KUMARAGURU COLLEGE OF TECHNOLOGY

An autonomous Institution affiliated to Anna University, Chennai

COIMBATORE – 641 049

B.E - AUTOMOBILE ENGINEERING

REGULATION 2024

I and VIII Semester

Automobile Engineering

VISION

To be the leading hub of innovation and excellence in automobile engineering education, research, and industry collaboration, where our graduates are empowered to drive the future of automotive technology and sustainability.

MISSION

- Develop students for successful careers in the **Automotive Sector**.
- Establish **Industry-Institute** interaction.
- Apply **emerging technologies** to solve **automotive research engineering problems**.
- Pursue **lifelong learning** and **sustainable innovation**.

PROGRAM SPECIFIC OBJECTIVES (PSOs)

The Program Specific Objectives of Automobile Engineering undergraduate Program are to prepare the graduates to

PSO1: design and manufacture automotive components using modern tools and engineering techniques.

PSO2: apply knowledge of electrical, electronics, and control systems in modern vehicles technology.

PSO3: innovate with strong automotive engineering skills & managerial capability to solve real-world problems.

KNOWLEDGE AND ATTITUDE PROFILE (WK)

WK1: A systematic, theory-based understanding of the natural sciences applicable to the discipline and awareness of relevant social sciences.

WK2: Conceptually-based mathematics, numerical analysis, data analysis, statistics and formal aspects of computer and information science to support detailed analysis and modelling applicable to the discipline.

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

WK4: Engineering specialist knowledge that provides theoretical frameworks and bodies of knowledge for the accepted practice areas in the engineering discipline; much is at the forefront of the discipline.

WK5: Knowledge, including efficient resource use, environmental impacts, whole-life cost, reuse of resources, net zero carbon, and similar concepts, that supports engineering design and operations in a practice area.

WK6: Knowledge of engineering practice (technology) in the practice areas in the engineering discipline.

WK7: Knowledge of the role of engineering in society and identified issues in engineering practice in the discipline, such as the professional responsibility of an engineer to public safety and sustainable development.

WK8: Engagement with selected knowledge in the current research literature of the discipline, awareness of the power of critical thinking and creative approaches to evaluate emerging issues.

WK9: Ethics, inclusive behavior and conduct. Knowledge of professional ethics, responsibilities, and norms of engineering practice. Awareness of the need for diversity by reason of ethnicity, gender, age, physical ability etc. with mutual understanding and respect, and of inclusive attitudes.

PROGRAM OUTCOMES (POs)

Graduates of the Automobile Engineering Undergraduate Program should have the ability to:

PO1: Engineering Knowledge:

Apply knowledge of mathematics, natural science, computing, engineering fundamentals and an engineering specialization as specified in WK1 to WK4 respectively to develop to the solution of complex engineering problems.

PO2: Problem Analysis:

Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions with consideration for sustainable development. (WK1 to WK4)

PO3: Design/Development of Solutions:

Design creative solutions for complex engineering problems and design/develop systems/components/processes to meet identified needs with consideration for the public health and safety, whole-life cost, net zero carbon, culture, society and environment as required. (WK5)

PO4: Conduct Investigations of Complex Problems:

Conduct investigations of complex engineering problems using research-based knowledge including design of experiments, modelling, analysis & interpretation of data to provide valid conclusions. (WK8).

PO5: Engineering Tool Usage:

Create, select and apply appropriate techniques, resources and modern engineering & IT tools, including prediction and modelling recognizing their limitations to solve complex engineering problems. (WK2 and WK6)

PO6: The Engineer and The World:

Analyze and evaluate societal and environmental aspects while solving complex engineering problems for its impact on sustainability with reference to economy, health, safety, legal framework, culture and environment. (WK1, WK5, and WK7).

PO7: Ethics:

Apply ethical principles and commit to professional ethics, human values, diversity and inclusion; adhere to national & international laws. (WK9)

PO8: Individual and Collaborative Team work:

Function effectively as an individual, and as a member or leader in diverse/multi-disciplinary teams.

PO9: Communication:

Communicate effectively and inclusively within the engineering community and society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations considering cultural, language, and learning differences

PO10: Project Management and Finance:

Apply knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, and to manage projects and in multidisciplinary environments.

PO11: Life-Long Learning:

Recognize the need for, and have the preparation and ability for i) independent and life-long learning ii) adaptability to new and emerging technologies and iii) critical thinking in the broadest context of technological change. (WK8)

