical Engineering				Semester				VIII					
Course Code	Course Name	Pre-Requisite	Credit Structure				Marks Distribution								
			L	T	P	C	INT	MID	END	Total					
ME418	AUTOMOBILE ENGINEERING	ME411	3	0	0	3	50	50	100	200					
			CO's	Statement				Bloom's Taxonomy							
Course Objectives	To understand the detailed construction and working principle of different parts of an automobile.		Course Outcomes	ME418.1	Able to identify the various parts of the automobile and their functions and materials.				Comprehension						
	To have the practice for assembling and dismantling of different parts of an automobile including engine and transmission system.			ME418.2	Able to comprehend the engine auxiliary systems and engine emission control.				Comprehension						
				ME418.3	Able to understand and distinguish the working of different types of transmission systems.				Comprehension, Analysis						
	To find out alternate sources of energy and reduce vehicular pollution.			ME418.4	Able to explain the Steering, Brakes and Suspension Systems.				Application						
				ME418.5	Able to predict possible alternate sources of energy for IC Engines and reduce vehicular pollution.				Application						
COs		Mapping with Program Outcomes (POs)										Mapping with PSOs			
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
	ME418.1	3	2	2			2			2	2	2		3	2
	ME418.2	3	3	2			2			2	2	2	2	3	2
	ME418.3	3	3	3	2		2			2	2	2	2	3	2
	ME418.4	3	3	3	2		2			2	2	2	2	3	2
	ME418.5	3	3	3	2		2	3		2	2	2	2	3	2
	ME418	3.0	2.8	2.6	2.0		2.0	3.0		2.0	2.0	2.0	2.0	3.0	2.0
SYLLABUS															
No.	Content													Hours	COs
I	Automotive Structure and Engines Types of automobiles vehicle construction and different layouts, chassis, frame and body, Vehicle aerodynamics (various resistances and moments involved), IC engines components-functions and materials, variable valve timing (VVT).													08	ME418.1
II	Auxiliary Systems of SI & CI Engine Electronically controlled gasoline injection system for SI engines, Electronically controlled diesel injection system (Unit injector system, Rotary distributor type and common rail direct injection system), Electronic ignition system (Transistorized coil ignition system, capacitive discharge ignition system), Turbo chargers (WGT, VGT), Engine emission control by three way catalytic converter system, Emission norms (Euro and BS), Lighting systems.													09	ME418.2
III	Transmission Systems Clutch-types and construction, gear boxes- manual and automatic, gear shift mechanisms, Over drive, transfer box, fluid flywheel, torque converter, propeller shaft, slip joints, universal joints, Differential and rear axle, Hotchkiss Drive and Torque Tube Drive.													08	ME418.3
IV	Steering, Brakes and Suspension Systems Steering geometry and types of steering gear box-Power Steering, Types of Front Axle, Types of Suspension Systems, Pneumatic and Hydraulic Braking Systems, Antilock Braking System (ABS), electronic brake force distribution (EBD) and Traction Control.													08	ME418.4
V	Alternative Energy Sources & Vehicular Emission Use of Natural Gas, Liquefied Petroleum Gas, Bio-diesel, Bio-ethanol, Gasohol and Hydrogen in Automobiles- Engine modifications required Performance, Combustion and Emission Characteristics of SI and CI engines with these alternate fuels- Electric and Hybrid Vehicles, Fuel Cell.													09	ME418.5
