Programme Structure

BACHELOR OF TECHNOLOGY

IN

Mechanical Engineering (ME) with Specialization

in Automotive Electrical Vehicles,

Mechatronics and Digital Manufacturing

Programme Code:- SET0601

Department of Mechanical Engineering

Sharda School of Engineering & Technology

(Batch: 2023-2027)

Sharda School of Engineering & Technology
B.Tech- Mechanical Engineering
Batch: 2023-2027
TERM: I

S. No.	Subject Code	Subjects	Teaching Load			Credits	UC/PC/PE/SEC
			L	T	P		
Theory Subjects							
1.	CSE113	Programming for Problem Solving	3	0	0	3	UC
2.	HMM111	Human Values and Ethics	2	0	0	2	UC
3.	MTH141	Calculus Analysis and Linear Algebra	3	1	0	4	UC
4.	EEE112	Principles of Electric and Electronics Engineering	2	1	0	3	UC
5.	ARP101	Communicative English -1	1	0	2	2	SEC
6.	MEP107	Introduction to Mechanical Engineering (Tinkering lab)	0	0	2	1	UC
7.	CVL103	Environmental Studies	2	0	0	0	UC
Practical/Viva-Voce/Jury							
8.	CSP113	Programming for Problem Solving Lab	0	0	2	1	P
9.	EEP112	Principles of Electrical and Electronics Engineering Lab	0	0	2	1	P
10.	MEP106	Computer Aided Design & Drafting	0	0	3	1.5	P
11.	MEP105	Mechanical Workshop	0	0	3	1.5	P
TOTAL CREDITS						**20**	

Sharda School of Engineering & Technology
B.Tech- Mechanical Engineering
Batch: 2023-2027
TERM: II

S. No.	Course Code	Course	Teaching Load			Credits	UC/PC/SEC
			L	T	P		
Theory Subjects							
1.	CSE114	Application based Programming in Python	3	0	0	3	UC
2.	MTH143	Differential Equations, Special Transforms and Complex Variable	3	1	0	4	UC
3.	PHY128	Engineering Physics	3	1	0	4	UC
4.	MEC236	Materials Science	3	0	0	3	PC
5.	ARP102	Communicative English -2	1	0	0	1	SEC
6.	MEP101	Idea Generation & Creativity	1	0	0	1	SEC
Practical/Viva-Voce/Jury							
7.	CSP114	Application based Programming in Python Lab	0	0	2	1	P
8.	MEP230	CAD Modeling through solid works Lab1	0	0	2	1	P
9.	PHY 162	Physics Lab II	0	0	2	1	P
10.	MEP101	Idea Generation & Creativity Lab	0	0	2	1	P
11.	ARP102	Communicative English -2	0	0	2	1	SEC
TOTAL CREDITS						**21**	
Industrial Internship conducted after II term to be evaluated in III term							

Sharda School of Engineering & Technology
B.Tech- Mechanical Engineering
Batch: 2023-2027 TERM: III

S. No.	Course Code	Course	Teaching Load			Credits	PC/SEC/UC/P
			L	T	P		
Theory Subjects							
1.	MEC229	Manufacturing Technology - I	3	0	0	3	PC
2.	MEC235	Introduction to Thermal Engineering I	3	0	0	3	PC
3.	MEC224	Strength of Materials	3	1	0	4	PC
4.	MEC238	Mechanics of Machines	3	1	0	4	UC
5.	ARP203	Logical Skills Building and Soft Skills	1	0	0	1	SEC
6.	MEC234	Research methodology	2	0	0	2	UC
Practical/Viva-Voce/Jury							
7.	ARP203	Aptitude Reasoning and Business Communication Skills - Basic	0	0	2	1	SEC
8.	MEP219	Manufacturing Technology - I Lab	0	0	2	1	P
9.	MEP235	Introduction to Thermal Engineering I Lab	0	0	2	1	P
10.	MEP255	Solid Mechanics Lab	0	0	2	1	P
11.	MEP238	Mechanics of Machines Lab	0	0	2	1	P
12.	MEP233	Industrial Internship	0	0	4	2	P
13.	MEP231	Project Based Learning-1	0	0	4	2	P
TOTAL CREDITS						**26**	

Sharda School of Engineering & Technology
B.Tech - Mechanical Engineering
Batch: 2023-2027
TERM: IV

S. No.	Course Code	Course	Teaching Load			Credits	PC/PE/OE/SEC/P/UC
			L	T	P		
Theory Subjects							
1.	MEC342	Manufacturing Technology – II	3	0	0	3	PC
2.	MEC237	Introduction to Thermal Engineering II	3	0	0	3	PC
3.	MEC322	Machine design	3	1	0	4	PC
4.	PE I	Program Elective I	3	0	0	3	PE
5.	ARP204	Quantitative and Qualitative Aptitude Skill Building	1	0	0	1	PE
6.	OE I	Open Elective I	2	0	0	2	OE
7.	MEC241	Entrepreneurship	2	0	0	2	SEC
8.	BTY223	Introduction to Biology	2	0	0	2	UC
Practical/Viva-Voce/Jury							
9.	ARP204	Quantitative and Qualitative Aptitude Skill Building	0	0	2	1	SEC
10.	MEP232	Project Based Learning-2	0	0	4	2	P
TOTAL CREDITS						**23**	
Industry Connect conducted after IV term to be evaluated in V term							

Sharda School of Engineering & Technology
B.Tech- Mechanical Engineering
Batch: 2023-2027
TERM: V

S. No.	Course Code	Course	Teaching Load			Credits	PC/PE/OE/SEC/P
			L	T	P		
Theory Subjects							
1.	MEC310	Design of Mechatronic System	3	0	0	3	PC
2.	MEC399	Production, planning and control	3	0	0	3	PC
3.	PE II	Program Elective II	3	0	0	3	PE
4.	OE II	Open Elective III	2	0	0	2	OE
5.	ARP301	Personality Development and Decision making Skills	1	0	0	1	SEC
Practical/Viva-Voce/Jury							
6.	ARP301	Personality Development and Decision making Skills	0	0	2	1	SEC
7.	MEP302	Machining and Metrology	0	0	2	1	P
8.	MEP331	Project Based Learning 3	0	0	4	2	P
9.	MEP333	Industry Connect	0	0	4	2	P
10	ECC301	Community Connect	0	0	4	2	P
11	MEP360	Automobile Engineering Lab 1	0	0	2	1	P
12	MEP310	Mechatronics Laboratory	0	0	2	1	P
						22	

Sharda School of Engineering & Technology
B.Tech- Mechanical Engineering
Batch: 2023-2027
TERM: VI

S. No.	Course Code	Course	Teaching Load			Credits	SC/PC/PE/OE/SEC/P
			L	T	P		
Theory Subjects							
1.	MEC330	Operations Research	3	0	0	3	SC
2.	MEC341	Lean production	3	0	0	3	PC
3.	PE -III	Program Elective-III	3	0	0	3	PE
4.	PE-IV	Program Elective -IV	3	0	0	3	PE
5.	PE- V	Program Elective -V	3	0	0	3	PE
6.	OE III	Open Elective III	3	0	0	3	OE
7.	ARP302	Campus to Corporate	1	0	0	1	SEC
Practical/Viva-Voce/Jury							
8.	ARP302	Campus to Corporate	0	0	2	1	SEC
9	MEP 327	Turbo Machinery Lab	0	0	2	1	P
10	MEP397	CNC Lab	0	0	2	1	P
11.	MEP301	Heat Transfer & RAC Laboratory	0	0	2	1	P
12.	MEP332	Project Based Learning 4	0	0	4	2	P
TOTAL CREDITS						**25**	
Summer Internship after VI term to be evaluated in VII term							

Sharda School of Engineering & Technology
B.Tech- Mechanical Engineering
Batch: 2023-2027
TERM: VII

S. No.	Course Code	Course	Teaching Load			Credits	UC/PE/OE/P
			L	T	P		
Theory Subjects							
1.	HMM305	Management for Engineers	3	0	0	3	UC
2.	PE VI	Program Elective VI	3	0	0	3	PE
3.	PE VII	Program Elective – VII	2	0	0	2	PE
4.	OE IV	Open Elective – IV	3	0	0	3	OE
Practical/Viva-Voce/Jury							
5.	MEP433	Summer Internship III	0-	0	4	2	P
6.	MEC460	Major Project-I	0	0	4	2	P
TOTAL CREDITS						**15**	

Sharda School of Engineering & Technology
B.Tech-Mechanical Engineering
Batch: 2023-2027
TERM: VIII

S. No.	Course Code	Course	Teaching Load			Credits	UC/PC/PE/OE/AECC/SEC
			L	T	P		
Practical/Viva-Voce/Jury							
1.	MEC461	Major Project-II	0	0	16	8	P
TOTAL CREDITS						**8**	

Specialization in Automobile Engineering:

S. No	Course Code	Course Name	L	T	P	C	Category	TERM
1	MEC314	Automotive Transmission	3	0	0	3	Engineering/Other	III
2	MEC329	Automotive Electrical and Electronics Systems	3	0	0	3	Engineering/Other	IV
3	AUT306	Electric Vehicle Technology	3	0	0	3	Engineering/Other	V
4	AUT307	Automotive Chassis	3	0	0	3	Engineering/Other	VI
5	AUT309	Modern Battery Technology	3	0	0	3	Engineering/Other	VII
		Total Credits to be taken				15		

Specialization in Mechatronics:

S. No	Course Code	Course Name	L	T	P	C	Category	TERM
1	MEC310	Design of Mechatronics System	3	0	0	3	Engineering/Other	III
2	ECE092	Control System Engineering	3	0	0	3	Engineering/Other	IV
3	ECE093	Digital Electronics	3	0	0	3	Engineering/Other	V
4	MEC364	Sensors and Signal Processing	3	0	0	3	Engineering/Other	VI
5	MEC365	Robotics and Machine Vision System	3	0	0	3	Engineering/Other	VII
		Total Credits to be taken				15		

Specialization in Digital Manufacturing:

S. No	Course Code	Course Name	L	T	P	C	Category	TERM
1	MDM201	Industry 4.0 and IIOT	3	0	0	3	Engineering/Other	III
2	MDM202	Big Data Analytics for Manufacturing	3	0	0	3	Engineering/Other	IV
3	MDM301	Additive Manufacturing	3	0	0	3	Engineering/Other	V
4	MDM302	Robotics and Automation	3	0	0	3	Engineering/Other	VI
5	MDM401	Reverse Engineering	3	0	0	3	Engineering/Other	VII
		Total Credits to be taken				15		

List of Programme Electives

S. No	Course Code	Course Name	L	T	P	C	Category	Prerequisite
1	MEC433	IC Engines	3	0	0	3	Engineering	Introduction to Thermal Engineering I
2	MEC356	Refrigeration and Air Conditioning	3	0	0	3	Engineering	Introduction to Thermal Engineering II
3	MEC335	Computer Integrated Manufacturing	3	0	0	3	Engineering	
4	MEC357	Introduction to six sigma	2	0	0	2	Engineering	
5	MEC358	Material Characterization Techniques	3	0	0	3	Engineering	
6	MEC359	Heat Treatment of Metals and Alloys	3	0	0	3	Engineering	
7	MEC360	Advanced Engineering Materials	3	0	0	3	Engineering	Materials Science and metrology
8	MEC318	Supply chain management	3	0	0	3	Engineering	
9	MEC361	Hydraulic machines	3	0	0	3	Engineering	Introduction to Thermal Engineering I
10	MEC334	Introduction to Robotics Engineering	3	0	0	3	Engineering	
11	AUT301	Automotive Safety Systems	2	0	0	2	Engineering	
12	AUT302	Auto Certification and Homologation	3	0	0	3	Engineering	

13	AUT303	Automotive Suspension and Steering Systems	2	0	0	2	Engineering	
14	AUT304	Vehicle Inspection and Maintenance	3	0	0	3	Engineering	
15	EEE332	Power Electronics	3	0	0	3	Engineering	Principles of Electrical and Electronics Engineering
16	MIC008	Virtual Instrumentation	3	0	0	3	Engineering	
17	ECE002	Microcontroller and Applications	2	0	0	2	Engineering	
18	MEC481	Mechanical Behavior of Nanomaterials	3	0	0	3	Engineering	
19	MEC482	Material Behaviors and Failure Prediction	3	0	0	3	Engineering	Materials Science and metrology
20	MEC483	Intermediate Fluid Mechanics	3	0	0	3	Engineering	
21	MEC484	Design for Additive Manufacturing	3	0	0	3	Engineering	
22	MEC485	Finite Element Methods in Solid Mechanics	3	0	2	4	Engineering	Strength of materials
23	MEC486	Design with Composite Materials	3	0	2	4	Engineering	Materials Science and metrology

School: SSET		**Batch: 2023-2027**	
Programme: B.Tech.		**Current Academic Year: 2023-2024**	
Branch: ME		**Semester:1**	
1	Course Code	CSE113	
2	Course Name	Programming for problem solving	
3	Credits	3	
4	Contact Hours (L-T-P)	3-0-0	
	Course Status	Core	
5	Course Objective	1. Learn basic programming constructs –data types, decision structures, control structures in C 2. learning logic aptitude programming in c language 3. Developing software in c programming	
6	Course Outcomes	After the successful completion of course, students will be able to: CO1: demonstrate the algorithm, Pseudo-code and flow chart for the given problem. CO2: develop better understanding of basic concepts of C programming. CO3: create and implement logic using array and function. CO4: construct and implement the logic based on the concept of strings and pointers. CO5: apply user-defined data types and I/O operations in file. CO6: design and develop solutions to real world problems using.	
7	Course Description	Programming for problem solving gives the Understanding of C programming and implement code from flowchart or algorithm	
8	Outline syllabus		CO Mapping
	Unit 1	**Logic Building**	
	A	Flowchart: Elements, Identifying and understanding input/ output, Branching and iteration in flowchart	CO1,
	B	Algorithm design: Problem solving approach(top down/bottom up approach)	CO1
	C	Pseudo Code : Representation of different construct, writing pseudo-code from algorithm and flowchart	CO1
	Unit 2	**Introduction to C Programming**	
	A	Introduction to C programming language, Data types, Variables, Constants, Identifiers and keywords, Storage classes	CO2

	B	Operators and expressions, Types of Statements: Assignment, Control, jumping.			CO2
	C	Control statements: Decisions, Loops, break, continue			CO2
	Unit 3	**Arrays and Functions**			
	A	Arrays: One dimensional and multi-dimensional arrays: Declaration, Initialization and array manipulation (sorting, searching).			CO3
	B	Functions: Definition, Declaration/Prototyping and Calling, Types of functions, Parameter passing: Call by value, Call by reference.			CO3
	C	Passing and Returning Arrays from Functions, Recursive Functions.			CO3
	Unit 4	**Pre-processors and Pointers**			
	A	Pre-processors: Types, Directives, Pre-processors Operators (#,##,\) , Macros: Types, Use, predefined Macros			CO4
	B	Pointer: Introduction, declaration of pointer variables, Operations on pointers: Pointer arithmetic, Arrays and pointers, Dynamic memory allocation.			CO4
	C	String: Introduction, predefined string functions, Manipulation of text data, Command Line Arguments.			CO4
	Unit 5	**User Defined Data Types and File Handling**			
	A	Structure and Unions: Introduction, Declaration, Difference, Application, Nested structure, self-referential structure, Array of structures, Passing structure in function.			CO5,CO 6
	B	Files: Introduction, concept of record, I/O Streaming and Buffering, Types of Files: Indexed file, sequential file and random file,			CO5,CO 6
	C	Creating a data file, Opening and closing a data file, Various I/O operations on data files: Storing data or records in file, adding records, Retrieving, and updating Sequential file/random file.			CO5,CO 6
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	Kernighan, Brian, and Dennis Ritchie. *The C Programming Language*			
	Other References	1. B.S. Gottfried - Programming With C - Schaum's Outline Series - Tata McGraw Hill 2nd Edition - 2004. 2. E. Balagurusamy - Programming in ANSI C - Second Edition - Tata McGraw Hill- 1999			

COURSE ARTICULATION MATRIX

COS	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CSE 113.1	**1**	**2**	**1**	**_**	**_**	**1**	**_**	**_**	**_**	**_**	**_**	**_**	**1**	**1**	**_**
CSE 113.2	**2**	**_**	**2**	**_**	**_**	**1**	**_**	**_**	**_**	**_**	**1**	**_**	**2**	**2**	**_**
CSE 113.3	**1**	**_**	**1**	**_**	**_**	**_**	**_**	**_**	**_**	**_**	**_**	**_**	**_**	**1**	**_**
CSE 113.4	**1**	**_**	**1**	**_**	**_**	**_**	**_**	**_**	**_**	**_**	**_**	**_**	**_**	**1**	**_**
CSE 113.5	**1**	**_**	**1**	**_**	**_**	**_**	**_**	**_**	**_**	**_**	**_**	**_**	**_**	**1**	**_**
CSE 113.6	**2**	**2**	**2**	**_**	**_**	**2**	**_**	**_**	**_**	**_**	**1**	**_**	**2**	**2**	**1**
CSE113	**2**	**2**	**1**	**-**	**-**	**1**	**-**	**-**	**-**	**-**	**1**	**-**	**2**	**-**	**1**

1-Slight (Low) **2-Moderate (Medium)** **3-Substantial (High)**

School: SSET		Batch: 2023-2027	
Programme: B.Tech.		Current Academic Year: 2023-2024	
1	Course Code	HMM111	
2	Course Name	Human values and Ethics	
3	Credits	2	
4	Contact Hours (L-T-P)C	(2-0-0)2	
5	Course Objective	To facilitate the development of a Holistic perspective among students towards life and profession as well as towards happiness and prosperity based on a correct understanding of the Human reality and the rest of Existence	
6	Course Outcomes	After the successful completion of course, students will be able to: CO1. Apply the importance of human values and ethics in technical education CO2. Examine the importance of 'I' and 'Body'. CO3. Infer the importance of harmony in the self, family and the society for mutual fulfilment. CO4. Infer the importance of harmony among human beings, other living beings and entire nature for universal equilibrium and mutual co-existence. CO5. Apply the ethical approach in profession for continuous happiness and sustained prosperity. CO6. Infer the importance of values and ethics in corporate sector	
7	Outline of syllabus:		
7.01	HMM111.A	Unit 1	The Need and Process for Value Education
7.02	HMM111.A1	Unit 1 Topic 1	The need, basic guidelines, content and process for Value Education
7.03	HMM111.A2	Unit 1 Topic 2	Concept of 'Natural Acceptance' and Experiential Validation- as the mechanism for self exploration; Continuous Happiness and Prosperity- A look at basic Human Aspirations
7.04	HMM111.A3	Unit 1 Topic 3	Right understanding, Relationship and Physical Facilities- the basic requirements for fulfilment of aspirations of every human being with their correct priority
7.05	HMM111.B	Unit 2	Understanding Harmony in the Human Being - Harmony in Myself
7.06	HMM111.B1	Unit 2 Topic 1	Human being as a co-existence of the sentient 'I' and the material 'Body'
7.07	HMM111.B2	Unit 2 Topic 2	The needs of Self ('I') and 'Body' ; Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer)

7.08	HMM111.B3	Unit 2 Topic 3	The characteristics and activities of 'I' and harmony in 'I' ; Understanding the harmony of I with the Body: Correct appraisal of Physical needs, meaning of Prosperity in detail
7.09	HMM111.C	Unit 3	Harmony in the Family and Society
7.10	HMM111.C1	Unit 3 Topic 1	Values in human-human relationship; Trust and Respect as the foundational values of relationship
7.11	HMM111.C2	Unit 3 Topic 2	Understanding the meaning of Trust; Difference between intention and competence; The meaning of Respect; Difference between respect and differentiation; the other salient values in relationship
7.12	HMM111.C3	Unit 3 Topic 3	Harmony in the society (society being an extension of family; Visualizing a universal harmonious order in society - from family to world family
7.13	HMM111.D	Unit 4	Harmony in the Nature and Existence
7.14	HMM111.D1	Unit 4 Topic 1	The harmony in the Nature
7.15	HMM111.D2	Unit 4 Topic 2	Interconnectedness and mutual fulfilment among the four orders of nature recyclability and self-regulation in nature
7.16	HMM111.D3	Unit 4 Topic 3	Understanding Existence as Co-existence of mutually interacting units in all-pervasive space
7.17	HMM111.E	Unit 5	Competence in professional ethics
7.18	HMM111.E1	Unit 5 Topic 1	Ability to utilize the professional competence for augmenting universal human order
7.19	HMM111.E2	Unit 5 Topic 2	Ability to identify the scope and characteristics of people-friendly and eco-friendly production systems,
7.20	HMM111.E3	Unit 5 Topic 3	Ability to identify and develop appropriate technologies and management patterns for above production systems.
8	Course Evaluation		
8.1	Course work: 30 marks		
8.11	Attendance	None	
8.12	Homework	4 assignments, no weight	
8.13	Quizzes/Class Tests	Two	
8.14	Projects	None	
8.15	Presentations	None	
8.16	Any other	None	
8.2	MTE	25 marks CE 25 marks	
8.3	End-term examination: 50 marks		
9.1	Text books	1. R.R Gaur, R Sangal, G P Bagaria, "A foundation course in Human Values and professional Ethics", Excel books, New Delhi	
9.2	Other references	1. B L Bajpai, 2004, Indian Ethos and Modern Management, New Royal Book Co., Lucknow.	

		2. A.N. Tripathy, 2003, Human Values, New Age International Publishers. 3. PL Dhar, RR Gaur, Science and Humanism, Commonwealth Purblishers.

COURSE ARTICULATION MATRIX

COs	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO11	PO12
HMM111.1	-	-	-	-	-	2	-	2	1	3	-	1
HMM111.2	-	-	-	-	-	2	-	2	1	3	-	1
HMM111.3	-	-	-	-	-	2	-	2	1	3	-	1
HMM111.4	-	-	-	-	-	2	-	2	1	3	-	1
HMM111.5	-	-	-	-	-	2	-	2	1	3	-	1
HMM111.6	-	-	-	-	-	2	-	2	1	3	-	1
HMM111	-	-	-	-	-	2	-	2	1	3	-	1

1-Slight (Low) **2-Moderate (Medium)** **3-Substantial (High)**

School: SSET		Batch: 2023-2027	
Programme: B.Tech.		Current Academic Year: 2023-2024	
Branch: ME		Semester: 1	
1	Course Code	**MTH 141**	
2	Course Title	**Calculus and Abstract Algebra**	
3	Credits	4	
4	Contact Hours (L-T-P)	3-1-0	
	Course Status	Program Core	
5	Course Objective	The objective of this course is to familiarize the prospective engineers with techniques in basic calculus and linear algebra. It aims to equip the students with standard concepts and tools at an intermediate to advanced level that will serve them well towards tackling more advanced level of mathematics and applications that they would find useful in their disciplines.	
6	Course Outcomes	After the successful completion of course, students will be able to: CO1: Interpret the basic Taylor's expansion of a function of two variables and maxima and minima of a function of two variables CO2: Evaluate surface using the concepts of double integrals. CO3: Apply basics of determinants, rank of matrices for linear systems. CO4: Interpret the basic concept of sets, relation, functions, groups, rings and field. CO5: Investigate the properties of vector spaces and subspaces using by linear transformations. CO6:Apply the concepts of eigen values, eigen vectors and diagonalisation in linear systems	
7	Course Description	This course is an introduction to the fundamental of Mathematics. The primary objective of the course is to develop the basic understanding of differential and integral calculus, linear Algebra and Abstract Algebra.	
8	**Outline syllabus: Calculus and Abstract Algebra**		**CO mapping**
	Unit 1	**Calculus**	
	A	Differentiation, Taylor's and Maclaurin theorems with remainders; indeterminate forms, L' Hospital's rule.	CO1

	B	Maxima and minima, Partial derivatives, Euler's theorem.			CO1
	C	Total derivative. Evaluation of double integration. Applications of double integral (to calculate area).			CO2
	Unit 2	**Matrices**			
	A	Matrices, vectors: addition and scalar multiplication, matrix multiplication.			CO3
	B	Linear systems of equations, linear Independence, rank of a matrix, determinants, Cramer's Rule			CO3
	C	Inverse of a matrix, Gauss elimination and Gauss-Jordan elimination.			CO3
	Unit 3	**Basic Algebra**			
	A	Sets, relations and functions.			CO4
	B	Basics of groups, cyclic groups.			CO4
	C	Subgroups, basics of Rings and Field.			CO4
	Unit 4	**Vector spaces**			
	A	Vector Space, linear dependence of vectors, basis, dimension.			CO5
	B	Linear transformations (maps), range and kernel of a linear map, rank and nullity.			CO5
	C	Inverse of a linear transformation, Matrix associated with a linear map.			CO5
	Unit 5	**Vector spaces (Prerequisite Module 2 –Matrices & Module-4 Vector spaces)**			
	A	Eigenvalues, Eigenvectors			CO6
	B	Symmetric, skew-symmetric, and orthogonal Matrices, Diagonalization			CO6
	C	Basic introduction of Inner product spaces, Gram-Schmidt orthogonalization.			CO6
	Mode	Theory			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	1. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002. 2. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.			
	Other References	1. D. Poole, Linear Algebra: A Modern Introduction, 2nd Edition, Brooks/Cole, 2005. 2. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008. 3. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010. 4. V. Krishnamurthy, V.P. Mainra and J.L. Arora, An introduction to Linear Algebra, Affiliated East–West press, Reprint 2005.			

COURSE ARTICULATION MATRIX

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
MTH 142.1	3	3	2	-	-	-	-	-	1	-	-	1
MTH 142.2	3	2	3	-	-	-	-	-	1	-	-	1
MTH 142.3	3	2	2	-	-	-	-	-	1	-	-	1
MTH 142.4	3	3	2	-	-	-	-	-	1	-	-	1
MTH 142.5	3	2	2	-	-	-	-	-	1	-	-	1
MTH 142.6	3	3	2	-	-	-	-	-	1	-	-	1
MTH 141	3	2	2	-	-	-	-	-	1	-	-	1

1-Slight (Low) **2-Moderate (Medium)** **3-Substantial (High)**

School: SSET		**Batch : 2023-2027**	
Programme: B.Tech		**Current Academic Year: 2023-2024**	
Branch: ME		**Semester: II**	
1	Course Code	EEE112	
2	Course Title	Principles of Electrical and Electronics Engineering	
3	Credits	3	
4	Contact Hours (L-T-P)	2-1-0	
	Course Status	Program Core	
5	Course Objective	To provide the students with an introductory concept in the field of electrical and electronics engineering to facilitate better understanding of the devices, techniques and equipment used in engineering applications.	
6	Course Outcomes	After the successful completion of course, students will be able to: CO1: Analyze and solve basic electrical circuits CO3: Infer the working principle of transformer. CO3: Explain the working principle of dc and ac motors. CO4: Apply the basics of diode to describe the working of rectifier circuits such as half and full wave rectifiers CO5: Apply the concepts of basic electronic devices to design various circuits CO6:Apply the basic concepts in Electrical and Electronics Engineering for multi-disciplinary tasks	
7	Course Description	This initial course introduces the concepts and fundamentals of electrical and electronic circuits and devices. Topics include basic circuit analysis, diode and transistor fundamentals and applications. This course also introduces working principle and applications of dc/ac motors and transformers.	
8	Outline syllabus		CO Mapping
	Unit 1	**DC & AC Circuits (6 lectures)**	
	A	Electrical circuit elements (R, L and C), series and parallel circuits, concept of equivalent resistance, Kirchhoff current and voltage laws, star-delta conversion	CO1,CO6
	B	Analysis of simple circuits with dc excitation and Superposition Theorem, Representation of sinusoidal waveforms, peak and rms values, real power, reactive power, apparent power, power factor	CO1,CO6

	C	Introduction to three phase system, relationship between phase voltages and line voltages,			CO1,CO6
	Unit 2	**Transformer(4 lectures)**			
	A	Working principle and construction of transformer, EMF equation			CO2,CO6
	B	Efficiency of transformer, Power and distribution transformer and difference between them			CO2,CO6
	C	Transformer applications in transmission and distribution of electrical power			CO2,CO6,
	Unit 4	**Electrical Motors (6 lectures)**			
	A	Construction, working principle, torque-speed characteristic and applications of dc motor.			CO3,CO6
	B	Construction, working principle and applications of a three-phase induction motor, significance of torque-slip characteristic			CO3,CO6
	C	Working principle starting methods and applications of single phase induction motor			CO3,CO6
	Unit 4	**Semiconductor Diode and Rectifier (5 lectures)**			
	A	PN junction and its biasing			CO4,CO6
	B	Semiconductor diode, ideal versus practical diode , VI characteristics of diode			CO4,CO6
	C	Half wave and full wave rectifiers with and without filters.			CO4,CO6
	Unit 5	**Transistors (5 lectures)**			
	A	Bipolar Junction Transistor (BJT) –Construction, working principle and input-output characteristics			CO5,CO6
	B	BJT as CE amplifier and as a switch			CO5,CO6
	C	Introduction to JFET			CO5,CO6
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	1. D. P. Kothari and I. J. Nagrath, “Basic Electrical Engineering”, Tata McGraw Hill, 2010. 2. S. K. Bhattacharya, “Basic Electrical and Electronics Engineering”, Pearson Publication. 3. Robert L Boylestad, “Electronic Devices and Circuit Theory” Pearson Education, 2009			
	Other References	1. V. D. Toro, “Electrical Engineering Fundamentals”, Prentice Hall India, 1989.			

COURSE ARTICULATION MATRIX

COs	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO1 1	PO1 2
EEE112.1	2	2	0	0	0	0	0	0	0	0	0	2
EEE112.2	2	1	0	0	0	0	0	0	0	0	0	2
EEE112.3	2	1	0	0	0	0	0	0	0	0	0	2
EEE112.4	2	2	0	0	0	0	0	0	0	0	0	2
EEE112.5	2	1	0	0	0	0	0	0	0	0	0	2
EEE112.6	2	2	0	0	0	0	0	0	0	0	0	2
EEE112	2	2	0	0	0	0	0	0	0	0	0	2

1-Slight (Low) 2-Moderate (Medium) 3-Substantial (High)

School: SSET **Programme: - B.Tech** **Branch: ME**		**Batch :** 2023-2027 **Academic Year:** 2023-2024 **Semester:** 1st
1	Course Code	**ARP101**
2	Course Title	Communicative English-1
3	Credits	2
4	Contact Hours (L-T-P)	1-0-2
5	Course Objective	To minimize the linguistic barriers that emerges in varied socio-linguistic environments through the use of English. Help students to understand different accents and standardise their existing English. Guide the students to hone the basic communication skills - listening, speaking, reading and writing while also uplifting their perception of themselves, giving them self-confidence and building positive attitude.
6	Course Outcomes	After completion of this course, students will be able to: CO1 Develop a better understanding of advanced grammar rules and write grammatically correct sentences CO2 Acquire wide vocabulary and punctuation rules and learn strategies for error-free communication. CO3 Interpret texts, pictures and improve both reading and writing skills which would help them in their academic as well as professional career CO4 Comprehend language and improve speaking skills in academic and social contexts CO5 Develop, share and maximise new ideas with the concept of brainstorming and the documentation of key critical thoughts articulated towards preparing for a career based on their potentials and availability of opportunities. CO6 Function effectively in multi-disciplinary teams through the knowledge of team work, Inter-personal relationships, conflict management and leadership quality
7	Course Description	The course is designed to equip students, who are at a very basic level of language comprehension, to communicate and work with ease in varied workplace environment. The course begins with basic grammar structure and pronunciation patterns, leading up to apprehension of oneself through written and verbal expression as a first step towards greater employability.
8	Outline syllabus – ARP 101	

	Unit A	**Sentence Structure**	**CO Mapping**
	Topic 1	Subject Verb Agreement	CO1
	Topic 2	Parts of speech	
	Topic 3	Writing well-formed sentences	
	Unit B	**Vocabulary Building & Punctuation**	
	Topic 1	Homonyms/ homophones, Synonyms/Antonyms	CO1, CO2
	Topic 2	Punctuation/ Spellings (Prefixes-suffixes/Unjumbled Words)	CO1, CO2
	Topic 3	Conjunctions/Compound Sentences	CO1, CO2
	Unit C	**Writing Skills**	
	Topic 1	Picture Description – Student Group Activity	CO3
	Topic 2	Positive Thinking - Dead Poets Society-Full-length feature film - Paragraph Writing inculcating the positive attitude of a learner through the movie | SWOT Analysis – Know yourself	CO3, CO2, CO3
	Topic 3	Story Completion Exercise –Building positive attitude - The Man from Earth (Watching a Full length Feature Film)	CO2, CO3
	Topic 4	Digital Literacy | Effective Use of Social Media	CO3
	Unit D	**Speaking Skill**	
	Topic 1	Self-introduction/Greeting/Meeting people – Self branding	CO4
	Topic 2	Describing people and situations - To Sir With Love (Watching a Full length Feature Film)	CO4
	Topic 3	Dialogues/conversations (Situation based Role Plays)	CO4
	Unit E	**Professional Skills | Career Skills**	
	Topic 1	Exploring Career Opportunities	CO4, CO5
	Topic 2	Brainstorming Techniques & Models	CO4, CO5
	Topic 3	Social and Cultural Etiquettes	CO4, CO5
	Topic 4	Internal Communication	CO4, CO5
	Unit F	**Leadership and Management Skills**	
	Topic 1	Managerial Skills	CO6
	Topic 2	Entrepreneurial Skills	CO6
9	Evaluations	*Class Assignments/Free Speech Exercises / JAM Group Presentations/Problem Solving Scenarios/GD/Simulations (25% CA and CE 25% ETE 50%*	*N/A*
10	Texts & References | Library Links	• Blum, M. Rosen. *How to Build Better Vocabulary*. London: Bloomsbury Publication • Comfort, Jeremy (et.al). *Speaking Effectively*. Cambridge University Press	

COURSE ARTICULATION MATRIX

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ARP101.1	-	-	-	-	-	-	-	-	1	3		2	-	-	-
ARP101.2	-	-	-	-	-	-	-	-	1	3		2	-	-	-
ARP101.3	-	-	-	-	-	-	-	-	1	3		2	-	-	-
ARP101.4	-	-	-	-	-	-	-	-	1	2	1	2	-	-	-
ARP101.5	-	-	-	-	-	-	-	-	1	2	1	2	-	-	-
ARP101.6	-	-	-	-	-	-	-	-	1	2	1	2	-	-	-
ARP101	-	-	-	-	-	-	-	-	1	2	1	2	-	-	-

1-Slight (Low) **2-Moderate (Medium)** **3-Substantial (High)**

School: SSET		**Batch: 2023-2027**	
Programme: B.Tech		**Current Academic Year: 2023– 24**	
Branch: ME		**Semester: I**	
1	Course Code	MEP 107	
2	Course Title	Introduction to Mechanical Engineering	
3	Credits	1	
4	Contact Hours (L-T-P)	0-0-2	
	Course Status	Basic Engineering	
5	Course Objective	To introduce different discipline of mechanical engineering, motivate students to pursue a career in the field of mechanical engineering and to perform hands on practice on mechanical components.	
6	Course Outcomes	After the successful completion of course students will be able to: CO1: Identify different areas of mechanical engineering and its application CO2:Demonstrate the working mechanism of internal combustion engine CO3: Apply the working principle of refrigeration system. CO4: Interpret the mechanical characteristics of engineering materials and its application CO5: Classify different plant layouts used in engineering applications. CO6: Interpret use of various production systems in the plant layout.	
8	Outline syllabus		CO Mapping
	Unit 1	**Introduction**	**03**
	A	Definition of Mechanical Engineering,	CO1
	B	Various streams like production & Industrial engineering, thermal and design etc.	
	C	Scope of mechanical Engineering. Career scope in Mechanical Engineering	
	Unit 2	**Introduction to IC Engine and Refrigeration, Air conditioning**	**05**
	A	Introduction engine and its nomenclature.	CO2
	B	Working of 2 stroke and 4 stroke petrol and diesel engine	
	C	Brief overview of transmission systems.	
	Unit 3	**Introduction to Refrigeration, Air conditioning**	**04**
	A	History and scope of refrigeration, application of refrigeration, difference in refrigeration and heat pump	CO3

	B	Natural Refrigeration methods: Ice refrigeration, refrigeration by salt solution and evaporative cooling			
	C	Name of Mechanical refrigeration systems and working of simple refrigeration system only.			
	Unit 4	**Engineering Materials**			**04**
	A	Classification of Engineering Materials			CO4
	B	Properties of engineering materials			
	C	Name and properties of smart materials			
	Unit 5	**Plant Layout**			**05**
		Plant Layout: factors, principle, objective and procedure of plant layout			CO5,CO6
		Advantages of good plant layout .Types of plant layout: process layout and product layout.			
		Overview of job mass and batch production, Industrial Safety Aspects			
		Total Hours			**20**
	Mode of examination	Practical			
	Weightage Distribution	CA	CE	ETE	
		25%	25%	50%	
	Text book/s*	1. Foundations of Materials Science and Engineering, William F. Smith, Javad Hashemi, TMH Publication.			
	Other References	1. Fundaments of Internal Combustion Engine, V. Ganeshan, TMH Publication 2. Refrigeration and Air Conditioning, P.K Nag, TMH Publication			

COURSE ARTICULATION MATRIX

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
MEP 107.1	2	2	1	-	-	-	1	-	1	-	-	1	-	-	-
MEP 107.2	2	1	1	-	-	-	1	-	1	-	-	1	-	-	-
MEP 107.3	2	2	1	-	-	-	1	-	1	-	-	1	-	-	-
MEP 107.4	2	2	1	-	-	-	1	-	1	-	-	1	-	-	-
MEP 107.5	2	3	1	-	-	-	1	-	1	-	-	1	-	-	-
MEP 107.6	2	2	1	-	-	-	1		1	-	-	1	-	-	-
MEP 107	2	3	1	-	-	-	1	-	1	-	-	1	-	-	-

1-Slight (Low) 2-Moderate (Medium) 3-Substantial (High)

School: SSET		**Batch : 2023-2027**	
Programme: B. Tech		**Current Academic Year: 2023-2024**	
Branch: ME		**Semester: I**	
1	Course Code	CVL103	
2	Course Title	Environmental Studies	
3	Credits	0	
4	Contact Hours (L-T-P)	2-0-0	
	Course Status	Compulsory	
5	Course Objective	1. Enable students to learn the importance of environmental studies, population growth and sustainable development 2. Provide students an insight to different aspects related to water i.e. water resources, pollution and its control 3. Provide knowledge about air resources i.e. atmosphere, atmospheric pollution, control of air pollution and climate change 4. Provide detailed knowledge about land resources, pollution and management of solid wastes 5. Provide and enrich the students about other natural resources i.e. energy, mineral and food resources and biodiversity and its conservation	
6	Course Outcomes	After the successful completion of course, students will be able to: CO1. Understand the scope of environmental study and knowledge about population growth and its effects on environment and health and sustainable development CO2. Comprehend different aspects related to water i.e. water resources, pollution and its control CO3. Understand different aspects related to air resources i.e. atmosphere, atmospheric pollution, control of air pollution and climate change CO4. Appreciate and comprehend land resources, pollution and management of solid wastes CO5. Understand about other natural resources i.e. energy, mineral and food resources and biodiversity and its conservation CO6. Understand overall environmental issues and their ways of their effective management	
7	Course Description	Environmental Studies emphasises on various aspects related to environment, its degradation and control measures such as: 1. Population and Environment; Sustainable Development 2. Water: Resources, Pollution and Control 3. Air: Atmosphere, Pollution, Control and Climate Change 4. Land: Resources, Pollution and Management 5. Energy, Mineral and Food Resources and Biodiversity and its Conservation	
8	Outline syllabus		CO Mapping
	Unit 1	**Introduction to the course, Population and Environment and Sustainable Development**	
	A	Environmental Studies: Background; Definition; Objectives; Scope; Major environmental issues of concern; Multidisciplinary nature of Environmental Studies	CO1, C06

	B	Human Population and Environment: Population growth/ explosion and its effects on human health and environment	CO1, C06
	C	Sustainable Development: Definition; Aim; Sustainability Development Goals (SDGs); Sustainability issues at various levels; Examples/ sustainability initiatives; Pillars of sustainable development; Desired outcomes	CO1, C06
	Unit 2	**Water: Resources, Pollution and Control**	
	A	Water Resources: Water cycle; Total water on earth; Residence time of water in different compartments; Classification of waters as per salt content; Stresses on water resources/ water crises; Water conservation; Water conflicts	CO2, C06
	B	Water Pollution: Impurities in water; Water quality parameters; Standards; Major categories of water pollutants and their sources and effects; Surface water versus groundwater quality; Point and non-point sources; Pollution of (i) fresh water streams (DO sag curve/ self-purification), (ii) lakes, (iii) groundwater/ aquifers, and (iv) oceans	CO2, C06
	C	Water Pollution Control: Water treatment (domestic and municipal); Wastewater treatment (on-site and municipal)	CO2, C06
	Unit 3	**Air: Atmosphere, Pollution, Control and Climate Change**	
	A	Atmosphere: Composition and structure; Classification of pollutants; Air pollution: sources and effects on humans, plants and materials; AQI and how it is calculated, Plume shapes	CO3, C06
	B	Air Pollution Control: Laws; Modifications in fuels and engines; Ambient air quality control; Control equipment's (in vehicles and industry); Stack height	CO3, C06
	C	Climate Change: Global warming and greenhouse effect; Ozone layer depletion and its consequences; Climate Change and its impact on ecosystem; International agreements	CO3, C06
	Unit 4	**Land: Resources, Pollution and Management**	
	A	Land Resources: Importance; Soil and its formation; Soil profile; Land degradation: causes and effects; Soil conservation through sustainable agriculture	CO4, C06
	B	Soil/ Land Pollution: Major categories of soil pollutants: sources and effects	CO4, C06
	C	Solid Waste Management: Classification of solid wastes; Engineering systems for management; Methods of treatment; Bio-medical wastes; Non-degradable wastes; Hazardous wastes; Electronic wastes; Plastic wastes etc.	CO4, C06
	Unit 5	**Energy, Mineral and Food Resources and Biodiversity and its Conservation**	
	A	Energy Resources: Conventional and non-conventional; Non-renewable and renewable; Fossil fuels: coal, petroleum and natural gas; Solar and wind energy	CO5, C06
	B	Mineral, Forest and Food Resources: (i) Minerals -Definition; Importance; Minerals in our diet, Metallic and non-metallic minerals, (ii) Forest - Direct and indirect benefits; Depletion of forest resources: causes and effects; and, (iii) Food - Three main calorie providers; Green revolution	CO5, C06
	C	Biodiversity and its Conservation: Definition; Threats to biodiversity; Extinct, endangered and endemic species; Conservation of biodiversity	CO5, C06

	Mode of examination	Theory through OMR sheet having 100 MCQs			
	Weightage Distribution	CA	MTE	ETE	
		25%	--	75%	
	Text book(s)	1. Erach Bharucha, Environmental Studies for Undergraduate Students, 3rd Ed., Universities Press, Hyderabad, 2021			
	Other Reference (s)	1. Joseph, Benny, Environmental Studies, Tata McGraw-Hill, New Delhi, 2022 2. Howard S. Peavy, Donald R. Rowe, and George Tchobanoglous, Environmental Engineering, McGraw-Hill, New York, 1985			

CO-PO Mapping

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	1	1	1	1	2	1	-	1	1	1	-	-	-
CO2	1	2	2	1	-	1	2	-	-	1	1	-	-	-	-
CO3	1	2	2	1	-	2	2	-	-	1	2	-	-	-	-
CO4	1	2	2	1	-	2	2	-	-	1	2	-	-	-	-
CO5	1	2	2	1	1	2	1	2	-	1	2	-	-	-	-
CO6	1	2	2	2	1	2	2	1	-	1	2	1	-	-	-
CO	1	2	2	1	1	2	1	1	-	1	2	1	-	-	-

School: SSET		Batch: 2023-2027	
Programme: B.Tech.		Current Academic Year: 2023-2024	
Branch: ME		Semester: I	
1	Course Code	CSP113	
2	Course Title	Programming for problem solving Lab	
3	Credits	1	
4	Contact Hours (L-T-P)	0-0-2	
	Course Status	Program Core	
5	Course Objective	1. Learn basic programming constructs –data types, decision structures, control structures in C 2. learning logic aptitude programming in c language 3. Developing software in c programming	
6	Course Outcomes	After the successful completion of course, students will be able to: CO1: demonstrate the algorithm, Pseudo-code and flow chart for the given problem. CO2: develop better understanding of basic concepts of C programming. CO3: create and implement logic using array and function. CO4: construct and implement the logic based on the concept of strings and pointers. CO5: apply user-defined data types and I/O operations in file. CO6: design and develop solutions to real world problems using C.	
7	Course Description	Programming for problem solving gives the Understanding of C programming and implement code from flowchart or algorithm	
8		Outline syllabus	CO Mapping
	Unit 1	**Logic Building**	**CO1,CO2**
		Draw flowchart for finding leap year	
		Write a c Program to Add Two Integers	
		Write a program to create a calculator	
	Unit 2	**Introduction to C Programming**	**CO2,CO1**
		Write a c program to convert length meter to cm	
		Write a c program to convert temp	
		Write a c program to swap two numbers	
	Unit 3	**Arrays and Functions**	**CO3,CO 6**
		Write a c program to calculate the average using arrays	
		Write a c program to find the largest element of the array	
	Unit 4	**Pre-processors and Pointers**	**CO4,CO6**

		Write a c program to swap two values using pointers			
		Write a c program to find largest number from array using pointers			
	Unit 5	**User Defined Data Types and File Handling**			**CO5,CO6**
		Write a c program to store information of a student using structure			
		Write a c program to store information of a student using union			
	Mode of examination	Practical			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	Kernighan, Brian, and Dennis Ritchie. *The C Programming Language*			
	Other References	1. B.S. Gottfried - Programming With C - Schaum's Outline Series - Tata McGraw Hill 2nd Edition - 2004. 2. E. Balagurusamy - Programming in ANSI C - Second Edition - Tata McGraw Hill-1999			
Softwares		Turbo C			

COURSE ARTICULATION MATRIX

COS	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CSP 113.1	1	2	1	_	_	1	_	_	_	_	_	_	1	1	_
CSP 113.2	2	_	2	_	_	1	_	_	_	_	1	_	2	2	_
CSP 113.3	1	_	1	_	_	_	_	_	_	_	_	_	_	1	_
CSP 113.4	1	_	1	_	_	_	_	_	_	_	_	_	_	1	_
CSP 113.5	1	_	1	_	_	_	_	_	_	_	_	_	_	1	_
CSP 113.6	2	2	2	_	_	2	_	_	_	_	1	_	2	2	1
CSP113	2	2	2	-	-	1	-	-	-	-	1	-	2	1	1

1-Slight (Low) **2-Moderate (Medium)** **3-Substantial (High)**

School: SSET		**Batch: 2023-27**	
Programme: B.Tech		**Current Academic Year: 2023-24**	
Branch: ME		**Semester: I**	
1	Course Code	EEP112	
2	Course Title	Principles of Electrical and Electronics Engineering Lab	
3	Credits	1	
4	Contact Hours (L-T-P)	0-0-2	
	Course Status	Program Core	
5	Course Objective	To provide the students with an introductory concept in the field of electrical and electronics engineering to facilitate better understanding of the devices, techniques and equipments used in engineering applications.	
6	Course Outcomes	After the successful completion of course, students will be able to: CO1: To configure and analyze any given circuit. CO2: To inspect the working of transformer and calculate its efficiency CO3: To understand the working of dc and ac motors and measure its various operating parameters. CO4: To design rectifier circuits such as half and full wave rectifiers and observe its output waveforms. CO5: To obtain the characteristics of BJT.	
7	Course Description	This initial course introduces the concepts and fundamentals of electrical and electronic circuits and devices. Topics include basic circuit analysis, diode and transistor fundamentals and applications. This course also introduces working principle and applications of dc/ac motors and transformers.	
8	Outline syllabus		CO Mapping
	Unit 1	**Practical based on DC & AC Circuits**	CO1
		To configure a dc circuit on breadboard, and measure voltage/current across/through each element	CO1
		To verify Kirchhoff's Laws	CO1
		To verify Superposition Theorem	CO1
		To find the real power, reactive power, apparent power and power factor of RL & RC load	CO1
	Unit 2	**Practical related to Transformers**	
		To find the efficiency of transformer by obtaining its losses.	CO2
	Unit 3	**Practical related to Electrical Motors**	
		To study cut-section of DC motor and induction motor.	CO3
		To start the DC motor and reverse its direction of rotation.	CO3
		To start an induction motor and reverse its direction of rotation.	CO3
	Unit 4	**Practical related to Diode and Rectifier**	

		To determine voltage-current characteristic of diode			CO4
		To assemble and test half wave and full wave rectifier circuits for their input and output waveform			CO4
	Unit 5	**Practical related to Transistors**			
		To determine input and output characteristics of BJT			CO5
		Validation of BJT as a switch			CO5
	Mode of examination	Practical			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	1. D. P. Kothari and I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill, 2010. 2. S. K. Bhattacharya, "Basic Electrical and Electronics Engineering", Pearson Publication. 3. Robert L Boylestad, "Electronic Devices and Circuit Theory" Pearson Education, 2009			
	Other References	1. V. D. Toro, "Electrical Engineering Fundamentals", Prentice Hall India, 1989.			