KUMARAGURU COLLEGE OF TECHNOLOGY									
AUTOMOBILE ENGINEERING REGULATION 2024 B.E. Automobile Engineering - Curriculum									
Semester I									
S.No	**Course code**	**Course Title**	**Course Mode**	**Course Type**	**L**	**T**	**P**	**J**	**C**
1	24HST101	Heritage of Tamil	Theory	HS	1	0	0	0	**1**
2	24MAI111	Linear Algebra and Calculus	Embedded	BS	3	0	2	0	**4**
3	24PHI106	Engineering Physics	Embedded	BS	3	0	2	0	**4**
4	24ADP001	Basics of Artificial Intelligence	Practical	ES	0	0	2	0	**1**
5	24MEI101	Engineering Graphics	Embedded	ES	2	0	2	0	**3**
6	24MEI102	Manufacturing Technology	Embedded	ES	3	0	2	0	**4**
7	24INP102	Innovation Practicum - 1	Practical	ES	0	0	2	0	**1**
8	24HSP111	Holistic wellness - 1	Practical	HS	0	0	2	0	**1**
9	24INO1--	FCLF General stack - 1	Practical	OE	0	0	2	0	**1**
10	24INP101	Design Thinking	Practical	ES	0	0	2	0	**1**
								Total Credits	**21**
								Total Contact Hours/week	**30**
Semester II									
S.No	**Course code**	**Course Title**	**Course Mode**	**Course Type**	**L**	**T**	**P**	**J**	**C**
1	24HST102	Tamils and Technology	Theory	HS	1	0	0	0	**1**
2	24HST103	Effective Communication	Theory	HS	2	0	0	0	**2**
	24HST104	Professional Communication	Theory	HS	2	0	0	0	
	24HSJ102	Fluency through practice	Project	HS	0	0	0	4	
3	24MAI121	Advanced Calculus and Laplace Transform	Embedded	BS	3	0	2	0	**4**
4	24CYI104	Material Chemistry	Embedded	BS	3	0	2	0	**4**
5	24MET104	Engineering Mechanics	Theory	ES	3	0	0	0	**3**
6	24CSI101	Logical Thinking and Problem solving	Embedded	BS	3	0	2	0	**4**
7	24INP103	Innovation Practicum – 2	Practical	ES	0	0	2	0	**1**
8	24HSP112	Holistic wellness – 2	Practical	HS	0	0	2	0	**1**
9	24INO1--	FCLF General stack - 2	Practical	OE	0	0	2	0	**1**
								Total Credits	**21**
								Total Contact Hours/week	**27/29**

Semester III									
S.No	**Course code**	**Course Title**	**Course Mode**	**Course Type**	**L**	**T**	**P**	**J**	**C**
1	24HSP005	Mastering Conversations	Practical	HS	0	0	2	0	1
2	24MAT231	Partial Differential Equations and Transforms Techniques	Theory	BS	3	1	0	0	4
3	24AUI201	Automotive Chassis and Transmission	Embedded	PC	3	0	2	0	4
4	24AUT202	Heat Power Engineering	Theory	PC	3	0	0	0	3
5	24AUI203	Strength of Materials	Embedded	PC	3	0	2	0	4
6	24AUI204	Automotive Electronics	Embedded	PC	2	0	0	2	3
7	24AUP205	Design and Prototyping Laboratory	Practical	PC	0	0	2	0	1
8	24INM201	Universal Human Values II: Understanding Harmony	Theory	HS	1	0	0	0	1
9	24INP201	Innovation Practicum - 3	Practical	ES	0	0	2	0	1
10	24INO---	FCLF General stack – 3	Practical	OE	0	0	2	0	1
11	24AUJ206	Internship – I	Internship	PRJ	0	0	0	2	1
Total Credits									**24**
Total Contact Hours/week									**32**

Semester IV									
S.No	**Course code**	**Course Title**	**Course Mode**	**Course Type**	**L**	**T**	**P**	**J**	**C**
1	24HSP006	Mastering Group Discussion and Presentation Skills	Practical	HS	0	0	2	0	**1**
2	24MAI241	Numerical Methods and Probability	Embedded	BS	3	0	2	0	**4**
3	24AUI207	Automotive Powertrain	Embedded	PC	2	0	2	0	**3**
4	24AUI208	Fluid Mechanics and Heat transfer	Embedded	PC	3	0	2	0	**4**
5	24AUI209	Automotive Embedded Systems	Embedded	PC	2	0	0	2	**3**
6	24AUT210	Design of Machine Elements	Theory	PC	2	1	0	0	**3**
7	24INM202	Environmental Science and Sustainability	Embedded	HS	1	0	2	0	**2**
8	24INM102	Indian Knowledge Systems in Science and Engineering	Theory	HS	1	0	0	0	**1**
9	24INP202	Innovation Practicum -4	Practical	ES	0	0	2	0	**1**
10	24INO___	FCLF Technical Stack -1	Practical	OE	0	0	2	0	**1**
11	24INO___	FCLF Emerging stack-1	Practical	OE	0	0	2	0	**1**
Total Credits									**24**
Total Contact Hours/week									**33**

Semester V									
S.No	**Course code**	**Course Title**	**Course Mode**	**Course Type**	**L**	**T**	**P**	**J**	**C**
1	24HSP007	Building Professional Readiness	Practical	HS	0	0	2	0	**1**
2	24AUI301	Mechanics of Machines	Embedded	PC	3	0	4	0	**4**
3	24AUI302	Automotive Electrical Systems	Embedded	PC	2	0	2	0	**3**
4	24AUI303	Finite Element Analysis for Automotive Engineering	Embedded	PC	3	0	2	0	**4**
5	24AUT304	Vehicle Body Engineering	Theory	PC	2	0	0	0	**2**
6	24AUP305	AI for Automotive systems Development	Practical	PC	0	0	2	0	**1**
7	24AUE---	Professional Elective - I	Theory	PE	3	0	0	0	**3**
8	24INO301	FCLF Technical stack -2	Practical	OE	0	0	2	0	**1**
9	24INO302	FCLF Emerging stack-2	Practical	OE	0	0	2	0	**1**
10	24AUJ306	Internship – II /Mini project	Internship	PRJ	0	0	0	4	**2**
11	24INM301	Constitution of India	Theory	MC	2	0	0	0	**0**
Total Credits									**22**
Total Contact Hours/week									**33**