Total Hours													42		
Essential Readings															
1. K.K. Jain and R.B. Asthana, Automobile Engineering, Tata McGraw Hill, 1 st edition, 2017.															
2. K. Singh, Automobile Engineering, Vol. 1 & 2, Standard Publishers, 14 th Edition, 2019.															
Supplementary Readings															
1. V. Ganesan, Internal Combustion Engines, Tata McGraw Hill, 4th Edition, 2012.															
2. J. Heitner, Automotive Mechanics, Principles and Practices, CBS Publishing 2 nd Edition, 2004.															

		National Institute of Technology Meghalaya An Institute of National Importance											CURRICULUM			
Programme		Bachelor of Technology in Mechanical Engineering						Year of Regulation					2024-25			
Department		Mechanical Engineering						Semester					VIII			
Course Code	Course Name	Pre-Requisite	Credit Structure				Marks Distribution									
			L	T	P	C	INT	MID	END	Total						
ME420	SUPPLY CHAIN AND LOGISTICS MANAGEMENT	-----	3	0	0	3	50	50	100	200						
			COs		Statement					Bloom's Taxonomy						
Course Objectives	To introduce the basic of supply chain and its drivers and use the knowledge of Demand and Supply in a Supply Chain in organization in E- business.	Course Outcomes	ME420.1	Able to Interpret the basic s of Supply chain and its strategies					Understanding							
			ME420.2	Able to Explain the drivers of supply chain, and structuring Drivers					Understanding							
	ME420.3		Able to Apply the knowledge of Planning Demand and Supply in a Supply Chain in organization in Ebusiness analysis.					Application								
	ME420.4		Able to Apply the knowledge of Network Design in the Supply Chain in network design decision in organizations					Application								
	ME420.5		Able to Analyse logistics and decisions, Benchmarking and performance analysis in organizations					Analysis								
COs		Mapping with Program Outcomes (POs)											Mapping with PSOs			
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ME420.1										2	2	2	2		2	
ME420.2										2	2	3	2		2	
ME420.3										3	3	3	3		3	
ME420.4									2	3	3	3	2		3	
ME420.5									2	3	3	3	3		3	
ME420									2	2.6	2.6	2.8	2.4		2.6	
No.	Content													Hours	COs	
I	Introduction to Supply Chain Management, Understanding the Supply Chain. Supply Chain Performance: Competitive and Supply Chain Strategies, achieving Strategic Fit and Scope of Strategic Fit													07	ME420.1	
II	Supply Chain Drivers and Metrics: Drivers of Supply Chain Performance, Framework for structuring Drivers, Facilities, Inventory, Transportation, Information, Sourcing and Pricing,													07	ME420.2	
III	Planning Demand and Supply in a Supply Chain: Demand Forecasting in a Supply Chain, Aggregate Planning in a Supply Chain. Designing Distribution Networks and Application to E-Business, Role of distribution, factors influencing distribution network design, design options for a distribution network, E-Business and the distribution network.													08	ME420.3	
IV	Network Design in the Supply Chain- Role of network design in the supply chain, factors influencing network design decisions, framework for network design decisions Role of Information Technology in supply chain, coordination in a supply chain, Bullwhip Effect, Effect on performance due to lack of coordination, obstacles to coordination in a supply chain.													10	ME420.4	
V	Factors influencing logistics and decisions. Modelling logistic problems, logistics in practice, Benchmarking and performance analysis techniques, the bin –packing problem, travelling salesman problem.													10	ME420.5	
Total Hours														42		
Essential Readings																
1. Supply Chain Management: Strategy, Planning & Operation- Sunil Chopra & Peter Meindle- Pearson, 5th ed. 2013.																
2. Julien Bramel and David Simchi-Levi, "The logic of Logistics Theory algorithms and Applications for Logistics management", Springer series in Operations Research, 1997																
Supplementary Readings																
1. Donald J. Bowersox & David J. Closs "Logistical Management: The integrated Supply Chain Process", TMH Publication, 2017																

		National Institute of Technology Meghalaya An Institute of National Importance										CURRICULUM				
Programme		Bachelor of Technology in Mechanical Engineering						Year of Regulation				2024-25				
Department		Mechanical Engineering						Semester				VIII				
Course Code	Course Name	Pre-Requisite	Credit Structure					Marks Distribution								
			L	T	P	C	INT	MID	END	Total						
ME 422	Industrial Hydraulics and Automation	-----	3	0	0	3	50	50	100	200						
Course Objectives	To describe the hydraulic circuit system construction, component and its operation To analyse the hydraulic circuit components and design of the circuit with specific application.	Course Outcomes	CO's		Statement					Bloom's Taxonomy						
			ME422.1	Students will be able to explain the importance of different hydraulic system components and identification of its application					Understanding							
	ME422.2		Students will be able to explain the method for constructing and operating the different hydraulic components					Understanding								
	ME422.3		Students will be able to solve problem associate hydraulic cylinder, pump and motor					Applying								
	ME422.4		Students will be able to solve problem associate hydraulic control valve					Applying								
	To analyse the hydraulic circuit components and design of the circuit with specific application.	ME422.5	Students will be able to analyze the hydraulic circuit					Analyse								