Course Articulation Matrix:

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PS O2	PS O3	PS O4
CO112 .1	3	3	3	1	1	-	-	-	-	-	-	-	2	-	-	-
CO112 .2	2	2	2	-	-	-	-	-	-	-	-	-	-	-	1	-
CO112 .3	2	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-
CO112 .4	2	1	3	-	-	-	-	-	-	-	-	-	2	-	-	-
CO112 .5	2	1	1	-	-	-	-	-	-	-	-	-	2	-	-	-
EEP11 2	2	2	2	1	1	-	-	-	-	-	-	-	2	-	1	-

School: SSET		**Batch : 2023-2027**	
Programme: B.Tech		**Current Academic Year: 2023-2024**	
Branch: ALL		**Semester: I**	
1	Course Code	MEP 106	
2	Course Title	Computer Aided Design & Drafting Laboratory	
3	Credits	1.5	
4	Contact Hours (L-T-P)	0-0-3	
	Course Status	Program Core	
5	Course Objective	The objective of this introductory course is to make students familiar with computer-aided drafting/ design, introduce them about the basic commands, tools and dimension techniques for creation and presentation of various engineering drawing by using AutoCAD software which helps in visualization and problem solving in engineering disciplines.	
6	Course Outcomes	After successful completion of this course the student will be able to CO1: Identify the fundamental features of CAD, AutoCAD workspace and user interface. CO2: Apply knowledge of drawing, editing and viewing tool to create two dimensional engineering drawings in AutoCAD. CO3: Choose advance features to present an engineering drawing in AutoCAD. CO4: Create an engineering drawing by implementing dimension techniques. CO5: Construct orthographic projections from a pictorial view. CO6: Apply the knowledge of AutoCAD in variousindustrial practice.	
7	Course Description	This introductory course is offered to students to make them proficient in design, layout, product development, and other careers that require technical drawing. Using the current version of the AutoCAD software, students will learn a variety of drawing techniques and be able to replicate specific drawings in multiple perspectives. The pinnacle of the class is to empower and enable students to create using the software provided. Career opportunities in 3D modeling, manufacturing, and engineering will also be explored. No drafting or computer experience is necessary.	
8	Outline syllabus		CO Mapping
	Experiment 1	Introduction to AutoCAD and its interface	CO1

	Experiment 2	Working with coordinates, Drawing ofline, circle, arc, polygon and creating sketches			CO2
	Experiment 3	Editing of drawing by using editing Tools and Power tools			CO2
	Experiment 4	Creating of advanced feature like fillet, chamfer, hatch and using of block			CO3
	Experiment 5	Representing text and dimensioning in AutoCAD			CO4
	Experiment 6	Creating the drawingsof mechanical components by using AutoCAD features.			CO2, CO3
	Experiment 7	Creating the electrical circuit drawings in AutoCAD.			CO2
	Experiment 8	Drawing plan and elevation of various buildings in AutoCAD.			CO2, CO4
	Experiment 9	Creating the drawing of renowned constructions such as Taj Mahal in AutoCAD			CO3, CO6
	Experiment 10	Creating of orthographic projections from a pictorial views			CO5, CO6
	Mode	Practical			
	Weightage	CA	CE	ETE	
		25%	25%	50%	
	Text book/s*	1. Ibrahim Zaid,"CAD/CAM- Theory and Practice", McGraw Hill, International Edition.			
	Software	AutoCAD			

COURSE ARTICULATION MATRIX

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO 3
MEP 106.1	2	-	1	2	2	-	-	-	1	-	-	1	-	-	-
MEP 106.2	1	-	-	2	3	-	-	-	1	-	-	1	-	-	-
MEP 106.3	2	-	-	-	3	-	-	-	-	-	-	1	-	-	-
MEP 106.4	1	-	-	-	3	-	-	-	-	-	-	1	-	-	-
MEP 106.5	2	-	-	2	-	-	-	-	-	-	-	1	-	-	-
MEP 106.6	2	-	1	2	3	-	-	-	1	-	1	1	-	-	-
MEP 106	2	-	1	2	3	-	-	-	1	-	1	1	-	-	-

1-Slight (Low) 2-Moderate (Medium) 3-Substantial (High)

School: SSET		**Batch : 2023-2027**
Programme: B.Tech		**Current Academic Year: 2023-2024**
Branch: ME		**Semester: I**
1	Course Code	MEP105
2	Course Title	**Mechanical Workshop**
3	Credits	1.5
4	Contact Hours (L-T-P)	0-0-3
	Course Status	Practical
5	Course Objective	The objective of this course is to make the students, familiar with the modern day manufacturing processes, introduce them to various hand tools and equipment, acclimatize with the measuring devices, and perform basic machine tool operations in various machine tools.
6	Course Outcomes	After the successful completion of course, students will be able to: CO1: Apply 5S (Seiri, Seiton, Seiso, Seiketsu and Shitsuke) methodology at workplace. CO2: Select various hand tools used in basic mechanical engineering workshop viz. black smithy, carpentry, assembling, welding etc. CO3: Choose different measuring devices according to the job CO4: Explain various machine tools and their operation CO5: Classify suitable tools for machining processes including turning, facing, thread cutting and tapping, milling, drilling and shaping. CO6: Buildup basic knowledge of workshop to manufacture basic metallic or wooden components
7	Course Description	**Black Smithy Shop:** Simple exercises based on black smithy operations such as upsetting, practice of S -Hook from circular bar using hand forging operations.**Carpentry Shop:** Study of different types of wood, Carpentry Tools, Equipment and different joints, Practice of T joint, cross lap joint, Mortise and Tenon T joint, Bridle T joint**Fitting Shop:** Preparation of Square joint, V joint, half round joint, dovetail jointas per the given specifications, which contains: Sawing, Filing, Grinding, and Practice marking operations. **Sheet Metal Shop:** Study of galvanized Iron (G.I.) Sheet material properties, hand tools and sheet metal machines, and projective geometry, demonstration of different sheet metal operations and practice of development of Tray, cylinder, hopper, funnel etc. **Welding Shop:**

		Introduction, Study of Tools and welding Equipment (Gas and Arc welding), Selection of welding electrode and current, Bead practice and Practice of Butt Joint, Lap Joint.**Machine Shop:** Study of machine tools in particular Lathe machine (different parts, different operations, study of cutting tools), Demonstration of different operations on Lathe machine, Practice of Facing, Plane Turning, step turning, taper turning, knurling and parting and Study of Quick return mechanism of Shaper.			
8	Outline syllabus				CO Mapping
	Experiment 1	To make a S shaped hook from a given circular rod using hand forging technique.			CO4,CO1
	Experiment 2	To make a dovetail lap joint in Carpentry shop.			CO2,CO3
	Experiment 3	To make a cross-half lap joint in Carpentry shop.			CO2,CO3
	Experiment 4	To make a square fit from the given mild steel pieces in fitting shop.			CO3,CO5
	Experiment 5	To prepare a V-Fit from the given mild steel pieces in fitting shop.			CO3, CO5
	Experiment 6	To make a rectangular tray of specified dimensions in sheet metal shop.			CO2, CO5
	Experiment 7	To make a Lap joint, using the given mild steel pieces using arc welding.			CO3, CO5
	Experiment 8	To perform step turning and taper turning operations on the given work piece			CO5
	Experiment 9	To prepare a sand mould, using the given single piece pattern			CO2,CO6
	Experiment 10	To prepare a sand mould, using the given Split-piece pattern.			CO2,CO6
	Mode of examination	Practical			
	Weight- age Distribution	CA	CE	ETE	
		25%	25%	50%	
	Text book/s*	1. Raghuwanshi B.S., Workshop Technology Vol. I & II, Dhanpath Rai & Sons. 2. Kannaiah P. and Narayana K.L., Workshop Manual, 2nd Edn, Scitech publishers. 3. John K.C., Mechanical Workshop Practice. 2nd Edn. PHI 2010. 4. Jeyapoovan T.and Pranitha S., Engineering Practices Lab Manual, 3rd Edn. Vikas Pub.2008.			

COURSE ARTICULATION MATRIX

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
MEP105.1	1	0	0	0	0	0	1	1	2	0	0	1	1	1	0
MEP105.2	1	0	0	0	0	0	1	0	0	0	0	1	1	1	0
MEP105.3	1	0	0	0	0	0	0	0	0	0	0	1	1	1	0
MEP105.4	1	0	0	0	0	0	0	0	0	0	0	1	1	1	0
MEP105.5	1	0	0	0	0	0	0	0	0	0	0	1	1	1	0
MEP105.6	1	0	1	0	0	0	1	1	2	0	0	1	1	1	0
MEP105	1	0	1	0	0	0	1	1	2	0	0	1	1	1	0

1-Slight (Low) 2-Moderate (Medium) 3-Substantial (High)

School: SSET		**Batch : 2023-2027**	
Programme: B.Tech		**Current Academic Year: 2023-2024**	
Branch: ME		**Semester: II**	
1	Course Code	CSE114	
2	Course Title	Application Based Programming in Python	
3	Credits	3	
4	Contact Hours (L-T-P)	3-0-0	
	Course Status	Program Core	
5	Course Objective	Emphasis is placed on procedural programming, algorithm design, and language constructs common to most high-level languages through Python Programming.	
6	Course Outcomes	After the successful completion of course, students will be able to: CO1. Apply decision and repetition structures in program design. CO2. Implement methods and functions to improve readability of programs. CO3. Demonstrate the use of Python lists, tuples and dictionaries CO4. Describe and apply object-oriented programming methodology. CO5. Apply top-down concepts in algorithm design. CO6. Write Python programs to illustrate concise and efficient algorithms	
7	Course Description	Python is a language with a simple syntax, and a powerful set of libraries. It is widely used in many scientific areas for data exploration. This course is an introduction to the Python programming language for students without prior programming experience. We cover data types, control flow, object-oriented programming.	
8	Outline syllabus		CO Mapping
	Unit 1	**Introduction**	
	A	Python Environment, Variables, Data Types, Operators.	CO1
	B	**Conditional Statements:** If, If- else, Nested if-else. **Looping:** For, While, Nested loops.	CO1
	C	**Control Statements:** Break, Continue, And Pass. Comments	CO1
	Unit 2	**List, Tuple and Dictionaries**	
	A	**Lists and Nested List:** Introduction, Accessing list, Operations, Working with lists, Library Function and Methods with Lists.	CO1, CO2
	B	Strings: Introduction, Accessing items of a string, Operations, Working, Library Functions and Methods with strings. **Tuple:** Introduction, Accessing tuples, Operations, Working, Library Functions and Methods with Tuples.	CO1, CO2
	C	Sets: Introduction, Operations, Working, functions with sets. Difference between set and lists. **Dictionaries :**Introduction, Accessing values in dictionaries, Working with dictionaries, Library Functions	CO1, CO2
	Unit 3	**Functions and Exception Handling**	
	A	**Functions:** Defining a function, Calling a function, Types of functions, Function Arguments	CO3

	B	Anonymous functions, Global and local variables			C03
	C	**Exception Handling**: Definition, Except clause, Try, finally clause, User Defined Exceptions			CO3
	Unit 4	**OOP and File Handling**			
	A	**OOPs concept** : Class and object, Attributes, Abstraction, Encapsulation, Polymorphism and Inheritance			C04
	B	Static and Final Keyword, Access Modifiers and specifiers, scope of a class			CO4
	C	File Handling: Introduction, File Operations			CO4
	Unit 5	**Application based programming**			
	A	**Modules& packages :**Importing module, Math module, Random module, creating Modules			CO5
	B	Introduction to Numpy, pandas, Matplotlib			CO5,CO6
	C	**Applications: Searching Linear Search, Binary Search. Sorting: Bubble Sort**			CO5,CO6
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	1. The Complete Reference Python, Martin C. Brown, McGraw Hill			
	Other References	1. Introduction to computing in problem solving using Python, E Balahurusamy, McGraw Hill 2. Introduction to programming using Python, Y. Daniel Liang, Pearson 3. Mastering Python, Rick Van Hatten, Packet Publishing House 4. Starting out with Python, Tony Gaddis, Pearson			

COURSE ARTICULATION MATRIX

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CSE114.1	1	3	2	2	1	-	-	-	1	-	1	-	2	2	1
CSE114.2	3	3	3	3	3	-	-	-	3	-	3	-	3	3	3
CSE114.3	3	3	3	3	2	-	-	-	3	-	2	-	3	3	2
CSE114.4	2	2	2	1	2	-	--	-	2	-	1	-	2	1	1
CSE114.5	2	3	2	1	2				1		2		1	2	2
CSE114.6	1	2	1	2	1				1		1		3	2	2
CSE114	2	2	2	1	2	-	-	-	1	-	1	-	2	2	2

1-Slight (Low) **2-Moderate (Medium)** **3-Substantial (High)**

School: SSET		**Batch : 2023-2027**	
Programme: B.Tech.		**Current Academic Year: 2023-24**	
Branch: ME		**Semester: II**	
1	Course Code	MTH 143	
2	Course Title	DIFFERENTIAL EQUATIONS, SPECIAL TRANSFORMS AND COMPLEX VARIABLE	
3	Credits	4	
4	Contact Hours (L-T-P)	3-1-0	
	Course Status	Program Core	
5	Course Objective	The objective of this course is to familiarize the prospective engineers with techniques in multivariate integration, ordinary and partial differential equations and complex variables. It aims to equip the students to deal with advanced level of mathematics and applications that would be essential for their disciplines.	
6	Course Outcomes	After the successful completion of course, students will be able to: CO1: Apply the concept of differential equations, illustrate the first and second order linear differential equations with constant coefficients CO2: Recognize the major classification of PDEs and the qualitative differences between the classes of equations CO3: Solve linear differential equations using the Laplace transform and Z transform technique CO4: Evaluate half range sine and cosine Fourier series and Fourier transform of the functions CO5: Apply the concept and consequences of analyticity and the Cauchy-Riemann equations and of results on harmonic CO6: Evaluate complex contour integrals directly and by the fundamental theorem and Represent functions as Taylor, power and Laurent series, classify singularities and poles	
7	Course Description	The primary objective of the course is to develop the basic understanding of differential equations, special transforms and complex analysis.	
8	**Outline syllabus :Differential Equations, Special Transforms and Complex Variable**		**CO Mapping**
	Unit 1	**Ordinary differential equations**	
	A	Exact differential equations, Second order linear differential equations with constant coefficients,	CO1
	B	Method of variation of parameters, Cauchy-Euler equation; Power series solutions;	CO1

	C	Introduction of Legendre and Bessel functions			CO1
	Unit 2	**Partial differential equations**			
	A	Definition, classification of partial differential equation, method of separation of variables			CO2
	B	Solution of wave equation,			CO2
	C	Heat equation and Laplace equation using method of separation of variables.			CO2
	Unit 3	**Laplace Transform and Z Transform**			
	A	Laplace transform of some standard functions and its properties			CO3
	B	Inverse Laplace transform and Convolution theorem			CO3
	C	Introduction to Z transforms.			CO3
	Unit 4	**Fourier series and Fourier Transform**			
	A	Fourier series, Fourier series in change of interval, Half range sine and cosine series			CO4
	B	Parseval's theorem. Fourier Transforms			CO4
	C	Fourier Cosine and sine Transform properties of Fourier Transform.			CO4
	Unit 5	**Complex Variable – Differentiation**			
	A	Differentiation, Cauchy-Riemann equations, analytic functions, harmonic functions,			CO5
	B	Contour integrals, Cauchy-Integral theorem, Cauchy Integral formula (without proof),			CO5, CO6
	C	Taylor's series and Laurent's series (without proof), zeros of analytic functions, singularities, Residues, Cauchy Residue theorem (without proof).			CO6
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	1. Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006. 2. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th reprint, 2010.			
	Other References	1. W. E. Boyce and R. C. DiPrima, Elementary Differential Equations			

		and Boundary Value Problems, 9th Edn., Wiley India, 2009. 2. S. L. Ross, Differential Equations, 3rd Ed., Wiley India, 1984. 3. E. A. Coddington, An Introduction to Ordinary Differential Equations, Prentice Hall India, 1995. 4. E. L. Ince, Ordinary Differential Equations, Dover Publications, 1958. 5. J. W. Brown and R. V. Churchill, Complex Variables and Applications, 7th Ed., McGraw Hill, 2004.	

COURSE OUTCOMES – PROGRAMME OUTCOMES MAPPING TABLE

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO143.1	3	2	2	-	-	-	-	-	-	-	-	1
CO143.2	3	2	2	-	-	-	-	-	-	-	-	1
CO143.3	3	2	2	-	-	-	-	-	-	-	-	1
CO143.4	3	2	2	-	-	-	-	-	-	-	-	1
CO143.5	3	2	2	-	-	-	-	-	-	-	-	1
CO143.6	3	2	2	-	-	-	-	-	-	-	-	1
MTH 143	3	2	2	-	-	-	-	-	-	-	-	1

School: SSET		Batch : 2023-2027	
Programme: B.Tech		**Current Academic Year: 2023-2024**	
Branch: ME		**Semester: II**	
1	Course Code	PHY128	
2	Course Title	Engineering Physics	
3	Credits	4	
4	Contact Hours (L-T-P)	3-1-0	
	Course Status	Program Core	
5	Course Objective	The course will cover statics and dynamics. Statics deals with forces, including friction forces, and moments acting on rigid bodies at rest. Much time will be spent finding resultant forces for a variety of force systems, as well as analyzing forces acting on bodies to find the reacting forces supporting those bodies. Dynamics course provides students with the skills they need to analyze and solve problems involving bodies in motion through the application of vector mechanics and Newton's laws	
6	Course Outcomes	After the successful completion of course, students will be able to: CO1. The student will demonstrate understanding of equivalent force systems CO2. The student will demonstrate and understanding on how to be able to solve statical equilibrium problems in two and three dimensions by finding reactions/unknown forces acting at a point/on a rigid body CO3. The student will apply knowledge of statics to determine forces in simple 2-D trusses and frames CO4. The student will demonstrate the ability to solve friction problems CO5. The student will be able to solve kinetics problems involving impulse and momentum CO6. The student will demonstrate an understanding of how to apply the knowledge of kinetics of particles to rigid bodies in two dimensions (2D) and three dimensions (3D)	
7	Course Description	The course introduces rate processes in fluid mechanics and in heat transfer. The course confines itself largely to be able to same simple estimates and use dimensionless parameters	
8	Outline syllabus		CO Mapping
	Unit 1	**Forces as Vectors and first law of Newton**	
	A	Forces: components and resultants	CO1
	B	Equilibrium of a particle in 2-D	CO1
	C	Equilibrium of a particle in 3-D	CO1
	Unit 2	**Equilibrium of rigid bodies**	
	A	External and internal forces, concept of moment	CO2
	B	Equivalent force system	CO2
	C	Centre of gravity	CO2
	Unit 3	**Friction and simple structures**	

	A	Solving problems with friction			CO4
	B	Simple 2-D trusses			CO3
	C	Simple 2-D frames			CO3
	Unit 4	**Kinematics and kinetics of particles**			
	A	Rectilinear and curvilinear motion of particles			CO5
	B	Newton's second law and linear momentum			CO5
	C	Energy methods applied to particles			CO5
	Unit 5	**Kinematics and kinetics of rigid bodies**			
	A	Translation and fixed axis rotation			CO6
	B	Kinetics of rigid bodies in plane motion			CO6
	C	Kinetics of rigid bodies in combined translation and rotation			CO6
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	1. Baker and Haynes, *Engineering Statics, Open and Interactive*, e-book			
	Other References	2. Beer and Johnston, Vector Mechanics for Engineers, Dynamics, McGraw-Hill			

COURSE ARTICULATION MATRIX

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	1					2			1	2		
CO2	3	2	1	1					2			1	2		
CO3	3	2	1	1					2			1	2		
CO4	3	2	1	1					2			1	2		
CO5	3	2	1	1					2			1	2		
CO6	3	2	1	1					2			1	2		
CO	3	2	1	1					2	-	-	1	2		

1-Slight (Low) 2-Moderate (Medium) 3-Substantial (High)

School: SSET		**Batch : Batch : 2023-2027**	
Programme: B.Tech		**Current Academic Year: 2023-2024**	
Branch: ME		**Semester: II**	
1	Course Code	MEC236	
2	Course Title	Materials Science	
3	Credits	3	
4	Contact Hours (L-T-P)	3-0-0	
5	Course Status	Program Core	
6	Course Outcomes	After the successful completion of course, students will be able to: CO1: Describe the structure and imperfections present in crystalline solids CO2: Explain the reasons behind variations in mechanical properties of different categories of materials CO3: Analyse phase diagrams and subsequently utilize it to predict the microstructure CO4: Compare and contrast the structure and properties of different constituents of Iron-carbon system CO5: Summarise the composition, properties and applications of different ferrous and non-ferrous alloys; and conduct materials testing CO6: Analyse the structure and performance of metal-alloy systems	
7	Course Description	The course focuses on the structure, defects and strengthening mechanisms associated with crystalline solids along with material testing. This course also covers phase diagram, phase transformations and processing of Iron-carbon system.	
8	Outline syllabus		CO Mapping
	Unit 1	**Structure and Imperfections in Crystalline Solids**	
	A	Binding forces and energies in solids, Unit 3ells, Metallic crystal structures, Density computations, Crystal structures, Crystallographic points, directions and planes	CO1, CO6
	B	Crystalline and non-crystalline materials, Point defects: Vacancies, Self-interstitials and Impurities in solids,	CO1, CO6
	C	Miscellaneous imperfections: Dislocations, Linear defects, Surface defects. Diffusion mechanisms and Factors that affect diffusion	CO1, CO6
	Unit 2	**Mechanical Properties of Metals**	
	A	Concepts of stress and strain, Stress-strain behavior, Anelasticity, Elastic properties of materials, True stress-strain curve and Elastic recovery	CO2, CO6
	B	Safety factors, Characteristics of dislocations, Slip systems, Plastic deformation in polycrystalline materials	CO2, CO6

	C	Strengthening mechanisms in metals: Strain hardening, Solid solution strengthening and Hall-Petch strengthening, Ductile and Brittle fracture			CO2, CO6
	Unit 3	**Phase Diagrams**			
	A	Solubility limit, Phases, Microstructure, Phase equilibria and Unary phase diagram			CO3
	B	Binary phase diagrams: Interpretation of phase diagram, Development of microstructure in Isomorphous and eutectic systems and Gibbs phase rule.			CO3
	C	Iron-Carbon system: Iron-Iron carbide phase diagram, Development of microstructure and influence of other alloying elements			CO3, CO6
	Unit 4	**Phase Transformations**			
	A	Kinetics of phase transformations: Homogenous and heterogeneous nucleation and Growth, Metastable and Equilibrium states			CO4
	B	Isothermal transformation diagrams, Athermal transformation and Continuous cooling transformation diagram			CO4
	C	Mechanical behavior of Iron-Carbon alloys: Pearlite, Spheroidite, Banite and Martensite, Tempered martensite and Temper embrittlement			CO4, CO6
	Unit 5	**Processing of Metal Alloys and Materials Testing**			
	A	Ferrous and Non-ferrous alloys: Composition, Mechanical properties and Applications			CO5, CO6
	B	Concept of lower critical and upper critical temperature, Annealing processes: Process annealing, Stress relief, Annealing of ferrous alloys: Normalizing, Full anneal and Spheroidizing			CO5
	C	Hardness test, Tensile test, Impact test, Significance of fatigue and creep properties, Fatigue test and Creep test			CO5
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	**Materials Science and Engineering an Introduction** by William D. Callister and David G. Rethwisch			
	Other References	**Materials Science and Engineering: A First Course** byV. Raghavan			

COURSE ARTICULATION MATRIX

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PSO 2	PS O3
MEC236.1	3	1	2	1	-	-	-	-	-	-	-	-	2	2	2
MEC236.2	1	1	2	-	-	-	-	-	-	-	-	-	3	3	3
MEC236.3	3	3	3	-	-	-	-	-	-	-	-	-	1	-	2
MEC236.4	3	3	3	-	-	-	-	-	-	-	-	-	3	2	3
MEC236.5	1	2	2	1	-	-	-	-	-	-	-	-	-	-	2
MEC236	2	2	2	1	-	-	-	-	-	--	-	-	2	2	2

1-Slight (Low) 2-Moderate (Medium) 3-Substantial (High)

Programme:- B.Tech Schools: SSET		**Batch :** 2023-2027	
		Current Academic Year: 2023-2024	
		Semester: 2nd (Second)	
1	Course Code	**ARP102**	
2	Course Title	Communicative English -2	
3	Credits	2	
4	Contact Hours (L-T-P)	1-0-2	
5	Course Objective	To Develop LSRW skills through audio-visual language acquirement, creative writing, advanced speech et al and MTI Reduction with the aid of certain tools like texts, movies, long and short essays.	
6	Course Outcomes	After the successful completion of course, students will be able to: CO1 Acquire Vision, Goals and Strategies through Audio-visual Language Texts CO2 Synthesize complex concepts and present them in creative writing CO3 Develop MTI Reduction/Neutral Accent through Classroom Sessions & Practice CO4 Determine their role in achieving team success through defining strategies for effective communication with different people CO5 Realize their potentials as human beings and conduct themselves properly in the ways of world. CO6 Acquire satisfactory competency in use of Quantitative aptitude and Logical Reasoning	
7	ourse Description	The course takes the learnings from the previous semester to an advanced level of language learning and self-comprehension through the introduction of audio-visual aids as language enablers. It also leads learners to an advanced level of writing, reading, listening and speaking abilities, while also reducing the usage of L1 to minimal in order to increase the employability chances.	
8	Outline syllabus – ARP 102		
	Unit 1	**Acquiring Vision, Goals and Strategies through Audio-visual Language Texts**	**CO Mapping**
	Topic 1	Pursuit of Happiness / Goal Setting & Value Proposition in life	CO1
	Topic 2	12 Angry Men / Ethics & Principles	
	Topic 3	The King's Speech / Mission statement in life | strategies & Action Plans in Life	
	Unit 2	**Creative Writing**	

	Topic 1	Story Reconstruction - Positive Thinking	CO2
	Topic 2	Theme based Story Writing - Positive attitude	
	Topic 3	Learning Diary Learning Log – Self-introspection	
	Unit 3	**Writing Skills 1**	
	Topic 1	Precis	CO2
	Topic 2	Paraphrasing	
	Topic 3	Essays (Simple essays)	
	Unit 4	**MTI Reduction/Neutral Accent through Classroom Sessions & Practice**	
	Topic 1	Vowel, Consonant, sound correction, speech sounds, Monothongs, Dipthongs and Tripthongs	CO3
	Topic 2	Vowel Sound drills , Consonant Sound drills, Affricates and Fricative Sounds	
	Topic 3	Speech Sounds | Speech Music| Tone | Volume| Diction |Syntax |Intonation | Syllable Stress |	
	Unit 5	**Gauging MTI Reduction Effectiveness through Free Speech**	
	Topic 1	Jam sessions	CO3
	Topic 2	Extempore	
	Topic 3	Situation-based Role Play	
	Unit F	**Leadership and Management Skills**	
	Topic 1	Innovative Leadership and Design Thinking	CO4
	Topic 2	Ethics and Integrity	CO4
	Unit F	**Universal Human Values**	
	Topic 1	Love & Compassion, Non-Violence & Truth	CO5
	Topic 2	Righteousness, Peace	CO5
	Topic 3	Service, Renunciation (Sacrifice)	CO5
	Unit G	**Introduction to Quantitative aptitude & Logical Reasoning**	
	Topic 1	Analytical Reasoning & Puzzle Solving	CO6

	Topic 2	Number Systems and its Application in Solving Problems	CO6
9	Evaluations	*Class Assignments/Free Speech Exercises / JAM Group Presentations/Problem Solving Scenarios/GD/Simulations (60% CA and 40% ETE*	*N/A*
10	Texts & References | Library Links	• Wren, P.C.&Martin H. *High English Grammar and Composition*, S.Chand& Company Ltd, New Delhi. • Blum, M. Rosen. *How to Build Better Vocabulary*. London: Bloomsbury Publication • Comfort, Jeremy(et.al). *Speaking Effectively*. Cambridge University Press. The Luncheon by W.Somerset Maugham - http://mistera.co.nf/files/sm_luncheon.pdf	

COURSE ARTICULATION MATRIX

COs	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ARP102.1	-	-	-	-	-	-	-	-	1	3	1	2	-	-	-
ARP102.2	-	-	-	-	-	-	-	-	1	3	1	2	-	-	-
ARP102.3	-	-	-	-	-	-	-	-	1	3	1	2	-	-	-
ARP102.4	-	-	-	-	-	-	-	-	1	2	1	2	-	-	-
ARP102.5	-	-	-	-	-	-	-	-	1	2	1	2	-	-	-
ARP102.6	1	-	-	-	-	-	-	-	1	2	1	2	-	-	-
ARP102	1	-	-	-	-	-	-	-	1	2	1	2	-	-	-

1-Slight (Low) 2-Moderate (Medium) 3-Substantial (High)

School: SSET		**Batch: 2023-2027**	
Programme: B.Tech		**Current Academic Year: 2023-24**	
Branch: ME		**Semester: II**	
1	Course Code	CSP114	
2	Course Title	Application Based Programming in Python Lab	
3	Credits	1	
4	Contact Hours (L-T-P)	0-0-2	
	Course Status	Program Core	
5	Course Objective	Emphasis is placed on procedural programming, algorithm design, and language constructs common to most high level languages through Python Programming.	
6	Course Outcomes	After the successful completion of course, students will be able to: CO1. Apply decision and repetition structures in program design. CO2. Implement methods and functions to improve readability of programs. CO3. Demonstrate the use of Python lists, tuples and dictionaries CO4. Elaborate and apply object-oriented programming methodology. CO5. Apply top-down concepts in algorithm design. CO6. Write Python programs to illustrate concise and efficient algorithms	
7	Course Description	Python is a language with a simple syntax, and a powerful set of libraries. It is widely used in many scientific areas for data exploration. This course is an introduction to the Python programming language for students without prior programming experience. We cover data types, control flow, object-oriented programming.	
8	Outline syllabus		CO Mapping
	Unit 1	**Practical based on conditional statements and control structures**	
		1. Program to implement all conditional statements 2. Program to implement different control structures	CO1,C06
	Unit 2	**Practical related to List, Tuples and dictionaries**	
		1. Program to implement operations on lists 2. Program to implement operations on Dictionary **3.** Program to implement operations on Tuple	CO3,CO6
	Unit 3	**Practical related to Functions and Exception Handling**	
		1. Program to implement Exception Handling **2.** Program to use different functions	CO2,CO6
	Unit 4	**Practical related to Object Oriented Programming**	
		Program to use object oriented concepts like inheritance, overloading polymorphism etc. Program for file handling	CO4,CO6
	Unit 5	**Practical related to Modules and Applications**	
		Program to use modules and package Program to implement searching and sorting	CO2,CO5,CO6

	Mode of examination	Practical/Viva			
	Weightage Distribution	CA	CE	ETE	
		25%	25%	50%	
	Text book/s*	1. The Complete Reference Python, Martin C. Brown, McGraw Hill			
	Other References	1. Introduction to computing in problem solving using Python, E Balagurusamy, McGraw Hill 1. Introduction to programming using Python, Y. Daniel Liang, Pearson 1. Mastering Python, Rick Van Hatten, Packet Publishing House 1. Starting out with Python, Tony Gaddis, Pearson			

COURSE ARTICULATION MATRIX

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CSP114.1	1	3	2	2	1	-	-	-	1	-	1	-	2	2	1
CSP114.2	3	3	3	3	3	-	-	-	3	-	3	-	3	3	3
CSP114.3	3	3	3	3	2	-	-	-	3	-	2	-	3	3	2
CSP114.4	2	2	2	1	2	-	--	-	2	-	1	-	2	1	1
CSP114.5	2	3	2	1	2				1		2		1	2	2
CSP114.6	1	2	1	2	1				1		1		3	2	2
CSP114	2	2	2	2	2	-	-	-	2	-	2	-	2	2	2

1-Slight (Low) 2-Moderate (Medium) 3-Substantial (High)

School: SSET		**Batch: 2023-2027**	
Programme: B. Tech		**Current Academic Year: 2023-2024**	
Branch: ME		**Semester: III**	
1	Course Code	MEP230	
2	Course Title	CAD modelling through solid works Laboratory	
3	Credits	1	
4	Contact Hours (L-T-P)	0-0-2	
	Course Status	Program Core	
5	Course Objective	The objective of this introductory course is to make students familiar with computer-aided design, introduce them about the basic commands, tools and dimension techniques for creation and presentation of various engineering part model by using Solidworks software which helps in visualization and problem solving in engineering disciplines.	
6	Course Outcomes	After the successful completion of course, students will be able to: CO1: explain the fundamental features of Solidworks workspace and user interface. CO2: Apply the sketch tools such as draw, edit, and view for creating two-dimensional engineering drawings in Solidworks. CO3: Choose advance features to present a 3D part model in Solidworks. CO4: Creating assembly drawings from the part models. CO5: Generating views and projections from a 3d part model. CO6: read an engineering drawing and use the software packages for drafting and modeling.	
7	Course Description	This introductory course is offered to students to make them proficient in design, layout, product development, and other careers that require technical drawing and modelling. Using the current version of the Solidworks software, students will learn a variety of 3D part model creation techniques and be able to assemble them for in multiple perspectives. The pinnacle of the class is to empower and enable students to create using the software provided. Career opportunities in 3D modeling, manufacturing, and engineering will also be explored. No drafting or computer experience is necessary.	
8	Outline syllabus		CO Mapping
	List of Experiments		

	Experiment 1	Introduction to Solidworks and its interface			CO1
	Experiment 2	Working with Sketch Entities and Tools – Inference line, Centerline line, Line, Circle, Arc, Ellipse, Rectangle, Slots, Polygon, Ellipse, Partial Ellipse, Spline, Points, Text, Construction geometry, Fillet, Chamfer, Offset, convert entities, Trim, Extend, Mirror, Dynamic Mirror, Move, Copy, Rotate, Scale, Stretch, Sketch pattern			CO2
	Experiment 3	Adding Sketch Relation, Automatic relations, Smart Dimensioning.			CO3
	Experiment 4	Creating of Part Features using Extrude, Revolve, Sweep and Loft			CO3
	Experiment 5	Creating Advance Part Features like Fillet, Inserting Hole types, Chamfer and Shell			CO3
	Experiment 6	Creating Rib and Pattern			CO4
	Experiment 7	Introduction to Assembly Modeling & Approaches – Top down and Bottom upApproach.			CO4
	Experiment 8	Applying Standard Mates- Coincident, Parallel, Perpendicular, Tangent, Concentric, Lock, Distance, Angle.			CO4
	Experiment 9	Generating drawing and Creating Explode Views			CO5, CO6
	Experiment 10	Creating views relative to model, Inserting predefined views, Auxiliary Views, Detailed Views, Crop view, Broken –Out Section, Broken Views, Section View, Alternate Position View, Drawing properties.			CO5, CO6
	Mode of examination	Practical			
	Weightage Distribution	CA	CE	ETE	
		25%	25%	50%	
	Text book/s*	1. Ibrahim Zaid,"CAD/CAM- Theory and Practice", McGraw Hill, International Edition.			
	Software	Solid works			

COURSE ARTICULATION MATRIX

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
MEP230.1	2	2	2	-	3	-	-	-	-	-	-	3	3	-	-
MEP230.2	2	2	2	-	3	-	-	-	-	-	-	3	3	-	-
MEP230.3	2	2	2	-	3	-	-	-	-	-	-	3	3	-	-
MEP230.4	2	2	2	-	3	-	-	-	-	-	-	3	3	-	-
MEP230.5	2	2	2	-	3	-	-	-	-	-	-	3	3	-	-
MEP230	2	2	2	-	3	-	-	-	-	-	-	3	3	-	-

1-Slight (Low) 2-Moderate (Medium) 3-Substantial (High)

School: SSET		**Batch: 2023-2027**	
Programme: B.Tech.		**Current Academic Year: 2023-2024**	
Branch: ME		Semester: II	
1	Course Code	PHY 162	
2	Course Title	Physics Lab 2	
3	Credits	1	
4	Contact Hours (L-T-P)	0-0-2	
	Course Status	Program Core	
5	Course Objective	To gain practical knowledge by applying the experimental methods to correlate with the Physics theory.	
6	Course Outcomes	After the successful completion of course, students will be able to: CO1: Knowledge and study of basic physics experiments based on simple harmonic motion CO2: Conduct the experiment and calculate modulus of rigidity, Young's modulus of engineering materials. CO3: Determine moment of inertia of different bodies. CO4: Draw the characteristic curves of different electronic components CO5:Evaluate the frequency of an electrically maintained tuning fork using Melde's Experiment CO6: Apply the mathematical concepts/equations to obtain quantitative results and ability to conduct, analyze and interpret experiments	
7	Outline Syllabus		CO Mapping
	Unit 1		
	A	To verify the relation of time period using simple pendulum. To determine the acceleration due to gravity and radius of Gyration of compound pendulum and compare with theoretical value.	CO1 CO2,CO6
	B		
	C		
	Unit 2		
	A	To measure the moment of inertia of a flywheel. To determine the Young's modulus of a beam using cantilever beam experiment apparatus. To determine vertical distance between two points using sextant.	CO2,CO6
	B		
	C		
	Unit3		
	A	To determine the modulus of rigidity of a material of a given wire with an inertia table (torsion pendulum) by dynamical method. To calculate Moment of inertia of different irregular shapes.	CO3,CO6 CO4,CO6
	B		
	C		
	Unit 4		

	A B C	To determine the frequency of an electrically maintained tuning fork using Melde's Apparatus. (i) Transverse mode of vibration (ii) Longitudinal mode of vibration. To determine the coefficient of viscosity of water by Poiseuille's method.	CO4,CO6
	Unit 5		
	A B C	To draw the characteristic curve of a PN junction diode. To trace the circuit of a Half Wave Rectifier circuit and determine efficiencies and ripple factors with capacitor and inductor filters. To trace the circuit of a Full Wave Rectifier circuit and determine efficiencies and ripple factors with capacitor and inductor filters.	CO5,CO6 CO5,CO6
	Mode of Examination	Practical/Viva	
	Weightage Distribution	CA: 25%	CE: 25% ETE: 50%
	Text books	B.Sc. Practical Physics- Harnam Singh, S. Chand Publishing. B.Sc. Practical Physics- C L Arora, S. Chand Publishing.	
	Other References	Geeta Sanon, BSc Practical Physics, 1st Edn. (2007), R. Chand & Co. B. L. Worsnop and H. T. Flint, Advanced Practical Physics, Asia Publishing House, New	

COURSE ARTICULATION MATRIX

COs	PO1	PO 2	PO3	PO 4	PO 5	PO 6	PO7	PO 8	PO 9	PO1 0	PO 11	PO 12
PHY 161.1	2	2	2	1					1			1
PHY 161.2	2	2	2	1					1			1
PHY 161.3	2	2	2	1					1			1
PHY 161.4	2	2	2	1					1			1
PHY 161.5	2	2	2	1					1			1
PHY 161.6	2	2	2	1					1			1
PHY 162	2	2	2	1					1			1

1-Slight (Low) **2-Moderate (Medium)** **3-Substantial (High)**

School: SSET		**Batch : 2023-2027**	
Programme: B.Tech		**Current Academic Year: 2023-2024**	
Branch: ME		**Semester: II**	
1	Course Code	MEP101	
2	Course Title	Idea Generation and Creativity Lab	
3	Credits	1	
4	Contact Hours (L-T-P)	0-0-2	
	Course Status	Program Core	
5	Course Objective	The objective of this course is to make the students understand the importance of creativity and innovation in engineering. Then course will enable students to generate better creative ideas and observation skills.	
6	Course Outcomes	After the successful completion of course, students will be able to: 1. Build the importance of creativity in solving complex problems 2. Analyze the observation skills through an understanding of creativity models. 3. Discuss the process and tools of new design thinking. 4. To provide the understanding for the mock review of presentation (generating solutions and ideas in classroom through discussion). 5. To identifying the fundamental problems and resolving the issues. 6. To define the final presentation detailing the solution to the selected problem/new modification.	
7	Course Description	This course focuses on the understanding of generating different ideas by creating new concepts to reality; it also bringsworkshop on-good engineering practices (GEP).	
8	Outline syllabus		CO Mapping
	List of Experiments		
	Experiment 1	Introduction and presentation on creative ideas that changed the world/Case studies	CO1
	Experiment 2	To discuss on various engineering issues/deficiencies in existing product/propose new design for an existing product.	CO2
	Experiment 3	To explore various ideas to tackle/list alternative solutions/challenges/ logical approach/what are the constraints/most economical	CO3
	Experiment 4	Mock review of the presentation (generating solutions and ideas in classroom through discussion)	CO4
	Experiment 5	To Identifying and resolving the issues	CO5
	Experiment 6	Final presentation detailing the solution to the selected problem/new modification.	CO6
	Experiment 7	To create the experiential learning concepts	CO2

	Experiment 8	Developing and Validating-Proof of Concept.			CO3,CO4
	Mode of examination	Practical			
	Weight- age Distribution	CA	CE	ETE	
		25%	25%	50%	
	Text book/s*	Mechanical Design Engineering Handbook,Peter R N Child			
		Garrat,S., "Motor Vehicles" , Butterworthy London,13th edition.			
		Bosch Hand Book, 3rd Edition, SAE,1993			
		MSC Software from http://pages.mscsoftware.com/MSC_Symposium2012_Vehicle_Home.htm			

COURSE ARTICULATION MATRIX

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
MEP201.1	1	2										2	1	1	1
MEP201.2	1	2										2	1	1	1
MEP201.3	1		1		2							2	1	1	1
MEP201.4			2	2					3	2		2	1	1	1
MEP201.5	1		2	2								2	1	1	1
MEP201.6	1	2										2	1	1	1
MEP101	1	2	2	2	2				3	2		2	1	1	1

1-Slight (Low) 2-Moderate (Medium) 3-Substantial (High)

School: SSET		**Batch : 2023-2027**	
Programme: B.Tech		**Current Academic Year: 2023-2024**	
Branch: ME		**Semester: III**	
1	Course Code	MEC229	
2	Course Title	Manufacturing Technology – I	
3	Credits	3	
4	Contact Hours (L-T-P)	3-0-0	
	Course Status	Program Core	
5	Course Objective	1. To familiarize casting process and various types of casting. 2. To learn the various metal joining processes. 3. To teach students different types of sheet metal processes. 4. To impart knowledge on selection of suitable manufacturing process for the typical mechanical component.	
6	Course Outcomes	After the successful completion of course, students will be able to: CO1: choose the various casting methods for product making with their advantages and disadvantages. CO2 Design solution for the different types of welding processes in metal joining. CO3 Choose appropriate bulk deformation processes line rolling, forging, Extrusion CO4 Analyse the various processes involved in sheet metal forming with its applications and salient features and Familiarize about the manufacturing processes used for plastic materials. CO5 Apply correct procedure while measuring the dimension of a component CO6 Apply the manufacturing technology and quality checking for a specific product.	
7	Course Description	Manufacturing is the creation, through one or several processing operation, of components or products from basic raw materials. The effectiveness of process selection will be based on the inter-related criterion of design parameters, material selection and process economies.	
8	Outline syllabus		CO Mapping
	Unit 1	**Metal Casting Processes**	
	A	Introduction to foundry, Types of Pattern and pattern allowances, Moulding materials, Core and core materials,	CO1, CO6
	B	Design of Gating system, Casting defects,	CO1, CO6
	C	Special casting processes - Shell mould casting, Investment casting, Die casting, Centrifugal casting	CO1, CO6
	Unit 2	**Metal Joining and Allied Processes**	
	A	Fusion welding processes: Introduction, Oxy-fuel Gas welding, Gas cutting, Flame characteristics, Electric Arc welding, Resistance Welding	CO2, CO6
	B	consumable electrode and non-consumable electrode, Manual metal arc welding, Gas Tungsten arc welding, Gas metal arc welding, TIG, MIG	CO2, CO6
	C	Solid state welding processes:Friction welding,Friction stir welding, Thermit welding, Brazing, soldering, Defects in welding.	CO2, CO6

	Unit 3	**Metal Forming Processes**			
	A	Hot and Cold working, Bulk Deformation Processes: Fundamentals of metal forming, Rolling, Forging			CO3, CO6
	B	Forging and various Forging operations, Forging defects and remedies. Extrusion principle,			CO3, CO6
	C	Hot and Cold extrusions, Wire drawing and Tube drawing			CO3, CO6
	Unit 4	**Sheet Metal Processes and Plastic processing**			
	A	Sheet metal characteristics, shearing, bending and drawing operations,Sheet metal processes : Blanking, Punching, Perforating, Notching, Spinning, Embossing, Coining,			CO4, CO6
	B	Sheet Metal Working: Deep drawing process, Die and Punch			CO4, CO6
	C	Types of Plastics, Types of Molding: Injection molding, Blow molding, Compression molding, Transfer molding			CO4, CO6
	Unit 5	**Metrology**			
	A	Terminologies associated with metrology, Surface plate, Tolerance, Limits and Fits: Hole basis system, Shaft basis system and Selective assembly			CO5, CO6
	B	Linear measurement, Angular measurement and Thread measurement			CO5, CO6
	C	Surface texture, Gauge and Gauge design			CO5, CO6
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	1. P.N. Rao, Manufacturing Technology: Foundry, Forming and Welding, Tata McGraw Hill, 2008. 2. Mikell P. Groover, Introduction to Manufacturing Processes, Wiley Publication, September 2011, ©2012			
	Other References	3. A Ghosh and A K Mallik, Manufacturing Science, Wiley Eastern, 2010.			

COURSE ARTICULATION MATRIX

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
MEC232.1	3	2	1	1	1	1			2	1		1	2		
MEC232.2	3	2	1	1	2	1			2	1		2	2		
MEC232.3	3	2	1	1	1	1	2		2	1		2	2		
MEC232.4	3	2	1	1	1	1			2	1		1	2		
MEC232.5	3	2	1	1	2	1	2		2	1		1	2		
MEC232.6	3	2	1	1	1	1			2	1		1	2		
MEC229	3	2	1	1	2	1	2		2	1		1	2		

1-Slight (Low) **2-Moderate (Medium)** **3-Substantial (High)**

School: SSET		**Batch : 2023-2027**	
Programme: B.Tech		**Current Academic Year: 2023-2024**	
Branch: ME		**Semester: III**	
1	Course Code	MEC235	
2	Course Title	Introduction to Thermal Engineering - I	
3	Credits	3	
4	Contact Hours (L-T-P)	3-0-0	
	Course Status	Program Core	
5	Course Objective	To appreciate the rate processes connected with momentum and heat transfer and develop the ability to make first estimates of the rates.	
6	Course Outcomes	After the successful completion of course, students will be able to: CO1. Deal with pressure variation in static fluids and in manometers CO2. solve simple problems involving mass balance, momentum balance and energy balance CO3. Appreciate the mechanics of fluid-dynamic drag of bodies CO4. Solve conduction problems (including unsteady problems) in one-dimension CO5. Calculate the convective heat transfer in simple situations CO6. Solve problems of radiative exchange using circuit analogy.	
7	Course Description	The course introduces rate processes in fluid mechanics and in heat transfer. The course confines itself largely to be able to same simple estimates and use dimensionless parameters	
8	Outline syllabus		CO Mapping
	Unit 1	**Introduction/ Fluid Statics**	
	A	Fluid and its properties	CO1
	B	Pressure and forces variations in static fluids	CO1
	C	Manometry	CO1
	Unit 2	**Fluid kinematics and dynamics**	
	A	Field description, acceleration, and momentum balance	CO2
	B	mass balance and momentum balance	CO2
	C	Bernoulli equation, engineering energy equation	CO2
	Unit 3	**Drag on bodies**	
	A	Concept of boundary layer	CO3
	B	Variations of drag with shape of bodies and with speeds	CO3
	C	Magnus effect	CO3
	Unit 4	Heat Transfer basics	
	A	Fourier law and 1-D conduction.	CO4
	B	Fins	CO4

	C	Unsteady heat transfer			CO5
	Unit 5	**Convection and radiative heat transfer**			
	A	Basic ideas of convection. Forced convection			CO5
	B	Internal convection and free convection			CO5
	C	Basic concepts of radiation			CO6
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	Gupta and Gupta, Fluid Mechanics and Its Applications, New Age, 2018 Gupta, Elements of Heat Transfer, New Age 2021			
	Other References				

COURSE ARTICULATION MATRIX

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
MEC235.1	3	2	1	1	1	1			2	1		1	2		
MEC235.2	3	2	1	1	2	1			2	1		2	2		
MEC235.3	3	2	1	1	1	1	2		2	1		2	2		
MEC235.4	3	2	1	1	1	1			2	1		1	2		
MEC235.5	3	2	1	1	2	1	2		2	1		1	2		
MEC235.6	3	2	1	1	1	1			2	1		1	2		
MEC235	3	2	1	1	1	1	2		2	1		1	2		

1-Slight (Low) 2-Moderate (Medium) 3-Substantial (High)

School: SSET		**Batch : 2023-2027**
Programme: B. Tech		**Current Academic Year: 2023-2024**
Branch: ME		**Semester: III**
1	Course Code	MEC224
2	Course Title	Strength of Materials
3	Credits	4
4	Contact Hours (L-T-P)	3-1-0
	Course Status	Program Core
5	Course Objective	1. To develop the relationship between the loads applied to a non-rigid body and the internal stresses and deformations induced in the body. 2. To study the general state of stresses and strains in a given loaded member and the magnitude and direction of the principal stresses 3. To understand the different approaches to calculate slope and deflection for various types of beams. 4. To analyze the columns with different edge conditions.
6	Course Outcomes	After the successful completion of course, students will be able to: CO1: Apply the concept of stress and strain, elastic constants and constitutive relations to materials. CO2: Determine the stresses and deformations in members subjected to axial, flexural and torsional loads. CO3: Construct the shear force and bending moment diagram of various beams subjected to various loads. CO4: Evaluate slope and deflection in various beams subjected to various loads using different methods. CO5: Determine principal stresses and strains by locating principal planes under combined loading. CO6: analyse future design models
7	Course Description	This course is about the performance of deformable solids in various materials under the action of different kinds of loads. Thus the main objective of the course will be to show how to determine the stress, strain, and deflection suffered by structural elements when subjected to different loads. Understanding the adequacy of mechanical and structural elements under different loads is essential for the design and safe evaluation of any kind of structure.
8	Outline syllabus	
	Unit 1	**Loads and Stresses**
	A	Strain and stress, Hooke's law, Stress-strain diagram, Deformation of resisting forces, Stress at a point, Notations for stress: Double index notation, Stress in thin circular pressure vessel
	B	Stress produced in compound bars subjected to axial loading
	C	Thermal stress and strain calculations, Shear stresses and shear strain, Complementary shear stress
	Unit 2	**Strains and material properties**

	A	Fundamental strategy of mechanics of deformable mechanics			
	B	Statically indeterminate problems, Lateral strain: Poisson ratio			
	C	Shear strain , Tensile test			
	Unit 3	**Torsion and moments in beams**			
	A	Angle of twist to twisting moment, Stresses and strain in a circular shaft, Hollow shaft ,Statically indeterminate shafts			
	B	Beams: Types of supports, Types of beams and Types of loads and support, Sign convention, Determining shear force and bending moment			
	C	Method of drawing shear force and bending moment diagrams			
	Unit 4	**Stress in beam and deflection**			
	A	Pure bending, Simple bending theory and its application to beams of different sections, Relating curvature of beam to the bending moment			
	B	Beam deflection, Relation between slope, Deflection and radius of curvature			
	C	Differential equation for deflection of beams, Method of superposition.			
	Unit 5	**Combined stresses and strain & stability**			
	A	Plane stress , Transformation of plane stresses, Mohr circle, Principle plane , Principal stresses and Maximum shear stresses			
	B	Displacement and strain , Strain gauges , Strain rosettes, Criteria for failure			
	C	Introduction to stability of columns, Critical load of an elastic column, Effective length			
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	Gupta and Gupta, An Introduction to Mechanics of Materials , New Age, 2018 Gupta, Elements of Heat Transfer, New Age 2021			

COURSE ARTICULATION MATRIX

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
MEC230.1	3	3	1	1								2	2	2	
MEC230.2	3	3	1	1								2	2	2	
MEC230.3	3	3	1	1								1	2	2	
MEC230.4	3	3	1	1								1	2	2	
MEC230.5	3	3	1	1								1	2	2	
MEC230.6	3	3	1	1								1	2	2	
MEC224	3	3	1	1								1	2	2	

1-Slight (Low) 2-Moderate (Medium) 3-Substantial (High)

School: SSET		Batch: 2023-27
Programme: B.Tech		Current Academic Year: 2023-2024
Branch: ME		Semester: IV
1	Course Code	MEC238
2	Course Title	Mechanics of Machines
3	Credits	4
4	Contact Hours (L-T-P)	3-1-0
	Course Status	Program Core
5	Course Objective	1. To familiarize students with links, joints, and degrees of freedom to perform position, velocity and acceleration analysis of simple mechanisms using graphical and analytical methods 2. To teach the basics of synthesis of simple mechanisms. 3. To teach students the kinematic analysis of cam-follower motion and gear train configurations. 4. To understand the concepts of turning moment diagrams, flywheel design, and the dynamics of reciprocating engines. 5. To understand the balancing procedures for rotating and reciprocating masses, rotors, and engines. 6. To provide students an understanding of different types of governors and the effect of gyroscopic couples in various vehicles
6	Course Outcomes	After the successful completion of course, students will be able to: CO1: Perform the position, velocity and acceleration analysis of planar mechanisms using various graphical techniques. CO2: Formulate the dimension synthesis of simple linkage mechanisms and construct the various cam profiles for specified motions of followers CO3: Apply the principles of the gear profiles and analyze the various gear trains. CO4: Perform the dynamic force analysis of machines such as engines and punching machine. CO5: Apply principles of balancing in machines and control systems such as gyroscopes and governors. CO6: Formulate and analyze the linkage and cam-follower systems using graphical and analytical techniques.
7	Course Description	This course introduces students to involve in kinematics and dynamics study how a physical system might develop or alter over time and study the causes of those changes. The fundamental physical laws such as Newton's laws of motion and Kennedy's Instantaneous centers' theorem and basic mathematics such as vector algebra, graphical techniques, and Chebychev equations are applied to synthesize and analyze feature of the simple mechanisms which simulates the motions of various machines. Further, the

		course describes the requirement of balancing of the rotor in a single and two planes under static and dynamic conditions	
8	Outline syllabus		CO Mapping
	Unit 1	**Kinematic Analysis of plane mechanisms**	
	A	Mechanisms & Machines, Kinematic pairs, Kinematic chains and their classification, Kinematic Inversions of four-link planar mechanisms and mobility	CO1
	B	Aronhold Kennedy's theorem, Velocity analysis of simple four-bar mechanisms using Instantaneous Centres.	CO1
	C	Velocity and Acceleration Analysis of Four bar and crank slider & their inversions only (Graphical)	CO1
	Unit 2	**Synthesis of Linkages and Cam follower mechanisms**	
	A	Types of dimension synthesis, Function Generation (Four bar mechanisms): Fruedenstein's Analytical method using Cheybychev's Spacing	CO2, CO6
	B	Classification of followers and Cams, Description of follower movements, Analysis of follower motion.	CO2, CO6
	C	Synthesis of radial cam profile (Graphical Approach)	CO2, CO6
	Unit 3	**Gears mechanisms and Gear train**	
	A	Spur gear terminology and definitions, Basics of nonstandard gear teeth -Helical – Bevel – Worm - Rack and pinion gears	CO3
	B	Law of toothed and involute gearing, Gear tooth action - Interference and undercutting, Comparison of involute and cycloidal tooth forms	CO3
	C	Kinematic analysis in simple, compound and epicyclic gear trains	CO3
	Unit 4	**Dynamic Force Analysis and Turning Moment Diagram**	
	A	D'Alembert's principle, Dynamic force analysis of slider-crank mechanism excluding inertia of connecting rod. Piston and crank effort. Turning moment on the crankshaft	CO4, CO6
	B	Equivalent offset inertia force. Engine force analysis including inertia of connecting rod.	CO4, CO6
	C	Turning moment on the crankshaft, turning moment diagrams-single cylinder double acting steam engine, four-stroke IC engine and multi-cylinder steam engine, fluctuation of energy, flywheel.	CO4, CO6
	Unit 5	**Balancing of machines and motion control**	
	A	Balancing of several rotating masses in the different planes. Partial balancing of two-cylinder locomotives, the variation of tractive force, swaying couple, hammer blow.	CO5, CO6

	B	Terminology, centrifugal governors-Watt governor, Deadweight governors-Porter & Proell governor, Sensitivity, Stability, Hunting, Isochronism.			CO5, CO6
	C	Principles of gyroscopic torque. Effect of gyroscopic couple on the stability of airplanes and ships			CO5, CO6
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	1. Ghosh, A. and Mallik, A.K, Theory of Mechanisms and Machines, 1988.			
	Other References	2. Shigley, J.E. and Uicker, J.J., Theory of Machines and Mechanisms, McGraw Hill, 1980. 3. Paul, B., Kinematics, and Dynamics of Planar Mechanisms, Prentice-Hall, 1979. 4. Bevan, T.E., Theory of Machines, Pearson, 3rd edition, 2010. 5. Rattan, S.S., Theory of Machines, TMH, 4th edition, 2014. Software: – Working Model 2-D. (http://design simulation.com/WM2D/download.php), MATLAB Simulink.			