***- Non CGPA course**

Semester VI									
S.No	**Course code**	**Course Title**	**Course Mode**	**Course Type**	**L**	**T**	**P**	**J**	**C**
1	24HST***	Indian/Foreign languages	Theory	HS	2	0	0	0	**2**
2	24AUI307	Vehicle Dynamics	Embedded	PC	3	0	2	0	**4**
3	24AUT308	Hybrid and Electric Vehicles	Theory	PC	3	0	0	0	**3**
4	24AUI309	Modelling and Simulation of Automotive Systems	Embedded	PC	2	0	2	0	**3**
5	24AUT310	Automotive Emissions and Control Techniques	Theory	PC	3	0	0	0	**3**
6	24AUE__	Professional Elective -II	Theory	PE	3	0	0	0	**3**
7	24AUE__	Professional Elective -III	Theory	PE	3	0	0	0	**3**
8	24INO303	FCLF Technical stack -3	Practical	OE	0	0	2	0	**1**
9	24INO304	FCLF Emerging stack-3	Practical	OE	0	0	2	0	**1**
Total Credits									**23**
Total Contact Hours/week									**28**

Semester VII									
S.No	**Course code**	**Course Title**	**Course Mode**	**Course Type**	**L**	**T**	**P**	**J**	**C**
1	24AUE__	Professional Elective -IV	Theory	PE	3	0	0	0	**3**
2	24AUE__	Professional Elective -V	Theory	PE	3	0	0	0	**3**
3	24AUE__	Professional Elective -V1	Theory	PE	3	0	0	0	**3**
4	24AUI401	Vehicle Maintenance and Diagnostics	Embedded	PC	2	0	2	0	**3**
5	24AUT402	Total Quality and Project Management	Theory	HS	3	0	0	0	**3**
6	24AUJ403	Project Phase I	Project	PRJ	0	0	0	6	**3**
								Total Credits	**18**
								Total Contact Hours/week	**22**

Semester VIII									
S.No	**Course code**	**Course Title**	**Course Mode**	**Course Type**	**L**	**T**	**P**	**J**	**C**
1	24AUJ404	Project Phase II	Project	PRJ	0	0	0	24	12
								Total Credits	**12**
								Total Contact Hours/week	**24**

Total Credits = 165

PROFESSIONAL ELECTIVES

Automotive Design & Manufacturing

S.No	Course Code	Course Name	Course Mode	CT	L	T	P	J	C
1	24AUE001	Design of Engine Components	Embedded	PE	2	0	2	0	**3**
2	24AUE002	Design of Chassis Components	Embedded	PE	2	0	2	0	**3**
3	24AUE003	Automotive Computational Fluid Dynamics	Embedded	PE	2	0	2	0	**3**
4	24AUE004	Measurements and Metrology	Embedded	PE	2	0	2	0	**3**
5	24AUE005	Geometrical Dimensioning and Tolerance	Embedded	PE	2	0	2	0	**3**
6	24AUE006	Composite Materials and Structures	Embedded	PE	2	0	2	0	**3**
7	24AUE007	Automotive Components Manufacturing	Theory	PE	3	0	0	0	**3**
8	24AUE008	Design for Manufacture and Assembly (DFMA)	Theory	PE	3	0	0	0	**3**
9	24AUE009	Additive Manufacturing and Tooling	Embedded	PE	2	0	2	0	**3**
10	24AUE010	Digital Manufacturing	Theory	PE	3	0	0	0	**3**

Automotive Electrical and Electronics

S.No	Course Code	Course Name	Course Mode	CT	L	T	P	J	C
1	24AUE011	LabVIEW-based Automotive Instrumentation and Virtual Prototyping	Embedded	PE	2	0	2	0	3
2	24AUE012	Power Electronics for Electric Vehicles	Embedded	PE	2	0	2	0	3
3	24AUE013	Model-Based Design for ARM Cortex-M4	Embedded	PE	2	0	2	0	3
4	24AUE014	Modern Automotive Architecture	Embedded	PE	2	0	2	0	3
5	24AUE015	Automotive Embedded Software Design	Embedded	PE	2	0	2	0	3
6	24AUE016	Development of Automotive ECU	Embedded	PE	2	0	2	0	3

Automotive Technology & Mobility Management

S.No	Course Code	Course Name	Course Mode	CT	L	T	P	J	C
1	24AUE017	Vehicle testing and Validation	Theory	PE	3	0	0	0	**3**
2	24AUE018	Machine Learning for Automotive Applications	Embedded	PE	2	0	2	0	3
3	24AUE019	Off Road Vehicles	Theory	PE	3	0	0	0	**3**
4	24AUE020	Vehicle Transport Management	Theory	PE	3	0	0	0	**3**
5	24AUE021	Entrepreneurship Development	Theory	PE	3	0	0	0	**3**
6	24AUE022	Product Design and Development	Embedded	PE	2	0	2	0	3
7	24AUE023	Product Lifecycle Management	Embedded	PE	2	0	2	0	3