COs		Mapping with Program Outcomes (POs)										Mapping with PSOs				
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
	ME422.1	3	3											3		
	ME422.2	3	3											3		
	ME422.3	2	3	3										3	3	
	ME422.4	2	2	3								1		3	3	
	ME422.5	2	2	3								1		3	3	
	ME422	2.4	2.6	3								1		3	3	
SYLLABUS																
No.	Content													Hours	COs	
I	Hydraulic System Introduction to hydraulic system, hydraulic system component, application of the hydraulic system and advantages over other system.													03	ME 422.1	
II	Electrohydraulic System Electrohydraulic system components, comparison with the hydraulic system, components of electrical signal control, sensors for displacement, pressure, temperature, flow measurement.													06	ME 422.1	
III	Hydraulic System Accessories Hydraulic oil, reservoir, pipelines, fittings, high pressure filter, low pressure filter, Hydraulic Accumulator.													06	ME 422.2	
IV	Hydraulic Cylinder Hydraulic cylinder operational feature, classification of hydraulic cylinder, cylinder mountings, cylinder force, velocity and power, cylinder cushions. Hydraulic Pumps & Motors Hydraulic pump operation, Pump classification, Pump noise, Pump selection. Hydraulic motors classification, principle of operation, Motor performance.													07	ME 422.3	
V	Hydraulic Valves Classification of the hydraulic valves, Principle of operation and its applications.													10	ME 422.4	
VI	Hydraulic Circuit Design and Analysis Application of the different hydraulic circuit, Regenerative circuit. Pump unloading circuit, Double pump Hydraulic system, Counter balance valve application. Hydraulic cylinder sequence circuit, Automatic cylinder reciprocating system, Locked cylinder system.													10	ME 422.5	
Total Hours													42			
Essential Readings																
1. A. Esposito, "Fluid Power with Applications", Pearson Education, 7th Edition, 2008																
Supplementary Readings																
1. M. G. Rabie, "Fluid Power Engineering", McGraw Hill, 2009																
2. H.E. Merrit, "Hydraulic Control Systems", Willey, 1991																

		National Institute of Technology Meghalaya An Institute of National Importance										CURRICULUM			
		Programme		Bachelor of Technology in Mechanical Engineering					Year of Regulation			2024-25			
Department		Mechanical Engineering					Semester			VIII					
Course Code	Course Name	Pre-Requisite	Credit Structure				Marks Distribution				Total				
			L	T	P	C	INT	MID	END						
ME424	Farm Machinery	-----	3	0	0	3	50	50	100	200					
Course Objectives	To understand the importance of farm mechanization in modern agriculture To familiarize students with the design and operation of various agricultural machines and equipment To introduce advanced technologies in agricultural machinery for precision farming To develop knowledge about machinery for different stages of crop production	Course Outcomes	CO's		Statement				Bloom's Taxonomy						
			ME424.1	Able to explain the significance of farm mechanization in enhancing agricultural productivity and addressing labor scarcity.				Understanding							
			ME424.2	Able to describe the design principles and components of various soil preparation, planting, and cultivation equipment.				Understanding							
			ME424.3	Able to analyze the working principles of advanced agricultural technologies such as variable rate applicators and microprocessor-based systems				Analysing							
			ME424.4	Able to evaluate the design and operation of harvesting machinery for different types of crops.				Evaluating							
ME424.5	Able to assess the role of machinery in land and soil management, including drainage, reclamation, and estate maintenance.				Evaluating										
COs	Mapping with Program Outcomes (POs)												Mapping with PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ME424.1	3	2	1		1		2				1	1	1		
ME424.2	3	1	1		1		2				1	1	1		
ME424.3	3	2	2	2	2		2				1	1	1		
ME424.4	3	2	2	1	2		2				1	1	1		
ME424.5	3	2	2	2	2		2				1	1	1		
ME424	3	1.8	1.6	1.67	1.6		2				1	1	1		
SYLLABUS															
No.	Content												Hours	COs	
I	Soil Preparation Machinery Ploughing and first opening of the soil, design and component details, Machinery for seedbed preparation operations												06	ME424.1	
II	Planting and Cultivation Equipment Equipment for sowing and planting, Inter-cultivation machinery												06	ME424.2	
III	Advanced Agricultural Technologies Variable Rate Fertilizer Applicator, Microprocessor Based Herbicide Applicator, Spraying equipment, Equipment for irrigation												06	ME424.2	
IV	Harvesting Machinery Machinery for crop harvesting: design and operation, Root crop harvesting machinery, Machinery for horticultural crops												06	ME424.3	
V	Crop Protection and Post-Harvest Equipment Equipment for crop protection and disease control, Machinery for transport and material handling												06	ME424.4	
VI	Land Management Machinery Machinery for land drainage and reclamation, Estate maintenance equipment												06	ME424.5	
VII	Soil Preparation Machinery Ploughing and first opening of the soil, design and component details, Machinery for seedbed preparation operations												06	ME424.5	
Total Hours												42			
Essential Readings															
1. Robert Allen Kepner, Roy Bainer, Edgar Lee Barger, Principles of Farm machinery, CBS, 3 rd Edition, 2005															
2. Ojha & Michael, Principles of Agricultural Engineering Jain Brothers, 15 th Edition, 2023															
3. Claude Culpin, Farm Machinery, Wiley India, 12 th Edition, 2014															