COURSE ARTICULATION MATRIX

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PS O2	PS O3
MEC238.1	3	3	3	-	-	-	-	-	-	-	-	2	1	1	-
MEC238.1.2	3	3	2	-	-	-	-	-	-	-	-	2	1	1	-
MEC238.1.3	3	3	3	-	-	-	-	-	-	-	-	2	1	1	-
MEC238.1.4	3	3	3	-	-	-	-	-	-	-	-	2	1	1	-
MEC238.1.5	3	3	3	-	-	-	-	-	-	-	-	2	1	1	-
MEC238.1.6	3	3	3	-	-	-	-	-	-	-	-	2	1	1	-
MEC238	**3**	**3**	**3**	-	-	-	-	-	-	-	-	**2**	**1**	**1**	-

1-Slight (Low) **2-Moderate (Medium)** **3-Substantial (High)**

School: SSET		Batch : 2023-2027	
Programme: B.Tech		**Academic Year:** 2023-2024	
Branch: ME		**Semester:** III	
1	Course Code	**ARP203**	
2	Course Title	**Logical Skills Building and Soft Skills**	
3	Credits	2	
4	Contact Hours (L-T-P)	1-0-2	
	Course Status	Active	
5	Course Objective	To enhance holistic development of students and improve their employability skills. To provide a 360-degree exposure to learning elements of Business English readiness program, behavioural traits, achieve softer communication levels and a positive self-branding along with augmenting numerical and altitudinal abilities. To step up skill and upgrade students across varied industry needs to enhance employability skills. By the end of this semester, a student will have entered the threshold of his/her 1st phase of employability enhancement and skill building activity exercise.	
6	Course Outcomes	After the successful completion of course, students will be able to: CO1: Ascertain a competency level through Building Essential Language and Life Skills CO2: Build positive emotional competence in self and learn GOAL Setting and SMART Goals techniques CO3: Apply positive thinking, goal setting and success-focused attitudes which would help them in their academic as well as professional career CO4: Acquire satisfactory competency in use of aptitude, logical and analytical reasoning CO5: Develop strategic thinking anddiverse mathematical concepts through building number puzzles CO6: Demonstrate an ability to apply various quantitative aptitude tools for making business decisions	
7	Course Description	This Level 1 blended training approach equips the students for Industry employment readiness and combines elements of soft skills and numerical abilities to achieve this purpose.	
8	Outline syllabus – ARP 203		
	Unit 1	**BELLS (Building Essential Language and Life Skills)**	**CO Mapping**
	A	*Know Yourself*: Core Competence. A very unique and interactive approach through an engaging questionnaire to ascertain a student's current skill level to design, architect and expose a student to the right syllabus as also to identify the correct TNI/TNA levels of the student.	CO1
	B	Techniques of Self Awareness | Self Esteem & Effectiveness|Building Positive Attitude | Building Emotional Competence	CO1, CO2
	C	Positive Thinking & Attitude Building | Goal Setting and SMART Goals – Milestone Mapping | Enhancing L S R W G	CO1, CO2,CO3

		and P (Listening Speaking Reading Writing Grammar and Pronunciation) | Verbal Abilities - 1	
	Unit 2	**Introduction to APTITUDE TRAINING- Reasoning- Logical/ Analytical**	
	A	Syllogism | Letter Series | Coding, Decoding , Ranking & Their Comparison Level-1	CO4
	B	Number Puzzles	CO5
	C	Selection Based On Given Conditions	CO5
	Unit 3	**Quantitative Aptitude**	
	A	Number Systems Level 1 | Vedic Maths Level-1	CO6
	B	Percentage ,Ratio & Proportion | Mensuration - Area & Volume |Algebra	CO6
	Weightage Distribution	*Class Assignment/Free Speech Exercises / JAM – 60% | Group Presentations/Mock Interviews/GD/ Reasoning, Quant & Aptitude – 40%*	
	Text book/s*	Wiley's Quantitative Aptitude-P Anand | Quantum CAT – Arihant Publications | Quicker Maths- M. Tyra | Power of Positive Action (English, Paperback, Napoleon Hill) | Streets of Attitude (English, Paperback, Cary Fagan, Elizabeth Wilson) The 6 Pillars of self-esteem and awareness – Nathaniel Brandon | Goal Setting (English, Paperback, Wilson Dobson	

COURSE ARTICULATION MATRIX

Cos	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1 0	PO1 1	PO1 2	PS O1	PSO 2	PSO 3
ARP203.1	-	-	-	-	1	-	-	-	1	3	-	2	-	-	-
ARP203.2	-	-	-	-	1	-	-	-	1	3	-	2	-	-	-
ARP203.3	-	-	-	-	1	-	-	-	1	3	-	2	-	-	-
ARP203.4	-	-	-	-	-	-	-	-	1	2	1	2	-	-	-
ARP203.5	1	-	-	-	-	-	-	-	1	2	1	2	-	-	-
ARP203.6	1	-	-	-	-	-	-	-	1	2	1	2	-	-	-
ARP203	1	-	-	-	-	-	-	-	1	2	1	2	-	-	-

1-Slight (Low) **2-Moderate (Medium)** **3-Substantial (High)**

School: SSET		Batch : 2023-2027
Programme: B. Tech.		**Academic Year:** 2023-2024
Branch: ME		**Semester: III**
1	Course Code	MEC234
2	Course Title	Research Methodology
3	Credits	2
4	Contact Hours (L-T-P)	2-0-0
	Course Status	Program Core
5	Course Objective	• To develop understanding of the basic framework of research process. • To develop an understanding of various research designs and techniques. • To identify various sources of information for literature review and data collection. • To develop an understanding of the ethical dimensions of conducting applied research. • Appreciate the components of scholarly writing and evaluate its quality.
6	Course Outcomes	After the successful completion of course, students will be able to: CO1: Infer the mind-set of a researcher CO2: Design a research plan CO3: Apply different methods for data collection CO4: Analyze the collected data CO5: Compile relevant data and prepare a report CO6: Infer the process of research right from inception of idea to execution and documentation.
7	Course Description	The course aims to develop a research orientation among the scholars and to acquaint them with fundamentals of research methods. Specifically, the course aims at introducing them to the basic concepts used in research and to scientific social research methods and their approach. It includes discussions on sampling techniques, research designs and techniques of analysis.

8	Outline syllabus				CO Mapping
	Unit 1	**Introduction**			
	A	Introduction to research – The role of research, research process overview			CO1
	B	Philosophies and the language of research theory building – Science and its functions, What is theory?, and The meaning of methodology			CO1,CO2
	C	Thinking like a researcher – Understanding Concepts, Constructs, Variables, and Definitions			CO1,CO2
	Unit 2	**Research Problem and Hypotheses**			
	A	Defining the research problem, The importance of problems			CO2,CO3
	B	Formulation of the research hypotheses, The importance of hypothesis			CO2,CO3
	C	Experimental and Non-experimental research design			CO2,CO3
	Unit 3	**Data Collection**			
	A	Field research, and Survey research			CO4,CO5
	B	Methods of data collection– Secondary data collection methods			CO4,CO5
	C	Methods of data collection– qualitative methods of data collection, and Survey methods of data collection			CO4,CO5
	Unit 4	**Data Analysis**			
	A	Attitude measurement and scaling – Types of measurement scales; Questionnaire designing – Reliability and Validity			CO5,CO6
	B	Sampling techniques – The nature of sampling, Probability sampling design, Non-probability sampling design, Determination of sample			CO5,CO6
	C	Processing and analysis of data			CO5,CO6
	Unit 5	**Report Writing**			
	A	Ethical issues in conducting research			CO6
	B	Report generation and report writing			CO6
	C	APA format – Title page, Abstract, Introduction, Methodology, Results, Discussion, References, and Appendices			CO6
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	• Chawla, Deepak & Sondhi, Neena (2011). Research methodology: Concepts and cases, Vikas Publishing House Pvt. Ltd. Delhi			

		• Bryman, Alan & Bell, Emma (2011). Business Research Methods (Third Edition), Oxford University Press.	
	Other References	• Kerlinger, F.N., & Lee, H.B. (2000). Foundations of Behavioural Research (Fourth Edition), Harcourt Inc. • Rubin, Allen & Babbie, Earl (2009). Essential Research Methods for Social Work, Cengage Learning Inc., USA.	

COURSE ARTICULATION MATRIX

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
MEC234.1				1						1	-	2	-	-	-
MEC234.2		1	1	1						2	-	2	-	-	-
MEC234.3		1		1				2		2	-	2	-	-	-
MEC234.4		1		1	1					1	1	2	-	-	-
MEC234.5		1		1				2	1	1	1	2	-	-	-
MEC234.6		1	1	2	1			2	1	2	1	2	-	-	-
MEC234		1	1	2	1			2	1	2	1	2			

1-Slight (Low) 2-Moderate (Medium) 3-Substantial (High)

School: SSET		**Batch : 2023-2027**	
Programme: B.Tech		**Current Academic Year: 2023-2024**	
Branch: ME		**Semester: III**	
1	Course Code	MEP 219	
2	Course Title	Manufacturing Technology – I Lab	
3	Credits	1	
4	Contact Hours (L-T-P)	0-0-2	
	Course Status	Program Core	
5	Course Objective	This course helps students to gain knowledge and possess a good understanding in diverse areas such as casting, welding processes and metal cutting process. After this course the students will be able • To understand the practical aspects of casting process. • To understand aspects of various Metal cutting processes • To understand aspects of welding operations.	
6	Course Outcomes	After the successful completion of course, students will be able to: CO1 – Demonstrate the mold making and casting process for a single piece pattern. CO2- Create a sand mold for a split pattern using casting process. CO3- Explain a drilling and boring process for a lathe machine. CO4- Make use of lathe machine to perform a threading operation. CO5- Illustrate a butt joint using arc welding and gas welding. CO6- Develop a specific product by using various manufacturing processes.	
7	Course Description	The course is designed to provide a basic understanding of traditional methods of materials processing such as casting, and metal cutting and joining used in product manufacturing. Through demonstrations and laboratory exposure, the student is given the applications of each process.	
8	Outline syllabus		CO Mapping
	List of Experiments		
	Experiment 1	Sand Mould Making and Casting for Single Piece Pattern	CO1
	Experiment 2	To prepare a sand mold, using the given split pattern	CO1

	Experiment 3	To perform a drilling and boring operation using lathe machine.			CO2
	Experiment 4	To perform a threading operation using lathe machine			CO3
	Experiment 5	To make a Butt joint using the given two M.S pieces by arc welding and gas welding.			CO3
	Experiment 6	To make piping joint by using Arc Welding.			CO3
	Experiment 7	To do the resharpening of single point cutting tool using grinding process			CO3
	Experiment 8	To prepare job on shaper involving plane surface.			CO4
					CO5
					CO6
	Mode of examination	Practical			
	Weightage Distribution	CA	CE	ETE	
		25%	25%	50%	
	Text book/s*	1. P.N. Rao, Manufacturing Technology: Foundry, Forming And Welding, Tata McGraw Hill, 2008.			
	Reference	Manuals provided in the lab			

COURSE ARTICULATION MATRIX

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
MEC 219.1	3	2	-	-	-	-	-	-	-	-	2	-	1	-	-
MEC 219.1.2	2	1	3	-	-	1	-	-	-	2	2	-	3	2	1
MEC 219.1.3	2	1	2	-	-	-	2	3	-	2	2	-	3	2	-
MEC 219.1.4	1	-	3	-	-	-	-	-	2	2	2	-	1	3	-
MEC 219.1.5	2	-	-	1	3	2	-	-	3	-	1	-	3	-	-
MEC 219.1.6	3	2	-	1	-	1	-	-	-	-	-	-	-	-	-
MEC 219.1	2	2	-	1	-	1	2	3	2	2	2	-	-	-	-
MEP 232	2	2	2	1	2	2	2	3	2	2	2	-	3	2	1

1-Slight (Low) **2-Moderate (Medium)** **3-Substantial (High)**

School: SSET		**Batch : 2023-2027**	
Programme: B.Tech		**2023-2024**	
Branch: ME		**Semester: III**	
1	Course Code	MEP235	
2	Course Title	Introduction to Thermal Science-I Laboratory	
3	Credits	1	
4	Contact Hours (L-T-P)	0-0-2	
	Course Status	Program Core	
5	Course Objective	To provide practical knowledge in verification of principles of fluid flow. To impart knowledge in measuring discharge and velocity of fluid flow To understand the major and minor losses Understand the concept of continuity and Bernoulli's equations	
6	Course Outcomes	After the successful completion of course, students will be able to: CO1: To analyse the uncertainty in experimental results CO2: To organize the contents of a lab notebook CO3: To use spreadsheets to make repeated calculations CO4: To experiment with manometers to determine pressure drops in various flow situations CO5: To interpret results of fluid mechanical experiments.	
7	Course Description	Introduction to fluid mechanics laboratory to understand physical processes more closely. Various apparatus are available in the laboratory like, Verification of Bernoulli's theorem apparatus, venturi & Orifice meters, orifice & mouth piece apparatus, Flow over notches apparatus to understand the concept of conservation of mass momentum and energy , head losses, condition of equilibrium and coefficient of discharge etc	
8	Outline syllabus		CO Mapping
	List of Experiments		
	Experiment 1	Determination of Reynolds number for a given flow	CO1-CO5
	Experiment 2	Determination of fluid viscosity	CO1-CO5
	Experiment 3	Determination of metacentric height of a flat bottomed vessel	CO1-CO5
	Experiment 4	Verification of Bernoulli's theorem	CO1-CO5
	Experiment 5	Flow measurement using venturimeter.	CO1-CO5
	Experiment 6	Flow measurement using orifice meter	CO1-CO5
	Experiment 7	Flow measurement using Pitot's tube	CO1-CO5
	Experiment 8	Determination of head loss in pipe due to sudden contraction, enlargement and elbow bend	CO1-CO5
	Experiment 9	Determination of co-efficient of friction for different pipes	CO1-CO5
	Experiment 10	Determination of drag on a sphere	CO1-CO5

	Mode of examination	Practical			
	Weightage Distribution	CA	CE	ETE	
		25%	25%	50%	
	Text book/s*	Lab manual handout			
	Software	EXCEL			

COURSE ARTICULATION MATRIX

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO215.1	2	2	-	-	-	-	-	-	-	-	-	2	1	-
CO215.2	1	1	-	2	-	-	-	-	-	-	-	2	1	-
CO215.3	1	2	-	-	-	-	-	-	-	-	-	2	1	-
CO215.4	1	2	1	2	-	-	-	-	-	-	-	2	1	-
CO215.5	1	2	1	2	-	-	--	-	-	-	-	2	1	-
MEP235	1	2	1	2	-	-	-	-	-	-	-	2	1	-

1-Slight (Low) **2-Moderate (Medium)** **3-Substantial (High)**

School: SSET		**Batch : 2023-2027**	
Programme: B.Tech		**Current Academic Year: 2023-2024**	
Branch: ME		**Semester: III**	
1	Course Code	MEP255	
2	Course Title	Solid Mechanics lab	
3	Credits	1	
4	Contact Hours (L-T-P)	0-0-2	
	Course Status	Program Core	
5	Course Objective	1. To familiarize students with various material test. 2.To provide students an understanding of different types of impact test 3. To teach the students about tensile and compression test. 4. To teach students about evaluation of torsional strength. 5. To provide students an understanding of different type of hardness test	
6	Course Outcomes	After the successful completion of course, students will be able to: CO1: Explain the principles of various material testing. CO2: Analyze the various impact test. CO3: Evaluate the torsional strength and modulus of rigidity of material. CO4: Demonstrate tension and compression test CO5: Evaluate hardness of different material by different methodology. CO6: Apply the concept of centre of gravity and centre of mass to solve problems and Compute coefficient static and dynamic friction between given surfaces.	
7	Course Description	This course introduces students about various material testing. The students get exposure of common material test like tensile test, compression test, impact test, hardness test.	
8	Outline syllabus		CO Mapping
	Experiment 1	To conduct the impact test on impact testing machine and find out the impact strength of mild steel specimen by CHARPY method and IZOD method	CO1,CO2
	Experiment 2	To find out the torsion strength and the modulus of rigidity of the material of the test rod.	CO1,CO3
	Experiment 3	To conduct a compressive test on CTM and determine the ultimate compressive strength of the given specimen	CO1,CO4

	Experiment 4	To conduct the hardness test on mild steel specimen and find out the hardness of material by Rockwell hardness test method			CO1,CO5
	Experiment 5	To conduct the hardness test on aluminium specimen and find out the hardness of material by Brinell hardness test method			CO1, CO5
	Experiment 6	To study the UTM and perform tensile test			CO1, CO4
	Experiment 7	To perform compression test on UTM.			CO1, CO4
	Experiment 8	To find out centre of gravity of different lamina.			CO6
	Experiment 9	To determine the coefficient of friction by inclined plane apparatus			CO6
	Experiment 10	To determine the coefficient of friction by belt-pulley apparatus			CO6
	Mode of examination	Practical			
	Weightage Distribution	CA	CE	ETE	
		25%	25%	50%	

COURSE ARTICULATION MATRIX

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
MEP255.1	1			2					3	1			1	1	
MEP255.2	1			2					3	1			1	1	
MEP255.3	1			2					3	1			1	1	
MEP255.4	1			2					3	1			1	1	
MEP255.5	1			2					3	1			1	1	
MEP255.6	1			2					3	1			1	1	
MEP255	1			2					3	1			1	1	

1-Slight (Low) 2-Moderate (Medium) 3-Substantial (High)

School: SSET		**Batch : 2023-2027**	
Programme: B.Tech		**Current Academic Year: 2023-2024**	
Branch: ME		**Semester: III**	
1	Course Code	MEP238	
2	Course Title	Mechanics of machines Lab	
3	Credits	1	
4	Contact Hours (L-T-P)	0-0-2	
	Course Status	Practical	
5	Course Objective	The course covers the procedures needed to develop the concepts related to precision measurement, inspection and analysis of dynamic behaviour of system	
6	Course Outcomes	After the successful completion of course, students will be able to: CO1: Classify the mechanisms used in the mechanical systems based on their kinematics. CO2: Analyze and select centrifugal governors based on the requirement and their characteristics. CO3: Demonstrate the gyroscopic effects in ships, aero-planes and road vehicles. CO4: Analyze balancing of masses in machinery. CO5: Demonstrate free and forced vibrations of single degree freedom systems CO6: Evaluate frequencies and modes of vibration of two rotor system.	
7	Course Description	The course covers the procedures needed to develop the concepts related to precision measurement, inspection and analysis of dynamic behavior of system	
8	Outline syllabus		CO Mapping
	List of Experiments		
	Experiment 1	To perform experiment to study and classify the mechanisms suitable for synthesizing machines.	CO1
	Experiment 2	To perform experiment on watt governor to prepare performance characteristics curve	CO2
	Experiment 3	To perform experiment on Porter governor to prepare performance characteristics curve	CO2
	Experiment 4	To perform experiment on Proell governor to prepare performance characteristics curve	CO2
	Experiment 5	Observation of gyroscopic behavior. And experimental justification of the equation C= I.ω.ωp for calculating the gyroscopic couple by observation and measurements of result for independent variation in applied couple C and precession ωp	CO3
	Experiment 6	To obtain balancing mass for the rotating mass system.	CO4

	Experiment 7	To study the longitudinal vibrations of helical spring and to determine the frequency or period of vibration (oscillation) theoretically and actually by experiment.			CO5
	Experiment 8	To determine the radius of gyration of compound pendulum using free vibration technique and compare with theoretical value.			CO5
	Experiment 9	To study the free vibration and to determine the natural frequency of vibration of two-rotor system.			CO5
	Experiment 10	To study whirling phenomenon in shaft and observe various modes of Vibrations under fixed end condition			CO6
	Mode of examination	Practical			
	Weightage Distribution	CA	CE	ETE	
		25%	25%	50%	
	Text book/s*	Handouts given by the instructor			
	Software	-			

COURSE ARTICULATION MATRIX

COS	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO3
MEP238.1	2	2							1			1	2	2	
MEP238.2	2	2							1			1	2	2	
MEP238.**3**	2	2							1			1	2	2	
MEP238.**4**	2	2							1			1	2	2	
MEP238.**5**	2	2							1			1	2	2	
MEP238.**6**	2	2							1			1	2	2	
MEP238	2	2							1			1	2	2	

1-Slight (Low) **2-Moderate (Medium)** **3-Substantial (High)**

School: SSET		**Batch : 2023-2027**
Programme: B.Tech		**Current Academic Year: 2023-2024**
Branch: ME		**Semester: III**
1	Course Code	MEP233
2	Course Title	Summer Internship I
3	Credits	2
4	Contact Hours (L-T-P)	0-0-4
	Course Status	Practical
5	Course Objective	To expose engineering students to the real industrial scenario, which is not possible in the classroom? Familiarize with various materials, processes, products and their applications along with relevant aspects of quality control and shop floor management. Understand the psychology of the workers and their habits, attitudes and approach to problem solving. Understand the social, economic and administrative considerations that influence the working environment of industrial organizations. Learn about team work, collaboration and leadership. Importance of time management, discipline, self-learning and effective communication. To apply the engineering knowledge in real industrial situations. To gain experience in writing reports in engineering works/projects. To enhance the employability of the students. Get exposed to the current technological developments relevant to the subject area to which the training pertains. To develop self-esteem for employment after graduation
6	Course Outcomes	After the successful completion of course, students will be able to: CO1: Infer the working environment of industry. CO2: Analyze the resources in practice. CO3: Apply Engineering Knowledge for Problem analysis CO4: Decide investigative procedure to sort out complex industrial problems CO5: Interpret the importance of working in a team CO6: Maximize his/her ability to make work related presentations.
7	Course Description	This practical course is intended to expose the students to real life scenario in industry with the intention to make them future ready for their professional role. In this, the students undergo in reputed Private / Public Sector / Government organization / companies for four weeks/one month in summer vacation after II semester. It is expected that the skills student gain via internship with an organization will help him/her perform better in the assigned job after graduation. Apart from this, the industrial internship enhances the chance for students to obtain employment after graduation. It is pertinent to mention that developing an awareness of general workplace behaviour and interpersonal skills are expected from students at the end of the Industrial internship. The student

		should be able relate, apply and adapt relevant knowledge and concepts within industrial ambience and ethics.	
8	Outline		CO Mapping
	A	**INTERNSHIP DIARY**	
		An internship diary is provided by the university for collecting the information during industrial internship on daily basis. It also helps the student for writing his/her report. The objective of maintaining daily diary is to cultivate the habit of documenting and encourage him/her to search for details. It develops the students' own thought process and reasoning abilities. The students should record in the daily training diary the day to day account of the observations, impressions and information gathered. It should contain the sketches & drawings related to the observations made by the students. On the basis of recorded data in the diary, the student will prepare a report.	CO1, CO2, CO3, CO5
	B	**INTERSHIP REPORT**	
		A student should learn about equipments, machines, plant layout and other industrial practices in industry. After collecting the information, one should prepare a comprehensive internship report at the end of one's internship to demonstrate what one has learnt in this period. Daily diary will facilitate to a great extent in writing the report. It is mandatory for the student to submit a hard copy of report to one's assigned coordinator for corrections and subsequently, submitting a final spiral bound copy to department. The assigned coordinator will check the followings things in the draft submitted by the student: Report is made as per the format approved by the department. Originality of the report Very adequate and purposeful write-up. Organization, drawings, sketches, format, style, language, fig no, table no and references etc. Variety and relevance of learning experience. After doing correction the corrected copies will be submitted at the time of presentation, duly signed by the faculty coordinator and Head of Department.	CO6
	C	**INDUSTRIAL INTERNSHIP EVALUATION PROCESS**	
		The Industrial Internship Evaluation is done in the presence of assigned Department Faculty coordinator	CO4, CO6

		and External Examiner, duly approved by The controller of Examination. The evaluation process includes a seminar presentation and viva-voce, done on the basis of following criteria. The Power Point Presentation Proper Planning of Presentation Effectiveness of Presentations Depth of knowledge and skills. Records in which internship diary and reports are analyzed along with presentation and viva voce	
	Mode of examination	Practical	

COURSE ARTICULATION MATRIX

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
MEP233.1	0	0	0	0	0	1	3	1	0	0	0	2	2	2	2
MEP233.2	0	0	0	0	0	0	2	0	0	0	0	2	2	2	2
MEP233.3	0	0	0	0	0	2	1	0	0	0	0	2	2	2	2
MEP233.4	0	0	0	0	0	2	0	0	0	0	0	2	2	2	2
MEP233.5	0	0	0	0	0	0	1	1	0	0	0	2	2	2	2
MEP233.6	0	0	0	0	0	0	0	0	0	2	0	3	3	3	3
MEP233	0	0	0	0	0	2	1	1	0	1	0	2	2	2	2

1-Slight (Low) **2-Moderate (Medium)** **3-Substantial (High**

School: SSET		**Batch : 2023-2027**	
Programme: B.Tech		**Current Academic Year: 2023-2024**	
Branch: ME		**Semester: III**	
1	Course Code	**MEP231**	
2	CourseTitle	Project Based Learning -1	
3	Credits	2	
4	Contact Hours (L-T-P)	0-0-4	
	Course Status	Practical	
5	Course Objective	• To align student's skill and interests with are a listic problem or project • To understand the significance of problem and its scope • Students will make decisions within a framework	
6	Course Outcomes	After the successful completion of course, students will be able to: CO1: Identify and formulate problem statement with systematic approach. CO2: Develop teamwork and problem-solving skills, along with the ability to communicate effectively with others. CO3: Design the problem solution as per the problem statement framed. CO4: Classify and understand techniques for software verification and validation of project successfully. CO5: Fabricate and implement the solution by using different aspects of programming language. CO6: Develop a glory of the need to engage in life-long learning.	
7	Course Description	In PBL-1, the students will learn how to define the problem for developing projects, identifying the skills required for developing the project based on given a set of specifications and all subjects of that Semester.	
8	Outline syllabus		CO Mapping
	Unit 1	Problem Definition, Team/Group formation and Project Assignment. Finalizing the problem statement, resource requirement, if any.	CO1, CO2
	Unit 2	Develop a work flow or block diagram for the proposed System / software.	CO2,CO3
	Unit 3	Design algorithms for the proposed problem.	CO3
	Unit 4	Implementation of work under the guidance of a faculty member and obtain the appropriate results.	CO3, CO4
	Unit 5	Demonstrate and execute Project with the team. Validate and verify the project modules.	CO4, CO5, CO6

		Report should include Abstract, Hardware/Software Requirement, Problem Statement, Design/Algorithm, Implementation Detail. Validation Reports. References if any. The presentation, report, work done during the term. Supported by the documentation, forms the basis of assessment.			
	Mode of examination	Practical /Viva			
	Weight age Distribution	CA	CE	ETE	
		25%	25%	50%	

COURSE ARTICULATION MATRIX

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
MEP231.1	3	3	-	3	-	-	-	-	3	3	2	3	2	2	1
MEP231.2	3	2	-	3	-	-	2	-	3	3	2	3			1
MEP231.3	3	2	-	-	2	-	-	-	3	3	2	3	2	2	
MEP231.4	3	3	-	-	-	2	-	-	3	3	2	3		2	
MEP231.5	3	3	2	2	2	2	3	3	3	3	2	3	2	2	
MEP231.6	3	3	-	3	-	-	-	-	3	3	2	3			1
MEP231	3	3	2	3	2	2	2	3	3	3	2	3	2	2	1

1-Slight (Low) **2-Moderate (Medium)** **3-Substantial (High)**

School: SSET		**Batch : 2023-2027**	
Programme: B.Tech		**Current Academic Year: 2023-2024**	
Branch: ME		**Semester: IV**	
1	Course Code	MEC342	
2	Course Title	Manufacturing Technology-II	
3	Credits	3	
4	Contact Hours (L-T-P)	3-0-0	
	Course Status	Program Core	
5	Course Objective	1. The objective of this course is to understand the basic mechanism of metal removal and selection of appropriate tool material for machining. 2. To understand the process parameters and their effects on the performance of various machining operations.	
6	Course Outcomes	After the successful completion of course, students will be able to: CO1:Apply the basic principles in metal cutting according to the need along with selection of the appropriate tool nomenclature for performing different machining operations. CO2:select of different characteristics of the materials through chip morphology CO3: Analyse the different forces during various cutting conditions. CO4:Identify and select the appropriate material for different types of machining and recognize different types of tool wear and the reasons behind that. CO5: Design and select the tools in different circumstances and understand machinability as well as economics of machining CO6: Demonstrate knowledge of various machine tools and machining operations that can be performed on them.	
7	Course Description	This course introduces students to the concept and basic mechanics of metal cutting, working of standard machine tools such as lathe, shaping and allied machines, milling, drilling and allied machines, grinding and allied machines and broaching. To make students understand the basic concepts of traditional machining processes, tool life, wear and tear and economics of machining.	
8	Outline syllabus		CO Mapping
	Unit 1	**Deformation and Cutting of Metals**	
	A	Elastic and Plastic deformation.	CO1
	B	Tool Nomenclature: Single Point cutting tool- Signification of the various angle of cutting tool and nose radius, tool nomenclature: Tool on hand, ASA & ORS.	CO1
	C	Nomenclature of drills, Milling cutters and broaches.	CO1
	Unit 2	**Mechanics of Metal Cutting**	

	A	Need for chip breaker, Mechanism of Formation of chips-types of chips and the condition conducive for the formation of each type-built-up edge, its effects			CO2
	B	Orthogonal Vs oblique cutting, Merchant's circle diagram-Force and velocity relationship, shear plane angle,			CO2
	C	Energy consideration in machining-Ernst Merchants theory of shear angle relationship.			CO2
	Unit 3	**Cutting Forces in Machining**			
	A	Forces in turning, drilling, milling.			CO3
	B	Forces in Grinding, Conventional Vs climb milling, Specific cutting force			CO3
	C	Introduction of tools dynamometer- construction and principle of operation of tools dynamometer for turning, drilling and milling based on tool deflection, tool deformation and pressure.			CO4
	Unit 4	**Tool Materials , Tools Wear and Tool life**			
	A	Requirement of tool materials- advances in tool materials-HSS,PM, HSS, coated HSS, carbides and coated carbides, ceramic, cold pressed, hot pressed, ceramic composites,			CO1,CO5
	B	CBN, Diamond properties, advantages and limitation- ISO specification for inserts and tools holders, Different kinds of Tool Wear and prevention techniques.			CO1,CO5
	C	Tool life, Machinability, economics of machining.			CO1,CO5
	Unit 5	**Machine Tools and operations**			
	A	Machining operation perform by - Lathe, Milling, shaping, slotting, planning, Drilling, Boring, Broaching, Grinding (cylindrical, surface, center less),			CO6
	B	Thread rolling and gear cutting machining.Machining on capstans and Turret lathe.			CO6
	C	Micro finishing operations like honing lapping, super finishing			CO6
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	1. A Ghosh and A K Mallik, Manufacturing Science, Wiley Eastern, 2010.			
	Other References	1) H.M.T, "Production Technology" 1st Edition, Tata Mc GrawHill Publishing Co.Ltd, 2008. 2) Introduction to machining Science by G.K Lal , New Age International (P) Limited 3) Mikell P. Groover, Introduction to Manufacturing Processes, Wiley Publication, September 2011, ©2012			

COURSE ARTICULATION MATRIX

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
MEC.1	3	-	-	-	-	-	-	-	-	-	-	1	3	2	2
MEC.2	3	3	3	-	-	-	-	-	-	-	-	1	2	1	2
MEC.3	3	3	3	-	-	-	-	-	-	-	-	1	2	1	2
MEC.4	3	-	-	-	-	-	-	-	-	-	-	1	2	1	2
MEC.5	3	-	-	-	2	-	-	-	-	-	-	1	1	1	2
MEC.6	3	-	-	-	2	-	-	-	-	-	2	1	1	3	2
MEC342	3	3	3	-	2	-	-	-	-	-	2	1	2	2	2

1-Slight (Low) **2-Moderate (Medium)** **3-Substantial (High**

School: SSET		**Batch: 2023-2027**	
Programme: B.Tech		**Current Academic Year: 2023-2024**	
Branch: ME		**Semester: IV**	
1	Course Code	MEC237	
2	Course Title	Introduction to Thermal Engineering-II	
3	Credits	3	
4	Contact Hours (L-T-P)	3-0-0	
	Course Status	Program Core	
5	Course Objective	1) To comprehend the fundament as of thermodynamics and be able to apply the same in Thermal Systems 2) Understand and analyse the Refrigeration Systems	
6	Course Outcomes	After the successful completion of course, students will be able to: CO1: apply first law to simple thermodynamic systems. CO2: apply the concepts of entropy to simple thermodynamic systems CO3: determine the efficiency of various simple thermodynamic cycles CO4: calculate simple refrigeration cycles CO5: make simple pshychrometric calculations CO6: Recommend a Refrigeration System.	
7	Course Description	The course teaches Thermodynamics and various Refrigeration Systems.	
8	Outline syllabus		CO Mapping
	Unit 1	**Energy and first law**	
	A	Thermodynamic properties and state, cycles, systems and processes, Path and point functions, Thermodynamic equilibrium,	CO1
	B	Zeroth law, Thermometry. First law applied to closed systems and in various process	CO1
	C	1st law of thermodynamic for steady flow process.Application of 1st law thermodynamics	CO1
	Unit 2	**Second law**	
	A	Kelvin-Planck and Clausius statements,Heat engines and heat pumps, Efficiency and COP	CO2
	B	Carnot Engine and Carnot cycle	CO2
	C	Clausius Inequality, Principle of entropy, Available energy, Availability.	CO2
	Unit 3	**Steam properties and thermodynamic cycle. Psychrometry**	
	A	Steam generation, Use of steam table	CO3
	B	Dryness fraction measurement, PVT surface	CO3

	C	Otto cycle, Diesel cycle, Sterling cycle, Brayton cycle and Rankine cycle, Rankine cycle with regeneration.			CO4
	Unit 4	**Refrigeration**			
	A	Refrigeration by non-cyclic process, vapour Compression Refrigeration Cycle			CO5
	B	Performance and Capacity of a vapour Compression Plan, Psychrometry, Heat load estimation			CO5
	C	Actual Vapour Compression Cycle, Components in a Vapour Compression Plant			CO5
	Unit 5	**Refrigeration Applications**			
	A	Multi-stage Vapour Compression Systems, Refrigerants,			CO5
	B	Absorption Refrigeration Cycle,Claude System of Air Liquefaction, Production of Solid Ice			CO6
	C	New technologies in refrigeration.			CO6
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	Engineering Thermodynamics: P.K.Nag Thermal Engineering: R.K.Rajput			

COURSE ARTICULATION MATRIX

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
MEC237.1	3	2	0	1	0	0	0	0	1	0	0	3	2	2	0
MEC237.2	3	2	0	1	0	0	0	0	1	0	0	3	2	2	0
MEC237.3	3	2	0	1	0	0	0	0	1	0	0	3	2	2	0
MEC237.4	3	2	0	1	0	0	0	0	1	0	0	3	2	2	0
MEC237.5	3	2	0	1	0	0	0	0	1	0	0	3	2	2	0
MEC237.6	3	2	0	1	0	0	0	0	1	0	0	3	2	2	0
MEC237	3	2	0	1	0	0	0	0	1	0	0	3	2	2	0

1-Slight (Low) 2-Moderate (Medium) 3-Substantial (High)

School: SSET		**Batch : 2023-2027**
Programme: B.Tech		**Current Academic Year: 2023-2024**
Branch: ME		**Semester: IV**
1	Course Code	MEC322
2	Course Title	Machine Design
3	Credits	4
4	Contact Hours (L-T-P)	3-1-0
	Course Status	Program Core
5	Course Objective	1: Develop an ability to apply knowledge of mathematics, science, and engineering 2: To develop an ability to design a system, component, or process to meet desired needs within realistic constraints. 3: To develop an ability to identify, formulate, and solve engineering problems. 4: To develop an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.
6	Course Outcomes	After the successful completion of course, students will be able to: CO1: Explain detail procedure, theory of failure and use of factor of safety in design of machine element CO2: Apply concept of stress concentration, Notch sensitivity and Goodman- Soderberg criteria for design of component CO3: Examine stress and design shaft and key in various load situation CO4:Evaluate stress and design riveted joint, bolted joint and springs under various load condition CO5: Evaluate various load in bearing, select suitable bearing and calculate various design parameter of bearing. CO6: Analyse the stresses and strains induced in a machine element.
7	Course Description	Machine design studies the conversion of one type of motion to another. Along with the change in the type and direction of motion, the rotational speed and torque may also change. This course begins with

		a review and further development of stress analysis (statics). At that point, specific components of machines, such as shafts and bearings and belts, chains and gears will be addressed.	
8	Outline syllabus		CO Mapping
	Unit 1	**Introduction and Design against Static Load**	
	A	Design requirements of machine elements, Design procedure, Standards in design, Selection of preferred sizes	CO1
	B	Modes of failure, Factor of safety, Principal stresses	CO2,CO6
	C	Stresses due to bending and torsion, Theory of failure	CO1, CO6
	Unit 2	**Design against Fluctuating Loads**	
	A	Cyclic stresses, Fatigue and endurance limit, Stress concentration factor, Stress concentration factor for various machine parts,	CO2,CO6
	B	Notch sensitivity, Design for finite and infinite life, Soderberg, Goodman & Gerber criteria	CO2,CO6
	C	Shafts subjected to fatigue loads, Design for rigidity	CO3,CO6
	Unit 3	**Shafts, Keys and couplings**	
	A	Cause of failure in shafts, Materials for shaft, Stresses in shafts	CO3,CO6
	B	Design of shafts subjected to twisting moment, bending moment and combined twisting and bending moments	CO3, CO6
	C	Types of keys, splines, Selection of square & flat keys, Strength of sunk key	CO3, CO6
	Unit 4	**Fasteners and Springs**	
	A	Threaded joints, Basic types of screw fastening, Design of bolted joint	CO4,CO6
	B	Riveted joints, Types of failure, Caulking & fullering, Design of riveted joints	CO4,CO6
	C	Types of springs, Terminology of helical springs, styles of end, spring materials, Design of helical springs against static and loads	CO4,CO6
	Unit 5	**Rolling Contact Bearing and Sliding Contact Bearing**	
	A	Bearings, Types of Rolling contact bearings, Selection of bearing types, Static load carrying capacity, Stribeck's equation	CO5,CO6
	B	Dynamic load carrying capacity, Equivalent bearing load, Load life relationship	CO5,CO6

	C	Basic modes of lubrication, Hydrostatic step bearing, Bearing design, comparison of rolling and sliding contact bearings			CO5,CO6
	Mode of examination	**Theory**			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	1)Bhandari, V.B.,"Design of Machinery" Tata McGraw Hill Publications, 2010			
	Other References	1) Shigley, J.O., "Mechanical Engineering Design" , McGraw Hill Publishers, 2004 2) Norton, R.L., "Machine Design an Integrated Approach", Prentice Hall publishers, 2006 3) Download MIT Calc for Shaft, Bearing and Spring design from http://www.mitcalc.com/en/download.htm			

COURSE ARTICULATION MATRIX

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
MEC 331.1	3	3	3	-	-	-	-	-	-	-	-	2	1	1	-
MEC 331.2	3	3	2	-	-	-	-	-	-	-	-	2	1	1	-
MEC 331.3	3	3	3	-	-	-	-	-	-	-	-	2	1	1	-
MEC 331.4	3	3	3	-	-	-	-	-	-	-	-	2	1	1	-
MEC 331.5	3	3	3	-	-	-	-	-	-	-	-	2	1	1	-
MEC 331.6	3	3	3	-	-	-	-	-	-	-	-	2	1	1	-
MEC322	3	3	3	-	-	-	-	-	-	-	-	2	1	1	-

1-Slight (Low) **2-Moderate (Medium)** **3-Substantial (High)**

School: SSET		**Batch : 2023-2027**	
Programme: B.Tech		**Academic Year:** 2023-2024	
Branch: ME		**Semester:** IV	
1	Course Code	**ARP204**	
2	Course Title	**Quantitative and Qualitative Aptitude Skill Building**	
3	Credits	2	
4	Contact Hours (L-T-P)	1-0-2	
	Course Status	Active	
5	Course Objective	To enhance holistic development of students and improve their employability skills. Provide a 360 degree exposure to learning elements of Business English readiness program, behavioural traits, achieve softer communication levels and a positive self-branding along with augmenting numerical and altitudinal abilities. To up skill and upgrade students' across varied industry needs to enhance employability skills. By the end of this semester, a will have entered the threshold of his/her 2nd phase of employability enhancement and skill building activity exercise.	
6	Course Outcomes	After the successful completion of course, students will be able to: CO1: Develop and deliver the effective presentations to interpret the deeper meaning of life. CO2: Improve listening skills so as to understand complex business communication in a variety ofglobal English accents through proper pronunciation CO3: Demonstrate a good understanding of effective business writing and telephone handling Skills CO4: Acquire higher level competency in use of aptitude, logical and analytical reasoning CO5: Develop higher level strategic thinking and diverse mathematical concepts through building number puzzles CO6: Demonstrate higher level quantitative aptitude tools for making business decisions	
7	Course Description	This course bundle allows students to build vision, mission and strategy statements while exposing them to various models of communication along with MTI reduction and the 2nd level of quant, aptitude and reasoning abilities	
8	Outline syllabus – ARP204		CO MAPPING
	Unit 1	**Communicate to Conquer**	
	A	VMOSA (Vision, Mission, Values and Ethics)|Business Communication - Verbal Communication Skills | Barriers in communication |Basics of effective communication – PRIDE & STAR Model	CO1
	B	Different styles of communication & style flexing (Based on the 4 social styles-Analytical, Driving, Expressive, Amiable) | Importance of Listening	CO2

		& practice of Active Listening |The Art of Giving Feedbacks| Feedback Skills | Asking fact finding questions- Probing Skills	
	C	Email Etiquette | Business Writing Skills|Telephone Etiquette Skills (Telephone Handling Skills) |Non Verbal Communication-Kinesthetics, Proxemics, Paralanguage | MTI Reduction Program | Verbal Abilities - 2	CO3
	Unit 2	**Introduction to APTITUDE TRAINING- Reasoning- Logical/ Analytical**	
	A	Coding Decoding , Ranking & Their Comparison Level-2	CO4
	B	Series, Blood Relations & Number Puzzle	CO5
	Unit 3	**Quantitative Aptitude**	
	A	Number System Level 2	CO5
	B	Vedic Maths Level-2 | Probability | Permutation & Combination	CO6
	C	Percentage, Profit & Loss ,Partnership,Simple Interest & Compound Interest	CO6
	Weightage Distribution	*(CA)Class Assignment/Free Speech Exercises / JAM – 60% | (ETE) Group Presentations/Mock Interviews/GD/ Reasoning, Quant & Aptitude – 40%*	
	Text book/s*	Wiley's Quantitative Aptitude-P Anand | Quantum CAT – Arihant Publications | Quicker Maths- M. Tyra | Power of Positive Action (English, Paperback, Napoleon Hill) | Streets of Attitude (English, Paperback, Cary Fagan, Elizabeth Wilson) The 6 Pillars of self-esteem and awareness – Nathaniel Brandon | Goal Setting (English, Paperback, Wilson Dobson	

COURSE ARTICULATION MATRIX

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ARP204.1	-	-	-	-	-	-	-	-	1	2	1	2	-	-	-
ARP204.2	-	-	-	-	-	-	-	-	1	2	1	2	-	-	-
ARP204.3	-	-	-	-	-	-	-	-	1	2	1	2	-	-	-
ARP204.4	-	-	-	-	-	-	-	-	1	2	1	2	-	-	-
ARP204.5	1	-	-	-	-	-	-	-	1	2	1	2	-	-	-
ARP204.6	1	-	-	-	-	-	-	-	1	2	1	2	-	-	-
ARP204	1	-	-	-	-	-	-	-	1	2	1	2	-	-	-

1-Slight (Low) **2-Moderate (Medium)** **3-Substantial (High)**

School: SSET		**Batch: 2023-2027**	
Programme: B. Tech.		**Current Academic Year: 2023-2024**	
Branch: ME		**Semester: IV**	
1	Course Code	MEC241	
2	Course Title	Entrepreneurship	
3	Credits	2	
4	Contact Hours (L-T-P)	2-0-0	
	Course Status	**Program Core**	
5	Course Objective	Entrepreneurship plays an influential role in the economic growth and development of the country. As the world economy is changing so is the dynamism of the business world. The aim of this course is to instil and kindle the spirit of Entrepreneurship amongst students. The idea of this course is to create "job providers rather than job seekers".	
6	Course Outcomes	After the successful completion of course, students will be able to: CO1: Describe the evolution of Entrepreneurship and its role in economic development CO2: Identify the factors that influence the emergence of Entrepreneurship CO3: Construct a business plan CO4: Choose the best way to manage capital, inventory and human resource while setting up a business CO5: Estimate the growth of a business and recommend measures to combat industrial sickness CO6: Identify and solve the problems present in the society	
7	**Outline syllabus**		**CO Mapping**
	Unit 1	**Introduction to Entrepreneurship**	**CO1**
	A	Meaning, Definition and concept of Enterprise, Entrepreneurship and Entrepreneurship Development, Evolution of Entrepreneurship	CO1
	B	Characteristics of Entrepreneurship, Concepts of Intrapreneurship, Entrepreneur v/s Intrapreneur	CO1
	C	Role of Entrepreneurship in Economic Development, Factors affecting Entrepreneurship, Problems of Entrepreneurship	CO1, CO6
	Unit 2	**Entrepreneurial Environment**	**CO2**
	A	Internal and external factors that influence emergence of Entrepreneurship	CO2
	B	Definition and Types of Ownership, Cooperatives and Joint Stock Company	CO2
	C	Government Policies for Small Scale Entrepreneurs- New Small Enterprise Policy 1991, Micro, Small & Medium Enterprises Development (MSMED) Act 2006	CO2, CO6
	Unit 3	**Preparation of Business Plan**	**CO3**
	A	Meaning of Project, Project classification and identification, Project objective, Internal and external constraints	CO3
	B	Project life cycle, Formulation of a Project- Need, Concept, Significance	CO3