FCLF Emerging Track									
S.No	**Course code**	**Course Title**	**Course Mode**	**CT**	**L**	**T**	**P**	**J**	**C**
1	24INO***	BMS for EV Applications	Practical	OE	0	0	2	0	1
2	24INO***	Design of Automotive ECU	Practical	OE	0	0	2	0	1
3	24INO***	CAE Meshing for Automotive Applications	Practical	OE	0	0	2	0	1
4	24INO***	Autotronics	Practical	OE	0	0	2	0	1
FCLF Technical Track									
1	24INO***	Automotive Styling	Practical	OE	0	0	2	0	1
2	24INO***	Multi-Body Dynamics Simulation using MATLAB	Practical	OE	0	0	2	0	1
3.	24INO***	EV Motor Design and Simulation	Practical	OE	0	0	2	0	1

SEMESTER I

24HST101	தமிழர் மரபு / HERITAGE OF TAMIL (Common to all Departments)	L	T	P	J	C
		1	0	0	0	1
HS		SDG		4, 11, 16		
Pre-requisite courses	-	Data Book / Code book (If any)		-		

Course Objectives:

The purpose of taking this course is to:

1	தமிழ் மொழி மற்றும் இலக்கியத்தின் அடிப்படை அம்சங்களை அறிமுகப்படுத்துதல், அதன் தொன்மைக்காலம் முதல் நவீனகாலம் வரையிலான வளர்ச்சியை விளக்கம் செய்யுதல். Introduce students to the foundational aspects of Tamil language and literature, tracing its evolution from ancient to modern times.
2	தமிழகத்தின் செழுமையான கலாச்சார பாரம்பரியத்தை அறிமுகப்படுத்துதல், பாறை ஓவியக் கலையிலிருந்து நவீன சிற்ப கலையின்படி அதன் கலை வெளிப்பாடுகளை ஆராய்தல். Familiarize students with the rich cultural heritage of Tamil Nadu, exploring its artistic expressions from rock art paintings to contemporary sculptures.
3	தமிழகத்தின் நாட்டுப்புறக் கலைகள் மற்றும் வீரவிளையாட்டுகளை அறிதல்- தினணக்கோட்பாடுகளை ஆராய்தல்- இந்திய தேசிய இயக்கத்தில் தமிழர்களின் பங்கினை அறிதல். To know the folk arts and heroic games of Tamilnadu-explore the concept of thinai -to know the role of Tamils in Indian National movement.

Course Outcomes

After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO1	தமிழ் மொழி மற்றும் இலக்கியத்தின் அடிப்படை அறிவை மேம்படுத்துதல். மொழி பண்பாட்டில் எவ்வாறு இணைந்துள்ளது என்பதை உணர்தல். Enhance the fundamental knowledge of Tamil language and literature	U
CO2	பழங்கால பாறை ஓவியங்கள், சிற்பம் என கலைகள் நவீன காலம்வரை எவ்வாறு பயணிக்கிறது என்பதை புரிந்துகொள்ளுதல். Understand the heritage, rock art paintings to modern art sculpture	U
CO3	நாட்டுப்புறக் கலைகள் தற்காப்புக் கலைகளாகவும், உடல் ஆரோக்கியத்தை மேம்படுத்தும் விதமாகவும் அமைவதை அறிந்து கலைகள் மீதான ஆர்வத்தை அதிகரிக்கச் செய்தல்- தமிழர்களின் அகத்திணை, புறத்திணை கோட்பாட்டினை புரிந்து கொள்ளுதல். இந்திய பண்பாட்டில் தமிழர்களின் பங்களிப்பை அறிதல். Acquire essential knowledge in the folk and martial arts-understanding the Agam and puram concept- to know the contribution of Tamils in Indian culture.	Ap

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11			
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	Automotive Design and Manufacturing	Automotive Electrical Electronics	Automotive Technology and Management
1							3	2	2		2			
2							3	3	2		2			
3							3	2	2		2			