	C	Elements of Project Formulation- Feasibility analysis, Techno-economic analysis, Project design and network analysis, Input analysis, Financial analysis, Social cost-benefit analysis, Project Appraisal			CO3, CO6
	Unit 4	**Setting Up Small Business Enterprises**			**CO4**
	A	Working capital management, Inventory management			CO4, CO6
	B	Human resource mobilization, production and operation management, Marketing and channel selection			CO4, CO6
	C	Growth strategies, Product launching, Incubation, Venture capital			CO4, CO6
	Unit 5	**Management of Small Business Enterprises**			**CO5**
	A	Stages of growth, Expansion, Diversification, Joint venture, Merger, Sub-contracting			CO5
	B	Industrial sickness: Path, signals, cause and consequence, Measures to combat industrial sickness			CO5
	C	Introduction to Industry 4.0 and Case Studies based on Role of Industry 4.0			CO5, CO6
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	1. Entrepreneurial Development by Dr S S Khanka, S Chand & Company Ltd 2. Entrepreneurship Development & Small Business Enterprises by Poornima M Charantimath, Pearson. 3. Lall & Sahai: Entreprenurship (Excel Books 2 edition) Couger, C-Creativity and Innovation (IPP, 1999)			

CO and PO Mapping

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	-	-	-	1	1	-	1	-	1	2
CO2	-	-	-	-	-	1	1	-	-	-	-	-
CO3	-	2	1	2	1	-	-	-	-	2	-	1
CO4	-	-	1	1	-	-	-	-	1	-	1	1
CO5	-	-	-	-	-	-	-	-	1	-	2	1
CO6	-	1	2	2	1	1	1	-	2	1	2	2
CO	-	1	1	2	1	1	1	-	1	1	1	1

1-Slight (Low) **2-Moderate (Medium)** **3-Substantial (High)**

School: SSET		**Batch : 2023-2027**	
Programme: B .Tech		**Current Academic Year: 2023-2024**	
Branch: ME		**Semester: IV**	
1	Course Code	**BTY223**	
2	Course Title	**INTRODUCTION TO BIOLOGY FOR ENGINEERS**	
3	Credits	2	
4	Contact Hours (L-T-P)	2-0-0	
	Course Status	**Program Core**	
5	Course Objective	1. To acquire a fundamental knowledge of Biomolecules, genetics, immunology. 2. To understand the different concepts of plant animal and microbial systems. 3. To understand basic concepts of bioremediation and biofetilizers.	
6	Course Outcomes	After the successful completion of course, students will be able to: CO1: To understand the fundamentals of living things, their classification, cell structure and biochemical constituents. CO2: To apply the concept of plant, animal and microbial systems and growth in real life situations. CO3: To comprehend genetics and the immune system. CO4 To know the cause, symptoms, diagnosis and treatment of common diseases. CO5: To give a basic knowledge of the applications of biological systems in relevant industries. CO6: Discuss various aspects of biological systems and their significance in design of products.	
7	Course Description	Students will be introduced to the functions and interactions of biological systems from a quantitative perspective. To provide a foundation in biology with engineering of living systems and to apply various tools of traditional engineering fields. To harness potential of living systems for the benefit of human mankind.	
8	Outline syllabus		CO Mapping
	Unit 1	**UNIT I: INTRODUCTION TO LIFE**	
	A	Characteristics of living organisms	CO1, CO2
	B	Cell theory	
	C	Structure of prokaryotic and eukaryotic cell	
	Unit 2	**UNIT II: Biomolecules**	
	A	General classification and important functions of carbohydrates and lipids	
	B	General classification and important functions of proteins	CO1, CO3
	C	General classification and important functions of DNA and RNA	
	Unit 3	**UNIT III: Genetics and Immune system**	
	A	Theories of Evolution	CO4 and CO6
	B	Mendel's laws of inheritance	
	C	Immune system and Immunity	
	Unit 4	**UNIT IV: Human Diseases**	
	A	Genetic diseases and Infectious diseases	CO5

	B	AIDS and Diabetes			
	C	Cancer and its causes			
	Unit 5	**UNIT V: Biology and its industrial application**			
	A	Vaccines and their types			CO5 and CO6
	B	Bioremediation and Biofertilizers			
	C	Bioreactors			
	Mode of examination	**Theory**/Jury/Practical/Viva			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	1. Karp, G. *Cell and Molecular Biology, 5th ed.*, John Wiley and Sons, Inc.			
	Other References	1. Alberts, B. et al. *Essential Cell Biology*, Garland Publishing, Inc. (ISBN: 081533480X) 4. 2. Berger, S. et al. *Introduction to Bioengineering*, Oxford University Press (ISBN: 978-0-19-856515-4)			

COURSE ARTICULATION MATRIX

Cos	PO 1	PO 2	PO 3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO **BTY223**.1	3	2	2	-	-	-	-	-	-	-	3	3	1	-	-
CO **BTY223**.2	3	3	3	-	-	-	-	-	-	-	3	3	1	-	-
CO **BTY223**.3	3	3	3	-	-	-	-	-	-	-	3	3	1	-	-
CO BTY223.4	3	3	3	-	-	-	-	-	-	-	3	3	1	-	-
CO BTY223.5	3	1	1	-	-	-	-	-	-	-	3	3	1	-	-
CO **BTY223**.6	3	2	2	-	-	-	-	-	-	-	3	3	1	-	-
CO **BTY223.7**	3	2	2								3	3	1		
BTY223	3	2	2	-	-	-	-	-	-	-	3	3	1	-	-

1-Slight (Low) **2-Moderate (Medium)** **3-Substantial (High)**

School: SSET		**Batch : 2023-2027**	
Programme: B.Tech		**Current Academic Year: 2023-2024**	
Branch: ME		**Semester: IV**	
1	Course Code	**MEP232**	
2	CourseTitle	Project Based Learning -2	
3	Credits	2	
4	Contact Hours (L-T-P)	0-0-4	
	Course Status	Practical	
5	Course Objective	1. To align student's skill and interests with area listic problem or project 2. To understand the significance of problem and its scope 3. Students will make decisions within a framework	
6	Course Outcomes	After the successful completion of course, students will be able to: CO1: Create better work habits towards learning CO2: Take part in brain storming activities CO3: Formulate their goals and objectives towards the research problem CO4: Improve their soft skills like communication, presentation etc. CO5: Evaluate the extent to which goals are achieved CO6: Make use of Technology to convert ideas into products	
7	Course Description	In PBL-2, the students will learn how to define the problem for developing projects, identifying the skills required for developing the project based on given a set of specifications and all subjects of that Semester.	
8	Outline syllabus		CO Mapping
	Unit 1	Problem Definition, Team/Group formation and Project Assignment. Finalizing the problem statement, resource requirement, if any.	CO1, CO2
	Unit 2	Develop a work flow or block diagram for the proposed system / software.	CO2,CO3
	Unit 3	Design algorithms for the proposed problem.	CO3
	Unit 4	Implementation of work under the guidance of a faculty member and obtain the appropriate results.	CO3, CO4
	Unit 5	Demonstrate and execute Project with the team. Validate and verify the project modules.	CO4, CO5, CO6
		Report should include Abstract, Hardware/Software Requirement, Problem Statement, Design/Algorithm, Implementation Detail. Validation Reports. References if any. The presentation, report, work done during the term Supported by the documentation, forms the basis of assessment.	
	Mode of examination	Practical /Viva	

	Weight age Distribution	CA		ETE	
		50%		50%	

COURSE ARTICULATION MATRIX

COS	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO2	PSO3
MEP232.1	3	3	-	3	-	-	-	-	3	3	2	3	2	2	1
MEP232.2	3	2	-	3	-	-	2	-	3	3	2	3			1
MEP232.3	3	2	-	-	2	-	-	-	3	3	2	3	2	2	
MEP232.4	3	3	-	-	-	2	-	-	3	3	2	3		2	
MEP232.5	3	3	2	2	2	2	3	3	3	3	2	3	2	2	
MEP232.6	3	3	-	3	-	-	-	-	3	3	2	3			1
MEP232	3	3	2	2	2	2	2	3	3	3	2	3	2	2	1

1-Slight (Low) **2-Moderate (Medium)** **3-Substantial (High)**

School: SSET		**Batch : 2023-2027**	
Programme: B.Tech		**Current Academic Year: 2023-2024**	
Branch: ME		**Semester: V**	
1	Course Code	MEC310	
2	Course Title	Design of Mechatronics System	
3	Credits	3	
4	Contact Hours (L-T-P)	3-0-0	
	Course Status	Program Elective	
5	Course Objective	● Mechatronics system design and simulation, ergonomics and safety ● Theoretical and practical aspects of computer interfacing, real time data acquisition and control ● Design of motion control, motion converter and temperature control.	
6	Course Outcomes	After the successful completion of course, students will be able to: CO1: Understand the basics and key elements of mechatronics design process CO2: Identify fundamental design tradeoffs by applying the principles of static and dynamic performance in mechatronic systems CO3: Apply the concepts of engineering system and dynamic response of the system CO4: Analyze the models of engineering system. CO5: Realize the concepts of real time interfacing and data acquisition CO6: Design and control a simple mechatronic system.	
7	Course Description	This course intends to impart through knowledge in system modelling, system identification and simulation of mechatronics system and to provide their applications in real-life.	
8	Outline syllabus		CO Mapping
	Unit 1	**Introduction to design of mechatronics system**	
	A	Introduction, Key elements, Integrated Design Issues in Mechatronics	CO1
	B	Mechatronics design process, Mechatronics and traditional design	CO1
	C	Applications in Mechatronics: Condition Monitoring, Monitoring On-Line, Model-Based Manufacturing, Supervisory Control Structure, Opt mechatronics, Mechatronic Systems in Use	CO1
	Unit 2	**Basic system modelling**	
	A	Introduction, Operator Notation and Transfer Functions, Block Diagrams, Manipulations, and Simulation	CO2

	B	Block Diagram Modelling—Direct Method, Analogy Approach and Modified Analogy Approach			CO2
	C	Mathematical modelling: Basic system modelling of mechanical, electrical, fluid and thermal system			CO2
	Unit 3	**Mechatronic system modelling and Controllers**			
	A	Engineering systems: Rotational-translational and electro-mechanical system			CO2, CO3
	B	Engineering systems: Pneumatic-mechanical, hydraulic-mechanical			CO2, CO3
	C	Control modes, Adaptive control system, Programmable logic controllers			CO2, CO3
	Unit 4	**Sensors and Transducers**			
	A	Sensor Classification, Parameter Measurement in Sensors and Transducers, Quality Parameters, Errors and Uncertainties in Mechatronic Modelling Parameters			CO4
	B	Sensors for Motion and Position Measurement, Digital Sensors for Motion Measurement, Force and Torque Sensors			CO4
	C	Vibration—Acceleration Sensors, Sensors for Flow Measurement, Temperature Sensing Devices and Sensor Applications			CO4
	Unit 5	**Actuating Devices and Real time interfacing**			
	A	Mechanical Actuators, Electrical Actuators and Pneumatic Actuators			CO4, CO5
	B	Fluid Power Actuation, Fluid Power Design Elements and Piezoelectric Actuators			CO4, CO5
	C	Elements of a Data Acquisition and Control System, Devices for Data Conversion and Data Conversion Process			CO5, CO6
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	1. Devdas Shetty, Richard A. Kolk, “Mechatronics System Design”, 2nd Edition, Cengage Learning 2011			
	Other References	1 Georg pelz, "Mechatronic Systems: Modeling and simulation" with HDL’s, John wiley and sons Ltd, 2003. 2. Bradley, D.Dawson, N.C. Burd and A.J. Loader, "Mechatronics: Electronics in Products and Processes", CRC Press 1991 , First Indian print 2010 3. De Silva, "Mechatronics: A Foundation Course", Taylor & Francis, Indian Reprint, 2013.			

COURSE ARTICULATION MATRIX

Cos	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
MEC310.1	3	1	1	1	-	-	-	-	-	-	-	1	-	3	3
MEC310.2	3	2	1	2	-	-	-	-	-	-	-	1	-	3	3
MEC310.3	3	3	3	3	-	-	-	-	-	-	-	1	-	3	3
MEC310.4	3	3	3	3	-	-	-	-	-	-	-	1	-	3	3
MEC310.5	3	3	3	3	-	-	-	-	-	-	-	1	-	3	3
MEC310.6	3	3	3	3	-	-		-	-	-	-	1	-	3	3
MEC310	3	3	3	3	-	-	-	-	-	-	-	1	-	3	3

School: SSET		**Batch: 2023-2027**	
Programme: B.Tech		**Current Academic Year: 2023-2024**	
Branch: ME		**Semester: V**	
1	Course code	MEC399	
2	Course Title	Production planning and Control	
3	Credits	3	
4	Contact Hours (L-T-P)	3-0-0	
5	Course Objective	The objective of PPC is to equip the learner with the knowledge and skills necessary to be able to perform in one of the many disciplines associated with production and inventory management such as planning, Demand forecasting, Production planning and control inventory control, materials planning etc.	
6	Course Outcomes	After the successful completion of course, students will be able to: CO1. Identify the principles and applications relevant to Production and operations of manufacturing/service firms. CO2. Forecast situations in a production system environment that suggests the use of certain quantitative methods to assist in decision making. CO3. Explain how Enterprise Resource Planning and MRPII systems are used in managing operations. CO4. Plan and contribute to manufacturing and business operations. CO5. Demonstrate the managerial responsibility for Operations and inventory management. CO6. Apply planning, control, and inventory management in real-life complex problem	
7	Outline syllabus		**CO MAPPING**
7.01	**Unit 1**	**INTRODUCTION**	
7.02	A	An Overview of production systems,	CO1
7.03	B	Production management objectives	CO1
7.04	C	Manufacturing strategy, Technological innovations in Manufacturing	CO1
7.05	**Unit 2**	**FORECASTING**	
7.06	A	The forecasting process	CO2
7.07	B	Monitoring and controlling the forecasting system	CO2
7.08	C	multi-item forecasting	CO2,CO6

7.09	**Unit 3**	**PLANNINGACTIVITIES**	
7.10	A	Aggregate Planning Strategies and methods	CO3, CO6
7.11	B	The Master Production Schedule,	CO3,CO6
ff7.12	C	Planning of material requirements-MRP, Manufacturing Resources Planning	CO3,CO6
7.13	**Unit 4**	**CONTROLACTIVITIES**	
7.14	A	Capacity planning and control	CO4, CO6
7.15	B	Production Activity control,, Scheduling in Manufacturing,	CO4, CO6
7.16	C	Theory of constraints and synchronous manufacturing.	CO4, CO6
7.17	**Unit 5**	**INVENTORYMANAGEMENT and TQM**	
7.18	A	Basic Inventory systems, Inventory systems under risk,	CO5, CO6
7.19	B	Distribution inventory management,	CO5, CO6
7.20	C	TQM basic concepts and application	CO5, CO6

8	Course Evaluation	
8.1	Course work:	30%
8.11	Attendance	None
8.12	Homework	Three best out of 4 assignments: 20 marks
8.13	Quizzes	Two 30-minutes surprise quizzes: 10 marks
8.14	Projects	None
8.15	Presentations	None
8.16	Any other	None
8.2	MTE	25 percent CE 25%
8.3	End-term examination: 50%	
9	References	
9.1	Text book	1. *Lee J.Krajewski,Larry P.Ritaman," Operations Management ",Addison-Wesley,2000.*
9.2	Other references	**Reference Books and Monographs** 1. *Seetharama L.Narasimhan,Dennis W.McLeavy,Peter J .Billington, ." Producion planning and inventory control ", PHI.* 2. *Averetle E Adam, Jr Ronaald J. Ebert "Production and operational management, PHI* 3. *Elwood S Bufa and Rakesh K Sarin " Modern Production/Operations Management", Wiley India Edition, Reprint 2009* 4. *Shailendra Kale, "Production and Operations Management", TMH Education,*

COURSE ARTICULATION MATRIX

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
MEC339.1		2	-	-	1	-	-	2	1			1	2	2	
MEC339.2	2	2	-	2	-	-	-	2	1			1	2	2	
MEC339.3	2	2	3	2	2	-	-	2	1			1	2	2	
MEC339.4	2	2	-	-	-	-	1	2	1			1	2	2	
MEC339.5	2	2	-	-	-	-	1	2	1			1	2	2	
MEC339.6	2	2	2	2	2	-	-	2	1			1	2	2	
MEC339	2	2	2	2	2	-	1	2	1	-	-	1	2	2	-

1-Slight (Low) **2-Moderate (Medium)** **3-Substantial (High)**

School: SSET		Batch : 2023-2027	
Programme: B.Tech		Academic Year: 2023-2024	
Branch: ME		Semester: V	
1	Course Code	ARP 301	
2	Course Title	Personality Development and Decision making Skills	
3	Credits	2	
4	Contact Hours (L-T-P)	1-0-2	
	Course Status	Active	
5	Course Objective	To enhance holistic development of students and improve their employability skills. Provide a 360 degree exposure to learning elements of Business English readiness program, behavioural traits, achieve softer communication levels and a positive self-branding along with augmenting numerical and altitudinal abilities. To up skill and upgrade students' across varied industry needs to enhance employability skills. By the end of this semester, a will have entered the threshold of his/her 3rd phase of employability enhancement and skill building activity exercise.	
6	Course Outcomes	After the successful completion of course, students will be able to: CO1: Apply skills of personality development which will help a student groom to meet the needed social strata for establishing themselves in the society CO2: Build a positive behavioural attitude and attributes developing interpersonal skills for building positive and meaningful social and professional relationships CO3: Review and revise development plans to adapt to changing aspirations, circumstances and working environments CO4: Acquire higher level competency in use of numbers and digits, logical and analytical reasoning CO5: Develop higher level strategic thinking and diverse mathematical concepts through building cubes and cuboids. CO6: Demonstrate higher level quantitative aptitude such as analytical and statistical tools for making business decisions.	
7	Course Description	This bundles Training approach attempts to explore the personality, character, and the natural style of the student. This helps to develop character, personality, confidence and interpersonal abilities within the student along with level 3 readiness in quant, aptitude and reasoning skills	
8	Outline syllabus – ARP301		
	Unit 1	**Impress to Impact**	**CO MAPPING**
	A	What is Personality?|Creating a positive impression – The 3 V's of Impression |Individual Differences and Personalities	CO1
	B	Personality Development and Transformation | Building Self Confidence | Behavioural and Interpersonal Skills	CO2

	C	Avoiding Arguments | The Art of Assertiveness | Constructive Criticism | The Personal Effectiveness Grid | Assessing our Strengths & Limitations and Creating an Action Plan for Learning with the 4M Model | Verbal Abilities-3	CO3
	Unit 2	**Introduction to APTITUDE TRAINING- Reasoning- Logical/ Analytical**	
	A	Numbers & Digits , Mathematical Operations | Analytical Reasoning	CO4
	B	Cubes & Cuboids | Statement & Assumptions	CO5
	C	Strong & Weak Argument	CO5
	Unit 3	**Quantitative Aptitude**	
	A	Work & Time ,Pipes & Cistern	CO6
	B	Time ,Speed & Distance, Quadratic & Linear Equations, Logs & Inequalities	CO6
	C	Sequence & Series,Logarithms, Data Interpretation | Data sufficiency - Level 1	CO6
	Weightage Distribution	*(CA)Class Assignment/Free Speech Exercises / JAM – 60% | (ETE) Group Presentations/Mock Interviews/GD/ Reasoning, Quant & Aptitude – 40%*	
	Text book/s*	Wiley's Quantitative Aptitude-P Anand | **Quantum CAT – Arihant Publications | Quicker Maths- M. Tyra |** Power of Positive Action (English, Paperback, Napoleon Hill) | Streets of Attitude (English, Paperback, Cary Fagan, Elizabeth Wilson) The 6 Pillars of self-esteem and awareness – Nathaniel Brandon | Goal Setting (English, Paperback, Wilson Dobson	

COURSE ARTICULATION MATRIX

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ARP301.1	-	-	-	-	-	1	-	-	1	2	1	2	-	-	-
ARP301.2	-	-	-	-	-	1	-	-	1	2	1	2	-	-	-
ARP301.3	-	-	-	-	-	-	-	-	1	2	1	2	-	-	-
ARP301.4	1	-	-	-	-	-	-	-	1	2	1	2	-	-	-
ARP301.5	1	-	-	-	-	-	-	-	1	2	1	2	-	-	-
ARP301.6	1	-	-	-	-	-	-	-	1	2	1	2	-	-	-
ARP 301	1	-	-	-	-	1	-	-	1	2	1	2	-	-	-

1-Slight (Low) **2-Moderate (Medium)** **3-Substantial (High)**

School: SSET		**Batch : 2023-2027**			
Programme: B. Tech.		**Current Academic Year: 2023-24**			
Branch: ME		**Semester: V**			
1	Course Code	MEP302			
2	Course Title	Machining and Metrology Lab			
3	Credits	1			
4	Contact Hours (L-T-P)	0-0-2			
	Course Status	Practical			
5	Course Objective	The course aims to give hands on experience of different machining processes and various precision measurement techniques to the students.			
6	Course Outcomes	After the successful completion of course, students will be able to: CO1: Identify different parts machining instruments and explain their working CO2: Perform various lathe machine operations CO3: Perform various machining operations on milling machine, shaper, grinder, drilling machine and slotter CO4: Explain the working of profile projector and utilize it for doing measurements CO5: Identify different parts of precision measuring instruments and carryout measurements CO6: Select a machining operation and corresponding measuring and machining tools for a specific application in real time.			
7	Outline syllabus				CO Mapping
	List of Experiments				
	Experiment 1	To perform step turning and taper turning operations on lathe machine.			CO1, CO2, CO6
	Experiment 2	To perform grooving, knurling and chamfering operations on lathe machine			CO1, CO2, CO6
	Experiment 3	To perform milling and shaping operations on the given specimen and attain the given dimensions.			CO1, CO3, CO6
	Experiment 4	To perform surface grinding operation on the given work piece			CO1, CO3, CO6
	Experiment 5	To drill and perform slotting on the given work pieces			CO1, CO2, CO6
	Experiment 6	Study of profile projector			CO4, CO6
	Experiment 7	Measurement of lengths, heights, diameters by Vernier calipers micrometers.			CO5, CO6
	Experiment 8	Measurement of bores by using a micrometer.			CO5, CO6
	Mode of examination	Practical			
	Weightage Distribution	**CA**	**CE**	**ETE**	
		25%	25%	50%	
	Text book/s*	Handouts given by the instructor			
	Software	-			

COURSE ARTICULATION MATRIX

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	-	-	-	-	-	-	-	-	-	-	-	1	1	-
CO2	1	-	-	-	-	-	-	-	-	-	-	-	1	1	-
CO3	1	-	-	-	-	-	-	-	-	-	-	-	1	1	-
CO4	1	-	-	-	1	-	-	-	-	-	-	-	1	1	-
CO5	1	-	-	-	1	-	-	-	-	-	-	-	1	1	-
CO6	1	-	-	-	-	-	-	-	-	-	1	2	2	2	1
MEP302	1	-	-	-	1	-	-	-	-	-	1	2	1	1	1

1-Slight (Low) **2-Moderate (Medium)** **3-Substantial (High)**

School: SSET		**Batch : 2023-2027**	
Programme: B.Tech		**Current Academic Year: 2023-2024**	
Branch: ME		**Semester: V**	
1	Course Code	**MEP331**	
2	CourseTitle	Project Based Learning -3	
3	Credits	2	
4	Contact Hours (L-T-P)	0-0-4	
	Course Status	Practical	
5	Course Objective	1. To align student's skill and interests with are alistic problem or project 2. To understand the significance of problem and its scope 3. Students will make decisions within a framework	
6	Course Outcomes	After the successful completion of course, students will be able to: CO1: Adapt general metacognitive knowledge strategies CO2:Solve the complex problems efficiently CO3: Relate deeply with the target content CO4:Develop constructive cumulative goal orientation acquisition process CO5: Build scientific writing skills by means of regular progress presentation CO6: Utilize technology-based knowledge to improvise the existing designs	
7	Course Description	In PBL-3, the students will learn how to define the problem for developing projects, identifying the skills required for developing the project based on given a set of specifications and all subjects of that Semester.	
8	Outline syllabus		CO Mapping
	Unit 1	Problem Definition, Team/Group formation and Project Assignment. Finalizing the problem statement, resource requirement, if any.	CO1, CO2
	Unit 2	Develop a work flow or block diagram for the proposed system / software.	CO2,CO3
	Unit 3	Design algorithms for the proposed problem.	CO3
	Unit 4	Implementation of work under the guidance of a faculty member and obtain the appropriate results.	CO3, CO4
	Unit 5	Demonstrate and execute Project with the team. Validate and verify the project modules.	CO4, CO5, CO6

		Report should in clued Abstract, Hardware/ Software Requirement, Problem Statement, Design/ Algorithm, Implementation Detail. Validation Reports. References if any. The presentation, report, work done during the term Supported by the documentation, forms the basis of assessment.			
	Mode of examination	Practical /Viva			
	Weight age Distribution	CA	CE	ETE	
		25%	25%	50%	

COURSE ARTICULATION MATRIX

COS	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO2	PSO3
MEP331.1	3	3	-	3	-	-	-	-	3	3	2	3	2	2	1
MEP331.2	3	2	-	3	-	-	2	-	3	3	2	3			1
MEP331.3	3	2	-	-	2	-	-	-	3	3	2	3	2	2	
MEP331.4	3	3	-	-	-	2	-	-	3	3	2	3		2	
MEP331.5	3	3	2	2	2	2	3	3	3	3	2	3	2	2	
MEP331.6	3	3	-	3	-	-	-	-	3	3	2	3			1
MEP331	3	3	2	3	2	2	2	3	3	3	2	3	2	2	1

1-Slight (Low) **2-Moderate (Medium)** **3-Substantial (High)**

School: SSET		**Batch : 2023-2027**
Programme: B.Tech		**Current Academic Year: 2023-2024**
Branch: ME		**Semester: V**
1	Course Code	MEP333
2	Course Title	Summer Internship II
3	Credits	2
4	Contact Hours (L-T-P)	0-0-4
	Course Status	Practical
5	Course Objective	To expose engineering students to the real industrial scenario, which is not possible in the classroom? Familiarize with various materials, processes, products and their applications along with relevant aspects of quality control and shop floor management. Understand the psychology of the workers and their habits, attitudes and approach to problem solving. Understand the social, economic and administrative considerations that influence the working environment of industrial organizations. Learn about team work, collaboration and leadership. Importance of time management, discipline, self-learning and effective communication. To apply the engineering knowledge in real industrial situations. To gain experience in writing reports in engineering works/projects. To enhance the employability of the students. Get exposed to the current technological developments relevant to the subject area to which the training pertains. To develop self-esteem for employment after graduation
6	Course Outcomes	After the successful completion of course, students will be able to: CO1: Explain the working environment of industry. CO2: Analyze the resources in practice. CO3: Apply Engineering Knowledge for Problem analysis CO4: Decide investigative procedure to sort out complex industrial problems CO5: Show the importance of working in a team CO6: Maximize his/her ability to make work related presentations.
7	Course Description	This practical course is intended to expose the students to real life scenario in industry with the intention to make them future ready for their professional role. In this, the students undergo in reputed Private / Public Sector / Government organization / companies for four weeks/one month in summer vacation after II semester. It is expected that the skills student gain via internship with an organization will help him/her perform better in the assigned job after graduation. Apart from this, the industrial internship enhances the chance for students to obtain employment after graduation. It is pertinent to mention that developing

		an awareness of general workplace behaviour and interpersonal skills are expected from students at the end of the Industrial internship. The student should be able relate, apply and adapt relevant knowledge and concepts within industrial ambience and ethics.	
8	Outline		CO Mapping
	A	**INTERNSHIP DIARY**	
		An internship diary is provided by the university for collecting the information during industrial internship on daily basis. It also helps the student for writing his/her report. The objective of maintaining daily diary is to cultivate the habit of documenting and encourage him/her to search for details. It develops the students' own thought process and reasoning abilities. The students should record in the daily training diary the day to day account of the observations, impressions and information gathered. It should contain the sketches & drawings related to the observations made by the students. On the basis of recorded data in the diary, the student will prepare a report.	CO1, CO2, CO3, CO4
	B	**INTERSHIP REPORT**	
		A student should learn about equipment's, machines, plant layout and other industrial practices in industry. After collecting the information, one should prepare a comprehensive internship report at the end of one's internship to demonstrate what one has learnt in this period. Daily diary will facilitate to a great extent in writing the report. It is mandatory for the student to submit a hard copy of report to one's assigned coordinator for corrections and subsequently, submitting a final spiral bound copy to department. The assigned coordinator will check the followings things in the draft submitted by the student: Report is made as per the format approved by the department. Originality of the report. Very adequate and purposeful write-up. Organization, drawings, sketches, format, style, language, fig no, table no and references etc. Variety and relevance of learning experience. After doing correction the corrected copies will be submitted at the time of presentation, duly signed by the faculty coordinator and Head of Department.	CO6 CO5
	C	**INDUSTRIAL INTERNSHIP EVALUATION PROCESS**	

		The Industrial Internship Evaluation is done in the presence of assigned Department Faculty coordinator and External Examiner, duly approved by The controller of Examination. The evaluation process includes a seminar presentation and viva-voce, done on the basis of following criteria. The Power Point PresentationProper Planning of PresentationEffectiveness of PresentationsDepth of knowledge and skills. Records in which internship diary and reports are analyzed along with presentation and viva voce	CO4, CO6
	Mode of examination	Practical	

COURSE ARTICULATION MATRIX

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
MEP333.1	0	0	0	0	0	1	3	1	0	0	0	2	2	2	2
MEP333.2	0	0	0	0	0	0	2	0	0	0	0	2	2	2	2
MEP333.3	0	0	0	0	0	2	1	0	0	0	0	2	2	2	2
MEP333.4	0	0	0	0	0	2	0	0	0	0	0	2	2	2	2
MEP333.5	0	0	0	0	0	0	1	1	0	0	0	2	2	2	2
MEP333.6	0	0	0	0	0	0	0	0	0	2	0	3	3	3	3
MEP333	0	0	0	0	0	2	1	1	0	2	0	2	2	2	2

1-Slight (Low) **2-Moderate (Medium)** **3-Substantial (High)**

<table>
<tr><td colspan="2">School: SSET</td><td>Batch : 2023-2027</td></tr>
<tr><td colspan="2">Programme: B.Tech
Branch: ME</td><td>Current Academic Year: 2023-2024</td></tr>
<tr><td>1</td><td>Course code</td><td>ECC301</td></tr>
<tr><td>2</td><td>Course Title</td><td>Community Connect</td></tr>
<tr><td>3</td><td>Credits</td><td>2</td></tr>
<tr><td>3.01</td><td>(L-T-P)</td><td>(0-0-2)</td></tr>
<tr><td>4</td><td>Learning Hours</td><td>
<table>
<tr><td>Contact Hours</td><td>60</td></tr>
<tr><td>Project/Field Work</td><td>40</td></tr>
<tr><td>Assessment</td><td>00</td></tr>
<tr><td>Guided Study</td><td>20</td></tr>
<tr><td>Total hours</td><td>60</td></tr>
</table>
</td></tr>
<tr><td>5</td><td>Course Objectives</td><td>1. To connect the students to the community.
2. To conduct survey of community people and record responses and identify the issues faced by the community.
3. To do detailed analysis of data collected in the survey and student will use their learning to propose suitable solution for these issues.
4. To enhance skills of students on communication, data analysis and report writing skills.
5.To conduct survey on general awareness.</td></tr>
<tr><td>6</td><td>Course Outcomes</td><td>After the successful completion of course, students will be able to:
CO1. Interpret knowledge on different issues faced by the community in better way.
CO2. Analyze data and identify problems
CO3. Solve the complex problems efficiently
CO4. Construct documentation, data analysis and report on any project.
CO5. Estimate the engineering and societal values of the developed solution for the problem
CO6. Utilize technology-based knowledge to improvise the existing solution for the problem</td></tr>
<tr><td>7</td><td>Theme</td><td>Major Sub-themes for research:
1. Energy solutions, saving and management
2. Electronics solution in everyday life
3. Civil works like transportation, drainage, water, construction etc.
4. Agriculture and irrigation, crop production
5. IoT and smart solutions
6. Medical and Healthcare issues
7. Environmental issues
8. Security and surveillance
9. Education and skills
10. Waste management
10. Any other issues</td></tr>
</table>

8.1	**Guidelines for Faculty Members**	● Any one of the sub-themes can be taken as survey topics ● It will be a group assignment. ● There should be not more than 10 students in each group. ● The faculty guide will guide the students to complete the survey and help the student in preparing final report. ● The questionnaire should be well design by the school and it should carry at least 40 questions (Including demographic questions). ● The faculty will guide each group of students to prepare the PPT. ● Each group should **submit the report** to CCC-Coordinator signed by the faculty guide before one week of last date of instruction mentioned in the Academic Calendar. ● The students have to send the hard copy of the **report and PPT**, and then only they will be allowed for ETE.
8.2	**Role of CCC-Coordinator**	The CCC Coordinator will supervise the whole process and assign students to faculty members.
8.3	**Layout of the Report**	Abstract (250 words) ● Introduction ● Literature review(optional) ● Objective of the research ● Research Methodology ● Finding and discussion ● Conclusion and recommendation ● References ● Research report should base on primary data.
8.4	**Guideline for Report Writing**	**Title Page: The following elements must be included:** ● Title of the article; ● Name(s) and initial(s) of author(s), preferably with first names spelled out; ● Affiliation(s) of author(s); ● Name of the faculty guide and Co-guide **Abstract:** Each article is to be preceded by a succinct abstract, of up to 250 words, that highlights the objectives, methods, results, and conclusions of the paper. **Text: Manuscripts should be submitted in Word.** ● Use a normal, plain font (e.g., 12-point Times Roman) for text. ● Use italics for emphasis. ● *Use the automatic page numbering function to number the pages.* ● *Save your file in docx format* (Word 2007 or higher) or doc format (older Word versions) **Reference list:** The list of references should only include works that are cited in the text and that have been published or accepted for publication. The soft copy of final report should be submitted along with the **hard copy signed by faculty / guide and countersigned by HoD / Dean.** **The report will be subject to plagiarism check as per the guidelines given in the notification.**
8.5	**Format:**	**The report should be Spiral / softbound** The Design of the Cover page to report will be given by the Coordinator-CCC

		Cover page Acknowledgement Content Project report Appendices
8.6	**<u>Important Dates:</u>**	Students will complete their community survey before last instruction date of the running semester and submit the same to concern faculty member. (Each group should complete min 50 questionnaires). Faculty members should guide students for report writing. The students should submit the hard copy and soft copy of the report to CCC-Coordinator signed by the faculty guide. **The students should submit the soft copy of the PPT to CCC-Coordinator signed by the faculty guide before 1 week of final presentation.** **The final presentation and evaluation should be organised by the School before last instruction date.**
8.7	**ETE**	**The students will be evaluated by panel of internal faculty members on the basis of their presentation.**

9	**Course Evaluation**	
9.01	**Continuous Assessment**	**60%**
	Noting responses to the questionnaire	**20 Marks**
	Data analysis and Report Writing	**40 Marks**
9.02	**ETE (PPT presentation)**	**40%**

COURSE ARTICULATION MATRIX

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
ECC301.1	2	1	1	1	-	1	2	-	-	-	1	1	1	1	-
ECC301.2	2	1	1	1	-	1	2	-	-	-	1	1	1	1	-
ECC301.3	2	1	1	1	-	1	2	-	-	-	1	1	1	1	-
ECC301.4	2	1	1	1	-	1	2	-	-	-	1	1	1	1	-
ECC301.5	2	1	1	1	-	2	2	-	-	-	1	1	1	1	-
ECC301.6	2	1	1	1	-	1	2	-	-	-	1	1	1	1	-
ECC301	2	1	1	1	-	1	2	-	-	-	1	1	1	1	-

1-Slight (Low) **2-Moderate (Medium)** **3-Substantial (High)**

School: SSET		**Batch : 2023-2027**	
Programme: B.Tech		**Current Academic Year: 2023-2024**	
Branch: ME		**Semester: V**	
1	Course Code	MEP360	
2	Course Title	Automobile Engineering Lab-I	
3	Credits	1	
4	Contact Hours (L-T-P)	0-0-2	
	Course Status	Practical	
5	Course Objective	To make the student able to gain knowledge about the various components of petrol engine and diesel engine by dismantling and assembling the parts like carburetor, fuel system, Cooling system etc and we have the multi cylinder diesel and petrol engines for easy learning. Although, the student can learn about the various electrical components of an automobile and the wiring circuits and to test the starter motor, ignition system, batteries etc.	
6	Course Outcomes	After the successful completion of course, students will be able to: CO1: Distinguish the basic parts of an engine in automobile. CO2: Identify the components of an engine in Maruti Suzuki 800 CC car. CO3: Explain the operation of Lubrication and Fuel System of SI and CI Engine. CO4: Summarize the operation of Engine Cooling and Ignition System CO5: Demonstrate the principles of Engine management systems. CO6: Determine the components of automotive electrical and electronics in modern vehicles.	
7	Course Description	This course covers the theory, construction, inspection, diagnosis, and repair of internal combustion engines and related systems. Topics include fundamental operating principles of engines and diagnosis, inspection, adjustment, and repair of automotive engines using appropriate service information. Upon completion, students should be able to perform basic diagnosis, measurement and repair of automotive engines using appropriate tools, equipment, procedures, and service information.	
8	Outline syllabus		CO Mapping
	List of Experiments		
	Experiment 1	To dismantle engine block, cylinder head and peripherals.	CO1
	Experiment 2	Scraping, refurbishing of engine block, cylinder head and. Peripherals fewer than 4 modes of fluid pressure washing.	CO2
	Experiment 3	To study the fuel supply of a petrol/CNG engine.	CO3

	Experiment 4	To study the fuel supply of a diesel engine.			CO3
	Experiment 5	To study engine's lubricating system.			CO3
	Experiment 6	To study engine's cooling system.			CO4
	Experiment 7	To study ignition system.			CO4
	Experiment 8	To assemble various engine sub systems and components.			CO5
	Experiment 9	Unmount the existing engine from the car's engine compartment and remount the assembled one by connecting all hoses, wire harnesses, couplers, relays, sensors and switches			CO6
	Experiment 10	To study engine management system.			CO5
	Mode of examination	Practical			
	Weightage Distribution	CA	CE	ETE	
		25%	25%	50%	
	Text book/s*	1. . Crouse, W.H., and Anglin, D.L., Automotive Mechanics, Tata McGraw Hill, New Delhi, 2005. 2. Heitner, J., Automotive Mechanics, Affiliated South West Press, New Delhi, 2000.			
	Software	ANSYS			

COURSE ARTICULATION MATRIX

COs	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PSO 2
MEP360.1	2	3	-	-	3	-	-	-	-	-	-	3	2	3
MEP360.2	3	3	-	-	3	-	-	-	-	-	-	3	2	3
MEP360.3	3	2	-	-	3	-	-	-	-	-	-	2	2	3
MEP360.4	2	3	-	-	3	-	-	-	-	-	-	2	2	3
MEP360.5	2	3	-	-	3	-	-	-	-	-	-	3	2	3
MEP360.6	2	2	-	-	3	-	-	-	-	-	-	3	2	3
MEP360	2	2	-	-	3	-	-	-	-	-	-	2	2	3

1-Slight (Low) **2-Moderate (Medium)** **3-Substantial (High)**

School: SSET		**Batch : 2023-2027**			
Programme: B.Tech		**Current Academic Year: 2023-2024**			
Branch: ME		**Semester: V**			
1	Course Code	MEP310			
2	Course Title	Mechatronics Laboratory			
3	Credits	1			
4	Contact Hours (L-T-P)	0-0-2			
	Course Status	Practical			
5	Course Objective	● Mechatronics system design and simulation, ergonomics and safety ● Practical aspects of computer interfacing, real time data acquisition and control			
6	Course Outcomes	After the successful completion of course, students will be able to: CO1: Apply the basic principles of sensors and actuators to stystems. CO2: Analyze various valves and cylinders used in pneumatic kits for various operations. CO3 assemble electro-pneumatic kits for various operations. CO4: Apply the concepts of design of mechatronics elements. CO5 Analyze automatic door opening and closing system using PLC. CO6: Design and control a simple mechatronic system.			
7	Course Description	This course intends to impart through knowledge in system modelling, system identification and simulation of mechatronics system and to provide their applications in real-life.			
8	List of Experiments				CO Mapping
	1	Study and demonstration of mechatronics system and its components			**CO1**
	2	Study and Demonstration of Sensors.			CO1
	3	Study and Demonstration of Actuators.			CO2
	4	Operation of a single acting cylinder			CO2
	5	Operation of a single acting cylinder Controlled from different positions using different valves			**CO3**
	6	Single cycle automation of multiple cylinders in sequence			CO3
	7	Operation of a single acting cylinder using solenoid valve			CO4
	8	Operation of a double acting cylinder using double solenoid valve			CO4
	9	Study of PLC and its applications.			**CO5**
	10	PLC Programming exercise for various systems			CO5
	11	Study and working of Automation studio			CO6
	Mode of examination	Lab			
		CA	CE	ETE	

	Weightage Distribution	25%	25%	50%	
	Text book/s*	2. Devdas Shetty, Richard A. Kolk, "Mechatronics System Design", 2nd Edition, Cengage Learning 2011			
	Other References	1 Pneumatics Manual , Janatics PVT Ltd 2. Electropneumatics Manual, Janatics PVT Ltd			

CO-PO mapping

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO1	3	1	1		-	-	-	-	-	-	-	2	-	3	3
CO2	3	2	1		-	-	-	-	-	-	-	2	-	2	2
CO3		3	2		-	-	-	-	-	-	-	3	-	3	3
CO4	3	3	3		-	-	-	-	-	-	-	3	-	3	3
CO5	3	2	2		3	-	-	-	-	-	-	3	-	2	3
CO6	3	2			3	-		-	-	-	-	3	-	3	3
MEP310	3	2	2		3	-	-	-	-	-	-	3	-	3	3

SCHOOL OF ENGINEERING & TECHNOLOGY **Branch: ME**	MECHANICAL ENGINEERING **Programme:- B.Tech**	**Current Academic Year: 2023-2024 Batch : 2023-2027**	Sem: VI

1	Course number	MEC330	
2	Course Title	OPERATIONS RESEARCH	
3	Credits	3	
4	Contact Hours (L-T-P)	3-0-0	
5	Course Objective	The objective of OR is to provide a scientific basis to the managers of an organisation for solving problems involving interaction of the components of the system, by employing a system approach by a team of experts drawn from different disciplines, for finding a solution which is in the best interest of the organisation as a whole.	
6	Course Outcomes	After the successful completion of course, students will be able to: CO1: To identify and visualize the modes of Operation research in different practical configurations CO2: To understand basic mathematical/numerical methods needed to solve different OR problems CO3: Proficiency with tools from optimization, probability, statistics, simulation, and engineering economic analysis, including fundamental applications of those tools in industry and the public sector in contexts involving uncertainty and scarce or expensive resources. CO4: Facility with mathematical and computational modelling of real decision-making problems, including the use of modelling tools and computational tools, as well as analytic skills to evaluate the problems. CO5: Facility with the design, implementation, and analysis of computational experiments.	
7	Outline syllabus		
7.01	MEC330.A	Unit A	**Introduction & Linear Programming Problems**
7.02	MEC330.A1	Unit A Topic 1	Introduction: OR models and their applications
7.03	MEC330.A2	Unit A Topic 2	Formulation of Linear Programming Problems, Graphical solution
7.04	MEC330.A3	Unit A Topic 3	Simplex procedure for maximization and minimization, Duality concept
7.05	MEC330.B	Unit B	**Transportation Model & Assignment Models**
7.06	MEC330.B1	Unit B Topic 1	Mathematical formulation, Methods to find IBFS like NWCR, LCM and VAM
7.07	MEC330.B2	Unit B Topic 2	MODI method, Degeneracy and its resolution.
7.08	MEC330.B3	Unit B Topic 3	Assignment Model: Hungarian Method, Travelling Salesman Problem
7.09	MEC330.C	Unit C	**Queuing Model & Inventory Control**
7.10	MEC330.C1	Unit C Topic 1	**Queuing Model:** Introduction, Kendall's notation, Classification of queuing models, Sequencing of n jobs and 2 & 3 machines, 2 jobs and m machines
7.11	MEC330.C2	Unit C Topic 2	**Inventory control:** Introduction, models of inventory,
7.12	MEC330.C3	Unit C Topic 3	fixed order quantity system, periodic quantity system EOQ model.
7.13	MEC330.D	Unit D	**Decision Theory and theory of games**
7.14	MEC330.D1	Unit D Topic 1	Decision making under certainty and uncertainty,
7.15	MEC330.D2	Unit D Topic 2	Decision tree
7.16	MEC330.D3	Unit D Topic 3	Theory of games-definition, pure and mixed strategy, algebraic and graphical Methods.
7.17	MEC330.E	Unit E	**Network Models & Computational Practices**
7.18	MEC330.E1	Unit E Topic 1	Basic concept, Rules for drawing the network diagram,
7.19	MEC330.E2	Unit E Topic 2	Applications of CPM and PERT techniques.
7.20	MEC330.E3	Unit E Topic 3	Cost analysis and crashing the network
8	Course Evaluation		

8.1	Course work:	30%
8.11	Attendance	None
8.12	Homework	Three best out of 4 assignments: 20 marks
8.13	Quizzes	Two 30-minutes surprise quizzes: 10 marks
8.14	Projects	None
8.15	Presentations	None
8.16	Any other	None
8.2	MTE	25% CE – 25%
8.3	End-term examination: 50%	
9	References	
9.1	Text book	1. Hira & Gupta, Operations Research, S. Chand & Co. New Delhi, 2007.
9.2	Other references	1. Sharma,J.K., Operations Research: Theory and Application, McMillan India Publication. New Delhi, 3rd Edition. 2. Taha, H.A., Introduction to Operation Research, PHl Publication, 9th edition. 3. Tripathy, Production and Operation Management, Scitech Publication, 2007 edition. 4. Rajgopal, K., Operation Research, PHI Learning Pvt Ltd., 1st Edition, 2012. 6. Paneerselvam, R., Operation Research, PHI Learning Pvt Ltd.,2nd Edition, 2009. 7. Use MATLAB Software– MATLAB R2011b; Version 8.1, and Microsoft Office Excel 2007 or2012.