Course Content

மொழி மற்றும் இலக்கியம் இந்திய மொழிக் குடும்பங்கள் – திராவிட மொழிகள் – தமிழ் ஒரு செம்மொழி – தமிழ் செவ்விலக்கியங்கள் - சங்க இலக்கியத்தின் சமய சார்பற்ற தன்மை – சங்க இலக்கியத்தில் பகிர்தல் அறம் – திருக்குறளில் மேலாண்மைக் கருத்துக்கள் – தமிழ்க் காப்பியங்கள், தமிழகத்தில் சமண பௌத்த சமயங்களின் தொடக்கம் -பக்தி இலக்கியம், ஆழ்வார்கள் மற்றும் நாயன்மார்கள் – சிற்றிலக்கியங்கள் – தமிழில் நவீன இலக்கியத்தின் வளர்ச்சி – தமிழ் இலக்கிய வளர்ச்சியில் பாரதியார் மற்றும் பாரதிதாசன் ஆகியோரின் பங்களிப்பு. LANGUAGE AND LITERATURE Language Families in India - Dravidian Languages – Tamil as a Classical Language - Classical Literature in Tamil – Secular Nature of Sangam Literature – Distributive Justice in Sangam Literature - Management Principles in Thirukural - Tamil Epics and Impact of Buddhism & Jainism in Tamil Land - Bakthi Literature Azhwars and Nayanmars - Forms of minor Poetry - Development of Modern literature in Tamil - Contribution of Bharathiyar and Bharathidhasan.	**3 Hours**
மரபு – பாறை ஓவியங்கள் முதல் நவீன ஓவியங்கள் வரை – சிற்பக்கலை நடுகல் முதல் நவீன சிற்பங்கள் வரை – ஐம்பொன் சிலைகள்– பழங்குடியினர் மற்றும் அவர்கள் தயாரிக்கும் கைவினைப் பொருட்கள், பொம்மைகள் – தேர் செய்யும் கலை – சுடுமண் சிற்பங்கள் – நாட்டுப்புற தெய்வங்கள் – குமரிமுனையில் திருவள்ளுவர் சிலை – இசைக் கருவிகள் – மிருதங்கம், பறை, வீணை, யாழ், நாதஸ்வரம் – தமிழர்களின் சமூக பொருளாதார வாழ்வில் கோவில்களின் பங்கு. **HERITAGE – ROCK ART PAINTINGS TO MODERN ART SCULPTURES** Hero stone to modern sculpture - Bronze icons - Tribes and their handicrafts - Art of temple car making - - Massive Terracotta sculptures, Village deities, Thiruvalluvar Statue at Kanyakumari, Making of musical instruments - Mridhangam, Parai, Veenai, Yazh and Nadhaswaram - Role of Temples in Social and Economic Life of Tamils.	**3 Hours**

நாட்டுப்புறக் கலைகள் மற்றும் வீர விளையாட்டுகள் தெருக்கூத்து, கரகாட்டம், வில்லுப்பாட்டு, கணியான் கூத்து, ஒயிலாட்டம், தோல்பாவைக்கூத்து, சிலம்பாட்டம், வளரி, புலியாட்டம், தமிழர்களின் விளையாட்டுகள். **FOLK AND MARTIAL ARTS** Therukoothu, Karagattam, Villu Pattu, Kaniyan Koothu, Oyillattam, Leather puppetry, Silambattam, Valari, Tiger dance - Sports and Games of Tamil	**3 Hours**
தமிழர்களின் திணைக்கோட்பாடுகள் தமிழகத்தின் தாவரங்களும், விலங்குகளும் – தொல்காப்பியம் மற்றும் சங்க இலக்கியத்தில் அகம் மற்றும் புறக்கோட்பொடுகள் – தமிழர்கள் போற்றிய அறக்கோட்பாடு – சங்ககாலத்தில் தமிழகத்தில் எழுத்தறிவும், கல்வியும் – சங்ககால நகரங்களும் துறைமுகங்களும் – சங்ககாலத்தில் ஏற்றுமதி மற்றும் இறக்குமதி – கடல்கடந்த நாடுகளில் தமிழர்களின் வெற்றி. **THINAI CONCEPTS OF TAMIL** Flora and Fauna of Tamils & Aham and Puram Concept from Tholkappiyam and Sangam Literature - Aram Concept of Tamils - Education and Literacy during Sangam Age - Ancient Cities and Ports of Sangam Age - Export and Import during Sangam Age - Overseas Conquest of Cholas.	**3 Hours**
இந்திய தேசிய இயக்கம் மற்றும் இந்திய பண்பாட்டிற்குத் தமிழர்களின் பங்களிப்பு இந்திய விடுதலைப் போரில் தமிழர்களின் பங்கு – இந்தியாவின் பிறப்பகுதிகளில் தமிழ்ப் பண்பாட்டின் தாக்கம் – சுயமரியாதை இயக்கம் – இந்திய மருத்துவத்தில், சித்த மருத்துவத்தின் பங்கு – கல்வெட்டுகள், கையெழுத்துப்படிகள் - தமிழ்ப் புத்தகங்களின் அச்சு வரலாறு. **CONTRIBUTIONS OF TAMIL TO INDIAN NATIONAL MOMENT AND INDIAN CULTURE** Contribution of Tamils to Indian Freedom Struggle - The Cultural Influence of Tamils over the other parts of India – Self-Respect Movement - Role of Siddha Medicine in Indigenous Systems of Medicine – Inscriptions & Manuscripts – Print History of Tamil Books.	**3 Hours**

Theory Hours:	**15**	**Tutorial Hours:**	**0**	**Practical Hours:**	**0**	**Project Hours:**	**0**	**Total Hours:**	**15**

Course Curated by			
Expert(s) from Industry	**Expert(s) from Higher Education Institution**		**Internal Expert(s)**
Recommended by BoS on	16.08.2024		
Academic Council Approval	No: 27	**Date**	24.08.2024

24MAI111	LINEAR ALGEBRA AND CALCULUS	L	T	P	J	C
		3	0	2	0	4
BS	(Common to AE, AU, CE, ME, MR)	SDG	9			

Pre-requisite courses	-	Data Book / Code book (If any)	-

Course Objectives:

The purpose of taking this course is to:

1	understand matrix theory for diagonalization, transformations, and their applications in engineering.
2	solve optimization problems using differential calculus.
3	apply partial differentiation for constrained optimization and numerical evaluation.
4	use integral calculus, including double and triple integrals, to solve engineering problems.
5	implement mathematical concepts using MATLAB to solve practical engineering problems.

Course Outcomes

After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO1	apply eigenvalues for matrix diagonalization and transformations and analyse results using computational tools.	Ap
CO2	apply differentiation for solving optimization problems and enhance solutions through computational tools.	Ap
CO3	Analyse and solve unconstrained and constrained optimization problems using the Lagrange multiplier method and determine the maxima and minima of functions with two or more variables relevant to engineering application	An
CO4	apply integral calculus and computational tools to solve engineering problems.	Ap
CO5	apply double integrals and computational tools for solving engineering problems.	Ap
CO6	apply triple integrals techniques and computational tools to solve complex problems.	Ap

Course Outcomes	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	Automotive Design and Manufacturing	Automotive Electrical Electronics	Automotive Technology and Management
1	2	2		1	1									
2	1	2		1	1									
3	1	1		1	1									
4	1	1		1	1									
5	1	1		1	1									
6	1	1		1	1									

Course Content:	
MATRICES Eigenvalues and Eigenvectors of a real matrix - Properties of eigenvalues and eigenvectors - Orthogonal matrices - Orthogonal transformation of a symmetric matrix to diagonal form - Reduction of quadratic form to canonical form by orthogonal transformation. **Practical Component** • Use MATLAB to compute Matrix Operations - Addition, Multiplication, Transpose, Inverse and Rank of a matrix. • Determining Eigenvalues and Eigenvectors of Matrices.	**9 Hours** **6 Hours**
DIFFERENTIAL CALCULUS Representation of Functions – Limit and Continuity – Differentiation – Rolles Theorem and Mean Value Theorem-Maxima and Minima **Practical Component** • Evaluating Limits and Derivatives • Determining Maxima and Minima of a function of one variable.	**9 Hours** **6 Hours**
PARTIAL DIFFERENTIALS Total derivative – Taylor's series expansion – Maxima and minima of functions of two variables – Constrained maxima and minima: Lagrange's multiplier method with single constraints – Jacobians. **Practical Component** • Function Approximations with Taylor Series • Determining Maxima and Minima of a function of two variables.	**9 Hours** **6 Hours**
INTEGRAL CALCULUS Definite and Indefinite integrals - Techniques of Integration: Substitution rule, Integration by parts, Trigonometric integrals, Trigonometric substitutions, Integration of rational functions by partial fraction. **Practical Component** • Integration of Rational Functions • Integration of Trigonometric Functions	**9 Hours** **6 Hours**
MULTIPLE INTEGRALS Double integration in Cartesian coordinates – Change of order of integration - Triple integration in Cartesian coordinates – Area as double integral and Volume as triple integral. **Practical Component** • Evaluating double integral with constant and variable limits. • Evaluating triple integral with constant and variable limits.	**9 Hours** **6 Hours**

Theory Hours: 45	Tutorial Hours: 0	Practical Hours: 30	Project Hours: 0	Total Hours: 75

Learning Resources

Textbooks

1. Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 44th Edition, 2023.
2. Ramana B.V., "Higher Engineering Mathematics", Tata McGraw-Hill Publishing Company Limited., New Delhi, 2018.
3. Kreyzig E., "Advanced Engineering Mathematics", John Wiley and Sons, 10th Edition, 2023.

Reference books

1. Veerarajan T., "Engineering Mathematics (for First Year)", Tata McGraw Hill Pub. Co. Ltd., New Delhi, Revised Edition, 2008.
2. Joel R. Hass, Christopher E. Heil, Maurice D. Weir, Przemyslaw Bogacki, George B. Thomas, "Thomas' Calculus", Pearson education 15th Edition, 2024.
3. G.B. Thomas and R.L. Finney, "Calculus and Analytical Geometry", 11th Edition, Pearson Education, 2010.
4. James Stewart, Daniel Clegg, Saleem Watson, "Calculus: Early Transcendentals", Cengage Learning, New Delhi, 9th Edition, 2020.
5. William J. Palm III, "MATLAB for Engineers: Global Edition", McGraw-Hill Education, 5th Edition, 2018.

Online Resources (Web Links)

1. Linear Algebra | Mathematics | MIT Open Courseware https://ocw.mit.edu/courses/mathematics/18-06-linear-algebra-spring-2010/
2. Matrix Algebra for Engineers | Coursera https://www.coursera.org/learn/matrix-algebra-engineers
3. Differential Calculus | Khan Academy https://www.khanacademy.org/math/calculus-1
4. Multivariable Calculus | Mathematics | MIT Open Courseware https://ocw.mit.edu/courses/mathematics/18-02sc-multivariable-calculus-fall-2010/
5. Integral Calculus | Khan Academy https://www.khanacademy.org/math/calculus-2
6. Multivariable Calculus | Khan Academy https://www.khanacademy.org/math/multivariable-calculus
7. Brilliant | Learn Interactively https://www.brilliant.org/