Mapping of Outcomes vs. Topics

Outcome no. → Syllabus topic↓	1	2	3	4	5
MEC330.A	X	X	X	X	X
MEC330.A1	X				
MEC330.A2				X	
MEC330.A3	X				
MEC330.B	X	X	X	X	X
MEC330.B1					
MEC330.B2					
MEC330.B3					
MEC330.C	X	X	X	X	X
MEC330.C1					
MEC330.C2					
MEC330.C3					
MEC330.D	X		X	X	X
MEC330.D1				X	
MEC330.D2				X	
MEC330.D3				X	
MEC330.E	X		X	X	X
MEC330.E1					
MEC330.E2					X
MEC330.E3					X

School: SSET		**Batch : 2023-2027**	
Programme: B.Tech		**Current Academic Year: 2023-2024**	
Branch: ME		**Semester: VI**	
1	Course Code	MEC341	
2	Course Title	Lean Production	
3	Credits	3	
4	Contact Hours (L-T-P)	3-0-0	
	Course Status	Program Core	
5	Course Objective	The Lean Production Course offers a practical introduction to lean management principles and techniques. The course is tailored to help the reader (s) implement lean manufacturing in business environment to improve productivity, business resilience, and to reduce waste.	
6	Course Outcomes	After the successful completion of course, students will be able to: CO1:label lean production and mass production CO2: Compare the process capacity and production system of different organization. CO3: Improve Workplace Visualization and maintaining continuous flow. CO4: Elaboratepull systems and scheduling. CO5: Recommend quality and continuous process improvement guidelines. CO6: Develop a resilient organization with minimum wastage	
7	Course Description	Lean production focuses on improving the speed of a process and the elimination of waste, primarily byeliminating non-value-added steps. Lean production deals with the effectiveness with which a process meetscustomer requirements. The graduate course covers these topics with an emphasis on quantitative methods.Employers are increasingly looking for candidates trained in process engineering.	
8	Outline syllabus		CO Mapping
	Unit 1	**INTRODUCTION: IDENTIFICATION OF WASTE**	
	A	Understand the basic differences between lean production and mass production.	CO1
	B	Review the history of Lean Production, focusing on Japan's Toyota Production System as an alternative to mass production.	CO1
	C	waste impacts productivity and Taiichi Ohno’s famous 7 Wastes.	CO1
	Unit 2	**UNDERSTANDING FLOW: CAPACITY ANALYSIS**	
	A	Basics of process analysis, process capacity and resource utilization, the important concepts of cycle time and takt time.	CO2, CO6
	B	The relationship between inventory, a waste and a flow time in a system through Little’s Law.	CO2, CO6

	C	Different types of production system			CO2, CO6
	Unit 3	**IMPROVING FLOW: WORKPLACE ORGANISATION AND VISUALIZATION**			
	A	Introduction to the concepts of Workplace Visualization			CO3
	B	Organization and 5S for improving and maintaining continuous flow in Lean Production,			CO3
	C	The concept of Total Productive Maintenance			CO3
	Unit 4	**MAINTAINING FLOW: ESTABLISHING PULL SYSTEMS AND SCHEDULING**			
	A	Define the key principle from the Toyota Production System, Just-In-Time (JIT)and the significance that JIT has for Lean Production in reducing waste and meeting customer demand.			CO4, CO6
	B	Review of production planning and Production Scheduling			CO4, CO6
	C	Mixed-Model Scheduling and Pull systems using Kanban, value stream mapping			CO4, CO6
	Unit 5	**QUALITY AND CONTINUOUS IMPROVEMENT**			
	A	The impact of defects on flow rate and Poka Yoka			CO5, CO6
	B	Kaizen Blitz for problem-solving and process improvements			CO5, CO6
	C	The Toyota Way 2001, and Jeffrey Liker's 14 Management Principles.			CO5, CO6
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	1. Lean And Six Sigma – Six Sigma Black Belt (2007 BOK): Enterprise-Wide Deployment Paper Back by Suvabrata Mitra			
	Other References	1.Toyota Production System -An integrated approach to Just in Time – Yasuhiro Monden, – Engineering aild Management Press -Institute of Industrial Engineers – 1983 2. James P Womack, Daniel T Jones, and Daniel Roos, The Machine that changed the World. The Story of Lean Production -Harper Perennial edition published 1991 3. Gemba Kaizen: A Commonsense Approach to a Continuous Improvement Strategy, Second Edition Hardcover – 2012by Masaaki Imai 4. Value Stream Mapping : How to Visualize Work and Align Leadership for Organizational Transformation Paperback – 2016 by Karen Martin , Mike Osterling			

COURSE ARTICULATION MATRIX

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
MEC341.1	2	2	-	-	1	-	-	2	2	3	2
MEC341.2	2	2	-	2	-	-	-	2	2	2	2
MEC341.3	3	3	3	2	2	-	-	2	2	2	2
MEC341.4	2	2	-	-	-	-	1	2	2	2	2
MEC341.5	2	2	-	-	-	-	1	2	2	2	2
MEC341.6	2	2	2	2	2	-	-	2	2	2	2
MEC341	2	2	2	2	2	-	1	2	2	2	2

1-Slight (Low) 2-Moderate (Medium) 3-Substantial (High)

School: SSET		**Batch : 2023-2027**	
Programme: B.Tech		**Current Academic Year:** 2023-2024	
Branch: ME		**Semester: VI**	
1	Course Code	**ARP 302**	
2	Course Title	**Campus to Corporate**	
3	Credits	2	
4	Contact Hours (L-T-P)	1-0-2	
	Course Status	Active	
5	Course Objective	To enhance holistic development of students and improve their employability skills. Provide a 360 degree exposure to learning elements of Business English readiness program, behavioural traits, achieve softer communication levels and a positive self-branding along with augmenting numerical and altitudinal abilities. To up skill and upgrade students' across varied industry needs to enhance employability skills. By the end of this semester, a will have entered the threshold of his/her 4th phase of employability enhancement and skill building activity exercise.	
6	Course Outcomes	After the successful completion of course, students will be able to: CO1: Develop a creative resumes, cover letters, interpret job descriptions and interpret KRA and KPI statements and art of conflict management. CO2: Build negotiation skills to get maximum benefits from deals in practical life scenarios. CO3: Develop skills of personal branding to create a brand image and self-branding CO4: Acquire higher level competency in use of logical and analytical reasoning such as direction sense,strong and weak arguments CO5: Develop higher level strategic thinking and diverse mathematical concepts through building analogies, odd one out CO6: Demonstrate higher level quantitative aptitude such as average, ratio & proportions, mixtures & allegation for making business decisions.	
7	Course Description	This penultimate stage introduces the student to the basics of Human Resources. Allows the student to understand and interpret KRA | KPI and understand Job descriptions. A student also understands how to manage conflicts, brand himself/herself, understand relations and empathise others with level-4 of quant, aptitude and logical reasoning	
8	Outline syllabus – ARP 302		
	Unit 1	**Ace the Interview**	**CO MAPPING**
	A	HR Sensitization (Role Clarity | KRA | KPI | Understanding JD) | Conflict Management	CO1
	B	Negotiation Skills | Personal Branding	CO3, CO4
	C	Uploading & Curating Resumes in Job Portals, getting Your Resumes Noticed | Writing Cover Letters | Relationship Management | Verbal Abilities-4	CO1, CO3
	Unit 2	**Introduction to APTITUDE TRAINING- Reasoning- Logical/ Analytical**	

	A	Sitting Arrangement & Venn Diagrams | Puzzles | Distribution | Selection	CO4
	B	Direction Sense | Statement & Conclusion | Strong & Weak Arguments	CO4
	C	Analogies,Odd One out | Cause & Effect	CO5
	Unit 3	**Quantitative Aptitude**	
	A	Average , Ratio & Proportions,Mixtures & Allegation	CO6
	B	Geometry-Lines,Angles& Triangles	CO6
	C	Problem of Ages | Data Sufficiency - L2	CO6
	Weightage Distribution	*(CA)Class Assignment/Free Speech Exercises / JAM – 60% | (ETE) Group Presentations/Mock Interviews/GD/ Reasoning, Quant & Aptitude – 40%*	
	Text book/s*	*Wiley's Quantitative Aptitude-P Anand* | ***Quantum CAT – Arihant Publications*** | ***Quicker Maths- M. Tyra*** | *Power of Positive Action (English, Paperback, Napoleon Hill)* | *Streets of Attitude (English, Paperback, Cary Fagan, Elizabeth Wilson) The 6 Pillars of self-esteem and awareness – Nathaniel Brandon* | *Goal Setting (English, Paperback, Wilson Dobson*	

COURSE ARTICULATION MATRIX

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ARP302.1	-	-	-	-	-	-	-	-	1	2	1	2	-	-	-
ARP302.2	-	-	-	-	-	-	-	-	1	2	1	2	-	-	-
ARP302.3	-	-	-	-	-	-	-	-	1	2	1	2	-	-	-
ARP302.4	1	-	-	-	-	-	-	-	1	2	1	2	-	-	-
ARP302.5	1	-	-	-	-	-	-	-	1	2	1	2	-	-	-
ARP302.6	1	-	-	-	-	-	-	-	1	2	1	2	-	-	-
ARP 302	1	-	-	-	-	-	-	-	1	2	1	2	-	-	-

1-Slight (Low) **2-Moderate (Medium)** **3-Substantial (High)**

School: SSET		**Batch : 2023-2027**	
Programme : B.Tech		**Current Academic Year: 2023-2024**	
Branch: ME		**Semester: VI**	
1	Course Code	MEP327	
2	Course Title	Turbo machinery Laboratory Lab	
3	Credits	1	
4	Contact Hours (L-T-P)	0-0-2	
	Course Status	Practical	
5	Course Objective	To understand the concept and basic concepts of turbomachinery, working of different turbines (such as pelton wheel, Kaplan and Francis turbine) and different pumps (reciprocating and centrifugal pump) through a series of experiments.	
6	Course Outcomes	After the successful completion of course, students will be able to: CO1- Analyze the forces exerted by a jet of fluid on vanes. CO2 - Study and analyze the construction features and working principles of different classes of hydraulic turbines. CO3 - Analyze the performance characteristic curves of hydraulic turbines. CO4 - Study and analyze the construction features and working principles of different pumps. CO 5 - Analyze the performance characteristic curves of hydraulic pumps. CO6- Understand the working principles of various hydraulic systems such as hydraulic lift and hydraulic ram.	
7	Course Description	The objective of this laboratory is to introduce to students the principles of working, constructional details, design features and performance characteristics of various machines like turbines, pumps and other devices using incompressible fluids (liquids) and the ability to visualize and design some simple equipment used in practice.	
8	Outline syllabus		CO Mapping
	List of Experiments		
	Experiment 1	To estimate the Impact of jet of a fixed vane.	CO1
	Experiment 2	To determine the characteristics of a Pelton turbine.	CO2, CO3
	Experiment 3	To determine the characteristics of a Francis turbine.	CO2, CO3

	Experiment 4	To determine the characteristics of a Kaplan turbine.			CO2, CO3
	Experiment 5	To determine the characteristics of a reciprocating pump			CO4, CO5
	Experiment 6	To determine the characteristics of a centrifugal pump			CO4, CO5
	Experiment 7	Experimental and analytical study of a Hydraulic ram.			CO6
	Experiment 8	Experimental and analytical study of a Hydraulic lift			CO6
	Mode of examination	Practical			
	Weightage Distribution	CA	CE	ETE	
		25%	25%	50%	
	Text book/s*	Rajput R.K., Hydraulic Machines, 4th Edition, S. Chand, 2010.			
	Reference	Manuals provided in the lab			

COURSE ARTICULATION MATRIX

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2
CO. 1	3	2	-	-	-	-	-	-	3	-	-	2	2	-
CO. 2	3	2	-	-	-	-	-	-	3	-	-	2	2	-
CO. 3	3	2	-	-	-	-	-	-	3	-	-	2	2	-
CO. 4	3	2	-	-	-	-	-	-	3	-	-	2	2	-
CO. 5	3	2	-	-	-	-	-	-	3	-	-	2	2	-
CO	**3**	**2**							**3**			**2**	**2**	

1-Slight (Low) 2-Moderate (Medium) 3-Substantial (High)

School: SSET		**Batch : 2023-2027**
Programme: B.Tech		**Current Academic Year: 2023-2024**
Branch: ME		**Semester VI**
1	Course Code	MEP 397
2	Course Name	CNC lab
3	Credits	1
4	Contact Hours (L-T-P)	0-0-2
	Course Status	Practical
5	Course Objective	The course provides an in-depth understanding and skill of writing programs by developing G and M codes for turning and Milling components. The students will have hands-on experience to generate automated tool paths for an engineering component.
6	Course Outcomes	After the successful completion of course, students will be able to: CO1: Build the CNC codes using Virtual CNC software. CO2: Apply the CNC programming for different kind of operation on a job operation in CNC lathe. CO3: Develop the CNC programming for drilling, grooving and boring on a job operation in CNC lathe. CO4: Apply the CNC programming using various kind of interpolation on a job operation in CNC Milling machine. CO5: Construct the CNC Programming on a job using mirror imaging in CNC Milling Machine. CO6: Analyse the CNC Programming on a job using Profiling in CNC Milling Machine.
7	Course Description	The objective of this laboratory enables the students will learn to use the CNC machines efficiently for manufacturing desired products and knowledge of programming and use of CNC tooling. The students will use programmable language called G code to input desired project dimensions and work conditions, such as feed rate and speed. This information is relayed to the CNC machine's integrated computer system as work instructions that control the machining process. These machines can be used for specialized and complex applications, including engraving and die sinking, or making impressions in die blocks.
8	Outline syllabus	CO Mapping

	Experiment 1	Generate and verify the CNC codes using Virtual CNC software.			CO1
	Experiment 2	Develop the CNC program for facing operation on a job of given dimension using CNC Lathe.			CO2
	Experiment 3	Develop the CNC program for Plain and Step turning operation on a job of given dimension using CNC Lathe.			CO2
	Experiment 4	Develop the CNC program for taper turning operation on a job of given dimension using CNC Lathe.			CO2
	Experiment 5	Develop the CNC program for internal and external threading operation on a job of given dimension using CNC Lathe.			CO2
	Experiment 6	Develop the CNC program for grooving, drilling and boring on a job of given dimension using CNC Lathe.			CO3
	Experiment 7	Develop the CNC program using linear interpolation for a job of given dimension using CNC Milling machine.			CO4
	Experiment 8	Develop the CNC program using circular interpolation for a job of given dimension using CNC Milling machine.			CO4
	Experiment 9	Develop the CNC program using mirror imaging on a job of given dimension using CNC Milling machine.			CO5
	Experiment 10	Develop the CNC program using profiling for a job of given dimension using CNC Milling machine.			CO6
	Mode of examination	Practical			
	Weightage Distribution	CA	CE	ETE	
		25%	25%	50%	
	Text book/s*	NITW CNC Lab Manual			
	Software	Handouts given by the instructor			

COURSE ARTICULATION MATRIX

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
MEP 397.1	3	-	2	-	2	-	-	-	3	-	-	2	2	-	-
MEP 397.2	3	-	2	-	2	-	-	-	3	-	-	2	2	-	-
MEP 397.3	3	-	2	-	2	-	-	-	3	-	-	2	2	-	-
MEP 397.4	3	-	2	-	2	-	-	-	3	-	-	2	2	-	-
MEP 397.5	3	-	2	-	2	-	-	-	3	-	-	2	2	-	-
MEP 397.6	3	-	2	-	2	-	-	-	3	-	-	2	2	-	-
MEP 397	3	-	2	-	2	-	-	-	3	-	-	2	2	-	-

1-Slight (Low) 2-Moderate (Medium) 3-Substantial (High)

School: SSET		**Batch: 2023-2027**		
Programme : B. Tech		**Current Academic Year: 2023-2024**		
Branch: ME		**Semester: VI**		
1	Course Code	MEP 301		
2	Course Title	Heat Transfer and Refrigeration & Air Conditioning Lab		
3	Credits	1		
4	Contact Hours (L-T-P)	0-0-2		
	Course Status	Practical		
5	Course Objective	The laboratory course is aimed to provide the practical exposure to the students with regard to the determination of amount of heat exchange in various modes of heat transfer along with the role of heat transfer in refrigeration & air conditioning by determining the performance of refrigeration & air conditioning test rigs		
6	Course Outcomes	After the successful completion of course, students will be able to: CO1: Determine the heat transfer performance of Glycerin, insulated heat pipe, composite walls CO2: Estimate average heat transfer coefficient for free and forced convection. CO3: Determine the surface emissivity of a test plate. CO4: Calculate the coefficient of performance of refrigeration system and air conditioning systems CO5: Perform the tubing and charging of refrigeration & air conditioning system CO6: Acquire the knowledge about refrigeration charging and compressor electrical connections		
7	Course Description	Heat Transfer laboratory provides fundamental and industrial knowledge about modes of heat transfer, like conduction, convection and radiation, and their application. Also, this course develops the understanding of principle of refrigeration & air conditioning along with hands on practice.		
8	Outline syllabus		CO Mapping	BTL
	List of Experiments			
	Experiment 1	To determine the thermal conductivity of Glycerin	CO1	K3

	Experiment 2	To draw the temperature distribution profile of a pin fin for natural and forced convection process	CO2	K3
	Experiment 3	Theoretical and experimental analysis of insulated heat pipe	CO1	K3
	Experiment 4	To determine the temperature at each face of composite wall and draw its temperature drop profile	CO1	K3
	Experiment 5	To determine the emissivity of a copper plates	CO3	K3
	Experiment 6	Determine coefficient of performance of a refrigeration test rig	CO4	K3
	Experiment 7	Determine coefficient of performance and tonnage capacity of air conditioning system	CO4	K3
	Experiment 8	Perform flaring and swaging operation in a pipe and prepare tube section with brazing and union joint	CO5	K3
	List of Value-Added Experiments			
	Experiment 1	Perform refrigerant charging process	CO6	K3
	Experiment 2	Recognize compressor electric connections	CO6	K2

	Mode of examination	Practical				
	Weightage Distribution	CA	CE	ETE		
		25%	25%	50%		
	Text book/s*	1. C.P. Arora, Refrigeration and Air Conditioning, TMH.				

COURSE ARTICULATION MATRIX

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO 2	PSO 3
MEP301.1	2	2	-	-	-	-	-	-	2	-	-	2	-	-	-
MEP301.2	2	2	-	-	-	-	-	-	2	-	-	2	-	-	-
MEP301.3	2	2	-	-	-	-	-	-	2	-	-	2	-	-	-
MEP301.4	2	2	-	-	-	-	-	-	2	-	-	2	-	-	-
MEP301.5	2	2	-	-	-	-	-	-	2	-	-	2	-	-	-
MEP301.6	2	1	-	-	-	-	-	-	2	-	-	2	-	-	-
MEP 301	2	2	-	-	-	-	-	-	2	-	-	2	-	-	-

1-Slight (Low) **2-Moderate (Medium)** **3-Substantial (High)**

School: SSET		**Batch : 2023-2027**	
Programme: B.Tech		**Current Academic Year: 2023-2024**	
Branch: ME		**Semester: VI**	
1	Course Code	**MEP332**	
2	Course Title	Project Based Learning -4	
3	Credits	1	
4	Contact Hours (L-T-P)	0-0-2	
	Course Status	Practical	
5	Course Objective	1. To align student's skill and interests with are alistic problem or project 2. To understand the significance of problem and its scope 3. Students will make decisions within a framework	
6	Course Outcomes	After the successful completion of course, students will be able to: CO1: Build self-directed learning CO2: Demonstrate the acquired knowledge in solving complex realistic problem CO3: Utilize and analyse various software, designing and modelling tools CO4: Develop a product that would be suitable as well as sustainable CO5: Solve the realistic problems of academia and industry CO6: Estimate the engineering and societal values of the developed process or product	
7	Course Description	In PBL-4, the students will learn how to define the problem for developing projects, identifying the skills required for developing the project based on given a set of specifications and all subjects of that Semester.	
8	Outline syllabus		CO Mapping
	Unit 1	Problem Definition, Team/Group formation and Project Assignment. Finalizing the problem statement, resource requirement, if any.	CO1, CO2
	Unit 2	Develop a work flow or block diagram for the proposed system / software.	CO2,CO3
	Unit 3	Design algorithms for the proposed problem.	CO3
	Unit 4	Implementation of work under the guidance of a faculty member and obtain the appropriate results.	CO3, CO4
	Unit 5	Demonstrate and execute Project with the team. Validate and verify the project modules.	CO4, CO5, CO6

		Report should include Abstract, Hardware/Software Requirement, Problem Statement, Design/Algorithm, Implementation Detail. Validation Reports. References if any. The presentation, report, work done during the term Supported by the documentation, forms the basis of assessment.			
	Mode of examination	Practical /Viva			
	Weight age Distribution	CA	CE	ETE	
		25%	25%	50%	

COURSE ARTICULATION MATRIX

COS	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO2	PSO3
MEP332.1	3	3	-	3	-	-	-	-	3	3	2	3	2	2	1
MEP332.2	3	2	-	3	-	-	2	-	3	3	2	3			1
MEP332.3	3	2	-	-	2	-	-	-	3	3	2	3	2	2	
MEP332.4	3	3	-	-	-	2	-	-	3	3	2	3		2	
MEP332.5	3	3	2	2	2	2	3	3	3	3	2	3	2	2	
MEP332.6	3	3	-	3	-	-	-	-	3	3	2	3			1
MEP332	3	3	2	3	2	2	2	3	3	3	2	3	2	2	1

1-Slight (Low) **2-Moderate (Medium)** **3-Substantial (High)**

School: SSET		**Batch : 2023-2027**
Programme: B.Tech		**Current Academic Year: 2023-2024**
Branch: ME		**Semester: VII**
1	Course Code	HMM305
2	Course Title	Management for Engineers
3	Credits	3
4	Contact Hours (L-T-P)	3-0-0
	Course Status	Program Core
5	Course Objective	The objective of this course is to expose the students to understand the basics of Management Foundations. The students will be given a detailed grounding for the theories and cases related to the general management. The aim of the course is to orient the students in theories and practices of Management so as to apply the acquired knowledge in actual business practices. This is a gateway to the real world of management and decision-making.
6	Course Outcomes	After the successful completion of course, students will be able to: CO1: List the basic principles and concepts related to management in an organization including the functions, different theories of management and roles they play in an organization. CO2: explain the primary function Planning with its process. Also, how forecasting is done in organizations with various techniques are used. CO3: compare different types of organization and also using decentralization and span of control in organizations. CO4: Analyze jobs, recruitment process, manpower planning, job rotation, trainings and rewards in various organizations. CO5: Measure motivation and management control concepts to obtain effective controlling in management system in organizations. CO6: Develop proper system in an organization by using all the functions of management.

7	Course Description	This course gives an overview of engineering management and help to understand the various functions of management used in an organization. The focus of the course is the development of individual skills and team work.			
8	Outline syllabus				CO Mapping
	Unit 1	Introduction of Management & Organisation			CO1
	A	Management-Definition of Management & Organisation			CO1
	B	Concept, Nature, Scope and Functions of Management, Levels of Management, Management Theories - Taylors principle, Fayol's Principles, Hawthorne Studies, Systems Approach and Contingency Approach to Management.			CO1
	C	Mintzberg's Managerial Roles, Skills of Manager, Functions of management			CO1
	Unit 2	Management Planning Process			CO2
	A	Planning objectives and characteristics.			CO2
	B	Hierarchies of planning.			CO2
	C	The concept and techniques of forecasting.			CO2
	Unit 3	Organizing			C03
	A	Meaning, Importance and Principles			C03
	B	Departmentalization, Span of Control			CO3
	C	Types of Organization, Authority, Delegation of Authority			CO3
	Unit 4	Staffing			CO4
	A	Meaning, Job analysis			CO4
	B	Manpower planning, Recruitment, Transfers and Promotions			CO4
	C	Appraisals, Management Development, Job Rotation, Training, Rewards and Recognition,			CO4
	Unit 5	Directing & Controlling			CO5
	A	Motivation, Co-ordination, Communication,			CO5
	B	Directing and Management Control, Decision Making,			CO5
	C	Management by objectives (MBO) the concept and relevance. Objectives and Process of Management Control			CO5
	Mode of examination	Theory			
	Weightage Distribution	CA	CE	ETE	
		25%	25%	50%	
	Text book/s*	1. Principles & practice of Mgmt., L.M. Prasad			
	Other References	1. Management Today, Burton & Thakur 2. Principles & Practices of Mgmt., C.B. Gupta 3. Understanding Management, Richard L.Daft 4. Management, Stoner, Freemand & Gilbert 5. Essential of Management, Koontz O' Donnel			

COURSE ARTICULATION MATRIX

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
HMM305.1	1	-	-	-	-	-	-	2	2	2	2	2	-	-	-
HMM305.1.2	1	-	-	-	-	-	-	-	2	2	2	2	-	-	-
HMM305.1.3	1	-	-	-	-	-	-	-	-	2	2	2	-	-	-
HMM305.1.4	1	-	-	-	-	-	-	-	2	2	2	2	-	-	-
HMM305.1.5	1	-	-	-	-	-	-	-	3	2	2	2	-	-	-
HMM305.1.6	1	-	-	-	-	-	-	-	-	2	2	2	-	-	-
HMM305	1	-	-	-	-	-	-	2	2	2	2	2	-	-	-

1-Slight (Low) 2-Moderate (Medium) 3-Substantial (High)

School: SSET		**Batch : 2023-2027**
Programme: B.Tech		**Current Academic Year: 2023-2024**
Branch: ME		**Semester: VII**
1	Course Code	MEP433
2	Course Title	Summer Internship III
3	Credits	2
4	Contact Hours (L-T-P)	0-0-4
	Course Status	Practical
5	Course Objective	To expose engineering students to the real industrial scenario, which is not possible in the classroom? Familiarize with various materials, processes, products and their applications along with relevant aspects of quality control and shop floor management. Understand the psychology of the workers and their habits, attitudes and approach to problem solving. Understand the social, economic and administrative considerations that influence the working environment of industrial organizations. Learn about team work, collaboration and leadership. Importance of time management, discipline, self-learning and effective communication. To apply the engineering knowledge in real industrial situations. To gain experience in writing reports in engineering works/projects. To enhance the employability of the students. Get exposed to the current technological developments relevant to the subject area to which the training pertains. To develop self-esteem for employment after graduation
6	Course Outcomes	After the successful completion of course, students will be able to: CO1: Explain the working environment of industry. CO2: Analyze the resources in practice. CO3: Apply Engineering Knowledge for Problem analysis CO4: Decide investigative procedure to sort out complex industrial problems CO5: Show the importance of working in a team CO6: Maximize his/her ability to make work related presentations.
7	Course Description	This practical course is intended to expose the students to real life scenario in industry with the intention to make them future ready for their professional role. In this, the students undergo in reputed Private / Public Sector / Government organization / companies for four weeks/one month in summer vacation after II semester. It is expected that the skills student gain via internship with an organization will help him/her perform better in the assigned job after graduation. Apart from this, the industrial internship enhances the chance for students to obtain employment after graduation. It is pertinent to mention that developing an awareness of general workplace behaviour and interpersonal skills

		are expected from students at the end of the Industrial internship. The student should be able relate, apply and adapt relevant knowledge and concepts within industrial ambience and ethics.	
8	Outline		CO Mapping
	A	**INTERNSHIP DIARY**	
		An internship diary is provided by the university for collecting the information during industrial internship on daily basis. It also helps the student for writing his/her report. The objective of maintaining daily diary is to cultivate the habit of documenting and encourage him/her to search for details. It develops the students' own thought process and reasoning abilities. The students should record in the daily training diary the day to day account of the observations, impressions and information gathered. It should contain the sketches & drawings related to the observations made by the students. On the basis of recorded data in the diary, the student will prepare a report.	CO1, CO2, CO3, CO5
	B	**INTERSHIP REPORT**	
		A student should learn about equipment's, machines, plant layout and other industrial practices in industry. After collecting the information, one should prepare a comprehensive internship report at the end of one's internship to demonstrate what one has learnt in this period. Daily diary will facilitate to a great extent in writing the report. It is mandatory for the student to submit a hard copy of report to one's assigned coordinator for corrections and subsequently, submitting a final spiral bound copy to department. The assigned coordinator will check the followings things in the draft submitted by the student: Report is made as per the format approved by the department. Originality of the report. Very adequate and purposeful write-up. Organization, drawings, sketches, format, style, language, fig no, table no and references etc. Variety and relevance of learning experience. After doing correction the corrected copies will be submitted at the time of presentation, duly signed by the faculty coordinator and Head of Department.	CO6
	C	**INDUSTRIAL INTERNSHIP EVALUATION PROCESS**	

		The Industrial Internship Evaluation is done in the presence of assigned Department Faculty coordinator and External Examiner, duly approved by The controller of Examination. The evaluation process includes a seminar presentation and viva-voce, done on the basis of following criteria. The Power Point PresentationProper Planning of PresentationEffectiveness of PresentationsDepth of knowledge and skills. Records in which internship diary and reports are analyzed along with presentation and viva voce	CO4, CO6
	Mode of examination	Practical	

COURSE ARTICULATION MATRIX

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
MEP433.1	0	0	0	0	0	1	3	1	0	0	0	2	2	2	2
MEP433.2	0	0	0	0	0	0	2	0	0	0	0	2	2	2	2
MEP433.3	0	0	0	0	0	2	1	0	0	0	0	2	2	2	2
MEP433.4	0	0	0	0	0	2	0	0	0	0	0	2	2	2	2
MEP433.5	0	0	0	0	0	0	1	1	0	0	0	2	2	2	2
MEP433.6	0	0	0	0	0	0	0	0	0	2	0	3	3	3	3
MEP433	0	0	0	0	0	2	2	1	0	2	0	2	2	2	2

1-Slight (Low) **2-Moderate (Medium)** **3-Substantial (High)**

School: SSET		**Batch : 2023-2027**		
Programme: B.Tech		**Current Academic Year: 2023-2024**		
Branch: ME		**Semester: VII**		
1	Course Code	**MEC 460**		
2	Course Title	**Major Project I**		
3	Credits	2		
4	Contact Hours (L-T-P)	0-0-4		
	Course Status	Practical		
5	Course Objective	The course provides an in-depth understanding and skill in the field of Mechanical Engineering and its associated fields.		
6	Course Outcomes	After the successful completion of course, students will be able to: CO1: Identify a topic in advanced areas of mechanical engineering CO2: Choose the literature to identify research gaps and define objectives CO3: Evaluate the feasibility of project. CO4: Develop and implement innovative ideas for social benefit. CO5: Create a prototype/models, experimental set up and software systems necessary to meet the objectives CO6: Compile the short report of literature survey and experimental work		
7	Course Description	The course provides an in-depth understanding and skill in the field of Mechanical Engineering and its associated fields.		
	Mode of examination	Project report and Viva-Voce		
	Weightage Distribution	CA	MTE	ETE
		25%	25%	50%
	Text book/s*	As per the field/specialization		
	http:/	Google scholar, Research gate.		

COURSE ARTICULATION MATRIX

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
MEC 460.1	3	-	-	-	-	-	-	-	2	-	2	2	-	-	-
MEC 460.2	3	3	-	-	-	-	-	-	2	-	2	2	2	-	-
MEC 460.3	3	3	3	-	-	-	-	-	2	-	2	2	2	2	2
MEC 460.4	3	-	3	2	-	2	-	-	2	-	2	2	2	2	2
MEC 460.5	3	-	3	-	3	-	-	-	2	-	2	2	2	2	2
MEC 460.6	-	-	-	-	-	-	-	3	2	3	2	2	-	-	-
MEC 460	3	3	3	2	3	2	-	3	2	3	2	2	2	2	2

1-Slight (Low) 2-Moderate (Medium) 3-Substantial (High)

School: SSET		**Batch : 2023-2027**		
Programme: B.Tech		**Current Academic Year: 2023-2024**		
Branch: ME		**Semester: VIII**		
1	Course Code	**MEC461**		
2	Course Title	**Major Project II**		
3	Credits	8		
4	Contact Hours (L-T-P)	0-0-16		
	Course Status	Practical		
5	Course Objective	The course provides an in-depth understanding and skill in the field of Mechanical Engineering and its associated fields.		
6	Course Outcomes	After the successful completion of course, students will be able to: CO1: Identify the methodology to carry the experiments towards significant outcome. CO2: Construct the procedures with a concern for society, environment and ethics CO3: Analyze the prototype/model using the mathematical models equation CO4: Compare the results with optimization tools and also draw the valid conclusions CO5: Create a report as per the recommended format and defend the work. CO6: Develop the possibility of publishing papers in symposium/conference proceedings.		
7	Course Description	The course provides an in-depth understanding and skill in the field of Mechanical Engineering and its associated fields.		
	Mode of examination	Project report and Viva-Voce		
	Weightage Distribution	CA	CE	ETE
		25%	25%	50%
	Text book/s*	As per the field/specialization		
	http:/	Google scholar, Research gate.		

COURSE ARTICULATION MATRIX

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
MEC461.1	3	-	2	-	2	-	-	-	2	-	-	2	2	2	2
MEC461.2	3	2	2	-	2	-	-	-	2	-	-	2	2	2	2
MEC461.3	3	3	-	3	3	-	-	-	2	-	-	2	2	2	2
MEC461.4	3	-	-	-	2	-	-	-	2	-	-	2	2	2	2
MEC461.5	-	-	-	-	2	-	-	2	2	2	2	2	-	-	-
MEC461.6	-	-	-	-	2	3	3	3	3	2	2	2	-	-	-
MEC461	3	2	2	3	2	3	3	3	2	2	2	2	2	2	2

1-Slight (Low) **2-Moderate (Medium)** **3-Substantial (High)**

School: SSET		**Batch : 2023-2027**	
Programme: B.Tech		**Current Academic Year: 2023-2024**	
Branch: ME		**Semester: III**	
1	Course Code	MEC314	
2	Course Title	Automotive Transmission	
3	Credits	3	
4	Contact Hours (L-T-P)	3-0-0	
	Course Status	Program Core	
5	Course Objective	In this course, Student will be able to learn the necessity of the transmission of power. Furthermore, They can able to apply elementary mathematical formulate, dynamics of machines, fluid mechanics and machine design involved in the basic transmission system and also formulate as well as solve typical problems based on different modes of power transmission. Eventually, they will be able to gain the knowledge on the latest technology of Drive and Axle in automobile.	
6	Course Outcomes	After the successful completion of course, students will be able to: CO1: Demonstrate the classification, principle and working of different types of Clutches. CO2: Summarize the necessity of different types of Gear Box in cars. CO3: Explain the concept of Final drive, Drive line and Axle of different models of car. CO4: Classify the technical requirements of Hydrodynamic Drive System in automobile CO5: Compare the technical requirements of Hydrostatic Drive System in automobile CO6: Express the concept of Automatic overdrive, Hydraulic control system of new launched cars.	
7	Course Description	This course prepares students to install, remove, maintain and repair this system in an automobile. This course introduces students to transmissions, transaxles and transmission services. It also discusses transmission theory as well as the maintenance of a latest vehicle's transmissions and transaxles.	
8	Outline syllabus		CO Mapping
	Unit 1	**Introduction and Clutch**	
	A	Need for Transmission system, Classification of Transmission systems, Front wheel, Rear wheel and Four wheel drive.	CO2

	B	Clutches: Principle, functions, general requirements, types of clutches: cone clutch, single-plate clutch, diaphragm spring clutch, multi-plate clutch.			CO1
	C	Centrifugal and electromagnetic clutch, clutch lining materials.			CO1
	Unit 2	**Gear Box**			
	A	Necessity of gear box, Resistance to motion of vehicle, Requirements of gear box, Functions of gear box			CO2
	B	Types of gear box: Principle, construction and working of Sliding mesh, Constant mesh and Synchromesh gear box, applications of helical gears.			CO2
	C	Gear selector mechanism, Lubrication of gear box.			CO2
	Unit 3	**Drive Line, Final Drive &Rear Axle**			
	A	Propeller shaft-universal joints, hooks and constant velocity U.J., Purpose of final drive, need of differential, Constructional Details of differential unit, Non slip differential.			CO3
	B	Function of rear axle, Types of loads acting on rear axle, Types of rear wheel drive: Hotchkiss drive & torque tube drive			CO3
	C	Types of rear axle support: semi-floating, full floating, three quarter floating,			CO3
	Unit 4	**Hydrodynamic & Hydrostatic Drive**			
	A	Fluid coupling, Principle of operation, Constructional details, Torque capacity, Performance characteristics, Torque converter-Principle of operation, constructional details, performance characteristics,			CO4
	B	Hydrostatic drive : principle, types, advantages, limitations – Comparison of hydrostatic drive with hydrodynamic drive			CO5
	C	Construction and working of typical Janny hydrostatic drive			CO5
	Unit 5	**Power Transmission**			
	A	Wilson Gear box, Ford - T-model gear box			CO2
	B	Continuous variable transmission (CVT)–operating principle, basic layout and operation, Advantages and disadvantages			CO2
	C	Automatic over drive, Hydraulic control system for automatic transmission.			CO6
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	

	Text book/s*	1. Crouse,W.H.,Anglin, D.L, "Automotive Transmission and Power Trains construction", McGraw-Hill, 1976	
	Other References	2. Heldt.P.M., " Torque converters ", Chilton Book Co., 1992. 3. Newton and Steeds, " Motor vehicles ", llliffe Publishers, 1985. 4. Judge.A.W., " Modern Transmission systems ", Chapman and Hall Ltd., 1990. SAE Transactions 900550 & 930910.	

COURSE ARTICULATION MATRIX

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
MEC314.1	3	2	-	2	-	-	-	-	-	-	2	2	-	3	3
MEC314.2	3	-	-	-	-	-	-	-	-	-	2	2	-	3	3
MEC314.3	3	-	-	-	-	-	-	-	-	-	2	2	-	3	3
MEC314.4	3	-	-	-	-	-	-	-	-	-	2	2	-	3	3
MEC314.5	3	-	-	-	-	-	-	-	-	-	2	2	-	3	3
MEC314.6	3	-	-	-	-	-	-	-	-	-	2	2	-	3	3
MEC314	3	2	-	2	-	-	-	-	-	-	2	2	-	3	3

1-Slight (Low) 2-Moderate (Medium) 3-Substantial (High)

School: SSET		**Batch : 2023-2027**	
Programme: B.Tech		**Current Academic Year: 2023-2024**	
Branch: ME		**Semester: IV**	
1	Course Code	MEC 329	
2	Course Title	Automotive Electric and Electronic	
3	Credits	3	
4	Contact Hours (L-T-P)	3-0-0	
	Course Status	Program Elective	
5	Course Objective	In this course, Students will be able to learn the mounting of electrical and electronics automotive parts in automobile and their functions and understanding of uses of batteries and their accessories even. Students will be able to learn the basics of electrical and electronics concept and also the use of sensors and activators.	
6	Course Outcomes	After the successful completion of course, students will be able to: CO1: Analyze the efficiency of the batteries. CO2: Demonstrate the concept of Starting System CO3: Summarize the concept of Charging system, Lighting System, Wiper System. CO4: Recall the concept of Automotive Electronics CO5: Illustrate the details of Automotive Electricals. CO6: Define the concept of Sensors	
7	Course Description	To provide the knowledge to the students is the principles of operation and constructional details of various Automotive Electrical and Electronic Systems like Batteries, Starting System, Charging System, Ignition System, Lighting System and Dash Board Instruments.	
8	Outline syllabus		CO Mapping
	Unit 1	**BATTERIES AND ACCESSORIES**	
	A	Principle and construction of lead acid battery, characteristics of battery, rating capacity and efficiency of batteries. various tests on batteries, maintenance and charging	CO1
	B	Lighting system: insulated and earth return system, details of head light and side light.	CO3
	C	LED lighting system, head light dazzling and preventive methods – Horn, wiper system and trafficator.	CO3,CO4
	Unit 2	**STARTING SYSTEM**	
	A	Starting Condition, behaviour of starter during starting, series motor and its characteristics.	CO2, CO5
	B	Principle and construction of starter motor.	CO2, CO5
	C	Working of different starter drive units, care and maintenance of starter motor, starter switches.	CO5
	Unit 3	**CHARGING SYSTEM**	
	A	Generation of direct current, shunt generator characteristics, armature reaction, third brush regulation	CO3, CO5

	B	Cut out, voltage and current regulators, compensated voltage regulator, alternators.			CO3, CO4, CO5
	C	Principle and constructional aspects and bridge rectifiers, new developments.			CO4, CO5
	Unit 4	**FUNDAMENTALS OF AUTOMOTIVE ELECTRONICS**			
	A	Electronic engine management system, electromagnetic interference suppression, electromagnetic compatibility			CO4,CO5
	B	Electronic dashboard instruments, onboard diagnostic system, security and warning system.			CO4,CO5
	C	Magneto–Ignition System.			CO4,CO5
	Unit 5	**SENSORS AND ACTIVATORS**			
	A	Types of sensors: Sensor for speed, throttled position, exhaust oxygen level, manifold pressure, crankshaft position, coolant temperature, exhaust temperature, air mass flow for engine application.			CO4,CO5,CO6
	B	Solenoids, stepper motors relay.			CO3,CO4,CO5, CO6
	C	Introduction to Microprocessor & Applications in Automobiles.			CO4,CO6
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	1. Young A.P. & Griffiths. L. "Automotive Electrical Equipment", ELBS & New Press - 1999.			
	Other References	2. William, B. R. "Understanding Automotive Electronics", Butter worth Heinemann Woburn, 5th edition – 1998. 3. Bechhold "Understanding Automotive Electronics", SAE, 1999 4. Crouse, W.H "Automobile Electrical Equipment", McGraw-Hill Book Co., Inc., New York, 3rd edition, 1986.			

COURSE ARTICULATION MATRIX

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
MEC 329.1	3	2	-	2	-	-	-	-	-	-	2	2	-	3	3
MEC 329.2	3	-	-	-	-	-	-	-	-	-	2	2	-	3	3
MEC 329.3	3	-	-	-	-	-	-	-	-	-	2	2	-	3	3
MEC 329.4	3	-	-	-	-	-	-	-	-	-	2	2	-	3	3
MEC 329.5	3	-	-	-	-	-	-	-	-	-	2	2	-	3	3
MEC 329.6	3	-	-	-	-	-	-	-	-	-	2	2	-	3	3
MEC 329	3	2	-	2	-	-	-	-	-	-	2	2	-	3	3

1-Slight (Low) **2-Moderate (Medium)** **3-Substantial (High)**

School: SSET		**Batch : 2023-2027**	
Programme: B.Tech		**Current Academic Year: 2023-2024**	
Branch: ME		**Semester: V**	
1	Course Code	AUT306	
2	Course Title	Electric Vehicle Technology	
3	Credits	3	
4	Contact Hours (L-T-P)	3-0-0	
	Course Status	Program Core	
5	Course Objective	In this course, Student will be able to understand the operation of battery driven electric vehicle. This course initiates candidates into the emerging area of Electric Vehicles and helps learn the Basics of Battery driven Electric Vehicle and its Dynamics, Motors, Power Electronics, Batteries, Charging etc. The program consists of instructor led live lecture sessions and demonstrations.	
6	Course Outcomes	After the successful completion of course, students will be able to: CO1: Explain the concept of Hybrid Electric Vehicle. CO2: Demonstrate the details of Electric drives. CO3: Design the various energy storage devices in electric vehicle. CO4: Explain the concept of Engine Mangement System. CO5: Apply the application of Connectors in Electric Vehicle. CO6: Create the idea of manufacturing the Electric Vehicle.	
7	Course Description	The course will start with introduction section which will enable the students to understand the focus areas that come under the umbrella of electric vehicles. Then the course will start covering this focus areas one by one such as vehicle dynamics, Motors, Power Electronics, Batteries charging etc. The most important part of this course will be that each topic will be analyzed and demonstrated through Matlab Simulink, so that the grip of the subject will be strong and the knowledge acquired will be useable in real time applications.	
8	Outline syllabus		CO Mapping
	Unit 1	**Introduction to Hybrid Electric Vehicle**	
	A	Introduction to Hybrid Electric Vehicles: Types of EVs	CO1
	B	Hybrid Electric Drive-train	CO1
	C	Tractive effort in normal driving	CO1
	Unit 2	**Electric Drives**	
	A	Energy consumption Concept of Hybrid Electric Drive Trains, Architecture of Hybrid Electric Drive Trains.	CO2

	B	Series Hybrid Electric Drive Trains, Parallel hybrid electric drive trains, Electric Propulsion unit, Configuration and control of DC Motor drives.			CO2
	C	Induction Motor drives, Permanent Magnet Motor drives, Switches reluctance motor.			CO2
	Unit 3	**Energy Storage**			
	A	Introduction to Energy Storage Requirements in Hybrid and Electric Vehicles:- Battery based energy storage and its analysis,			CO3
	B	Fuel Cell based energy storage and its analysis, Hybridization of different energy storage devices. Sizing the drive system.			CO3
	C	Design of Hybrid Electric Vehicle and Plug-in Electric Vehicle.			CO3
	Unit 4	**Energy Management System**			
	A	Energy Management Strategies, Automotive networking and communication.			CO4
	B	EV charging standards, V2G, G2V, V2B, V2H.			CO4, CO6
	C	Business: E-mobility business, electrification challenges, Business- E- mobility business, electrification challenges.			CO4, CO6
	Unit 5	**Mobility and Connectors**			
	A	Connected Mobility and Autonomous Mobility- case study Emobility Indian Roadmap Perspective. Policy: EVs in infrastructure system, integration of EVs in smart grid, social dimensions of EVs.			CO5, CO6
	B	**Connectors-** Types of EV charging connector, North American EV Plug Standards, DC Fast Charge EV Plug Standards in North America			CO5, CO6
	C	CCS (Combined Charging System), CHAdeMO, Tesla, European EV Plug Standards,			CO5, CO6
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	1. Emadi, A. (Ed.), Miller, J., Ehsani, M., "Vehicular Electric Power Systems" Boca Raton, CRC Press, 2003			
	Other References	2. Husain, I. "Electric and Hybrid Vehicles" Boca Raton, CRC Press, 2010.			
		3. Larminie, James, and John Lowry, "Electric Vehicle Technology Explained" John Wiley and Sons, 2012			
		4. Tariq Muneer and Irene IllescasGarcía, "The automobile, In Electric Vehicles: Prospects and Challenges", Elsevier, 2017			

COURSE ARTICULATION MATRIX

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
AUT306.1	3	-	-	-	-	2	-	-	-	-	-	3	-	2	2
AUT306.2	3	-	-	-	-	2	-	-	-	-	-	3	-	2	2
AUT306.3	3	-	-	-	-	2	-	-	-	-	-	3	-	2	2
AUT306.4	3	-	-	-	-	2	-	-	-	-	-	3	-	2	2
AUT306.5	3	-	-	-	-	2	-	-	-	-	-	3	-	2	2
AUT306.6	3	-	-	-	-	2	-	-	-	-	-	3	-	2	2
AUT306	3	-	-	-	-	2	-	-	-	-	-	3	-	2	2

1-Slight (Low) 2-Moderate (Medium) 3-Substantial (High)

School: SSET		**Batch : 2023-2027**	
Programme: B. Tech		**Current Academic Year: 2023-2024**	
Branch: ME		**Semester: VI**	
1	Course Code	AUT307	
2	Course Title	Automotive Chassis	
3	Credits	3	
4	Contact Hours (L-T-P)	3-0-0	
	Course Status	Program Elective	
5	Course Objective	After the successful completion of course, students will be able to: 1. To gain the basic knowledge about the vehicle frame. 2. To help the students to identify the various type of steering systems. 3. To understand the different types of drive line and final drive. 4. To study the fundamental and working of different types of suspension systems, wheels and tyres. 5. To acquire the fundamental knowledge about the braking systems. 6. To enable the students to apply the knowledge of automotive chassis to develop modern vehicle parts.	
6	Course Outcomes	On successful completion of the course, the student will be able to, CO1: Possess the knowledge about various vehicle frames and vehicle sub systems CO2: Know the suitable steering system for different vehicles application. CO3: Familiarize the various axles and drive line systems for automobiles CO4: Evaluate the different type of suspension system and brake performances. CO5: Select suitable wheels and tires according to the application. CO6: Apply the fundamental knowledge to develop modern vehicle systems.	
7	Course Description	This course prepares students to install, remove, maintain and repair this system in an automobile. This course introduces students to transmissions, transaxles and transmission services. It also discusses transmission theory as well as the maintenance of a latest vehicle's transmissions and transaxles.	
8	Outline syllabus		CO Mapping
	Unit 1	**CHASSIS LAYOUTS and FRAMES**	
	A	Types of Chassis Layout with reference to Power Plant Location and Drive.	CO1, CO6

	B	Automotive Frames - Material Selection and its Constructional Details, Various types			CO1, CO6
	C	Different Loads acting on Frame, Testing of Automotive Frames.			CO1, CO6
	Unit 2	**STEERING SYSTEM**			
	A	Types of Front Axles and Stub Axles, Front Wheel Geometry, Condition for True Rolling Motion of Wheels during Steering.			CO2, CO6
	B	Steering Mechanisms, Steering Error Curve, Steering Linkages, Different Types of Steering Gears			CO2, CO6
	C	Slip Angle, Over Steer and Under Steer, Reversible and Irreversible Steering, Power Assisted Steering.			CO2, CO6
	Unit 3	**DRIVE LINE**			
	A	Propeller Shaft - Design Considerations & Constructional Details, Universal Joints, Constant Velocity Joints.			CO3, CO6
	B	Hotchkiss Drive, Torque Tube Drive, Radius Rods and Stabilizers, Final drive - Different types, Multiaxled Vehicles			CO3, CO6
	C	Differential - Working Principle and Constructional Details, Non–Slip Differential, Differential Locks			CO3, CO6
	Unit 4	**SUSPENSION SYSTEM**			
	A	Need for Suspension System, Types of Suspension Springs, Constructional details and Characteristics of Single Leaf, Multi Leaf, Coil			CO4, CO6
	B	Constructional details and Characteristics of Torsion bar, Rubber, Pneumatic and Hydro – elastic Suspension Systems, Independent Suspension System			CO4, CO6
	C	Shock Absorbers - Types and Constructional details.			CO4, CO6
	Unit 5	**BRAKING SYSTEMS**			
	A	Stopping Distance, Braking Efficiency, Weight Transfer during Braking.			CO5, CO6
	B	Drum Brakes - Constructional Details, Leading and Trailing Shoe, Braking Torque, Disc Brake - Types and Constructional Details, Relative advantages and disadvantages over Disc Brakes. Hydraulic Braking System.			CO5, CO6
	C	Pneumatic Braking System, Power–Assisted Braking System, Servo Brakes, Retarders, Types and Construction.			CO5, CO6
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	K.V James, D Halderman (2013) "Automotive Chassis Systems" 6th Edition, Prentice Hall Publisher.			

	Other References	1. James E Duffy (2011) "Modern Automotive Technology", Goodheart-Willcox; Seventh Edition. 2. Jack Erjavec (2009) "Automotive Technology – A systems approach", Cengage Learning. 3. William H. Crouse and Donald L. Anglin (2007) Automotive Mechanics, 10th edition.	

COURSE ARTICULATION MATRIX

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
AUT307.1	3	-	-	2	2	3	3	-	-	1	3	2	3	2	3
AUT307. 2	3	-	-	2	2	3	3	-	-	1	3	2	3	2	3
AUT307. 3	3	-	-	2	2	3	3	-	-	1	3	2	3	2	3
AUT307. 4	3	-	-	2	2	3	3	-	-	1	3	2	3	2	3
AUT307. 5	3	-	-	2	2	3	3	-	-	1	3	2	3	2	3
AUT307.6	3	-	-	2	2	3	3	-	-	1	3	2	3	2	3
AUT307	3	-	-	2	2	3	3	-	-	1	3	2	3	2	3

1-Slight (Low) 2-Moderate (Medium) 3-Substantial (High)

School: SSET		**Batch : 2023-2027**	
Programme: B.Tech		**Current Academic Year: 2023-24**	
Branch: ME		**Semester: VII**	
1	Course Code	AUT309	
2	Course Title	Modern Battery Technology	
3	Credits	3	
4	Contact Hours (L-T-P)	3-0-0	
	Course Status	Program Core	
5	Course Objective	In this course, Student will be able to impart fundamental knowledge on electrochemical energy storage systems considering the operation and design of various battery technologies.	
6	Course Outcomes	After the successful completion of course, students will be able to: CO1: Recognize the basic physical concepts of thermodynamics and kinetics involved in electrochemical reactions CO2: Apply the various changes in energy in cells CO3: Select the appropriate battery system with respect to application. CO4: Interpret the recent developments in battery systems. CO5: Demonstrate the requirements of battery systems for automotive applications and understand the modelling of battery systems. CO6: Interpret the Life Cycle Analysis according to cost and environmental aspects; material and energy consumption, reuse, recycling	
7	Course Description	The course will start with introduction section which will enable the students to understand the requirement of batteries for automotive application combined with environment policy considerations.	
8	Outline syllabus		CO Mapping
	Unit 1	**Introduction**	
	A	Introduction to battery technologies. Electrochemical Power sources, Nomenclature, The renaissance in battery development,	CO1
	B	A survey of common battery types and application. The electrical double layer and the formation of electric potentials at interface,	CO1
	C	Thermodynamics of galvanic cells, Current flow in electrochemical cell	CO1
	Unit 2	**Electrochemical energy storage**	
	A	Electromotive force- Reversible cells- Relation between electrical energy and energy content of a cell	CO2
	B	Free energy changes and electromotive force in cell	CO2
	C	Current challenges in Energy storage Technologies.	CO2

	Unit 3	**Major Battery Chemistries Development and testing:**			
	A	Battery performance evaluation- Primary battery - Service time- Voltage data- Service life – ohmic load curve- Effect of operating temperature on service life.			CO3
	B	Secondary batteries- Discharge curves Terminal voltages- Plateau voltage			CO3
	C	Lead acid Batteries – Construction and application			CO3
	Unit 4	**Recent Technologies:**			
	A	Recent development of electrode materials in lithium ion batteries- Recent development of solid electrolytes and their application to solid state batteries			CO4
	B	Polymer solid electrolytes for lithium ion conduction– Thin Film solid state Batteries: Fundamentals, Constriction and application			CO4
	C	Super Capacitors: Fundamental, Construction and application.			CO4
	Unit 5	**Batteries for Automotives – Future prospects:**			
	A	Degrees of vehicle electrification - Battery size vs. application			CO5
	B	USABC and DOE targets for vehicular energy storage systems - Analysis and Simulation of batteries			CO
	C	Equivalent circuit and life modelling – Environmental concerns in battery production – recycling of batteries.			CO6
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	1. T.Minami, M.Tatsumisago,M.Wakihara,C. Iwakura,S. Kohijiya, Solid state ionics for batteries, Springer Publication, 2009 2. Sandeep Dhameja, Electric Vehicle Battery Systems, Newnes publication, 2001.			
	Other References	1. Bard, Allen J., and Larry R. Faulkner. Electrochemical Methods: Fundamentals and Applications. 2nd ed.,Wiley-VCH, Verlag, GmbH, 2000. 2. Masataka Wakihara and Osamu Yamamoto, Lithium ion Batteries Fundamental and Performance,Wiley–VCH, Verlag GmbH, 1999. 3. Robert A.Huggins, Advanced Batteries – Materials science aspects,Springer, 2009.			