Assessment (Embedded course)

CAT, Activity and Learning Task(s), Mini project, MCQ, End Semester Examination (ESE) Lab Workbook, Experimental Cycle tests, viva-voce

Course Curated by

Expert(s) from Industry	Expert(s) from Higher Education Institution	Internal Expert(s)
Mr. Ramesh V.S., STEPS Knowledge Services Private Limited, Coimbatore. Mr.Jayakumar Venkatesan, Valles Marineras International Private Limited- Chennai. Mr. Imran Khan, GE Transportation Company, Bangalore	Dr.T.Govindan, Government College of Engineering, Srirangam, Trichy. Dr.C.Porkodi, PSG College of Technology, Coimbatore. Dr.P.Paramanathan, Amrita Vishwa Vidyapeetham, Coimbatore.	1. Dr. N.Anitha, 2. Ms. S. Sivasakthi, 3. Dr. S.Selvanayaki, Department of Mathematics
Recommended by BoS on	16.8.2024	
Academic Council Approval	No: 27	**Date** 24.8.2024

24PHI106	ENGINEERING PHYSICS (Common for AE, AU, ME)	L	T	P	J	C
		3	0	2	0	4
BS		SDG	7, 9			

Pre-requisite courses	-	Data Book / Code book (If any)	-

Course Objectives:

The purpose of taking this course is to:

1	provide students with a strong understanding of the principles of elasticity, quantum mechanics, and laser technology.
2	enable students to analyze and apply techniques related to non-destructive testing and surface coatings for various engineering applications.
3	introduce and assess green energy technologies, guiding students in recommending sustainable solutions for energy use.

Course Outcomes

After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO 1	apply the principles of elasticity to solve problems related to stress, strain, and bending of beams.	U
CO 2	analyse the fundamentals of quantum mechanics to interpret the behaviors of particles at the atomic and subatomic levels	Ap
CO 3	evaluate the principles of laser operation to assess their applications in various fields such as imaging and holography.	Ap
CO 4	examine the methods of non-destructive testing to categorize and select appropriate surface coating techniques.	Ap
CO 5	assess various green energy technologies to recommend efficient solutions for sustainable energy use.	U
CO 6	apply scientific methods and experiment techniques to enhance understanding of fundamental concepts and their application in various technological fields.	Ap

Course Outcomes	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	Automotive Design and Manufacturing	Automotive Electrical Electronics	Automotive Technology and Management
1	3	2			1						2			
2	3	2			1									
3	3	2			1									

4	3	2		2	1						2			
5	3	2			1						2			
6	3	2			1									

Course Content	
PROPERTIES OF MATTER Hooke's Law - Elastic moduli - Relation between elastic constants - Poisson's Ratio – Stress - Strain Diagram and its uses – factors affecting elastic modulus – Bending of beams – Expression for bending moment and depression - Cantilever - Depression of a cantilever - experimental determination of Young's modulus by Non uniform bending – I shape girders. **Practical Component** 1. Non-uniform bending – Determination of Young's modulus 2. Compound pendulum – Determination of acceleration due to gravity	**9 Hours** **6 Hours**
QUANTUM PHYSICS Necessity of quantum mechanical picture- Planck's concept (hypothesis) - Wave particle duality - de-Broglie waves - Physical significance of wave function - Schrodinger equation- Time independent and time dependent equation - Particle in a box- Eigen values and Eigen function- Superposition Principle- Quantum mechanical tunnelling through a barrier. **Practical Component** 1. Determination of Planck's constant – Electroluminescence method.	**9 Hours** **6 Hours**
LASERS Interaction of light and matter - Quantization of electromagnetic radiation – Absorption, Spontaneous emission and Stimulated emission - Einstein's theory of stimulated emission- Population inversion - Sources of excitation - Active medium -Laser beam output- Nd-YAG laser - CO_2 laser - Applications – Laser Imaging and Holography- Laser gyroscopes. **Practical Component** 1. Semiconductor laser: a. Determination of wavelength of laser b. Determination acceptance angle and numerical aperture of an optical fiber. c. Determination of particle size 2. Spectrometer – Determination of wavelength of mercury source using grating	**9 Hours** **6 Hours**
NDT AND SURFACE COATINGS NDT: Liquid penetrant method – ultrasonic flaw detector: A scan, B scan and C scan – X- ray radiography and fluoroscopy – thermography Surface Coatings: Thin film deposition through - Electro deposition – Spin coating – Electrospinning- Physical Vapour Deposition (PVD)- Industrial Applications - Automotive Industry and aerospace Industry. **Practical Component** 1. Determination of thermal conductivity of a bad conductor – Lee's Disc method 2. Melde's string – Determination of frequency of a tuning fork 3. Determination of magnetic susceptibility of a solid material – B-H curve apparatus	**9 Hours** **6 Hours**

GREEN ENERGY Introduction to Green energy – Solar energy: Energy conversion by photovoltaic principle – Solar cells – Efficiency measurements – Types (First, Second and Third Generation) of Solar Cells - Wind energy: Basic components and principle of wind energy conversion systems – Ocean energy: Wave energy – Wave energy conversion devices. Futuristic Energy: Hydrogen – Methane Hydrates – Carbon capture and storage (CCS). **Practical Component** 1. Determination of efficiency of solar cell 2. Determination of band gap of a semiconductor	**9 Hours** **6 Hours**