COURSE ARTICULATION MATRIX

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO309.1	3	2	-	-	-	-	-	-	-	-	1	2	2	3	-
CO309.2	3	2	-	-	-	-	-	-	-	-	1	2	2	3	-
CO309.3	3	2	-	-	-	-	-	-	-	-	1	2	2	3	-
CO309.4	3	-	-	-	-	2	-	-	-	-	1	2	2	3	-
CO309.5	3	-	-	-	-	2	-	-	-	-	1	2	2	3	-
CO309.6	3	2	-	-	-	-	-	-	-	-	1	2	2	3	-
AUT309	3	2	-	-	-	2	-	-	-	-	1	2	2	3	-

1-Slight (Low) 2-Moderate (Medium) 3-Substantial (High)

School: SSET		**Batch : 2023-2027**	
Programme: B.Tech		**Current Academic Year: 2023-2024**	
Branch: ME		**Semester: III**	
1	Course Code	MEC310	
2	Course Title	Design of Mechatronics System	
3	Credits	3	
4	Contact Hours (L-T-P)	3-0-0	
	Course Status	Program Core	
5	Course Objective	● Mechatronics system design and simulation, ergonomics and safety ● Theoretical and practical aspects of computer interfacing, real time data acquisition and control ● Design of motion control, motion converter and temperature control.	
6	Course Outcomes	After the successful completion of course, students will be able to: CO1: Understand the basics and key elements of mechatronics design process CO2: Familiar with basic system modelling CO3: Understand the concepts of engineering system and dynamic response of the system CO4: Understanding the concepts of design of mechatronics elements. CO5: Realize the concepts of real time interfacing and data acquisition CO6: Design and control a simple mechatronic system.	
7	Course Description	This course intends to impart through knowledge in system modelling, system identification and simulation of mechatronics system and to provide their applications in real-life.	
8	Outline syllabus		CO Mapping
	Unit 1	**Introduction to design of mechatronics system**	
	A	Introduction, Key elements, Integrated Design Issues in Mechatronics	CO1
	B	Mechatronics design process, Mechatronics and traditional design	CO1
	C	Applications in Mechatronics: Condition Monitoring, Monitoring On-Line, Model-Based Manufacturing, Supervisory Control Structure, Opt mechatronics, Mechatronic Systems in Use	CO1
	Unit 2	**Basic system modelling**	
	A	Introduction, Operator Notation and Transfer Functions, Block Diagrams, Manipulations, and Simulation	CO2

	B	Block Diagram Modelling—Direct Method, Analogy Approach and Modified Analogy Approach			CO2
	C	Mathematical modelling : Basic system modelling of mechanical, electrical, fluid and thermal system			CO2
	Unit 3	**Mechatronic system modelling and Controllers**			
	A	Engineering systems: Rotational-translational and electro-mechanical system			CO2, CO3
	B	Engineering systems: Pneumatic-mechanical, hydraulic-mechanical			CO2, CO3
	C	Control modes, Adaptive control system, Programmable logic controllers			CO2, CO3
	Unit 4	**Sensors and Transducers**			
	A	Sensor Classification, Parameter Measurement in Sensors and Transducers, Quality Parameters, Errors and Uncertainties in Mechatronic Modelling Parameters			CO4
	B	Sensors for Motion and Position Measurement, Digital Sensors for Motion Measurement, Force and Torque Sensors			CO4
	C	Vibration—Acceleration Sensors, Sensors for Flow Measurement, Temperature Sensing Devices and Sensor Applications			CO4
	Unit 5	**Actuating Devices and Real time interfacing**			
	A	Mechanical Actuators, Electrical Actuators and Pneumatic Actuators			CO4, CO5
	B	Fluid Power Actuation, Fluid Power Design Elements and Piezoelectric Actuators			CO4, CO5
	C	Elements of a Data Acquisition and Control System, Devices for Data Conversion and Data Conversion Process			CO5, CO6
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		30%	20%	50%	
	Text book/s*	3. Devdas Shetty, Richard A. Kolk, “Mechatronics System Design”, 2nd Edition, Cengage Learning 2011			
	Other References	1 Georg pelz, "Mechatronic Systems: Modeling and simulation" with HDL’s, John wiley and sons Ltd, 2003. 2. Bradley, D.Dawson, N.C. Burd and A.J. Loader, "Mechatronics: Electronics in Products and Processes", CRC Press 1991 , First Indian print 2010 3. De Silva, "Mechatronics: A Foundation Course", Taylor &Francis, Indian Reprint, 2013.			

COURSE ARTICULATION MATRIX

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
MEC310.1	3	1	1	1	-	-	-	-	-	-	-	1	-	3	3
MEC310.2	3	2	1	2	-	-	-	-	-	-	-	1	-	3	3
MEC310.3	3	3	3	3	-	-	-	-	-	-	-	1	-	3	3
MEC310.4	3	3	3	3	-	-	-	-	-	-	-	1	-	3	3
MEC310.5	3	3	3	3	-	-	-	-	-	-	-	1	-	3	3
MEC310.6	3	3	3	3	-	-		-	-	-	-	1	-	3	3
MEC310	3	3	3	3	-	-	-	-	-	-	-	1	-	3	3

1-Slight (Low) **2-Moderate (Medium)** **3-Substantial (High)**

School: SSET		**Batch : 2023-2027**
Programme: B.Tech		**Current Academic Year: 2023-2024**
Branch: ME		**Semester: IV**
1	Course Code	ECE092
2	Course Title	Control System Engineering
3	Credits	3
4	Contact Hours (L-T-P)	3-0-0
	Course Status	Program Elective
5	Course Objective	1. To introduce the components and their representation of control systems 2. To learn various methods for analyzing the time response, frequency response and stability of the systems. 3. To learn the various approach for the state variable analysis.
6	Course Outcomes	After the successful completion of course, students will be able to: CO1: Apply transfer function models, signal flow graphs and block diagram algebra to obtain the transfer function of a given system CO2: Obtain system response in time domain CO3: Design a closed-loop control system to satisfy dynamic performance specifications using frequency response CO4: Analyze closed-loop control systems for stability and steady-state performance CO5: Measure the performance of simple feedback controllers and compensators to meet desired specifications CO6: Able to solve the state equation of a control system
7	Course Description	The objective of this course is to introduce different types of system and identify a set of algebraic equations to represent and model a complicated system into a more simplified form to interpret different physical and mechanical systems in terms of electrical system to construct equivalent electrical models for analysis. Employment of time domain analysis to predict and diagnose transient performance parameters of the system for standard input functions and identify the needs of different types of controllers and compensator to ascertain the

		required dynamic response from the system. Formulation of different types of analysis in frequency domain to explain the nature of stability of the system.	
8	Outline syllabus		CO Mapping
	Unit 1	**SYSTEMS COMPONENTS AND THEIR REPRESENTATION**	**CO1, CO2**
	A	Control System: Terminology and Basic Structure-Feed forward and Feedback control theory	CO1, CO2
	B	Electrical and Mechanical Transfer Function Models-Block diagram Models	CO1, CO2
	C	Signal flow graphs models-DC and AC servo Systems, Synchros -Multivariable control system	CO1, CO2
	Unit 2	**TIME REPONSE ANALYSIS**	**CO2**
	A	Transient response-steady state response-Measures of performance of the standard first order and second order system	CO2
	B	Effect on an additional zero and an additional pole-steady error constant and system- type number	CO2
	C	PID control-Analytical design for PD,PI,PID control systems	CO2
	Unit 3	**FREQUENCY RESPONSE AND SYSTEM ANALYSIS**	**CO3**
	A	Closed loop frequency response-Performance specification in frequency domain	CO3
	B	Frequency response of standard second order system-Bode Plot - Polar Plot- Nyquist plots	CO3
	C	Design of compensators using Bode plots-Cascade lead compensation-Cascade lag compensation-Cascade lag-lead compensation	CO3
	Unit 4	**CONCEPTS OF STABILITY ANALYSIS**	**CO4, CO5**
	A	Concept of stability-Bounded, Input Bounded, Output stability	CO4, CO5
	B	Routh stability criterion, Relative stability	CO4, CO5
	C	Root locus concept-Guidelines for sketching root locus-Nyquist stability criterion.	CO4, CO5
	Unit 5	**CONTROL SYSTEM ANALYSIS USING STATE VARIABLE METHODS**	**CO1, CO6**
	A	State variable representation-Conversion of state variable models to transfer functions-Conversion of transfer functions to state variable models	CO1, CO6
	B	Solution of state equations-Concepts of Controllability and Observability-Stability of linear systems-Equivalence	CO1, CO6

		between transfer function and state variable representations			
	C	State variable analysis of digital control system-Digital control design using state feedback.			CO1, CO6
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	1. M.Gopal, "Control System — Principles and Design", Tata McGraw Hill, 4th Edition, 2012.			
	Other References	1. J.Nagrath and M.Gopal, "Control System Engineering", New Age International Publishers, 5 th Edition, 2007. 2. K. Ogata, 'Modern Control Engineering', 5th edition, PHI, 2012. 3. S.K.Bhattacharya, Control System Engineering, 3rd Edition, Pearson, 2013. 4. Benjamin.C.Kuo, "Automatic control systems", Prentice Hall of India, 7th Edition,1995.			

COURSE ARTICULATION MATRIX

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ECE092.1	3	3	1	1	1	-	-	-	-	1	-	-	2	3	2
ECE092.2	3	3	1	1	1	-	-	-	-	1	-	-	2	3	2
ECE092.3	3	2	1	1	1	-	-	-	-	1	-	-	2	3	1
ECE092.4	3	2	1	1	1	-	-	-	-	1	-	-	2	3	2
ECE092.5	3	3	1	2	2	-	-	-	-	1	-	-	2	3	2
ECE092.6	3	3	1	2	1	-	-	-	-	1	-	-	2	3	2
ECE092	3	3	1	2	2	-	-	-	-	1	-	-	2	3	2

1-Slight (Low) 2-Moderate (Medium) 3-Substantial (High)

School: SSET		**Batch : 2023-2027**	
Programme: B.Tech		**Current Academic Year: 2023-2024**	
Branch: ME		**Semester: V**	
1	Course Code	ECE093	
2	Course Title	Digital Electronics	
3	Credits	3	
4	Contact Hours (L-T-P)	3-0-0	
	Course Status	Program Elective	
5	Course Objective	1. To present the Digital fundamentals, Boolean algebra and its applications in digital systems 2. To familiarize with the design of various combinational digital circuits using logic gates 3. To introduce the analysis and design procedures for synchronous and asynchronous sequential circuits 4. To explain the various semiconductor memories and related technology	
6	Course Outcomes	After the successful completion of course, students will be able to: CO1: Design and analyse combinational logic circuits CO2: Distinguish between modular combinational circuits with MUX/DEMUX, Decoder, Encoder CO3: Choose the different flip flops and convert them. CO4: Solve synchronous sequential logic circuits CO5: Select different programmable connections and FPGA implementation of logic functions. CO6: Compare different memory elements used in the electronics systems	
7	Course Description	This course covers combinational and sequential logic circuits. Topics include number systems, Boolean algebra, logic families, medium scale integration (MSI) and large scale integration (LSI) circuits, analog to digital (AD) and digital to analog (DA) conversion, and other related topics. Upon completion, students should be able to construct, analyze, verify, and troubleshoot digital circuits using appropriate techniques and test equipment.	
8	Outline syllabus		CO Mapping
	Unit 1	**DIGITAL FUNDAMENTALS**	**CO1**
	A	Number Systems – Decimal, Binary, Octal, Hexadecimal, 1‘s and 2‘s complements	CO1
	B	Codes – Binary, BCD, Excess 3, Gray, Alphanumeric codes, Boolean theorems, Logic gates, Universal gates	CO1,CO6
	C	Sum of products and product of sums, Minterms and Maxterms, Karnaugh map Minimization and Quine-McCluskey method of minimization	CO1,CO6
	Unit 2	**COMBINATIONAL CIRCUIT DESIGN**	**CO2**
	A	Design of Half and Full Adders, Half and Full Subtractors	CO2
	B	Binary Parallel Adder – Carry look ahead Adder, BCD Adder,	CO2

	C	Multiplexer, Demultiplexer, Magnitude Comparator, Decoder, Encoder, Priority Encoder			**CO2**
	Unit 3	**SYNCHRONOUS SEQUENTIAL CIRCUITS**			**CO3**
	A	Flip flops – SR, JK, T, D, Master/Slave FF – operation and excitation tables, Triggering of FF			CO3
	B	Analysis and design of clocked sequential circuits – Design – Moore/Mealy models, state minimization, state assignment, circuit implementation			CO3
	C	Design of Counters- Ripple Counters, Ring Counters, Shift registers, Universal Shift Register.			**CO3**
	Unit 4	**ASYNCHRONOUS SEQUENTIAL CIRCUITS**			**CO4**
	A	Stable and Unstable states, output specifications, cycles and races			CO4
	B	State reduction, race free assignments, Hazards, Essential Hazards			CO4,CO6
	C	Pulse mode sequential circuits, Design of Hazard free circuits.			**CO4, CO6**
	Unit 5	**MEMORY DEVICES AND DIGITAL INTEGRATED CIRCUITS**			**CO5,CO6**
	A	Basic memory structure – ROM -PROM – EPROM – EEPROM –EAPROM, RAM – Static and dynamic RAM			CO5,CO6
	B	Programmable Logic Devices – Programmable Logic Array (PLA) – Programmable Array Logic (PAL) – Field Programmable Gate Arrays (FPGA) – Implementation of combinational logic circuits using PLA, PAL.			CO5,CO6
	C	Digital integrated circuits: Logic levels, propagation delay, power dissipation, fan-out and fan-in, noise margin, logic families and their characteristics-RTL, TTL, ECL, CMOS			CO5,CO6
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	1. M. Morris Mano and Michael D. Ciletti, "Digital Design", 5th Edition, Pearson, 2014			
	Other References	1. Charles H.Roth. "Fundamentals of Logic Design", 6th Edition, Thomson Learning, 2013. 2. Thomas L. Floyd, "Digital Fundamentals", 10th Edition, Pearson Education Inc, 2011 3. S.Salivahanan and S.Arivazhagan"Digital Electronics", Ist Edition, Vikas Publishing House pvt Ltd, 2012. 4. Anil K.Maini "Digital Electronics", Wiley, 2014. 5. A.Anand Kumar "Fundamentals of Digital Circuits", 4th Edition, PHI Learning Private Limited, 2016. 6. Soumitra Kumar Mandal " Digital Electronics", McGraw Hill Education Private Limited, 2016.			

COURSE ARTICULATION MATRIX

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ECE093.1	2	3	2	3	1								3	3	3
ECE093.2	2	2	1	2	2								3	2	2
ECE093.3	3	2	2	2	1								3	1	2
ECE093.4	3	3	2	2	1								2	2	3
ECE2093.5	3	3	1	2	1								3	2	2
ECE093.6	3	2	2	2	2								2	2	3
ECE093	3	2	2	2	1	-	-	-	-	-	-	-	2	2	2

1-Slight (Low) 2-Moderate (Medium) 3-Substantial (High)

School: SSET		**Batch : 2023-2027**	
Programme: B.Tech		**Current Academic Year: 2023-2024**	
Branch: ME		**Semester: VI**	
1	Course Code	MEC364	
2	Course Title	Sensors and Signal Processing	
3	Credits	3	
4	Contact Hours (L-T-P)	3-0-0	
	Course Status	Program Elective	
5	Course Objective	1. To impart knowledge of units and standards of measurement. 2. To understand the sensors and signal processing used mechatronics.	
6	Course Outcomes	After the successful completion of course, students will be able to: CO1: Make use of the actuator and impart knowledge on open loop and closed loop system CO2: Choose among the various units and standards used in measurement system CO3: Examine various types of resistive, inductive and capacitive transducers CO4: Determine the behaviour of smart and intelligent actuators CO5: Interpret amplification, filtering, signal conditioning and data logging of a system CO6: Minimize the measurement error associated with the instruments used in different industries	
7	Course Description	This is a course on sensors and signal processing used for mechatronics engineer. The focus is on building knowledge and skills in several sensor network applications.	
8	Outline syllabus		CO Mapping
	Unit 1	**INTRODUCTION**	**CO1**
	A	Definitions: Mechatronics & actuator; current & voltage sources	CO1
	B	Grounding; Solenoids, relays, electrical motors for actuators;	CO1
	C	Basics of open loop and closed loop systems, block diagram of mechatronics system	CO1
	Unit 2	**SCIENCE OF MEASUREMENT**	**CO2,CO6**
	A	Units and Standards, Calibration techniques, Errors in Measurements	CO2, CO6
	B	Generalized Measurement System	CO2, CO6
	C	Transducer, Response of transducers to different timevarying inputs, Classification of transducers	CO2
	Unit 3	**ELECTRICAL MEASUREMENTS**	**CO3**
	A	Resistive transducers: Potentiometer, RTD , Thermistor, Thermocouple, Strain gauges use in displacement, temperature, force measurement	CO3
	B	Inductive transducer: LVDT ,RVDT use in displacement	CO3
	C	Capacitive transducer: Piezo electric transducer, Digital displacement transducers	CO3
	Unit 4	**SMART AND INTELLIGENT SENSORS**	**CO4**

	A	Definitions: Smart and intelligent sensor			CO4
	B	Architecture and operation of smart sensor			CO4
	C	intelligent actuator without feedback sensor and intelligent actuator with feedback sensor			**CO4**
	Unit 5	**SIGNAL CONDITIONING AND DATA ACQUISITION**			**CO5**
	A	Amplification, Filtering			CO5
	B	Sample and Hold circuits, Data Acquisition: Single channel and multi-channel data acquisition			CO5
	C	Data logging			CO5
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	1. E. O. Doebelin, 'Measurement Systems – Applications and Design ', Tata McGraw Hill, edition 1992. 2. A. K. Sawhney, ' A course in Electrical and Electronic Measurement and Instrumentation', Dhanpat Rai and Co (P) Ltd, 2004.			
	Other References	1.Beckwith, Marangoni and Lienhard, 'Mechanical Measurements', Addison – Wesley,5th Edition, 2000. 2. D. Roy Choudry, Sheil Jain, ' Linear Integrated Circuits', New Age International Pvt.Ltd., 2000. 3. Patranabis. D, "Sensors and Transducers", 2nd edition PHI, New Delhi, 2003.			

COURSE ARTICULATION MATRIX

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
MEC364.1	3	2	1	1	2	-	-	-	-	1	-	-	3	3	3
MEC363.2	3	1	1	1	2	-	-	-	-	1	-	-	3	3	3
MEC364.3	3	1	2	2	3	-	-	-	-	1	-	-	3	2	2
MEC364.4	3	2	2	1	2	-	-	-	-	1	-	-	3	3	2
MEC364.5	3	2	2	3	3	-	-	-	-	1	-	-	3	3	2
MEC364.6	3	2	2	3	3	-	-	-	-	1	-	-	3	3	3
MEC364	3	2	2	2	2	-	-	-	-	1	-	-	3	3	3

1-Slight (Low) 2-Moderate (Medium) 3-Substantial (High)

School: SSET		**Batch : 2023-2027**	
Programme: B.Tech		**Current Academic Year: 2023-2024**	
Branch: ME		**Semester: VII**	
1	Course Code	MEC365	
2	Course Title	Robotics and Machine Vision System	
3	Credits	3	
4	Contact Hours (L-T-P)	3-0-0	
	Course Status	Program Elective	
5	Course Objective	1. To know about the principles and applications of vision system in modern manufacturing environment 2. To learn about the algorithms in vision 3. To know about the recognition of object 4. To be familiar about the applications regarding vision 5. To know about the components used for vision	
6	Course Outcomes	After the successful completion of course, students will be able to: CO1: Explain the gadgets and vision systems CO2: Select the image capturing and processing techniques CO3: Develop the vision system in other machines CO4: Knowledge for recognizing the objects based on sensors CO5: Application of vision and image processing in robot operations CO6: Apply the robotics and machine vision principles on real time industrial applications	
7	Course Description	The objective of this course is to provide engineering students theoretical and practical experience with automation technologies that will be of prime importance over the next decade: data acquisition and instrumentation, machine vision and motion control. Future manufacturing engineers need to be aware of machine vision technology, so they can realize the opportunities to integrate this technology into other processes where it is not currently available. Describe the components of a machine vision Systems, their functions, and the various technological options available for them. Be familiar with the most common image processing algorithms used in industrial applications. Identify situations or systems that could be improved by the application of machine vision.	
8	Outline syllabus		CO Mapping
	Unit 1	**VISION SYSTEM**	**CO1,CO6**
	A	Basic Components — Elements of visual perception	CO1
	B	Lenses: Pinhole cameras, Gaussian Optics	CO1,CO6
	C	Cameras — Camera-Computer interfaces	CO1,CO6
	Unit 2	**VISION ALGORITHMS**	**CO1,CO2**

	A	Fundamental Data Structures: Images, Regions, Sub-pixel Precise Contours			CO1, CO2
	B	Image Enhancement: Gray value transformations, image smoothing, Fourier Transform — Geometric Transformation			CO2
	C	Image segmentation — Segmentation of contours, lines, circles and ellipses — Camera calibration — Stereo Reconstruction.			CO2
	Unit 3	**OBJECT RECOGNITION**			**CO3**
	A	Object recognition, Approaches to Object Recognition			CO3
	B	Recognition by combination of views — objects with sharp edges, using two views only			CO3
	C	Recognition by combination of views - using a single view, use of dept values.			CO3
	Unit 4	**APPLICATIONS**			**CO4**
	A	Transforming sensor reading, Mapping Sonar Data, Aligning laser scan measurements			CO4
	B	Vision and Tracking: Following the road, Iconic image processing, Multiscale image processing			CO4
	C	Video Tracking - Learning landmarks: Landmark spatio grams, K-means Clustering, EM Clustering.			CO4
	Unit 5	**ROBOT VISION**			**CO5,CO6**
	A	Basic introduction to Robotic operating System (ROS) - Real and Simulated Robots			CO6
	B	Introduction to OpenCV, Open NI and PCL			CO6
	C	Installing and testing ROS camera Drivers, ROS to OpenCV - The cv_bridge Package.			CO5, CO6
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	1. Carsten Steger, Markus Ulrich, Christian Wiedemann, "Machine Vision Algorithms and Applications", WILEY-VCH, Weinheim,2008. Damian m Lyons, "Cluster Computing for Robotics and Computer Vision", World Scientific, Singapore, 2011.			
	Other References	1. Rafael C. Gonzalez and Richard E.woods, "Digital Image Processing", Addition - Wesley Publishing Company, New Delhi, 2007. 2. Shimon Ullman, "High-Level Vision: Object recognition and Visual Cognition", A Bradford Book, USA, 2000. R.Patrick Goebel, " ROS by Example: A Do-It-Yourself Guide to Robot Operating System —Volume I", A Pi Robot Production, 2012.			

COURSE ARTICULATION MATRIX

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
MEC365.1	3	2	2	-	-	-	-	-	-	-	-	2	3	2
MEC365.2	2	2	2	-	-	-	-	-	-	-	-	2	2	3
MEC365.3	2	2	2	-	-	-	-	-	-	-	-	1	2	3
MEC365.4	3	2	2	-	-	-	-	-	-	-	-	2	2	3
MEC365.5	3	2	2	-	-	-	-	-	-	-	-	2	2	3
MEC365.6	3	2	2	-	-	-	-	-	-	-	-	3	2	3
MEC365	3	2	2									2	2	3
MEC365	3	2	2	-	-	-	-	-	-	-	-	2	2	3

1-Slight (Low) **2-Moderate (Medium)** **3-Substantial (High)**

School: SSET		**Batch : 2023-2027**
Programme: B.Tech		**Current Academic Year: 2023-2024**
Branch: ME		**Semester: VI**
1	Course Code	MEC433
2	Course Title	I C Engines
3	Credits	3
4	Contact Hours (L-T-P)	3-0-0
	Course Status	Program Elective
5	Course Objective	The objective of this course is to make the students familiar with the various internal combustion engines, thermodynamic analysis of S.I and C.I engines, requirements and understanding of combustion related principles, lubrication systems, ignition processes, measurement of important parameters for the performance evaluation.
6	Course Outcomes	After the successful completion of course, students will be able to: CO1: Demonstrate the ability to perform a thermodynamic analysis of Otto, Diesel, and Dual cycle models. CO2: Explain the characteristics of common liquid and gaseous fuels with the ability to perform a combustion analysis of these fuels in the basic cycles. CO3: Examine the characteristic of homogeneous combustion in SI-Engines and spray combustion in CI-Engines. CO4: Improve the performance parameters of CI-Engines CO5: Analyze different ignition system, fuel injection systems, lubrication systems, supercharging and its effect. CO6: Measure and calculate the engine performance parameters and its operating characteristics.
7	Course Description	This course studies the fundamentals of how the design and operation of internal combustion engines affect their performance, operation, fuel requirements, and environmental impact. Topics include thermodynamics, combustion, friction phenomena and fuel properties with reference to engine power, efficiency, and emissions. Students examine the design features and

		operating characteristics of different types of internal combustion engines: spark-ignition, diesel, and stratified-charge.	
8	Outline syllabus		CO Mapping
	Unit 1	**Introduction to I.C Engines**	
	A	Engine classification, Air standard cycles, Otto, Diesel, Stirling, Ericsson cycles, Actual cycle analysis.	CO1
	B	Two and four stroke engines, SI and CI engines.	CO1
	C	Valve timing diagram, Scavenging in 2 Stroke engines, Rotary engines, stratified charge engine.	CO1
	Unit 2	**Fuels**	
	A	Fuels for SI and CI engine, important qualities SI engine fuels, Rating of SI engine fuels, Important qualities of CI engine fuels.	CO2
	B	Dopes, Additives, Gaseous fuels, LPG, CNG, Biofuels, Alternative fuels for IC engines.	CO2
	C	Thermo-chemical reactions.	CO2
	Unit 3	**SI Engines**	
	A	Principle of carburetion, Mixture requirements, Combustion in SI engine, Flame speed, Ignition delay	CO3
	B	Abnormal combustion and it's control, combustion chamber design for SI engines	CO3
	C	Magneto and battery ignition systems, ignition timing and spark plug, Electronic ignition, MPFI.	CO3
	Unit 4	**CI Engine**	
	A	Fuel injection in CI engines, Requirements, Types of injection systems, Fuel pumps, Fuel injectors, Injection timings	CO3
	B	Combustion in CI engines, Ignition delay, Knock and it's control, Combustion chamber design of CI Engines	CO3
	C	Exhaust emission and it's control of I.C Engine.	CO4
	Unit 5	**Engine Cooling and recent development**	
	A	Lubrication**:** Engine friction, Lubrication principal, Type of lubrication, Lubrication oils, Crankcase ventilation	CO5
	B	Supercharging and Turbocharging**:** Effect of altitude on power output, Types of supercharging	CO5
	C	Testing and Performance: Performance parameters, Basic measurements, Testing of SI and CI engines	CO6

	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	1. Ganeshan V., I.C Engines, Tata Mc Graw Hill Publishers			
	Other References	1.Haywood B., Internal Combustion Engine Fundamentals, McGraw-Hill Science/Engineering Engineering, 2010 2.Willard W. Pulkrabek, Fundamentals of the Internal Combustion Engine, PHI Publication, 2010 3.Richard Stone, Introduction to Internal Combustion Engine, Society of Automotive Engineers Inc., 2011 4.Gill, Smith,Ziurs, Fundamentals of Internal Combustion Engine, Oxford & IBH Publishing, 2010 5.Rogowsky ,COIC Engines, International Book Co., 2010 6.Engine CR software, download from http://www.sharewareconnection.com/enginecr.htm			

COURSE ARTICULATION MATRIX

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO433.1	3	2	2	-	-	-	-	-	-	-	-	1	2	-
CO433.2	3	2	3	-	-	-	-	-	-	-	-	1	2	1
CO433.3	3	2	2	-	-	-	-	-	-	-	-	1	2	1
CO433.4	3	3	2	-	-	-	-	-	-	-	-	2	2	1
CO433.5	2	2	2	-	-	-	-	-	-	-	-	2	2	-
CO433.6	3	2	2	-	-	-	-	-	-	-	-	1	2	-
MEC433	3	2	2	-	-	-	-	-	-	-	-	2	2	1

1-Slight (Low) 2-Moderate (Medium) 3-Substantial (High)

School: SSET		Batch : 2023-2027
Programme: B.Tech		**Current Academic Year: 2023-2024**
Branch: ME		**Semester: VI**
1	Course Code	MEC356
2	Course Title	Refrigeration & Air Conditioning
3	Credits	3
4	Contact Hours (L-T-P)	3-0-0
	Course Status	Program Core
5	Course Objective	After the successful completion of course, students will be able to: 1. To develop knowledge of Reversed Carnot cycle, Bell Coleman cycle 2. To provide students an understanding of working of Vapour Compression System 3. To provide students an understanding of working of Vapour Absorption system 4. To develop knowledge of different Refrigerants 5. To develop an understanding of working of Air Conditioning systems 6. To teach students different refrigeration & air conditioning equipments
6	Course Outcomes	On successful completion of this module students will be able to: CO1. Explain the working principle of reverse Carnot Cycle, Air refrigeration systems and classify various air refrigeration cycles. CO2. Identify the various factors affecting the working and COP of vapour compression system and explain the need of multistage vapour compression system. CO3. Distinguish between the vapour compression and vapour absorption system working and characterize different refrigerants CO4. Analyse psychometric processes and design air conditioning systems for various applications. CO5. Explain different refrigeration & air conditioning equipment CO6. Formulate and analyse the COP of refrigeration and air conditioning systems

7	Course Description	This course focus on the different methods of refrigeration and air conditioning, thermal comfort conditions, psychometry, its application in air conditioning and the understanding of heat transfer in buildings and duct designing.	
8	Outline syllabus		CO Mapping
	Unit 1	**Refrigeration & Air Refrigeration cycle**	
	A	Introduction to refrigeration system, Methods of refrigeration, Carnot refrigeration cycle, Reversed Carnot cycle	CO1, CO6
	B	Bell Coleman or Reversed Joule air refrigeration cycle, Unit of refrigeration, Refrigeration effect & C.O.P, Open and closed air refrigeration cycles,	CO1, CO6
	C	Aircraft refrigeration system, Classification of aircraft refrigeration system, Simple, Boot strap refrigeration, Regenerative, Reduced ambient, Dry air rated temperature (DART)	CO1
	Unit 2	**Vapour Compression System**	
	A	Analysis of vapour compression cycle, Use of T-S and P-H charts	CO2
	B	Effect of change in suction and discharge pressures on C.O.P, Effect of sub cooling of condensate & superheating of refrigerant vapour on C.O.P of the cycle	CO2, CO6
	C	Actual vapour compression refrigeration cycle, vapour compression system requirement, Different configurations of multistage vapour compression system with removal of flash gas & Intercooling, Cascade system	CO2, CO6
	Unit 3	**Vapour Absorption system**	
	A	Working Principal of vapour absorption refrigeration system, Comparison between absorption & compression systems, Elementary idea of refrigerant absorbent mixtures	CO3, CO6
	B	Water vapour absorption system, Lithium- Bromide water vapour absorption system, Three fluid absorption system	CO3
	C	Classification of refrigerants, Nomenclature, Desirable properties of refrigerants, Common refrigerants, Secondary refrigerants and CFC free refrigerants	CO3
	Unit 4	**Air Conditioning**	
	A	Introduction to air conditioning, Psychometric properties and their definitions, Psychometric chart, Different Psychometric processes	CO4

	B	Internal heat gain , Sensible heat factor (SHF), By pass factor, Grand Sensible heat factor (GSHF), Apparatus dew point (ADP), Thermal analysis of human body,			CO4
	C	Effective temperature and comfort chart, Infiltration & ventilation, Basic difference between comfort and industrial air conditioning.			CO4
	Unit 5	**Refrigeration Equipment & Application**			
	A	Elementary knowledge of refrigeration & air conditioning equipments: compressors, condensers, evaporators & expansion devices			CO5
	B	Air washers, Cooling towers, Ice plant, Water coolers			CO5
	C	Elementary knowledge of transmission and distribution of air through ducts and fans			CO5
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	1. C.P. Arora, Refrigeration and Air Conditioning, TMH..			
	Other References	1. Prasad Manohar, Refrigeration and Air Conditioning, New Age Publication. 2. Stoecker, W.F.; Jones, J.W., Refrigeration and Air conditioning, McGraw-Hill Publishing Company, 1982. 3. Dossat, Roy J., Principles of Refrigeration, Prentice Hall Publishing, 2001.			

COURSE ARTICULATION MATRIX

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
MEC356.1	2	-	-	-	-	-	-	-	-	2	-	-	-	-	1
MEC356.2	2	1	1	-	-	-	-	-	-	2	-	-	-	-	1
MEC356.3	2	1	-	-	2	-	-	-	-	2	-	-	-	-	1
MEC356.4	2	-	-	-	2	-	-	-	-	2	-	-	-	-	1
MEC356.5	2	1	-	-	2	-	-	-	-	2	-	-	-	-	1
MEC356.6	2	2	-	-	2	-	-	-	-	2	-	2	-	-	1
MEC356	2	1	1	-	2	-	-	-	-	2	-	2	-	-	1
MEC356	2	1	1	-	2	-	-	-	-	2	-	2	-	-	1

1-Slight (Low) 2-Moderate (Medium) 3-Substantial (High)

School: SSET		**Batch : 2023-2027**
Programme: B.Tech		**Current Academic Year: 2023-2024**
Branch: ME		**Semester: VII**
1	Course Code	MEC 335
2	Course Title	Computer Integrated Manufacturing Systems
3	Credits	3
4	Contact Hours (L-T-P)	3-0-0
	Course Status	Program Elective
5	Course Objective	After the successful completion of course, students will be able to: 1. The students will acquire knowledge of different elements of automated processes in a modern manufacturing environment integrated with computer control. 2. The students will have an understanding of using engineering design, and modelling techniques towards computer controlmanufacturing. 3. The students will get knowledge about the integration robot in flexible manufacturing systems. 4. The students will get some exposure to the Future of Automated Industry.
6	Course Outcomes	After completion of the this course the students will be able to CO1: Identify the main elements in computer integrated manufacturing systems. CO2: Analyze the assembly line balancing and Familiarize about the Flexible manufacturing system. CO3: Select the CAD/CAM tools and CNC in manufacturing processes. CO4: Plan the use of robotics in modern manufacturing. CO5: Apply the modern trends in Manufacturing like Industry 4.0 and applications of Toyota system leading to Smart Manufacturing. CO6: Explain the applications of computer in planning, manufacturing and controlling.
7	Course Description	This course is designed to give you a thorough understanding of the technology used in manufacturing systems. You will also be introduced to the concepts of computer integrated manufacturing and relevant standards, future of automationindustry, product life cycle management, computer aided manufacturing, and Flexible manufacturing.

8	Outline syllabus				CO Mapping
	Unit 1	**Introduction and Automated Flow Line**			
	A	Introduction, Product Development through CIM, Product development cycle, Types of production, Functions.			CO1
	B	Transfer mechanism, Buffer storage, Analysis of transfer lines, Line unbalancing concept, Automated assembly systems			CO1
	C	Line balancing,methods of line balancing, Largest candidate rule and Ranked Positional Weights method of line balancing.			CO1
	Unit 2	**Automated Material Handling and FMS**			
	A	The material handling function, Types of Material Handling Equipment, Conveyor Systems, Automated Guided Vehicle Systems.			CO2
	B	Automated Storage Systems: Storage System Performance, Automated Storage/Retrieval Systems, Carousel Storage Systems			CO2
	C	Flexible Manufacturing Systems, types of FMS, FMS components			CO2
	Unit 3	**CAD and CAM**			
	A	Applications of computers in design, software configuration, functions of graphics package, 2D transformations and geometric modeling.			CO3
	B	Introduction, components of CNC, CNC programming, manual part programming, G Codes and M Codes			CO3
	C	Programming of simple components in turning and milling systems			CO3
	Unit 4	**Robotics**			
	A	Robot anatomy, joints and links, common robot configurations.			CO4
	B	Robot control systems, End effectors, Sensors in robotics			CO4
	C	Industrial Robots, Applications of robots in material handling, processing and assembly and inspection.			CO4
	Unit 5	**Future of Automated Industry**			
	A	Focus on Waste, Relationship of Waste to Profit, Lean manufacturing			CO5
	B	Toyota Production System			CO5, CO6
	C	Industry 4.0, functions, applications and benefits. Components of Industry 4.0			CO5, CO6
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	**Text Book** 1. Mikell Groover, (2015), Automation, Production Systems and Computer-Integrated Manufacturing, 4th. Ed., ISBN # 0-13-349961-8, Pearson, New Jersey			
	Other References	**Reference Books** 1. M.P. Groover, (2008), Automation Production systems and Computer Integrated manufacturing, Pearson, Education 2. T.C. Chang, R. Wysk and H.P. Wang, (2009), Computer aided Manufacturing, Third Edition, Pearson **Education Software: –** AutoCAD and Solidworks			

COURSE ARTICULATION MATRIX

POS / COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
MEC335.1	1	1	-	-	1	-	-	-	-	-	-	-	2	3	2
MEC335.2	2	2	-	-	-	-	-	-	-	-	-	-	2	2	2
MEC335.3	2	2	-	-	2	-	-	-	-	-	-	-	2	2	2
MEC335.4	2	2	-	-	-	-	-	-	-	-	-	-	2	2	2
MEC335.5	2	2	-	-	-	-	-	-	-	-	-	-	2	2	2
MEC335.6	2	2	-	-	2	-	-	-	-	-	-	-	2	2	2
EC 335	2	2	-	-	2	-	-	-	-	-	-	-	2	2	2

1-Slight (Low) 2-Moderate (Medium) 3-Substantial (High)

School: SSET		**Batch : 2023-2027**	
Programme: B.Tech		**Current Academic Year: 2023-2024**	
Branch: ME		**Semester: VII**	
1	Course Code	MEC357	
2	Course Title	Introduction to Six Sigma	
3	Credits	2	
4	Contact Hours (L-T-P)	2-0-0	
	Course Status	Program Elective	
5	Course Objective	The objective of this course is to focus managerial strategy of process improvement and variation reduction and to put six sigma concepts into perspective	
6	Course Outcomes	After the successful completion of course, students will be able to: CO1: Identify and know the aspects of quality in an organization. CO2: Explain the fundamentals and applications of statistics in an organization. CO3: Describe the concepts of six sigma CO4: Interpret how processes can be statistically controlled CO5: Classify and describe various six sigma tools. CO6: Define the process of implementing six sigma.	
7	Course Description	To highlight its importance, as well as to present in-depth ideas on different methodologies, tools and techniques followed in implementing Six sigma in organization.	
8	Outline syllabus		CO Mapping
	Unit 1	**INTRODUCTION**	
	A	Definition of six sigma, Dimensions of Quality	CO1
	B	Quality Planning	CO1
	C	Quality costs - Analysis Techniques for Quality Costs, Quality control	CO1
	Unit 2	**APPLICATION OF SIX SIXMA**	
	A	Industrial application and implementation of six sigma	CO2, CO6
	B	Challenges in implementing Six Sigma	CO2, CO6
	C	Mass production Vs lean production	CO2, CO6
	Unit 3	**PROCESS IMPROVEMENT USING SIX SIGMA**	
	A	Continuous Process Improvement –PDSA & PDCA Cycle	CO3
	B	Application of Kaizen, benchmarking	CO3
	C	voice of customer, basic matrices	CO3
	Unit 4	**TOOLS OF SIX SIGMA**	
	A	Hoshin Kanri, DMAIC, Value Stream Mapping (VSM)	CO4, CO6
	B	Application of Just in time, 5S, Kanban	CO4, CO6
	C	The seven Muda, Pareto chart, control charts	CO4, CO6
	Unit 5	**IMPLEMENTATION OF SIX SIGMA**	

	A	Taguchi Quality curve and Taguchi Quality Loss Function			CO5, CO6
	B	Quality Function Deployment (QFD) – House of Quality, QFD Process			CO5, CO6
	C	Various case studies of Six sigma implementation			CO5, CO6
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	1. Six sigma handbook by pyzdek, McGraw Hill			
	Other References	1. The Six Sigma Black Belt Handbook | Third Edition | By Pearson 2. Introduction to Six Sigma 1st Edition 2016 by Dr Niaz Ahmed Siddiqui, New Age International (P) Ltd Publishers			

COURSE ARTICULATION MATRIX

POS / COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
MEC357.1	1	1	-	-	-	-	-	-	-	-	-	-	2	3	2
MEC357.2	2	2	-	-	-	-	-	-	-	-	-	-	2	2	2
MEC357.3	2	2	-	-	-	-	-	-	-	-	-	-	2	2	2
MEC357.4	2	2	-	-	-	-	-	-	-	-	-	-	2	2	2
MEC357.5	2	2	-	-	-	-	-	-	-	-	-	-	2	2	2
MEC357.6	2	2	-	-	-	-	-	-	-	-	-	-	2	2	2
MEC357	2	2	-	-	-	-	-	-	-	-	-	-	2	2	2

1-Slight (Low) 2-Moderate (Medium) 3-Substantial (High)

School: SSET		**Batch : 2023-2027**	
Programme: B.Tech		**Current Academic Year: 2023-2024**	
Branch: ME		**Mechanical Engineering**	
1	Course Code	MEC358	
2	Course Title	Material Characterization Techniques	
3	Credits	3	
4	Contact Hours (L-T-P)	3-0-0	
5	Course Status	Program Elective	
6	Course Outcomes	After the successful completion of course, students will be able to: CO1: Explain different terminologies associated with optical image formation; and describe sample preparation procedure and working of optical microscopes CO2: Summarise the properties, generation and detection of X-rays and its utilization in analysing a microstructure CO3: Describe principle, working and construction of an SEM along with sample preparation techniques required for capturing the microstructure effectively CO4: Describe principle, working and construction of a TEM along with sample preparation techniques required for capturing the microstructure effectively CO5: Explain the instrumentation and working principle of TGA, DSC and Raman spectroscopy CO6: Conduct, evaluate and analyse microstructural characterization	
7	Course Description	The course covers the basic principles and techniques of X-ray diffraction, optical, scanning electron and transmission electron microscopy along with the sample preparation technique required for the microstructural analysis. The course also gives an overview of thermal and spectroscopic techniques.	
8	Outline syllabus		CO Mapping
	Unit 1	**Optical Microscopy (OM)**	
	A	Optical image formation, Resolution, Depth of Field and Depth of Focus, Light sources and condenser systems, Selection of objective lenses	CO1
	B	Sampling and sectioning, Mounting and grinding, Polishing and Etching methods, Reflection and absorption of light	CO1
	C	Bright field and dark field image contrast, Phase contrast microscopy, Working with digital images, Image interpretation and Utilization of OM in latest research papers	CO1, CO6

	Unit 2	**X-ray diffraction (XRD) Analysis**	
	A	Properties of X-rays: Electromagnetic radiation, Continuous and characteristic spectrum, Absorption, Filters, Production and Detection of X-rays and Safety precautions	CO2
	B	Diffraction, Bragg's law, X-ray spectroscopy, Diffraction directions, Diffraction methods, Diffraction under non ideal conditions	CO2
	C	Concept of allowed and forbidden reflection, Indexing of cubic crystals, Use of XRD to analyse structure of polycrystalline aggregates: grain size, particle size, crystal quality and Utilization of XRD in latest research papers	CO2, CO6
	Unit 3	**Scanning Electron Microscopy (SEM)**	
	A	Components of SEM, Beam focusing conditions, Inelastic scattering and Energy losses, Characteristics of X-ray images and Image contrast in backscattered electron images	CO3
	B	Factors affecting secondary electron emission, Secondary electron image contrast, Sputter coating and contrast enhancement and Fractography	CO3, CO6
	C	Principles of operation and construction, Ion beam-specimen interactions and Utilization of SEM in latest research papers	CO3, CO6
	Unit 4	**Transmission Electron Microscopy (TEM)**	
	A	Wave properties of electrons, Resolution limitations, Lens aberrations, Comparative performance of SEM and TEM	CO4
	B	Specimen preparation: Mechanical thinning, Electrochemical thinning, Ion milling, Sputter coating, Carbon coating and Replica methods	CO4
	C	Working principle and the origin of contrast in TEM, Principle of reciprocity in electron optics, Scanning TEM and Utilization of SEM in latest research paper	CO4, CO6
	Unit 5	**Thermal and Spectroscopic Techniques**	
	A	Thermo-gravimetric analysis (TGA): Introduction, Instrumentation, Working principle and utilization in latest research papers	CO5, CO6
	B	Differential Scanning Calorimetry (DSC): Introduction, Instrumentation, Working principle and Utilization in latest research papers	CO5, CO6
	C	Raman Spectroscopy: Introduction, Instrumentation, Working principle and Utilization in latest research papers	CO5, CO6

	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	• **Microstructural Characterization of Materials** by David Brandon and Wayne Kaplan • **Elements of X-ray Diffraction** by B. D. Cullity			
	Other References	• **Materials Characterization Techniques** bySam Zhang, Lin Li and Ashok Kumar • **Scanning Electron Microscopy and X-Ray Microanalysis** by Joseph I. Goldstein et al.			

COURSE ARTICULATION MATRIX

POS / COS	PO1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO 11	PO 12	PS O1	PS O2	PS O3
MEC358.1	1	1	-	-	-	-	-	-	-	-	-	-	2	2	2
MEC358.2	2	2	-	-	-	-	-	-	-	-	-	-	2	2	2
MEC358.3	2	2	-	-	-	-	-	-	-	-	-	-	2	2	2
MEC358.4	2	2	-	-	-	-	-	-	-	-	-	-	2	2	2
MEC358.5	2	2	-	-	-	-	-	-	-	-	-	-	2	2	2
MEC358.6	2	2	-	-	-	-	-	-	-	-	-	-	2	2	2
MEC358	2	2	-	-	-	-	-	-	-	-	-	-	2	2	2

1-Slight (Low) 2-Moderate (Medium) 3-Substantial (High)

School: SSET		**Batch : 2023-2027**	
Programme: B.Tech		**Current Academic Year: 2023-2024**	
Branch: ME		**Mechanical Engineering**	
1	Course Code	MEC359	
2	Course Title	Heat Treatment of Metals and Alloys	
3	Credits	3	
4	Contact Hours (L-T-P)	3-0-0	
5	Course Status	Program Elective	
6	Course Outcomes	After the successful completion of course, students will be able to: CO1: Explain the principle behind different heat treatment processes and its effect on the properties of the product CO2: Describe the significance of hardenability and quenchants; and carry out temperature measurement CO3: Compare and contrast different chemical heat treatment processes and surface hardening methods CO4: Make use of different TMT processes to obtain desired properties CO5: Evaluate the quality of the heat treated product CO6: Modify the properties of a component as per the requirement	
7	Course Description	The course comprehensively covers almost every aspect of heat treatment processes; right from principle, mechanism, inspection and quality control to the cause and remedy of defects that might occur during the treatment. It is expected that the students will be able to tailor the mechanical properties of metals and alloys as per the need upon completion of this course.	
8	Outline syllabus		CO Mapping
	Unit 1	**Heat Treatment Processes for Steels and Aluminium**	
	A	Stress relieving, Annealing and its types, Spheroidizing, Normalizing, Hardening methods and Factors affecting hardening process	CO1, CO6
	B	Tempering: Structural changes, Effect of alloying elements, Temper brittleness and colours, Austempering, Martempering, Sub-zero treatment and Patenting	CO1, CO6
	C	Heat treatable and non-heat treatable aluminium alloys, Classification, Heat treatment of cast and wrought aluminium alloys	CO1, CO6
	Unit 2	**Hardenability, Quenchants and Temperature Measurement**	
	A	Significance of hardenability, relationship of hardenability with transformation rates and Determination of hardenability, Factors affecting hardenability: Austenitic grain size, Carbon content and Alloying elements	CO2

	B	Removal of heat during quenching, Quenching media and Characteristics of quenchants			CO2
	C	Thermocouples: Thermocouple material and its selection criteria, Temperature measurement and calibration, Indirect methods of temperature measurement and Temperature control			CO2
	Unit 3	**Chemical Heat Treatment of Steels and Surface Hardening**			
	A	Carburizing types: Pack, Liquid, Gas and Vacuum; Post carburizing heat treatments, Cyaniding and Carbonitriding			CO3, CO6
	B	Nitriding, Plasma nitriding, Salt bath nitrocarburizing, Boronizing, Chromizing and Toyota Diffusion (TD) process			CO3, CO6
	C	Surface hardening types: Flame, Induction, Electron beam and Laser; Case depth measurement in steels			CO3, CO6
	Unit 4	**Thermomechanical Treatment and Defects in Heat Treatment**			
	A	Classification, Controlled rolling, Hot-cold working, Ausforming, and Isoforming			CO4, CO6
	B	Marstraining, Cryoforming, Preliminary TMT, Thermomechanical annealing and TMT of non-ferrous alloys			CO4, CO6
	C	Low hardness and strength after hardening, Soft spots, Oxidation, Decarburizing, Overheating and Burning of steels; Distortion and Wrapping; Methods to reduce distortion and Treatment for stabilizing dimension			CO4
	Unit 5	**Quality Control and Energy Economy in Heat Treatment**			
	A	Inspection: Steps, Objectives, Manner, Process, Types and Stages; Factors controlling quality, Quality control			CO5
	B	Quality control in heat treatment: Product design, Heat treatment specifications, Material selection, Dimensional considerations, Selection and working of equipment and accessories; Inspection in heat treatment			CO5
	C	Energy economy through: Material change, Heat treatment practice and Processing; Air pollution in heat treatment			CO5
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	**Heat Treatment Principles and Techniques** by T.V. Rajan, C.P. Sharma and Ashok Sharma			
	Other References	**Steel and Its Heat Treatment** by Karl-Erik Thelning			

COURSE ARTICULATION MATRIX

POS / COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
MEC359.1	1	1	-	-	-	-	-	-	-	-	-	-	2	3	2
MEC359.2	2	2	-	-	-	-	-	-	-	-	-	-	2	2	2
MEC359.3	2	2	-	-	-	-	-	-	-	-	-	-	2	2	2
MEC359.4	2	2	-	-	-	-	-	-	-	-	-	-	2	2	2
MEC359.5	2	2	-	-	-	-	-	-	-	-	-	-	2	2	2
MEC359.6															
MEC359	2	2	-	-	-	-	-	-	-	-	-	-	2	2	2

1-Slight (Low) 2-Moderate (Medium) 3-Substantial (High)

School: SSET		**Batch : 2023-2027**	
Programme: B. Tech.		**Current Academic Year: 2023-2024**	
Branch: ME		**Mechanical Engineering**	
	Course Code	MEC360	
2	Course Title	Advanced Engineering Materials	
3	Credits	3	
4	Contact Hours (L-T-P)	3-0-0	
5	Course Status	Program Elective	
6	Course Outcomes	After the successful completion of course, students will be able to: CO1: Explain the structure, properties, fabrication routes and applications of ceramics CO2: Summarise the structure, properties, fabrication routes and applications of polymers CO3: Describe the constituents, properties, fabrication routes and applications of composites CO4: Explain the structure, properties, synthesis routes and applications of nanomaterials and the challenges associated with it CO5: Describe the composition, properties, fabrication routes and applications of other emerging materials such as functionally graded materials, high entropy alloys and super alloys CO6: Analyse the problems and accordingly suggest materials for different applications	
7	Course Description	This course will familiarize the students with the structure/composition, properties, processing and applications of various classes of engineering materials. The students will develop an understanding that for a particular application which kind of materials can be used and how its properties can be altered as per the requirement.	
8	Outline syllabus		CO Mapping
	Unit 1	**Ceramics**	
	A	Crystal structure, Silicate ceramics, Imperfections in ceramics, Diffusion in ionic materials, Ceramic phase diagram	CO1
	B	Fracture behaviour, Stress-strain curve, Mechanisms of plastic deformation, Types and applications of ceramics: Glasses, Refractories, Abrasives, cements etc.	CO1, CO6
	C	Fabrication and processing of glasses, glass-ceramics and clay product; Powder pressing and Tape casting	CO1

	Unit 2	**Polymers**			
	A	Polymer molecule chemistry, Molecular configuration, Polymer types, Copolymers, Crystallinity and crystals in polymers, Defects and diffusion in polymeric materials			CO2
	B	Stress-strain behaviour, Fracture behaviour, Mechanical properties, Deformation behaviour and Factors affecting mechanical properties of polymers			CO2, CO6
	C	Crystallization, Melting, Glass-transition, Types and applications, Polymerization, Additives, Forming techniques, Fabrication of elastomers, fibres and films			CO2
	Unit 3	**Composites**			
	A	Principle of combined action, Matrix phase, Reinforcement, Rule of mixture, Large particle composite and Dispersion strengthened composites			CO3
	B	Influence of fibre length, Elastic behavior and Tensile stress-strain behavior of continuous and aligned fibre composites, discontinuous and aligned fibre composites and discontinuous and randomly oriented fibre composites			CO3
	C	Fabrication/processing, properties and applications of different types of composites			CO3, CO6
	Unit 4	**Nanomaterials**			
	A	History and scope, Classification, Microstructure and Defects in Nanocrystalline Materials and Effect of Nano-dimensions on Materials Behaviour			CO4
	B	Synthesis Routes: Bottom-Up Approaches, Top-Down Approaches and Consolidation of Nanopowders			CO4
	C	Applications of nanomaterials, Comparison of composites and nanocomposites, Nanostructured Materials with High Application Potential, Concerns and Challenges of Nanotechnology			CO4, CO6
	Unit 5	**Emerging Engineering Materials**			
	A	Functionally Graded Materials: Introduction, Composition, Fabrication, Properties and Applications			CO5, CO6
	B	High Entropy Alloys: Introduction, Composition, Fabrication, Properties and Applications			CO5, CO6
	C	Super Alloys: Introduction, Composition, Fabrication, Properties and Applications			CO5, CO6
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	

	Text book/s*	• **Materials Science and Engineering an Introduction** by William D. Callister and David G. Rethwisch • **Textbook of Nanoscience and Nanotechnology** by B.S. Murthy, P. Shankar, Baldev Raj, B.B. Rath and James Murday	
	Other References	**Materials Science and Engineering: A First Course** byV. Raghavan	

COURSE ARTICULATION MATRIX

POS / COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
MEC360.1	1	1	-	-	-	-	-	-	-	-	-	-	2	3	2
MEC360.2	2	2	-	-	-	-	-	-	-	-	-	-	2	2	2
MEC360.3	2	2	-	-	-	-	-	-	-	-	-	-	2	2	2
MEC360.4	2	2	-	-	-	-	-	-	-	-	-	-	2	2	2
MEC360.5	2	2	-	-	-	-	-	-	-	-	-	-	2	2	2
MEC360.6	2	2	-	-	-	-	-	-	-	-	-	-	2	2	2
MEC360	2	2	-	-	-	-	-	-	-	-	-	-	2	2	2

1-Slight (Low) **2-Moderate (Medium)** **3-Substantial (High)**

School: SSET		**Batch : 2023-2027**	
Programme: B.Tech		**Current Academic Year: 2023-2024**	
Branch: ME		**Semester: VI**	
1	Course Code	MEC318	
2	Course Title	Supply Chain Management	
3	Credits	3	
4	Contact Hours (L-T-P)	3-0-0	
	Course Status	Program Elective	
5	Course Objective	1. To familiarize students with various drivers and metrics of supply chain management system 2. To provide students an understanding of different types of supply chain networks 3. To teach the basics of economics in supply chain management system 4. To teach students the basics of cross functional supply chain metrics	
6	Course Outcomes	After the successful completion of course, students will be able to: CO1: explain basic terminology and supply chain operations in the context of today's business environment. CO2: design the supply chain networks. CO3: manage inventory effectively and planning policy, demand variability, forecasting and lead time on inventory level and cost. CO4: improve in transportation and logistics in supply chain operations. CO5: perceive the importance of strategic supply chain alliances and the impact of information Technology in SCM. CO6: develop supply chain which is financially and environmentally sustainable	
7	Course Description	The objective of SCM is to introduce the major building blocks, major functions, major business processes, performance metrics, major decisions (strategic, tactical, and operational) and role of IT in supply chain Management.	
8	Outline syllabus		CO Mapping
	Unit 1	**INTRODUCTION**	
	A	Understanding the Supply Chain	CO1
	B	Supply Chain Performance: Achieving Strategic Fit and Scope	CO1
	C	Supply Chain Drivers and Metrics	CO1
	Unit 2	DESIGNING THE SUPPLY CHAIN NETWORK	
	A	Designing Distribution Networks	CO2, CO6
	B	Network Design in the Supply Chain	CO2, CO6
	C	Network Design in an Uncertain Environment	CO2, CO6
	Unit 3	PLANNING AND MANAGING INVENTORIES IN A SUPPLY CHAIN	
	A	Managing Economies of Scale in a Supply Chain: Cycle Inventory	CO3

	B	Managing Uncertainty in a Supply Chain: Safety Inventory			CO3
	C	Determining the Optimal Level of Product Availability			CO3
	Unit 4	DESIGNING AND PLANNING TRANSPORTATION NETWORKS			
	A	The Role of Transportation in a Supply Chain			CO4, CO6
	B	Modes of Transportation			CO4, CO6
	C	Trade-Offs in Transportation Design			CO4, CO6
	Unit 5	MANAGING CROSS-FUNCTIONAL DRIVERS IN A SUPPLY CHAIN			
	A	Sourcing Decisions in a Supply Chain			CO5, CO6
	B	Information Technology in a Supply Chain			CO5, CO6
	C	Coordination in a Supply Chain, Sustainability in SCM			CO5, CO6
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	2. Chopra, Sunil; Meindl Peter and Kalra Dharam vir; Supply chain Management, Pearson Publcation			
	Other References	1. Scharj,P.B.,Lasen,T.S.,Managingtheglobalsupplychain,Vivabooks,NewDelhi,2000. 2. Ayers,J.B.,Handbookofsupplychainmanagement,TheSt.Lenciepress,2000. 3. Nicolas,J.N.,Competeivemanufacturingmanagement-continuousimprovement,Leanproduction,customer focussedquality,McGrawHill,NY,1998. 4..Steudel,H.J.andDesruelle,P.,Manufacturinginthenineteen-Howtobecomeamean, leanand world classcompetitor,VanNostrandReinhold,NY,1992.			

COURSE ARTICULATION MATRIX

POS / COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
MEC318.1	3	2	-	-	3	-	2	-	-	-	-	2	2	3	2
MEC318.2	1	1	3	-	3	2	-	-	-	-	-		2	2	2
MEC318.3	1	1	-	-	3	-	-	1	3	1	3	-	2	2	2
MEC318.4	3	-		2	-	-	-	-	-	-	3	2	2	2	2
MEC318.5		1	-	-	3	1	-	-	-	-	-	3	2	2	2
MEC318.6	3	2	3	3	2	-	3	-	-	2	2	3	2	2	2
MEC318	2	2	3	2	3	1	2	1	3	1	3	2	2	2	2

1-Slight (Low) **2-Moderate (Medium)** **3-Substantial (High)**

School: SSET		**Batch: 2023-2027**	
Programme: B.Tech		**Current Academic Year: 2023-2024**	
Branch: ME		**Mechanical Engineering**	
1	Course Code	MEC361	
2	Course Title	Hydraulic Machines	
3	Credits	3	
4	Contact Hours (L-T-P)	3-0-0	
	Course Status	Program Elective	
5	Course Objective	1)To teach design principles of turbines and pumps and to use them in engineering 2)To introduce the theory of hydraulic machines and it's applications. 3)The student will be aware of the importance, function and performance of hydro machinery. 4)The student will be in a position to evaluate the performance characteristics of hydraulic turbines	
6	Course Outcomes	After the successful completion of course, students will be able to: CO1: Define the concepts of dynamics of fluid flow and the forces exerted by a jet of fluid on vanes. CO2: Explain construction features and working principles of different hydraulic turbines. CO3: Develop the concept of Centrifugal pumps. CO4: Design the reciprocating pump. CO5: Elaborate the concepts of various hydraulic machines. CO6: Build the concepts of various hydraulic turbines and pumps.	
7	Course Description	The objective of this course is to introduce to students the principles of working, constructional details, design features and performance characteristics of various machines like turbines, pumps and other devices using incompressible fluids (liquids) and the ability to visualize and design some simple equipments used in practice	
8	Outline syllabus		CO Mapping
	Unit 1	Principles of hydraulic Machinery	
	A	Newton's Second law of motion, linear momentum Equation and angular momentum equations. Impact of jet on fixed and moving plates.	CO1
	B	Angular momentum equation and its applications. Fundamental equation of fluid Machines (Euler's Equation).	CO1
	C	Hydro Electric Power plant: Classifications, layout and its components	CO1, CO6
	Unit 2	Hydraulic Turbines	
	A	Classification: Impulse and Reaction turbine, pelton wheel turbine and its components	CO2, CO6

	B	Reaction turbines: introduction and classification ofreaction turbines, difference between impulse& reaction, discharge, power produced, work done, efficiencies, francis turbine and Kaplan turbine			CO2
	C	Draft tubes, unit quantities, specific speed, selection of turbine based on specific speed and head of water			CO2
	Unit 3	**Centrifugal Pump**			
	A	Centrifugal pumps: classification, working principle			CO3
	B	Manometric head, efficiencies, discharge, powerrequired to drive centrifugal pump			CO3, CO6
	C	Specific speed of CP, selection of pumps based on specific speed and head, concept of NPSH			CO3
	Unit 4	**Reciprocating Pump**			
	A	Reciprocating pumps: classification, working principle			CO4
	B	single stage and multi stage pumps, Air-vessel, Selection criterion			CO4
	C	Comparision of reciprocating and Centrifugal pumps			CO4
	Unit 5	**Miscellaneous Hydraulic Machines**			
	A	Jet pump, Air lift pump, Hydraulic Ram			CO5
	B	Hydraulic press, Hydraulic Lift, Pressure Intensifier			CO5
	C	Fluid Coupling & Torque Converter			CO5
	Mode				
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	Rajput R.K., Hydraulic Machines, 4th Edition, S. Chand, 2010.			

COURSE ARTICULATION MATRIX

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
MEC361.1	3	3	1	2	1	-	-	-	-	1	-	-	3	3	3
MEC361.2	3	3	1	1	1	-	-	-	-	-	-	-	3	3	3
MEC361.3	3	2	1	2	1	-	-	-	-	1	-	-	3	3	3
MEC361.4	3	2	1	3	2	-	-	-	-	1	-	-	3	3	3
MEC361.5	3	1	1	2	2	-	-	-	-	1	-	-	3	2	2
MEC361.6	3	2	1	3	3	-	-	-	-	1	-	-	3	3	3
MEC361	3	2	1	2	2	-	-	-	-	1	-	-	3	3	3

1-Slight (Low) **2-Moderate (Medium)** **3-Substantial (High)**

School: SSET		**Batch : 2023-2027**
Programme: B.Tech		**Current Academic Year: 2023-2024**
Branch: ME		**Mechanical Engineering**
1	Course Code	MEC334
2	Course Title	Introduction to Robotics Engineering
3	Credits	3
4	Contact Hours (L-T-P)	3-0-0
	Course Status	Program Elective
5	Course Objective	1. To be familiar with the automation and brief history of robot and applications. 2. To give the student familiarities with the kinematics of robots. 3. To give knowledge about robot end effectors and their design. 4. To learn about Robot Programming methods & Languages of robot 5. To give knowledge about various Sensors and their applications in robots.
6	Course Outcomes	After the successful completion of course, students will be able to: CO1: Identify with the automation and brief history of robot and it's applications. CO2: Analyze the various types of kinematic motions of robot. CO3: Modify various robot end effectors and their design concepts. CO4: Classify the various robot Programming methods & various Languages associated with the robots. CO5: Distinguish between various Sensors and their applications in robots. CO6: Choose the various robot installation and planning process.
7	Course Description	This course covers all aspects of mobile robot systems design and programming from both a theoretical and a practical perspective. The basic subsystems of control, localization, mapping, perception, and planning are presented. For each, the discussion will include relevant methods from applied mathematics. aspects of physics necessary in the construction of models of system and environmental behavior, and core algorithms which have proven

		to be valuable in a wide range of circumstances. This also includes various applications of robotics engineering.	
8	Outline syllabus		CO Mapping
	Unit 1	**Robotics Introduction**	**CO1,CO2**
	A	Robot definition: Robotic systems	CO1
	B	Role of robotics in automated manufacturing system, Robot anatomy	CO1,CO2
	C	Robot classifications and specifications.	CO1
	Unit 2	**Robot Kinematics**	**CO1,CO2,CO3**
	A	Robot kinematics, forward and reverse transformation, homogeneous transformations	CO2
	B	Robot actuators and control; Pneumatic, hydraulic and electrical drives and controls used in robots.	CO2
	C	Robot end-effectors, mechanical, magnetic and vacuum grippers, gripping forces RCC and design features of grippers.	**CO1,CO2,C03**
	Unit 3	**Robotic vision systems**	**CO1,CO2,CO4,CO5**
	A	Robot sensors, different types of contact and non-contact sensors.	CO2,CO5
	B	Robot vision and their interfaces	CO2,CO5
	C	Robot languages and programming techniques.	**CO1, CO2.CO4**
	Unit 4	**Applications of robots**	**CO1,CO2,CO3,C04**
	A	Applications of robots in materials handling	CO1,CO2,CO3,CO4
	B	Machine loading/unloading, inspection	CO1,CO2,CO3,CO4
	C	Welding, spray painting and finish coating, and assembly, etc.	**CO1,CO2,CO3,CO4**
	Unit 5	**Economy and safety related with robots**	**CO1,CO2,CO3,CO4,CO5,CO6**
	A	Economic performance and evaluation strategies.	CO4
	B	Robot installation and planning.	CO1,CO2,CO3,CO4, CO6
	C	Robot safety features	**CO1,CO2,CO3,CO4**
	Mode of examination	Theory	

	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	1.Groover, M.P., "Industrial Robotic Technology - Programming and Application", McGrawhill			
	Other References	1. Koren, Y. ,"Robotics for Engineers", McGrawhill. 2. Deb, S.R., "Robotics Technology and Flexible Automation" Tata Mc Graw Hill			

COURSE ARTICULATION MATRIX

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
MEC334.1	3	-	-	2	2	3	3	-	-	1	3	2	3	2	3
MEC334.2	3	-	-	2	2	3	3	-	-	1	3	2	3	2	3
MEC334.3	3	-	-	2	2	3	3	-	-	1	3	2	3	2	3
MEC334.4	3	-	-	2	2	3	3	-	-	1	3	2	3	2	3
MEC334.5	3	-	-	2	2	3	3	-	-	1	3	2	3	2	3
MEC334.6	3	-	-	2	2	3	3	-	-	1	3	2	3	2	3
MEC334	3	-	-	2	2	3	3	-	-	1	3	2	3	2	3

1-Slight (Low) **2-Moderate (Medium)** **3-Substantial (High)**

School: SSET		**Batch : 2023-2027**	
Programme: B. Tech		**Current Academic Year: 2023-2024**	
Branch: ME		**Mechanical Engineering**	
1	Course Code	AUT301	
2	Course Title	Automotive Safety Systems	
3	Credits	2	
4	Contact Hours (L-T-P)	2-0-0	
	Course Status	Program Elective	
5	Course Objective	1. To help the students to acquire in-depth knowledge of automotive safety systems. 2. To make students to understand the underlying concepts and methods of automotive safety. 3. To make students to differentiate the different active and passive safety systems. 4. To make the students to be familiar with latest safety systems. 5. To enable the students to apply the knowledge of safety systems to develop less accident-prone vehicles	
6	Course Outcomes	After the successful completion of course, students will be able to: CO1: Comprehend the steps involved in the automotive body design to improve safety CO2: Differentiate the active and passive safety systems and their impact on passengers CO3: Explain the construction and working principle of various safety equipment employed in automobiles. CO4: Evaluate the behaviour of various safety systems on improving safety, comfort and convenience. CO5:Assess the performance of different testing procedures involved in passenger and occupant safety CO6: Evaluate the environmental impact, cost and economics of homologation and certification	
7	Course Description	This course prepares students to install, remove, maintain and repair this system in an automobile. This course introduces students to vehicle safety and collision warning. It also discusses aboutergonomics in vehicles.	
8	Outline syllabus		CO Mapping
	Unit 1	**INTRODUCTION**	
	A	Design of the body for safety, energy equation, engine location,	CO1

	B	Deceleration of vehicle inside passenger compartment, deceleration on impact with stationary and movable obstacle,			CO1
	C	Concept of crumble zone, safety sandwich construction.			CO1
	Unit 2	**ERGONOMICS and HUMAN RESPONSE to IMPACT**			
	A	Importance of Ergonomics in Automotive safety, Locations of controls, Anthropometry, Human impact tolerance			CO2, CO6
	B	Determination of Injury thresholds, Severity Index, Study of comparative tolerance, Application of Trauma for analysis of crash injuries.			CO2, CO6
	C	Injury criteria's and relation with crash and modeling and simulation studies in dummy			CO2, CO6
	Unit 3	**ACTIVE and PASSIVE SAFETY**			
	A	Driving safety, conditional safety, perceptibility safety.			CO3
	B	Operating safety, Exterior safety, Interior safety,			CO3
	C	Deformation behaviour of vehicle body, speed and acceleration characteristics of passenger compartment on impact.			CO3
	Unit 4	**SAFETY EQUIPMENTS, COLLISON WARNING and AVOIDANCE.**			
	A	Seat belt, regulations, automatic seat belt tightener system, collapsible steering column.			CO4
	B	Tiltable steering wheel, air bags, Electronic system for activating air bags.			CO4
	C	Steering wheel, air bags, electronic system for activating air bags and bumper design for safety.			CO4
	Unit 5	**COMFORT and CONVENIENCE**			
	A	Steering and mirror adjustment, Central locking system ,			CO5
	B	Garage door opening system, Tyre pressure control system.			CO5
	C	Rain sensor system, Environment information system			CO5
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	Raymond M. Brach and R. Matthew Brach, "Vehicle Accident Analysis and Reconstruction Methods", SAE International, 2011			
	Other References	1. Ulrich Seiffert and LotharWech, "Automotive Safety Handbook", SAE International, 2007. 2. ISO Standards, ICS: 43.020, 43.040, 43.100 3. Automotive Industry Standards, AIS			

COURSE ARTICULATION MATRIX

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
AUT301.1	3	-	-	2	2	3	3	-	-	1	3	2	3	2	3
AUT301.2	3	-	-	2	2	3	3	-	-	1	3	2	3	2	3
AUT301.3	3	-	-	2	2	3	3	-	-	1	3	2	3	2	3
AUT301.4	3	-	-	2	2	3	3	-	-	1	3	2	3	2	3
AUT301.5	3	-	-	2	2	3	3	-	-	1	3	2	3	2	3
AUT301.6	3	-	-	2	2	3	3	-	-	1	3	2	3	2	3
AUT301	3	-	-	2	2	3	3	-	-	1	3	2	3	2	3

1-Slight (Low) **2-Moderate (Medium)** **3-Substantial (High)**

School: SSET		**Batch : 2023-2027**
Programme: B. Tech		**Current Academic Year: 2023-2024**
Branch: ME		**Mechanical Engineering**
1	Course Code	AUT302
2	Course Title	Auto Certification and Homologation
3	Credits	3
4	Contact Hours (L-T-P)	3-0-0
	Course Status	Program Elective
5	Course Objective	1. To help students gain essential and basic knowledge on Auto Certification and Homologation for various types of vehicles, so as to equip them with knowledge required for getting certification and homologation for different classification of vehicles. 2. To train the students on vehicle classification with respect to certification and homologation. 3. To impart knowledge on vehicle testing procedures and norms for steering certification, engine certification, glasses and seat belts, brakes and wheels and lighting and signalling devices. 4. To teach students about the importance of advances and trends in certification and homologation.
6	Course Outcomes	After the successful completion of course, students will be able to: CO1: Describe the vehicle classification with respect to certification and homologation CO2: Identify the regulations governing for each vehicle type CO3: Apply proficiency in testing methodologies for vehicle level testing CO4: Perform and analyze system level testing for certification of the engine, braking, steering and lighting systems CO5:Obtain know-how in testing methodologies for certification of components testing CO6: Evaluate the environmental impact, cost and economics of homologation and certification
7	Course Description	This course prepares students to install, remove, maintain and repair this system in an automobile. This course introduces students to vehicle classification and engine and steering certification. It also discusses aboutergonomics in vehicles.

8	Outline syllabus				CO Mapping
	Unit 1	**VEHICLE CLASSIFICATION**			
	A	Specification & Classification of Vehicles (including M, N and O layout).			CO1
	B	Regulations overview (ECE, EEC, FMVSS, AIS, CMVR, ADR), Type approval and Conformity of Production			CO1
	C	Engine and Vehicle specifications, Two Wheeler certification			CO1
	Unit 2	**VEHICLE TESTING**			
	A	Vehicle Testing - Photographs, CMVR physical verification, Vehicle weightment, Coast down test, Brake test, ABS.			CO2
	B	Turning circle diameter test, Steering effort test, Speedometer calibration, Pass by noise test,			CO2
	C	External projection test, Gradability test, Acceleration control system			CO2
	Unit 3	**ENGINE and STEERING CERTIFICATION**			
	A	Engine power test (petrol & diesel), Indian driving cycle and Vehicle mass emission.			CO3, CO6
	B	Evaporative emission (petrol vehicles), Broad band / Narrow band EMI test. Steering Impact test (GVW<1500 kg), Body block test, Head form test,			CO3, CO6
	C	Fixtures charges, Crash test with dummies, OBD I, Bumper testing, Documentation SHL, Certification charges			CO3, CO6
	Unit 4	**GLASSES and SEAT BELTS**			
	A	Safety Glasses: Windscreen laminated safety glass, Side window / door glass.			CO4
	B	Back light / Rear toughened glass, Wind screen wiping system, Wiper Blade			CO4
	C	Safety belt assemblies, Safety belt anchorages, Seat anchorages & head restraints, door locks & door retention			CO4
	Unit 5	**LIGHTING and SIGNALISNG DEVICES**			
	A	Performance requirement for lighting & signaling devices - Vertical orientation of dipped beam- head lamp, driver's field of vision, Head lamp assembly (glass lens & plastic lens).			CO5
	B	Head lamp + Front position lamp / Front indicator lamp / front fog lamp, Rear combinational lamp (each additional function), Independent front position lamp / Front direction indicator lamp / Front fog lamp.			CO5
	C	Rear combination lamp (single function), Warning triangles, Fuel tank: Metallic & Plastic (excluding fire resistance test).			CO5
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	Raymond M. Brach and R. Matthew Brach, "Vehicle Accident Analysis and Reconstruction Methods", SAE International, 2011			

	Other References	1. Ulrich Seiffert and LotharWech, "Automotive Safety Handbook", SAE International, 2007. 2. ISO Standards, ICS: 43.020, 43.040, 43.100 3. Automotive Industry Standards, AIS	

COURSE ARTICULATION MATRIX

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
AUT302.1	3	-	-	2	2	3	3	-	-	1	3	2	3	2	3
AUT302.2	3	-	-	2	2	3	3	-	-	1	3	2	3	2	3
AUT302.3	3	-	-	2	2	3	3	-	-	1	3	2	3	2	3
AUT302.4	3	-	-	2	2	3	3	-	-	1	3	2	3	2	3
AUT302.5	3	-	-	2	2	3	3	-	-	1	3	2	3	2	3
AUT302.6	3	-	-	2	2	3	3	-	-	1	3	2	3	2	3
AUT302	3	-	-	2	2	3	3	-	-	1	3	2	3	2	3

1-Slight (Low) **2-Moderate (Medium)** **3-Substantial (High)**

School: SSET		**Batch : 2023-2027**	
Programme: B. Tech		**Current Academic Year: 2023-2024**	
Branch: ME		**ME with Automobile Engineering**	
1	Course Code	AUT303	
2	Course Title	Automotive Suspension and Steering Systems	
3	Credits	2	
4	Contact Hours (L-T-P)	2-0-0	
	Course Status	Program Elective	
5	Course Objective	To provide the students with sufficient background to understand the steering and suspension systems so as to enable them to design a steering and suspension system for better ride and comfort.	
6	Course Outcomes	After the successful completion of course, students will be able to: CO1: Demonstrate the construction and mechanism of steering system components. CO2: Identify various suspension systems used in automotive vehicles. CO3: Summarize computer controlled suspension systems. CO4: Define the mechanisms involved in the stability of vehicle. CO5:Explain various steering and suspension system used in automotive vehicles. CO6: Explain the recent development in the area of suspension and steering systems.	
7	Course Description	This course prepares students to install, remove, maintain and repair this system in an automobile. This course introduces students to steering system, and suspension system. It also discusses power assisted steering theory as well as the computer controlled suspension system of a latest vehicle.	
8	Outline syllabus		CO Mapping
	Unit 1	**STEERING SYSTEM**	
	A	Axle parts and materials, Loads and stresses, Front axle loads, Steering heads.	CO1, CO6
	B	Factors of wheel alignment, Wheel balancing, Centre point steering , Correct steering angle, Steering mechanisms	CO1, CO6
	C	Cornering force, Self-righting torque, Under steer and over steer, Lift off over steer, Torque steer	CO1, CO6
	Unit 2	**MECHANISM and LINKAGES**	
	A	Condition for perfect rolling - Ackermann mechanism - Davis Mechanism.	CO2, CO6
	B	Steering linkage for rigid axle suspension, Steering linkage for independent suspension	CO2, CO6
	C	Steering gears, Special steering columns	CO2, CO6
	Unit 3	**POWER ASSISTED STEERING**	
	A	Hydraulic power assisted steering, Integral piston linkage	CO3, CO6

	B	Rack and pinion, External cylinder power assisted			CO3, CO6
	C	Electric and electronic power assisted steering			CO3, CO6
	Unit 4	**INTRODUCTION to SUSPENSION SYSTEMS**			
	A	Basic considerations - Types of suspension springs, Rubber springs and Plastic springs.			CO4, CO6
	B	Pneumatic suspension, Hydraulic suspension, Telescopic shock absorbers, Independent suspension			CO4, CO6
	C	Front wheel independent suspension, Rear wheel independent suspension, Stabilizer Rod Types			CO4, CO6
	Unit 5	**COMPUTER CONTROLLED SUSPENSION SYSTEMS and STABILITY CONTROL**			
	A	Introduction - Programmed ride control system, Electronic air suspension system, Air suspension system design variations.			CO5, CO6
	B	Vehicle dynamic suspension system, Electronic suspension control (ESC) system, Integrated electronic systems and networks.			CO5, CO6
	C	Vehicle stability control, Active roll control systems, Active cruise control, Lane departure warning systems, Collision mitigation systems, Telematics			CO5, CO6
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	Automotive Engineering - Powertrain, Chassis System and Vehicle Body - David A. Crolla, Butterworth-Heinemann, First Edition, 2009			
	Other References	1. A Practical Approach to Motor Vehicle Engineering and Maintenance - Allan Bonnick. 2. Derek Newbold, Butterworth-Heinemann, Third Edition, 2011. 3. The Automotive Chassis: Engineering Principles - Prof. Dipl. Ing. Jörnsen Reimpell.			

COURSE ARTICULATION MATRIX

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
AUT303.1	3	-	-	2	2	3	3	-	-	1	3	2	3	2	3
AUT303.2	3	-	-	2	2	3	3	-	-	1	3	2	3	2	3
AUT303.3	3	-	-	2	2	3	3	-	-	1	3	2	3	2	3
AUT303.4	3	-	-	2	2	3	3	-	-	1	3	2	3	2	3
AUT303.5	3	-	-	2	2	3	3	-	-	1	3	2	3	2	3
AUT303.6	3	-	-	2	2	3	3	-	-	1	3	2	3	2	3
AUT303	3	-	-	2	2	3	3	-	-	1	3	2	3	2	3

1-Slight (Low) **2-Moderate (Medium)** **3-Substantial (High)**

School: SSET		**Batch : 2023-2027**	
Programme: B. Tech		**Current Academic Year: 2023-2024**	
Branch: ME		**Semester:**	
1	Course Code	AUT304	
2	Course Name	Vehicle Inspection and Maintenance	
3	Credits	3	
4	Contact Hours (L-T-P)	3-0-0	
	Course Status	Program Elective	
5	Course Objective	1. To gain fundamental knowledge about various vehicle maintenances 2. To gain basics knowledge for preparing the inspection schedule 3. To acquire knowledge about the various engine faults and recovery methods 4. To impart the fundamental knowledge in fuel, cooling and lubrication systems. 5. To make the students to understand the common problem arises in transmission systems and rectification procedure. 6. To familiarize the students with the servicing procedures of braking, electrical and modern vehicle systems	
6	Course Outcomes	After the successful completion of course, students will be able to: CO1: Demonstrate the importance of vehicle inspection and maintenance. CO2: Diagnose the causes of Engine problem and provide the remedial action CO3: Implement the knowledge to rectify the fuel, cooling and lubrication systems defects. CO4: Identify the causes, servicing the clutch, gear box, universal joints, propeller shaft, and differential. CO5:Apply the basic knowledge and rectify the transmission systems problems CO6: Possess the knowledge about the inspection and maintenance of vehicle braking, electrical and modern vehicle systems.	
7	Course Description	This course prepares students to install, remove, maintain and repair this system in an automobile. This course introduces students to transmissions, transaxles and transmission services. It also discusses transmission theory as well as the maintenance of a latest vehicle's transmissions and transaxles.	
8	Outline syllabus		CO Mapping

	Unit 1	**MAINTENANCE BASICS and INSPECTION SCHEDULES**			
	A	Need for maintenance, types of maintenance: preventive and breakdown maintenance.			CO1, CO6
	B	Requirements of maintenance, preparation of check lists. Inspection schedule, maintenance of records			CO1, CO6
	C	Log sheets and other forms, safety precautions in maintenance: General safety, tool safety.			CO1, CO6
	Unit 2	**ENGINE SERVICE**			
	A	Tools used for engine disassembly, dismantling of engine components: cylinder head, valve train.			CO2, CO6
	B	Dismantling of engine components: cylinder block, connecting rod, piston and crankshaft assembly			CO2, CO6
	C	Cleaning and inspection of engine components, reconditioning of components			CO2, CO6
	Unit 3	**FUEL and LUBRICATION SYSTEMS**			
	A	Servicing and maintenance of fuel system, Engine tune-up,			CO3, CO6
	B	Cooling system: water pump, radiator, thermostat.			CO3, CO6
	C	Lubrication system maintenance, Anticorrosion and anti-freeze additives.			CO3, CO6
	Unit 4	**TRANSMISSION SYSTEMS and BRAKING SYSTEMS**			
	A	Servicing and maintenance of clutch, gear box, universal joints, propeller shaft, differential system.			CO4, CO6
	B	Service and maintenance of brake – disc and drum brakes, steering wheel			CO4, CO6
	C	Service and maintenance of suspension systems, wheel alignment and vehicle body maintenance.			CO4, CO6
	Unit 5	**ELECTRICAL SYSTEMS**			
	A	Servicing and maintenance of battery, starter motor, alternator and generator.			CO5, CO6
	B	Servicing and maintenance of ignition system, lighting system, electric horn			CO5, CO6
	C	Servicing and maintenance of wiper motor, Modern vehicle systems.			CO5, CO6
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	

	Text book/s*	Knott and Phil Knott, "An Introductory Guide to Motor Vehicle Maintenance: Light Vehicles", EMS publishing, 2010.	
	Other References	1. William H. Crouse and Donald L. Anglin, "Automotive Mechanics", 10th edition, 2007. 2. Tim Giles, "Automotive service: Inspection, maintenance and repair", 3rd edition, 2007. 3. Jack Erjavec, "Automotive technology: A systems approach", 5th edition, 2009.	

COURSE ARTICULATION MATRIX

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
AUT304.1	3	3	-	1	2	-	-	-	-	1	-	-	2	3	3
AUT304.2	3	2	-	1	1	-	-	-	-	1	-	-	2	2	2
AUT304.3	3	2	-	1	1	-	-	-	-	1	-	-	2	2	2
AUT304.4	3	2	-	1	1	-	-	-	-	1	-	-	2	2	2
AUT304.5	3	3	-	1	1	-	-	-	-	1	-	-	2	3	2
AUT304.6	3	3	-	3	3	-	-	-	-	2	-	-	2	3	3
AUT304	3	3	-	1	2	-	-	-	-	1	-	-	2	3	3

1-Slight (Low) **2-Moderate (Medium)** **3-Substantial (High)**

School: SSET		**Batch : 2023-2027**	
Programme: B.Tech		**Current Academic Year: 2023-2024**	
Branch: ME		**Semester: VII**	
1	Course Code	EEE332	
2	Course Title	Power Electronics	
3	Credits	3	
4	Contact Hours (L-T-P)	3-0-0	
	Course Status	Program Elective	
5	Course Objective	1. To know the power electronics devices, basic structure, symbol and characteristics. 2. To understand the topologies and analyze ac to dc, dc to dc and dc to ac converters.	
6	Course Outcomes	After the successful completion of course, students will be able to: CO1: Compare the working mechanism of semi-conductor devices CO2: Analyse and design DC-DC converters CO3: Predict the behaviour of phase-controlled converters CO4: Evaluate the performance of AC-AC and AC-DC converters CO5: Improve the functioning of different voltage source for inverters CO6: Choose the converters for real time applications	
7	Course Description	The field of power electronics encompasses the application of fundamental concepts in several disciplines: electronic devices and circuits, variable speed drives and control systems. Variable speed drives has resulted automation in production processes. The use of electric cars, electric trains and electric subway trains can substantially reduce urban pollution problems. Students learn power electronics devices like thyristors, MOSFET, IGBT, GTO etc., various phase controlled single phase and three phase rectifiers with performance factors, dual converters, principle of dc to dc conversion, class A,B,C,,D,E,F Choppers, commutation techniques, comprehensive treatment of dc to ac inverters, ac voltage converters and cycloconverters.	
8	Outline syllabus		CO Mapping
	Unit 1	**Power semiconductor Devices**	**CO1**
	A	Power semiconductor devices their symbols and static characteristics: Characteristics and specifications of switches	CO1
	B	Operation, steady state and switch characteristics, switching limits of Power Transistor Operation and steady state characteristics of Power MOSFET and IGBT	CO1
	C	Snubber circuit, Series and parallel operation of thyristors, Commutation techniques of thyristor, methods of turn-on of thyristor, operation of GTO, MCT and TRIAC	CO1

	Unit 2	**DC-DC Converters**			**CO2**
	A	Principles of step-down chopper, step down chopper with R-L			CO2
	B	Load Principle of step-up chopper, and operation with RL load			CO2
	C	Classification of choppers. Buck and boost converter.			**CO2**
	Unit 3	**Phase Controlled Converters**			**CO2,CO3**
	A	Single phase line commutated converters: single phase half controlled converter with resistive and inductive loads, Single phase fully controlled converter, mid point and bridge connections with resistive and inductive loads, effect of freewheeling diode, performance parameters, effect of source inductance, single phase dual converter.			CO2,CO3
	B	Three phase line commutated converters: Three phase half wave converter, three phase fully controlled and half controlled converters with resistive and inductive loads, effect of freewheeling diode, performance parameters, effect of source inductance, three phase dual converter.			CO2,CO3
	C	Single phase half wave controlled rectifier with resistive and inductive loads, effect of freewheeling diode.			**CO2,CO3**
	Unit 4	**AC Voltage Controllers**			**CO4**
	A	Principle of On-Off and phase control, Single phase two SCRs in anti parallel with R and RL load			CO4
	B	Triac with R and RL load, Three phase ac voltage controllers (various configurations and comparison only)			CO4
	C	Cyclo Converters: Basic principle of operation, single phase to single phase, three phase to single phase and three phase to three phase cyclo converters, output voltage equation.			CO4
	Unit 5	**Inverters**			**CO5,CO6**
	A	Single phase series resonant inverter, single phase bridge inverter			CO5, CO6
	B	Three phase bridge inverters, Voltage control of inverters			CO5, CO6
	C	Harmonics reduction techniques, Single phase and three phase current source inverters.			**CO5, CO6**
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	1. M.H. Rashid,"Power Electronics: Circuits, Devices & Applications", Prentice Hall of India, Ltd. 3rd Edition,2004 2. V.R. Moorthy, "Power Electronics : Devices, Circuits and Industrial Applications" Oxford, University Press,2007.			

		3. M.D.Singh & K.B.Khanchandani, "Power Electronics", Tata McGraw Hill publishing company, 1989	
	Other References	1. M.S. Jamil Asghar, "Power Electronics" Prentice Hall of India Ltd., 2004. 2. Chakrabarti &Rai, "Fundamentals of Power Electronics & Drives" DhanpatRai& Sons.	

COURSE ARTICULATION MATRIX

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
EEE332.1	3	3	-	-	1	-	-	-	-		-	-	2	3	3
EEE332.2	3	2	-	-	1	-	-	-	-		-	-	2	2	2
EEE332.3	3	2	-	-	1	-	-	-	-		-	-	2	2	2
EEE332.4	3	2	-	-	1	-	-	-	-		-	-	2	2	2
EEE332.5	3	3	-	-	1	-	-	-	-		-	-	2	3	2
EEE332.6	3	3	-	-	2	-	-	-	-		-	-	2	3	3
EEE332	3	3	-	-	1	-	-	-	-	-	-	-	2	2	3

1-Slight (Low) **2-Moderate (Medium)** **3-Substantial (High)**

School: SSET		**Bath: 2023-2027**
Programme: B.Tech		**Current Academic Year: 2023-2024**
Branch: ME		**Semester: VIII**
1	Course Code	MIC008
2	Course Title	Virtual Instrumentation
3	Credits	3
4	Contact Hours (L-T-P)	3-0-0
	Course Status	Program Elective
5	Course Objective	1. Introduction to the various models of Virtual Instruments, their comparison with traditional instruments and major application areas of VI. 2. Introduction to basics of Labview 3. VI Programming techniques like loops, arrays, clusters, plotting and Strings and files. 4. Basics of signal conditioning techniques along with DAQ hardware and software and various signal processing techniques available in LABVIEW. 5. Advanced concepts in Lab view with main concepts of real time applications in Image acquisition and Motion control. 6. Building of Virtual Instruments with various types of controls and indicators.
6	Course Outcomes	After the successful completion of course, students will be able to: CO1:Understand various models and areas of application of Virtual Instrumentation. CO2: Understand various components of Lab VIEW required for the development of VI. CO3: Understand and apply various programming functions of LabVIEW like loops, arrays, clusters and file I/Os for building of simple Virtual instruments. CO4: Understand the concepts of Data acquisition hardware and software and to apply basic signal processing techniques available in LabVIEW. CO5: Understand the real time applications of LabVIEW in motion control and Image acquisition. CO6:Able to build VI for simulated and real time applications.

7	Course Description	The course content of this subject includes an introduction to graphical system design. This course also focuses on introduction to LabVIEW which extensively elaborate the Graphical programming language .In Unit 3, building of VI by using loops, arrays, clusters etc. have been dealt with. Use of strings and I/O are also elaborated in this course. Data acquisition and various signal processing techniques are also covered in this course. Two real time applications motion control and Image acquisition by using LabVIEW have been elaborated in this course.	
8	Outline syllabus		CO Mapping
	Unit 1	**Introduction**	CO1
	A	Graphical system design model - design model, prototype model, deployment model	
	B	Building blocks of VI; Virtual instrument versus traditional instrument, Hardware and software in VI	
	C	Graphical system Design using LabVIEW; Graphical programming and Textual programming	
	Unit 2	**Graphical system Design using LabVIEW**	CO2,CO6
	A	Advantages of LabVIEW; Components of VI Software - Front panel windows, Block diagram windows, Icon /connector pane	
	B	Creating and saving a VI; Toolbars, Palettes, Front panel controls and indicators, Block diagram – terminals, nodes, functions	
	C	Sub VIs, Express VIs and VIs, wires; Data types, Data flow program	
	Unit 3	**Programming Techniques**	**CO3,CO6**
	A	Modular Programming in Lab View; Building VI front panel and block diagram	
	B	Loops – for and while loops, Local and Global variables in LabVIEW, Arrays in LabVIEW,	
	C	Clusters in LabVIEW; Conversion between arrays and clusters, Plotting data in LabVIEW, Strings and File I/O in LabVIEW	
	Unit 4	**Data Acquisition and Signal Processing in LabVIEW**	**CO4,CO6**
	A	Transducers and Signal conditioning ,sampling and aliasing	
	B	Basics of DAQ hardware and software, DAQ modules and drivers for building virtual instruments	
	C	Fourier transforms; Power spectrum, Correlation methods; Windowing & filtering	
	Unit 5	**Advanced concepts in LabVIEW**	**CO5, CO6**
	A	Data Socket, TCP/IP VI's synchronization	

	B	Serial interface buses - RS 232, RS485,USB			
	C	Concepts of real time systems; Image acquisition; Motion control			
	Mode of examination	Theory/Jury/Practical/Viva			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	1. Jovitha Jerome, "Virtual Instrumentation and LABVIEW", PHI Learning			
	Other References	1. C.L. Clark, "LabVIEW Digital Signal Processing", TMH Publishing Company. 2. Technical Manuals for DAQ Modules, Advantech and National Instruments 3. www.profhkverma.info: Chapter 2: Technologies/ Protocols for Wired Sensor Network 4. NI USER MANUAL http://www.ni.com/pdf/manuals/376445b.pdf www.ni.com			

COURSE ARTICULATION MATRIX

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
MIC008.1	1	2	2	2	2	1	1	2	1	2	-	2	2	2	1
MIC008.2	3	2	1	2	3	1	2	2	1	1	-	2	2	2	2
MIC008.3	3	2	3	2	3	2	2	2	1	2	-	2	2	2	2
MIC008.4	2	2	2	2	1	2	2	2	2	2	-	3	3	2	2
MIC008.5	2	3	3	2	2	2	2	2	2	2	-	3	3	2	2
MIC008.6	2	3	3	2	3	2	2	2	2	3	2	3	3	2	3
MIC008	2	2	3	2	3	2	2	2	2	3	2	3	3	3	3

1-Slight (Low) **2-Moderate (Medium)** **3-Substantial (High)**

School: SSET		**Batch : 2023-2027**
Programme: B.Tech		**Current Academic Year: 2023-2024**
Branch: ME		**Mechanical Engineering**
1	Course Code	ECE002
2	Course Title	Microcontrollers and Applications
3	Credits	2
4	Contact Hours (L-T-P)	2-0-0
	Course Status	Program Elective
5	Course Objective	• Embedded Systems and design issues • Advanced Computer Architecture • Embedded System Installation/ Configuration using AVR microcontroller • Development of Embedded Firmware using AVR microcontroller • Troubleshooting and Maintenance of embedded system
6	Course Outcomes	After the successful completion of course, students will be able to: CO1: Apply and illustrate advanced computer architecture CO2: Embedded system installation/ configuration using AVR microcontroller CO3: Apply different modes, Input Capture and Compare Match. in controller CO4: Interpret the programmes by using interrupts and timer CO5: Development of Embedded Firmware for peripheral functions
7	Course Description	In this course, the fundamentals of embedded system hardware and firmware design will be explored. Issues such as embedded processor selection, hardware/firmware partitioning, glue logic, circuit design, circuit layout, circuit debugging, development tools, firmware architecture, firmware design, and firmware debugging will be discussed. The AVR, a very popular 8 microcontroller family, will be studied. The architecture and instruction set of the microcontroller will be discussed, and a wire wrapped microcontroller board will be built and debugged by each student. The course will culminate with a significant final project which will extend the concepts covered earlier in the course. Learning may be supplemented with periodic guest lectures by embedded systems engineers from industry
8	Outline syllabus		CO Mapping
	Unit 1	**AVR RISC Microcontrollers**	

	A	Introduction to AVR RISC Microcontrollers, Architecture overview, status register, general purpose register file, memories,			CO1, CO2
	B	Instruction set, Data Transfer Instructions, Arithmetic and Logic Instructions, Branch Instructions			CO1, CO2
	C	Bit and Bit-test Instructions, MCU Control Instructions. Simple programs in Assembly Language / C Language			CO1, CO2
	Unit 2	**Interrupts and Timer**			
	A	Introduction to System Clock, Reset sources,			CO3, CO4
	B	Introduction to interrupts, External interrupts, IO Ports, 8-bit and 16-bit Timers,			CO3, CO4
	C	Introduction to different modes, Input Capture and Compare Match.			CO3, CO4
	Unit 3	**Inbuilt Peripheral Functions**			
	A	Analog Comparator, Analog-to-Digital Converter, Serial Peripheral Interface (SPI),			CO5
	B	The Universal Synchronous and Asynchronous serial Receiver and Transmitter (USART),			CO5,
	C	Two Wire Interface (TWI) / I^2C bus			CO5
Mode of examination		Theory			
Weightage Distribution		CA	MTE	ETE	
		25%	25%	50%	
Text book/s*		1.AVR Microcontroller and Embedded Systems: Using Assembly and C by Muhammad Ali Mazidi, Sarmad Naimi, Sepehr Naimi, PHI 2. Embedded system Design - Frank Vahid and Tony Givargis, John Wiley, 2002			
Other References		1.Programming and Customizing the AVR Microcontroller by D V Gadre, McGraw- Hill 2. Atmel AVR Microcontroller Primer: Programming and Interfacing by Steven F. Barrett, Daniel J. Pack, Morgan & Claypool Publishers 3. An Embedded Software Primer by David E Simon, Addison Wesley 4. AVR Microcontroller Datasheet, Atmel Corporation, www.atmel.com			

COURSE ARTICULATION MATRIX

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ECE002.1	3	3	-	-	-	-	-	-	-	-	-	2	1	-	2
ECE002.2	2	3	-	-	-	-	-	-	-	-	-	2	1	-	2
ECE002.3	3	3	-	-	-	-	-	-	-	-	-	2	1	-	2
ECE002.4	2	3	-	-	-	-	-	-	-	-	-	2	1	-	2
ECE002.5	2	3	-	-	-	-	-	-	-	-	-	2	1	-	2
ECE002.6	2	3	-	-	-	-	-	-	-	-	-	2	1	-	2
ECE002	2	3	-	-	-	-	-	-	-	-	-	2	1	-	2

1-Slight (Low) 2-Moderate (Medium) 3-Substantial (High)

School: SSET		**Batch : 2023-2027**	
Programme: B.Tech		**Current Academic Year: 2023-2024**	
Branch: ME		**Mechanical Engineering**	
1	Course Code	MEC481	
2	Course Title	Mechanical Behaviour of Nanomaterials	
3	Credits	3	
4	Contact Hours (L-T-P)	3-0-0	
5	Course Status	Program Core	
6	Course Outcomes	After the successful completion of course, students will be able to: CO1: Explain the principle and influence of process variables of chemical and inert gas condensation route adopted for synthesis of nanostructured particles CO2: Compare and contrast different processing routes commonly adopted for fabrication of nanostructured components CO3: Analyse and suggest ways to alter the mechanical properties of a metal/alloy CO4: Select appropriate tools for nanomaterial characterization CO5: Distinguish between the mechanical behaviour of nanostructured components and conventional components possessing large grain size CO6: Develop nanostructured components as per the requirements	
7	Course Description	The course along with mechanical behaviour of nanomaterials, also focuses extensively on synthesis and characterization of nanomaterials.	
8	Outline syllabus		CO Mapping
	Unit 1	**Synthesis of Nanostructured Particles**	
	A	Chemical Synthesis of Nanostructured Particles: Nucleation and Growth, Dispersion and Agglomeration, Metals, Ceramics and Cytotoxicity of Nanoparticles	CO1, CO6
	B	Synthesis of Nanostructured Materials by Inert-Gas Condensation (IGC) Methods: Introduction, Principle, Classification, Evaporation Techniques; and Classical Nucleation Theory	CO1, CO6
	C	Influence of IGC Process Variables on Particle Size, Advantages, Limitations and Recent Developments in IGC	CO1
	Unit 2	**Fabrication of Nanostructured Components**	
	A	Phenomenology of Nanostructure Formation, High-Energy Ball Milling and Mechanical Attrition, Phase Stability at Elevated Temperatures and Severe Plastic Deformation (SPD)	CO2, CO6

	B	Thermodynamics, Mechanisms and Kinetics of Nanocrystalline Powder Densification: Thermodynamic and Kinetic Effects, Sintering Mechanisms, Role of Impurities, Green Density, Pore Size Effect on Densifications and Grain Growth			CO2
	C	Methods for Full Densification of Nanopowders: Characterization of Nanomaterials Densification, Density and Grain Size Measurements, Conventional and Non-Conventional Sintering methods			CO2
	Unit 3	**Strengthening in Polycrystalline Materials**			
	A	Yield Strength of a Perfect Crystal, Dislocations: Types, Properties and Mechanisms of dislocation motion			CO3
	B	Initiation of plastic flow in single crystals, Stress-Strain behavior of single crystals, Plastic flow in poly-crystals and Geometrically Necessary Dislocations			CO3
	C	General Description of Strengthening, Work Hardening, Boundary Strengthening, Solid-Solution Strengthening and Particle Hardening			CO3
	Unit 4	**Tools to Characterize Nanomaterials**			
	A	X-ray Diffraction (XRD), Small Angle X-ray Scattering (SAXS), Scanning Electron Microscopy (SEM) and Transmission Electron Microscopy (TEM)			CO4
	B	Atomic Force Microscopy (AFM) and Scanning Tunnelling Microscope (STM), Field Ion Microscope (FIM) and Three-dimensional Atom Probe (3DAP)			CO4
	C	Nanoindentation: Principle, Working, Evaluation of Elastic modulus, Hardness, Wear properties etc.			CO4, CO5
	Unit 5	**Mechanical Behaviour of Nanostructured Materials**			
	A	Models and Computer Simulations of Mechanical Behavior of Nanocrystalline Materials, Effect of Density, Pores and Microcracks			CO5, CO6
	B	Elastic Properties, Strength, Hardness and Ductility of Nanocrystalline Metals			CO5, CO6
	C	Mechanical Properties at Room and Elevated Temperatures: Al-Based Two-Phase Nanostructured Alloys, Mg-Based Amorphous and Nanostructured Alloys, Zr and Ti based Alloys and Mechanically Attrited Composites			CO5, CO6
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	**Nanostructured Materials: – Processing, properties and applications** by Karl C. Koch			
	Other References	**Textbook of Nanoscience and Nanotechnology by** B.S. Murthy, P. Shankar, Baldev Raj, B.B. Rath and James Murday			

COURSE ARTICULATION MATRIX

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
MCH001.1	3	3	1		-	-	1	1	-	-	-	1	1		
MCH001.2	2	3	1		-	-	1	1	-	-	-	1	1		
MCH001.3	3	3	1		-	-	1	1	-	-	-	1	1		
MCH001.4	2	3	1		-	-	1	1	-	-	-	1	1		
MCH001.5	2	3	1		-	-	1	1	-	-	-	1	1		
MCH001.6	3	3	1		-	-	1	1	-	-	-	1	1	-	
MEC481	3	3	1	-	-	-	1	1	-	-	-	1	1	-	-

1-Slight (Low) **2-Moderate (Medium)** **3-Substantial (High)**

School: SSET		**Batch : 2023-2027**	
Programme: B.Tech		**Current Academic Year: 2023-2024**	
Branch: ME		**Mechanical Engineering**	
1	Course Code	MEC482	
2	Course Title	Material Behaviour and Failure Prediction	
3	Credits	2	
4	Contact Hours (L-T-P)	3-0-0	
	Course Status	Program Core	
5	Course Objective	1. To develop knowledge of crystals and their imperfections. 2. To understand different strengthening mechanisms of materials. 3. To understand behavior of materials under tension. 4. To understand mechanisms of brittle and ductile fracture. 5. To study the mechanisms of fatigue and creep.	
6	Course Outcomes	After the successful completion of course, students will be able to: CO1: Define different crystal systems and Bravais lattice along with defects in crystals. CO2: Classify different strengthening mechanisms. CO3: Develop the knowledge of tensile test. CO4: Analyse mechanisms of brittle and ductile fracture. CO5: Explain the mechanisms of fatigue and creep in materials. CO6: Build the knowledge of deformation of materials under tension, fatigue and creep.	
7	Course Description	This course focuses on the deformation behavior of materials under tension, fatigue, creep and fracture behavior of brittle and ductile materials.	
8	Outline syllabus		CO Mapping
	Unit 1	**Crystal Systems and Imperfections**	
	A	Basic knowledge about various crystal systems, Bravais lattice	CO1
	B	Crystal Imperfections such as point defects, line defects, surface and interfacial defects	CO1
	C	Types of dislocations, Bergers vector, dislocation loop, dislocations in FCC, BCC and HCP lattice	CO1
	Unit 2	**Strengthening mechanism of crystalline materials**	
	A	Grain boundary strengthening	CO1
	B	Solid solution strengthening, Strengthening due to second phase particles	CO3
	C	Strain hardening, Bauschinger effect	CO3
	Unit 3	**Tensile test**	
	A	Engineering stress-strain curve, true stress-strain curve	CO2

	B	Instability in tension, effects of strain rate and temperature on tensile properties			CO2
	C	Notch tensile test			CO2
	Unit 4	**Fracture**			
	A	Types of fracture in metals, theoretical cohesive strength			CO4
	B	Griffith theory of brittle fracture, modifications of the Griffith theory			CO5
	C	Fracture of single crystals, ductile fracture, notch effect in fracture			CO5
	Unit 5	**Fatigue and Creep in materials**			
	A	Fatigue, crack initiation and propagation, S-N Curve			CO6
	B	Surface effects and fatigue, corrosion Fatigue			CO6
	C	Creep, stages of creep curve, stress and temperature effects			CO6
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	1. G. E. Dieter,Mechanical metallurgy, McGRAW-HILL BOOK COMPANY..			
	Other References				

COURSE ARTICULATION MATRIX

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
MCH002.1	3	3	2	1	-	-	-	-	-	-	-	-	2	2
MCH002.2	2	3	2	1	-	-	-	-	-	-	-	-	3	3
MCH002.3	3	3	1	2	-	-	-	-	-	-	-	-	1	-
MCH002.4	2	3	1	3	-	-	-	-	-	-	-	-	3	2
MCH002.5	2	3	3	3	-	-	-	-	-	-	-	-	-	-
MCH002.6	3	3	3	3	-	-	-	-	-	-	-	-	-	-
MEC482	3	3	2	2	-	-	-	-	-	-	-	-	2	2

1-Slight (Low) 2-Moderate (Medium) 3-Substantial (High)

School: SSET		**Batch : 2023-2027**	
Programme: B.Tech		**Current Academic Year: 2023-2024**	
Branch: ME		**Mechanical Engineering**	
1	Course Code	MEC483	
2	Course Title	Intermediate Fluid Mechanics	
3	Credits	4	
4	Contact Hours (L-T-P)	3-0-0	
	Course Status	Program Elective	
5	Course Objective	To use mathematics to make models of fluid flow and solve them for some simple engineering applications	
6	Course Outcomes	After the successful completion of course, students will be able to: CO1. Understand the concept of fields and local rates of change CO2. Solve simple problems as analytical solutions of NS equation CO3. Make approximations in fluid mechanics. CO4. Use simple concepts of boundary layers CO5. Understand simple models of turbulent flows CO6. Make simple applications of unsteady flows	
7	Course Description	The course teaches fluid mechanics and its application with mo9re mathematics	
8	Outline syllabus		CO Mapping
	Unit 1	**Fluid Flow fields and rates of change with time**	
	A	Introduction to Eulerian descriptions and time rates of change	CO1
	B	Control volume analysis and Reynolds transport theorem	CO1
	C	Applications to mass. Momentum and energy balance for CVs	CO1
	Unit 2	**Navier-Stokes equation**	
	A	Derivation of NS equation	CO2
	B	Applications to some fully-developed flows	CO2
	C	Applications to Raleigh problems	CO2
	Unit 3	**Similitude and Approximations**	
	A	Normalization of equations and Pi numbers	CO3
	B	Approximations.	CO3
	C	Low Re flows	CO3
	Unit 4	**Boundary layer flows**	
	A	Introduction to boundary layers	CO4
	B	Blassius solutions and Falkner Skan solutions	CO4
	C	Boundary layue separation	CO5
	Unit 5	**Turbulence and Unsteady flows**	
	A	Basic concepts of turbulence	CO5
	B	Simple models of turbulence	CO5

	C	Unsteady flows			CO6
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	Som and Biswas: Introduction to Fluid Mechanics and Fluid Machines, Gupta and Gupta: Fluid Mechanics and Its applications			
	Other References				

COURSE ARTICULATION MATRIX

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
MEC483.1	3	3	1	1	1	1			2	1		1	2		
MEC483.2	3	3	1	1	2	1			2	1		2	2		
MEC483.3	3	3	1	1	1	1	2		2	1		2	2		
MEC483.4	3	3	1	1	1	1			2	1		1	2		
MEC483.5	3	3	1	1	2	1	2		2	1		1	2		
MEC483.6	3	3	1	1	1	1			2	1		1	2		
MEC483	3	3	1	1	1	1	2		2	1		1	2		

1-Slight (Low) 2-Moderate (Medium) 3-Substantial (High)

School: SSET		**Batch : 2023-2027**	
Programme: B.Tech		**Current Academic Year: 2023-2024**	
Branch: ME		**Mechanical Engineering**	
1	Course Code	MEC484	
2	Course Title	Design for Additive Manufacturing	
3	Credits	3	
4	Contact Hours (L-T-P)	3-0-0	
	Course Status	Program Elective	
5	Course Objective	Generating a good understanding of Additive Manufacturing, its development and applications, To expose the students to different types of Additive Manufacturing Processes, Pre and post processing of additive manufacturing and mathematical modeling for additive manufacturing	
6	Course Outcomes	After the successful completion of course, students will be able to: 1. Explain the working principle and its application. 2. Select the suitable material for fabricating a given product 3. Identify pre and post processing of additive manufacturing 4. Select an Additive manufacturing technology for a given component 5. Design and develop mathematical model for additive manufacturing 6. Explore the applications and limitations of AM processes in various fields	
7	Course Description	Additive Manufacturing (AM) is a process of joining materials to make objects from 3D model data, usually layer up on layer, as opposed to subtractive manufacturing methodologies, such as traditional machining. The basic principle of AM is that a model, initially generated using a three dimensional computer Aided Design system, can be fabricated directly. AM technologies have significantly evolved over the last decade. Because of their potential to extensively transform the nature of manufacturing processes by enabling " Freedom of Design " several industries have been attracted by these technologies. Using AM, manufacturing of highly complex parts can be an economically viable alternative to conventional manufacturing technologies.	
8	Outline syllabus		CO Mapping
	Unit 1	**Introduction**	
	A	Introduction to Additive Manufacturing and classification. of Additive Manufacturing Processes: Additive, Subtractive, Formative, Generic AM process	CO1

	B	Applications of additive manufacturinginrapidprototyping,rapidmanufacturing,rapidtooling,repairingandcoating	CO1,CO6
	C	Indirect Processes - Indirect Prototyping. Indirect Tooling, Indirect Manufacturing	CO1
	Unit 2	**Materials science for Additive Manufacturing**	
	A	Use of material for additive manufacturing. Liquid Based Materials : Photopolymers development , Photopolymer Chemistry	CO2
	B	Solid Based Materials : Polymers, Metals, Composites, Ceramics	CO2
	C	Use of multiple materials, multifunctional and graded materials in AM Role of solid if I cation rate ,Evolution of non-equilibrium structure property relationship, Grain structure and microstructure.	CO2
	Unit 3	**Pre and Post Processing of Additive Manufacturing Processes**	
	A	Pre-Processing in Additive Manufacturing :Preparation of 3D-CAD model, Reverse engineeringandReconstructionof3D-CADmodel,Partorientation and support generation,	CO3
	B	STL Conversion,STLerrordiagnostics,SlicingandGenerationofcodesfortool path,Surfacepreparation of materials	CO3
	C	Post-Processing in Additive Manufacturing: Support material removal ,improvement of surface texture ,accuracy and aesthetic; property enhancements.	CO3
	Unit 4	**Additive Manufacturing Technology**	
	A	3D-printing,Stereo lithography apparatus (SLA), Fused deposition modelling (FDM),Laminated Object Manufacturing(LOM)).	CO4
	B	Selective deposition lamination(SDL),Ultra sonic consolidation, Selective laser sintering (SLS), Laser engineered net shaping (LENS), Electron beam freeform fabrication(EBFFF),	CO4
	C	Electron beam melting(EBM), Plasma transferred arc additive manufacturing(PTAAM), Tungsten inert gas additive manufacturing(TIGAM),Metal inert gas additive manufacturing (MIGAM).	CO4
	Unit 5	**Mathematical Models for Additive manufacturing**	
	A	Transport phenomena models: temperature, fluid flow and composition, buoyancy driven tension driven free surface flow pool	CO5
	B	Case studies: Numerical Modeling of additive manufacturing process, Powder bed melting based process, droplet based printing process,	CO5
	C	Residual stress, part fabrication time, cost, optimal orientation, defects in additive manufacturing and role of transport simulations(choice of parameter, model validation)	CO5

	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	Gibson D W Rosen, Brent Stucker., Additive Manufacturing Technologies: Rapid Prototyping to Direct Digital Manufacturing, Springer,2010			
	Other References	1. Chua C K, Leong K F, Chu S L, Rapid Prototyping: Principles and Applications in Manufacturing, World Scientific. 2. 3. Liou W L, Liou F W, Rapid Prototyping and Engineering applications: A tool box for prototype development, CRC Press. 3. Kamrani A K, Nasr E A, Rapid Prototyping: Theory and practice, Springer, 4. Noorani R, Rapid Prototyping: Principles and Applications in Manufacturing, John Wiley & Sons			

COURSE ARTICULATION MATRIX

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
MCH004.1	3	3	1		-	-	-	-	-	-	-	1	1		
MCH004.2	2	3	1		-	-	-	-	-	-	-	1	1		
MCH004.3	3	3	1		-	-	-	-	-	-	-	1	1		
MCH004.4	2	3	1		-	-	-	-	-	-	-	1	1		
MCH004.5	2	3	1		-	-	-	-	-	-	-	1	1		
MCH004.6	3	3	1		-	-	-	-	-	-	-	1	1	-	
MEC484	2	3	1		-	-	-	-	-	-	-	1	1	-	-

1-Slight (Low) 2-Moderate (Medium) 3-Substantial (High)

School: SSET		**Batch : 2023-2027**	
Programme: B.Tech		**Current Academic Year: 2023-2024**	
Branch: ME		**Mechanical Engineering**	
1	Course Code	MEC485	
2	Course Title	Finite Element Methods in Solid Mechanics	
3	Credits	3	
4	Contact Hours (L-T-P)	3-0-0	
	Course Status	Program Elective	
5	Course Objective	• To enable the students understand the mathematical and physical principles underlying the Finite Element Method (FEM) as applied to solid mechanics problems • To teach the students the characteristics of various elements and selection of suitable elements for the problems being solved • To make the students derive finite element equations for simple and complex elements	
6	Course Outcomes	After the successful completion of course, students will be able to: CO1. Distinguish different numerical methods involved in Finite Element Analysis CO2. Apply equations in finite element methods for 1D, 2D and 3D problems. CO3. Apply shape functions in finite element formulations and use linear, quadratic, and cubic shape functions for interpolation CO4. Analyse beams and shafts using finite element analysis CO5. Formulate and solve basic problems in solid mechanics CO6. Apply commercial FEA packages like ANSYS and modern CAD/CAE tools for solving real life problems.	
7	Course Description	This course introduces finite element methods for the analysis of solid mechanics problems. Applications of finite element methods, modelling and analysis of problems, and interpretation of numerical results.	
8	Outline syllabus		CO Mapping
	Unit 1	**Introduction to Finite Element Method**	
	A	General description of Finite Element Method – Historical development	CO1
	B	Comparison with classical methods – Other numerical methods such as FDM, BEM, etc.	CO1
	C	General procedure of FEM– Application software's in FEM.	CO1

	Unit 2	**Approximate Solutions to Engineering Problems**			
	A	General field problems – formulation of Governing Differential Equations.			CO2
	B	Approximate solution as a polynomial, minimization of residue			CO2
	C	Method of least squares and Galerkin method, Variational formulation Ritz method			CO2
	Unit 3	**Shape functions in Finite Element Formulations**			
	A	Formulation for the subdomain using interpolation polynomial - Nodal approximation using shape function			CO3
	B	Selection of interpolation polynomials (shape functions) for 1 D and 2 D elements			CO3
	C	Derivation of shape functions for various elements – Isoparametric elements. Numerical Integration and its advantages.			CO3
	Unit 4	**Bar Problems**			
	A	II order problems - Bar Problem – Formulation for the whole domain – Formulation for the subdomain (finite element) using interpolation polynomial			CO4, CO6
	B	Nodal approximation using shape functions of Bar elements. Computing stiffness, mass and force element matrices			CO4, CO6
	C	Assembly of bar element matrices – Application of B.Cs – solution			CO4, CO6
	Unit 5	**Beam Problems**			
	A	IV order problems - Beam Problem – Formulation for the whole domain – Formulation for the subdomain (finite element) using interpolation polynomial			CO5, CO6
	B	Nodal approximation using shape functions of Beam elements. Computing stiffness, mass and force element matrices			CO5, CO6
	C	Assembly of beam element matrices – Application of B.Cs – solution			CO5, CO6
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	Tirupathi R. Chandrupatla and Ashok D. Belugundu, Introduction to Finite Elements in Engineering, 4th Edition, Prentice Hall, 2011			
	Other References	1 Reddy, J.N., Finite Element Method in Engineering, Tata McGraw Hill, 2007. 2. Young W Kwon and Hyochoong Bang, The finite element method using MATLAB, 2ed, CRC Press, London. 2000.			

		3. Seshu P, Textbook of Finite Element Analysis, PHI. 2004	

COURSE ARTICULATION MATRIX

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
MCH005.1	3	3	-	-	1	-	-	-	-	-	-	2	1	-	-
MCH005.2	2	3	-	-	1	-	-	-	-	-	-	2	1	-	-
MCH005.3	3	3	-	-	1	-	-	-	-	-	-	2	1	-	-
MCH005.4	2	3	-	-	1	-	-	-	-	-	-	2	1	-	-
MCH005.5	2	3	-	-	1	-	-	-	-	-	-	2	1	-	-
MCH005.6	3	3	-	-	1	-	-	-	-	-	-	2	1	-	-
MEC485	2	3	-	-	1	-	-	-	-	-	-	2	1	-	-

1-Slight (Low) 2-Moderate (Medium) 3-Substantial (High)

School: SSET		**Batch : 2023-2027**	
Programme: B.Tech		**Current Academic Year: 2023-2024**	
Branch: ME		**Mechanical Engineering**	
1	Course Code	MEC486	
2	Course Title	Design with Composite Materials	
3	Credits	3	
4	Contact Hours (L-T-P)	3-0-0	
	Course Status	Program Elective	
5	Course Objective	• Provide students with a basic understanding of the composition and uses of composite materials, their structural and mechanical properties. • Develop the student's skills in understanding the different manufacturing methods available for composite material • Illuminate the knowledge and analysis skills in applying mechanics to the composite materials.	
6	Course Outcomes	After the successful completion of course, students will be able to: CO1. Classify composite materials and their applications CO2. Apply the principles of micro and macro mechanics in composite materials CO3. Analyze composite laminates using the fundamentals of Classical Lamination Theory CO4. Apply failure criteria on composite structures subjected to various types of loading CO5. Design a composite structure for the specific mechanical applications. CO6. Demonstrate the design of composite laminates subjected to mechanical, thermal stresses for different environmental conditions.	
7	Course Description	This course provides students a background in modern lightweight composite materials which are being used in an ever-increasing range of applications and industries. Topics covered include: current and potential applications of composite materials, fibers, matrices, manufacturing methods for composites, review of elasticity of anisotropic solids, micromechanics of continuous and discontinuous fiber systems, laminated plate analysis, static analyses of laminated composites, edge effects in laminates and both macroscopic and microscopic failure analysis of composite materials and design of laminates.	
8	Outline syllabus		CO Mapping
	Unit 1	**Introduction & Applications**	

	A	Composites, Multiscale Composites and Nanocomposites, Reinforcements and Matrices,	CO1
	B	Properties of the composites in comparison with standard materials	CO1
	C	Applications: Applications of metal, ceramic and polymer matrix composites, Multiscale and nano composites, Hybrid composites and Sandwich composites, self-reinforced composites and carbon/carbon composites	CO1
	Unit 2	**Micro and Macro mechanical analysis of composite materials**	
	A	Micromechanical Analysis of a Lamina. Volume and Mass Fractions, Density, and Void Content-	CO2
	B	Prediction of engineering properties using micromechanics-Material properties of the fiber and matrix	CO2
	C	Macro mechanical analysis of a lamina -linear elastic stress-strain characteristics of Fiber Reinforced material	CO2
	Unit 3	**Classical Lamination Theory**	
	A	Kirchhoff Hypothesis- Laminate Nomenclature and Classification. Laminate strains and displacements - Laminate stresses & strains	CO3
	B	Stress distributions through the thickness- Force and moment resultants	CO3
	C	Laminate stiffness matrix: ABD Matrix-Classification of laminates and their effect on the ABD Matrix-Elastic couplings	CO3
	Unit 4	**Theories of Failures of Laminates**	
	A	Maximum stress and strain criterion	CO4, CO6
	B	Tsai-Hill, Tsai-Wu criterion	CO4, CO6
	C	Inter-laminar stresses- Impact resistance	CO4, CO6
	Unit 5	**Design of Composite Products**	
	A	Smart composites, Joints and assembly of composites, Design for assembly and environment	CO5, CO6
	B	Materials selection- design principles in composites for various load carrying applications	CO5, CO6

	C	Case studies in design and development of composite parts, boats, pressure vessels, automotive parts, aerospace parts, electronics parts and composites for space vehicles.			CO5, CO6
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
		1. Autar, K. Kaw, Mechanics of Composite Materials, Taylor & Francis, 2006			
	Other References	1. Robert Millard Jones, Mechanics of composite materials, Taylor & Francis, 1999 2. Laszlo, P. Kollar, George, S. Springer, Mechanics of composite structures, Cambridge University Press, 2003.			

COURSE ARTICULATION MATRIX

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
MEC486.1	3	3	2	-	-	-	-	-	-	-	-	2	1	-	-
MEC486.2	2	3	2	-	-	-	-	-	-	-	-	2	1	-	-
MEC4863	3	3	2	-	-	-	-	-	-	-	-	2	1	-	-
MEC486.4	3	3	2	-	-	-	-	-	-	-	-	2	1	-	-
MEC486.5	3	3	2	-	-	-	-	-	-	-	-	2	1	-	-
MEC486.6	3	3	2	-	-	-	-	-	-	-	-	2	1	-	-
MEC486	3	3	2	-	-	-	-	-	-	-	-	2	1	-	-

1-Slight (Low) 2-Moderate (Medium) 3-Substantial (High)

School: SSET		**Batch : 2023-2027**
Programme: B.Tech		**Current Academic Year: 2023-2024**
Branch: ME		**Mechanical Engineering**
1	Course Code	MEP486
2	Course Title	Design with Composite Materials Lab
3	Credits	1
4	Contact Hours (L-T-P)	0-0-2
	Course Status	Practical
5	Course Objective	• Provide students with a basic understanding of the composition and uses of composite materials, their structural and mechanical properties. • Develop the student's skills in understanding the different manufacturing methods available for composite material • Illuminate the knowledge and analysis skills in applying mechanics to the composite materials.
6	Course Outcomes	After the successful completion of course, students will be able to: CO1. Evaluate the fundamental elastics properties of UD glass/epoxy composite materials CO2. Test and Interpret static bending behaviour of glass/epoxy composite beams CO3. Analyse buckling behaviour of glass/epoxy composite beams CO4. Test and Interpret dynamic bending behaviour of UD glass/epoxy composite beams CO5. Design a glass/epoxy laminate with high stiffness through optimizing the volume fraction and ply orientations CO6. Formulate an optimization problems for designing a laminate and validate with experimentation
7	Course Description	This course provides students a background in modern lightweight composite materials which are being used in an ever-increasing range of applications and industries. Topics covered include: current and potential applications of composite materials, fibers, matrices, manufacturing methods for composites, review of elasticity of anisotropic solids, micromechanics of continuous and discontinuous fiber systems, laminated plate analysis, static analyses of laminated composites, edge effects in laminates and both macroscopic and microscopic failure analysis of composite materials and design of laminates.

8	Outline syllabus				CO Mapping
	List of Experiments				
	Experiment 1	Evaluate the Elastic moduli in longitudinal and transverse direction of UD glass/epoxy composite materials and verify with micromechanics			CO1, CO6
	Experiment 2	Evaluate the Shear moduli in in-plane direction of UD glass/epoxy composite materials and verify with micromechanics			CO1, CO6
	Experiment 3	Test and Interpret central deflection of UD glass/epoxy composite beams with uniform cross section and verify with numerical simulation			CO2, CO6
	Experiment 4	Test and Interpret central deflection of UD glass/epoxy composite beams with tapered cross section and verify with numerical simulation			CO2, CO6
	Experiment 5	Evaluate the critical buckling load of UD glass/epoxy composite beams and verify with numerical simulation			CO3, CO6
	Experiment 6	Test and Interpret dynamic response of UD glass/epoxy composite beams and verify with numerical simulation			CO4, CO6
	Experiment 7	Design a glass/epoxy laminate with high stiffness through optimizing the volume fraction and ply orientations			CO5, CO6
	Experiment 8	Formulate an optimization problem for designing a laminate and validate with experimentation			CO6
	Mode of examination	Practical			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	1. Young W Kwon and Hyochoong Bang, The finite element method using MATLAB, 2ed, CRC Press, London. 2000. 2. A			

COURSE ARTICULATION MATRIX

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
MCP006.1	3	3	-	-	-	-	-	-	-	-	-	2	1	-	-
MCP006.2	2	3	-	-	-	-	-	-	-	-	-	2	1	-	-
MCP006.3	3	3	-	-	-	-	-	-	-	-	-	2	1	-	-
MCP006.4	2	3	-	-	-	-	-	-	-	-	-	2	1	-	-
MCP006.5	2	3	-	-	-	-	-	-	-	-	-	2	1	-	-
MCP006.6	3	3	-	-	-	-	-	-	-	-	-	2	1	-	-
MEP486	3	3	-	-	-	-	-	-	-	-	-	2	1	-	-

1-Slight (Low) 2-Moderate (Medium) 3-Substantial (High)

School: SSET		**Batch : 2023-2027**	
Programme: B.Tech		**Current Academic Year: 2023-2024**	
Branch: ME		**Semester: IV**	
1	Course Code	MDM201	
2	Course Title	Industry 4.O and IIOT	
3	Credits	3	
4	Contact Hours (L-T-P)	3-0-0	
	Course Status	DSE	
5	Course Objective	1. To familiarize students with concept of Industry 4.O and it's applications. 2. To provide students an understanding of lean manufacturing process. 3. To teach the basics of Internet of things. 4. To teach students the basics of Industry IoT applications in modernmanufacturing industry.	
6	Course Outcomes	After the successful completion of course, students will be able to: CO1: Interpret the concept of Industry 4.0 and its applications CO2: Apply the concept of internet of things on real industrial problems. CO3: Identify Industry 4.O applications in a manufacturing industry. CO4: Apply the concept of IIOT and Lean manufacturing tools and techniques in industrial problems. CO5: Compare Industry IoT applications in a manufacturing industry. CO6: Analyze applications and changes driven by it. 4.O.	
7	Course Description	The objective of this course is to make the students realize about the concept of Industry 4.O, Internet of Things, IIOT, Lean manufacturing and applications in the Industry. After learning this course the student will be able to implement all these concepts and techniques in an industry to help the industries growth in the market as well as overall development of the country.	
8	Outline syllabus	CO Mapping	
	Unit 1	**Introduction To Industry 4.0**	
	A	The Various Industrial Revolutions - Digitalisation and the Networked Economy - Drivers, Enablers, Compelling Forces and Challenges for Industry 4.0	CO1

	B	The Journey so far: Developments in USA, Europe, China and other countries - Comparison of Industry 4.0 Factory and Today's Factory			CO1
	C	Trends of Industrial Big Data and Predictive Analytics for Smart Business Transformation.			CO1
	Unit 2	**Road To Industry 4.0**			
	A	Internet of Things (IoT) & Industrial Internet of Things (IIoT) & Internet of Services			CO2
	B	Smart Manufacturing - Smart Devices and Products			CO2
	C	Smart Logistics - Smart Cities - Predictive Analytics			CO2
	Unit 3	**Industry4.O in Manufacturing Industry**			
	A	Rise of Collaborative robot (COBOT), Edge Computing & IoT, Industrial Data Space.			CO3, CO6
	B	Logistics4.O, Industrial Iot gateways			CO3, CO6
	C	IioT Cybersecurity Risks and evolution, Iiot communication and connectivity technology, Maintenance and asset management with IioT.			CO3, CO6
	Unit 4	**Introduction to Industrial IoT (IIoT) Systems:**			
	A	Fourth Revolution – Sustainability assessment of Manufacturing Industry.			CO4, CO6
	B	Lean Production system – Smart and connected business perspective – smart factories			CO4, CO6
	C	cyber-physical systems – collaboration platform and PLM.			CO4, CO6
	Unit 5	**Industrial IoT Applications**			
	A	Health Care Management, Chemical and Pharmaceutical industry,			CO5, CO6
	B	Industrial IoT in Power Plants ,Quality Control and InventoryManagement			CO5, CO6
	C	Plant Safety and Security, Facility Management			CO5, CO6
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	1. The Fourth Industrial Revolution‖ by Klaus Schwab, World Economic Forum 2.Industrial Engineering and Production Management-Martand Telsang-S. Chand & CO.			

	Other References	1.Internet of Things: A Hands-On Approach‖ by Arsheep Bahga and Vijay Madisetti, University Press 2.NOC: Introduction to Industry 4.0 and Industrial Internet of Things Buffa, E.S., "Modern Production/Operations Management",John Wiley sons, 2003 3. Elsayed A Elsayed, Thomas O. Boucher, "Analysis andcontrol of Production System", Prentice Hall, 2002.	

COURSE ARTICULATION MATRIX

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO201.1	3	2	-	-	-	2	-	-	-	-	-	2	1	1	1
CO201.2	3	2	-	-	-	2	-	-	-	-	-	2	1	1	1
CO201.3	3	2	-	-	-	2	-	-	-	-	-	2	1	1	1
CO201.4	3	2	-	-	-	2	-	-	-	-	-	2	1	1	1
CO201.5	3	2	-	-	-	2	-	-	-	-	-	2	1	1	1
CO201.6	3	2	-	-	-	2	-	-	-	-	-	2	1	1	1
MDM201	3	2	-	-	-	2	-	-	-	-	-	2	1	1	1

1-Slight (Low) **2-Moderate (Medium)** **3-Substantial (High)**

School: SSET		**Batch: 2023-2027**	
Programme: B.Tech		**Current Academic Year: 2023-2024**	
Branch: ME		**Semester: V**	
1	Course Code	MDM 202	
2	Course Title	Big Data Analytics for Manufacturing	
3	Credits	3	
4	Contact Hours (L-T-P)	3-0-0	
	Course Status	DSE	
5	Course Objective	1. To understand the need of Big Data, challenges and different analytical architectures. 2. Installation and understanding of Hadoop Architecture and its ecosystems 3. Processing of Big Data with Advanced architectures like Spark. 4. Describe graphs and streaming data in Spark	
6	Course Outcomes	After the successful completion of course, students will be able to: CO1: Discuss the challenges and their solutions in Big Data. CO2: Summarize the data using basic statistics. CO3: Interpret and work on Hadoop Framework and eco systems. CO4: Familiarize and analyze the use of robotics in modern manufacturing. CO5: Demonstrate spark programming with different programming languages and live streaming data in Spark CO6: Analyze and translate vast data in to abstract concepts necessary for engineering practices.	
7	Course Description	This course is designed to give you a thorough understanding of data analysis which plays a crucial role in the increasingly digital world and cyber-physical systems. This course will introduce engineering students to key techniques for deriving meaningful insights from structure & unstructured data, with specific examples derived from the world of design, manufacturing and management.	
8	Outline syllabus		CO Mapping
	Unit 1	**Introduction To Big Data**	
	A	Data Storage and Analysis - Characteristics of Big Data —	CO1
	B	Big Data Analytics - Typical Analytical Architecture	CO1
	C	Requirement for new analytical architecture – Challenges in Big Data Analytics – Need of big data frameworks	CO1
	Unit 2	**Traditional Method and Statistical Techniques for data Analytics**	
	A	Introduction to Missing data, Traditional methods for dealing with missing data, Maximum Likelihood Estimation – Basics, Missing data handling, Improving the accuracy of analysis	CO2
	B	Statistical data elaboration, 1-D Statistical data analysis, 2-D Statistical data Analysis, ND Statistical data analysis	CO2
	C	Inferential statistics, Regression and ANOVA	CO2
	Unit 3	**Big Data Framework**	
	A	Hadoop – Requirement of Hadoop Framework - Design principle of Hadoop – Comparison with other system	CO3
	B	Hadoop Components – Hadoop 1 vs Hadoop 2 – Hadoop Daemon's – HDFS Commands	CO3

	C	Map Reduce Programming: I/O formats, Map side join, Reduce Side Join, Secondary sorting, Pipelining MapReduce jobs			CO3
	Unit 4	**Spark Framework and Data Analysis with it**			
	A	Introduction to GPU Computing, CUDA Programming Model, CUDA API, Simple Matrix, Multiplication in CUDA,			CO4
	B	CUDA Memory Model, Shared Memory Matrix Multiplication, Additional CUDA API Features.			CO4
	C	Data Analysis with Spark Shell - Writing Spark Application - Spark Programming in Scala, Python, R,			CO4
	Unit 5	**Streaming of Data through Spark**			
	A	SQL Context – Importing and Saving data – Data frames – using SQL			CO5
	B	Graph X overview – Creating Graph – Graph Algorithms.			CO5, CO6
	C	Overview – Errors and Recovery – Streaming Source – Streaming live data with spark			CO5, CO6
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	**Text Book** 1. Mike Frampton, "Mastering Apache Spark", Packt Publishing, 2015. 2. TomWhite,"Hadoop:TheDefinitiveGuide",O'Reilly,4thEdition,2015 3. NickPentreath, Machine Learning with Spark, Packt Publishing,2015.			
	Other References	**References** 1. NPTEL Online course on Data Analytics by IITM (http://nptel.ac.in/courses/110106064/) 2. Mohammed Guller, Big Data Analytics with Spark, Apress,2015 3. Donald Miner, Adam Shook, "Map Reduce Design Pattern", O'Reilly, 2012			

COURSE ARTICULATION MATRIX

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO202.1	**3**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**-**	**1**	**1**
CO202.2	**3**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**-**	**1**	**1**
CO202.3	**3**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**-**	**1**	**1**
CO202.4	**3**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**-**	**1**	**1**
CO202.5	**3**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**-**	**1**	**1**
CO202.6	**3**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**-**	**1**	**1**
MDM 202	**3**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**-**	**1**	**1**

1-Slight (Low) **2-Moderate (Medium)** **3-Substantial (High)**

School: SSET		**Batch : 2023-2027**	
Programme: B.Tech		**Current Academic Year: 2023-2024**	
Branch: ME		**Semester: VI**	
1	Course Code	MDM301	
2	Course Title	Additive Manufacturing	
3	Credits	2	
4	Contact Hours (L-T-P)	2-0-0	
	Course Status	DSE	
5	Course Objective	Generating a good understanding of Additive Manufacturing, its development and applications, To expose the students to different types of Additive Manufacturing Processes, materials used in AM systems and reverse engineering.	
6	Course Outcomes	After the successful completion of course, students will be able to: CO1: Interpret the scope and necessity of additive manufacturing processes in the industry. CO2: Create and modify various required file formats and path programming for the additive creation process CO3: Select suitable materials/tooling for the additive manufacturing process CO4: Distinguish among various types of additive manufacturing machines. CO5: Apply additive manufacturing techniques to reverse engineering CO6: Construct any complex geometry model that has market appeal.	
7	Course Description	Additive Manufacturing (AM) is a process of joining materials to make objects from 3D model data, usually layer up on layer , as opposed to subtractive manufacturing methodologies, such as traditional machining. The basic principle of AM is that a model, initially generated using a three dimensional computer Aided Design system, can be fabricated directly. AM technologies have significantly evolved over the last decade. Because of their potential to extensively transform the nature of manufacturing processes by enabling " Freedom of Design " several industries have been attracted by these technologies. Using AM, manufacturing of highly complex parts can be an economically viable alternative to conventional manufacturing technologies	
8	Outline syllabus		CO Mapping
	Unit 1	**Introduction**	
	A	World of AM, What is AM, Basic Process, Industries Using AM, Growth of AM, Installations by Countries, Technology Development.	CO1
	B	History of AM: Early history, Early solid Freeform Fabrication, Commercial Development , Chronology of AM Development	CO1
	C	Traditional Prototyping Vs Rapid Prototyping, Classification of Additive Manufacturing Processes, Applications in Education and Industry.	CO1
	Unit 2	**Principles of Additive Manufacturing Processes**	

	A	Principles of Automated Processes, AM Fundamentals: Creation of solid Models, Conversion to STL File, Slicing the File, Making or Growing the Prototype, Post processing			CO2
	B	Data interfacing: formats (STL, SLC, CLI, AMI, LEAF, IGES, HP/GL, CT, STEP), conversation, validity checks , repair procedures			CO2
	C	Part orientation and support generation, Support structure design, Model Slicing algorithms and contour data organization, direct and adaptive slicing, Tool path generation.			CO2
	Unit 3	**Materials for Additive Manufacturing Processes**			
	A	Introduction ; Nature of Materials , Chemical bonding and Structure Types of Materials: Polymers, Metals, Ceramics , Composites			CO3
	B	Liquid Based Materials : Photopolymers development , Photopolymer Chemistry			CO3
	C	Solid Based Materials : Polymers, Metals, Composites, Ceramics			CO3
	Unit 4	**Liquid and Solid based AM Systems**			
	A	Classification: Liquid based system-Stereo lithography Apparatus SLA, details of SL process, products, Advantages and Disadvantages, Limitations, Applications and Uses.			CO4
	B	Soild based System-Fused Deposition Modeling, Principle, Process, products, Advantages and Disadvantages, Applications and Uses, Laminated Object Manufacturing			CO4
	C	Case Study: Fabricating a Prototype using liquid and solid based AM systems, Post processing operations.			CO4, CO5
	Unit 5	**Powder based AM Systems**			
	A	Selective Laser Sintering-Principles of SLS process, principle of sinter bonding process, laser sintering materials , products, advantages and disadvantages applications, research and development.			CO5, CO6
	B	Three Dimensional printing process and applications, Direct shell production casting –key strength, process, applications and uses, case studies			CO5,CO6
	C	Laser Sintering System, Errors in AM processes: Pre processes, processing, post processing errors, Parts building errors.			CO5,CO6
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	Noorani R, Rapid Prototyping: Principles and Applications in Manufacturing, John Wiley & Sons			
	Other References	1. Chua C K, Leong K F, Chu S L, Rapid Prototyping: Principles and Applications in Manufacturing, World Scientific.			

		2. Gibson D W Rosen, Brent Stucker., Additive Manufacturing Technologies: Rapid Prototyping to Direct Digital Manufacturing, Springer. 3. Liou W L, Liou F W, Rapid Prototyping and Engineering applications: A tool box for prototype development, CRC Press. 4. Kamrani A K, Nasr E A, Rapid Prototyping: Theory and practice, Springer,	

COURSE ARTICULATION MATRIX

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO301.1	3	2	2	-	-	-	-	-	-	-	-	-	2	3
CO301.2	3	3	3	-	-	-	-	-	-	-	-	-	3	3
CO301.3	2	3	3	-	-	-	-	-	-	-	-	-	3	3
CO301.4	3	3	3	-	-	-	-	-	-	-	-	-	3	3
CO301.5	3	3	3	-	-	-	-	-	-	-	-	-	3	3
CO301.6	2	2	2	-	-	-	-		-	-	-	-	2	3
MDM301	2	3	2	-	-	-	-	-	-	-	-	-	3	3

1-Slight (Low) **2-Moderate (Medium)** **3-Substantial (High)**

School: SSET		**Batch : 2023-2027**			
Programme: B.Tech		**Current Academic Year: 2023-2024**			
Branch: ME		**Semester: VI**			
1	Course Code	MDM301			
2	Course Title	Additive Manufacturing Lab			
3	Credits	1			
4	Contact Hours (L-T-P)	0-0-2			
	Course Status	DSE			
5	Course Objective	Generating a good understanding of Additive manufacturing, its development and applications, To expose the students about Additive Manufacturing Processes, materials used in AM systems and reverse engineering concept.			
6	Course Outcomes	After the successful completion of course, students will be able to: CO1. Explain the scope and necessity of additive manufacturing processes in the industry. CO2. Create and modify various required file formats and path programming for the additive creation process CO3. Select suitable materials/tooling for the additive manufacturing process CO4. Distinguish among various types of additive manufacturing machines. CO5. Apply additive manufacturing techniques to reverse engineering CO6. Construct any complex geometry model that has market appeal.			
7	Course Description	Additive Manufacturing (AM) is a process of joining materials to make objects from 3D model data , usually layer up on layer , as opposed to subtractive manufacturing methodologies, such as traditional machining. The basic principle of AM is that a model, initially generated using a three dimensional computer Aided Design system, can be fabricated directly. AM technologies have significantly evolved over the last decade. Because of their potential to extensively transform the nature of manufacturing processes by enabling " Freedom of Design " several industries have been attracted by these technologies. Using AM, manufacturing of highly complex parts can be an economically viable alternative to conventional manufacturing technologies			
8	Outline syllabus				CO Mapping
	Experiments1	**Introduction to additive manufacturing**			**CO1**
	Experiment 2	Design and printing of spur gear, Helical Gear			CO2
	Experiment 3	Design and Printing gear train			CO2,CO6
	Experiment 4	Design and printing of Knuckle joint			CO2,CO6
	Experiment 5	Design and Printing of crankshaft			CO6
	Experiment 6	Design and Printing of camshaft			CO6
	Experiment 7	Design and Printing of Bearing			CO2,CO6
	Experiment 8	Design and Printing of casting pattern			CO2,CO6
	Mode of examination	Practical			
	Weight- age Distribution	CA	CE	ETE	
		25%	25%	50%	

	Text book/s*	Noorani R, Rapid Prototyping: Principles and Applications in Manufacturing, John Wiley & Sons
		1. Chua C K, Leong K F, Chu S L, Rapid Prototyping: Principles and Applications in Manufacturing, World Scientific. 2. Gibson D W Rosen, Brent Stucker., Additive Manufacturing Technologies: Rapid Prototyping to Direct Digital Manufacturing, Springer. 3. Liou W L, Liou F W, Rapid Prototyping and Engineering applications: A tool box for prototype development, CRC Press. 4. Kamrani A K, Nasr E A, Rapid Prototyping: Theory and practice, Springer,

COURSE ARTICULATION MATRIX

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO301.1	-	-	-	-	-	2	-	2	-	-	-	2	-	-	-
CO301.2	1	-	-	-	1	2	-	-	-	-	-	1	1	1	-
CO301.3	2	-	-	-	1	2	-	-	-	-	-	2	1	1	-
CO301.4	2	-	1	-	2	2	-	-	-	-	-	2	-1	1	-
CO301.5	2	-	1	-	2	2	-	-	-	-	-	2	2	1	-
MDM301	2	-	1	-	2	2	-	-	-	-	-	2	2	1	-

School: SSET		**Batch : 2023-2027**	
Programme: B. Tech		**Current Academic Year: 2023-2024**	
Branch: ME		**Semester: VI**	
1	Course Code	MDM 302	
2	Course Title	Robotics and Automation	
3	Credits	3	
4	Contact Hours (L-T-P)	3-0-0	
5	Course Outcomes	After the successful completion of course, students will be able to: CO1: Interpret the various applications of Robots CO2: Select suitable gripper and sensor for robot CO3: Apply the principles of industrial automation in the industrial applications CO4: Classify manufacturing automation CO5: Interpret transfer mechanism, automation for machining operation CO6: Recommend automation and robot for industrial application	
6	Outline syllabus		CO Mapping
	Unit 1	**Robotics Introduction**	
	A	Evolution of Robot and Robotics, Laws of Robotics, Progressive advancement in robotics,	CO1
	B	classification with respect to geometrical configuration (Anatomy),Wrist configuration	CO1
	C	End effector, Manipulation and control, Designation of configurations of robot.	CO1
	Unit 2	**Robot Grippers & Sensors**	
	A	Mechanical Gripper-Grasping force, mechanisms for actuation, Magnetic gripper	CO2

	B	vacuum cup gripper-considerations in gripper selection & design, Sensors used in robots- Contact and noncontact sensors	CO2
	C	Proximity sensor: Inductive proximity sensor, capacitive proximity sensor, Comparison of inductive proximity and capacitive proximity and their relative merits and demerits.	**CO2**
	Unit 3	**Automation Introduction**	
	A	Definition, Advantages, goals, types, need, laws and principles of Automation. Elements of Automation..	CO3
	B	Fluid power and its elements, application of fluid power, Pneumatics vs. Hydraulics,	CO3
	C	benefit and limitations of pneumatics and hydraulics systems, Role of Robotics in Industrial Automation.	**CO3**
	Unit 4	**Manufacturing Automation**	
	A	Manufacturing Automation: Classification and type of automatic transfer machines; Automation in part handling and feeding, Analysis of automated flow lines	CO4
	B	design of single model, multi-model and mixed model production lines.	CO4
	C	Programmable Manufacturing Automation CNC machine tools, Machining centers, Programmable robots, Robot time estimation in manufacturing operations**.**	**CO4, CO6**
	Unit 5	**Type Automation**	
	A	Type Automation: Automated Flow lines, Methods of Work part Transport,	CO5
	B	Transfer Mechanism, Buffer Storage, Control Functions	CO5
	C	Automation for Machining Operations, Design and Fabrication Considerations.	**CO5,CO6**

	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	1.Groover, M.P., "Industrial Robotic Technology – Programming and Application", McGrawhill 2. Automation, Production Systems and Computer Integrated Manufacturing"- M.P.Grover, PearsonEducation			
	Other References	1. Koren, Y. ,"Robotics for Engineers", McGrawhill. 2. Deb, S.R., "Robotics Technology and Flexible Automation" Tata Mc Graw Hill 3. Anatomy of Automation – Amber G.H & P.S. Amber, PrenticeHall			

COURSE ARTICULATION MATRIX

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO302.1	2	1	-	-	1	-	-	-	-	-	-	2	1	1	-
CO302.2	2	1	-	-	1	-	-	-	-	-	-	2	1	1	-
CO302.3	2	1	-	-	1	-	-	-	-	-	-	2	1	1	-
CO302.4	2	1	-	-	1	-	-	-	-	-	-	2	1	1	-
CO302.5	2	1	-	-	1	-	-	-	-	-	-	2	1	1	-
CO302.6	2	1	-	-	1	-	-	-	-	-	-	2	1	1	-
MDM 302	2	1	-	-	1	-	-	-	-	-	-	2	1	1	-

1-Slight (Low) **2-Moderate (Medium)** **3-Substantial (High)**

School: SSET		**Batch : 2023-2027**	
Programme: B.Tech		**Current Academic Year: 2023-2024**	
Branch: ME		**Semester: VII**	
1	Course Code	MDM 401	
2	Course Title	Reverse Engineering	
3	Credits	3	
4	Contact Hours (L-T-P)	3-0-0	
	Course Status	DSE	
5	Course Objective	To introduces the concept of reverse engineering along with techniques associated with this process for scanning and converting physical parts into solid models or 3-D surfaces through automatic reverse engineering. In addition to this objective is to develop a knowledge of rapid prototyping to develop tangible prototyping of designs layer by layer through computer aided design data.	
6	Course Outcomes	After the successful completion of course, students will be able to: CO1: Interpret the necessary of reverse engineering along with methodologies and techniques used for the same. CO2: Build the knowledge of RE data acquisition and application of RE software to convert RE produced data into 3-D model. CO3: Choose appropriate reverse engineering system for object as per their application CO4: Develop tangible prototyping of designs layer by layer through computer aided design data. CO5: Develop relationship between Reverse Engineering and Rapid Prototyping CO6: Acquire knowledge of reverse engineering & rapid prototyping to design and develop a 3-D product.	
7	Course Description	This course enables the students to explore the necessary of reverse engineering and rapid prototyping in industrial sectors, educational sector, medical sector etc. Through this course students will come across with methodologies, techniques, hardware and software used for the same.	
8	Outline syllabus		CO Mapping
	Unit 1	**Introduction to Reverse Engineering**	
	A	Necessary of reverse engineering, Reverse Engineering– The Generic Process, Contact Scanners, Noncontact Scanners	CO1, CO6
	B	–Point Processing, Application Geometric Model Development, Computer-aided (Forward) Engineering	CO1, CO6
	C	Computer-aided Reverse Engineering, Computer Vision and Reverse Engineering, Structured-light Range Imaging, Scanner Pipeline	CO1
	Unit 2	**Reverse Engineering: Hardware and Software**	
	A	Introduction, Reverse Engineering Hardware: Contact Methods,	CO2
	B	Contact Methods, Destructive Method	CO2, CO6

	C	Reverse Engineering Software: Reverse Engineering Software Classification, Reverse Engineering Phases, Reverse Engineering Phases			CO2, CO6
	Unit 3	**Reverse Engineering System Selection**			
	A	The Selection Process, Point Capture Devices, Triangulation Approaches			CO3, CO6
	B	Time-of-flight" or Ranging Systems, Structured-light and Stereoscopic Imaging Systems, Destructive Systems			CO3
	C	Barriers to Adopting Reverse Engineering: The Research Model, Research Methodology, The Research Model			CO3
	Unit 4	**Introduction to Rapid Prototyping**			
	A	Introduction to Rapid Prototyping, Current Techniques and Material: Current Techniques and Material, Selective Laser Sintering, Fused Deposition Modeling, Three-dimensional Printing. Laminated Object Manufacturing, Multijet Modeling, Laser-engineered Net Shaping			CO4
	B	Rapid Prototyping, Rapid Tooling, Rapid Manufacturing			CO4
	C	Legal Aspects of Reverse Engineering			CO4
	Unit 5	**Relationship Between Reverse Engineering and Rapid Prototyping**			
	A	Modeling Cloud Data in Reverse Engineering, Data Processing for Rapid Prototyping, Integration of RE and RP for Layer-based			CO5
	B	The Adaptive Slicing Approach for Cloud Data Modeling, Planar Polygon Curve Construction for a Layer			CO5
	C	Determination of Adaptive Layer Thickness¸ Reverse Engineering in the Automotive Industry, Reverse Engineering in the Aerospace Industry			CO5
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	1. Reverse Engineering An Industrial Perspective Vinesh Raja and Kiran J. Fernandes (Eds.), Springer			
	Other References	1. Reverse Engineering: Mechanisms, Structures, Systems & Materials, By Robert W. Messler, McGraw-Hill Education			

COURSE ARTICULATION MATRIX

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO401.1	3	2	2	-	-	-	-	-	-	-	-	1	1	1
CO401.2	3	2	3	-	-	-	-	-	-	-	-	1	1	1
CO401.3	3	2	2	-	-	-	-	-	-	-	-	1	1	1
CO401.4	3	3	2	-	-	-	-	-	-	-	-	1	1	1
CO401.5	2	2	2	-	-	-	-	-	-	-	-	1	1	1
CO401.6	3	2	2	-	-	-	-	-	-	-	-	1	1	1
MDM 401	3	2	2	-	-	-	-	-	-	-	-	1	1	1

1-Slight (Low) **2-Moderate (Medium)** **3-Substantial (High)**