Theory Hours: 45	**Tutorial Hours:**	**0**	**Practical Hours:**	**30**	**Project Hours:**	**0**	**Total Hours:**	**75**

Learning Resources

Textbooks:

1. M N Avadhanulu, P.G. Kshirsagar, and TVS Arun Murthy. A Textbook of Engineering Physics, 11th Edition. S. Chand Publications (2018).
2. R.K. Gaur and S.L. Gupta. Engineering Physics, 10th Edition. Dhanpat Rai Publications (P) Ltd., New Delhi (2016).
3. Arthur Beiser, Shobhit Mahajan, and S. Rai Choudhury. Concepts of Modern Physics, 7th Edition. McGraw Hill Education, New Delhi (2017).
4. V. Rajendran. Applied Physics. Tata McGraw Hill Publishing, New Delhi (2017).

References:

1. Brij Lal and Subrahmanyam. Properties of Matter. S. Chand & Co Ltd., New Delhi (2014).
2. Satya Prakash. Quantum Mechanics. Pragati Prakashan Publishers (2015).
3. K. Thiagarajan and Ajoy Ghatak. Lasers: Fundamentals and Applications. Springer Science & Business Media (2010).
4. Marcel Dekker. Ultrasonics: Fundamentals, Technology, Applications, Second Edition. New York (1988).
5. William Silfvast Hill. Laser Fundamentals. Cambridge University Press (2018).
6. S.O. Pillai. Solid State Physics, Ninth Edition. New Age International Press (2020). Godfrey Boyle. Renewable Energy: Power Sustainable Future, Second Edition. Oxford University Press, UK (2019).
7. Chetan Singh Solanki. Solar Photovoltaics – Fundamentals, Technologies and Applications. PHI Learning Private Limited (2019).

Online Resources (Weblinks)

1. https://www.khanacademy.org/science/physics/forces-newtons-laws/hookes law-and-elasticity
2. https://ocw.mit.edu/courses/1-050-solid-mechanics-fall-2004/
3. https://ocw.mit.edu/courses/8-04-quantum-physics-i-spring-2016/
4. https://spie.org/PA/conferencedetails/holography-and-diffractive-optics#_=_
5. https://archive.nptel.ac.in/courses/113/106/113106070/
6. https://onlinecourses.nptel.ac.in/noc24_ge56/preview
7. https://ocw.mit.edu/courses/ec-s07-photovoltaic-solar-energy-systems-fall_2004/

Assessment (Embedded course)
CAT, Activity and Learning Task(s), Mini project, MCQ, End Semester Examination (ESE) Lab Workbook, Experimental Cycle tests, viva-voce

Course Curated by			
Expert(s) from Industry	**Expert(s) from Higher Education Institution**		**Internal Expert(s)**
			Dr R Sengodan & Dr M Selvambikai Department of Physics
Recommended by BoS on	16.08.2024		
Academic Council Approval	No: 27	**Date**	24.08.2024

24ADP001	BASICS OF ARTIFICIAL INTELLIGENCE (Common to all Departments except CS, IT, AD)	L	T	P	J	C
		0	0	2	0	1
ES		SDG	8, 9, 16			
Pre-requisite courses	-	Data Book / Code book (If any)	-			

Course Objectives:	
The purpose of taking this course is to:	
1	introduce students to the fundamentals of Artificial Intelligence (AI) and Generative AI, and its key concepts
2	enable students to explore and experiment with common generative AI models and tools for generating text, images, audio, video, and code
3	equip students with the techniques and best practices for crafting effective prompts for AI models

Course Outcomes		
After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO 1	understand the fundamentals of AI and generative AI, including its potential impact, issues, limitations, and ethical concerns and its practical use cases in real-world scenarios.	U
CO 2	explore common generative AI models and tools for text, code, image, audio, and video generation.	E
CO 3	apply common prompt engineering techniques and approaches for writing effective prompts.	Ap

Course Outcomes	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	Automotive Design and Manufacturing	Automotive Electrical Electronics	Automotive Technology and Management
1	2						2							
2	2		2											
3					2					2				

Course Content

Introduction to Artificial Intelligence (AI) **Practical Component** Introduction to Artificial Intelligence (AI) - Generative AI Overview and Use Cases - Impact and Examples of AI - Application Domains for AI - Generative AI Applications. AI Concepts, Terminology - Cognitive Computing (Perception, Learning, Reasoning) - Terminology and Related Concepts of AI- Machine Learning Techniques and Training -	**8 Hours**

Deep Learning - Neural Networks - Natural Language Processing, Speech, Computer Vision - Self Driving Cars. AI: Issues, Concerns and Ethical Considerations - AI Ethics, Regulations, Governance, and ESG. The evolution and future of AI - The AI Ladder – The Journey for Adopting AI Successfully - Hotbeds of AI Innovation.	
Generative AI: Introduction and Applications **Practical Component** Introduction and Capabilities of Generative AI - Applications of Generative AI - Tools for Text Generation - Tools for Image Generation - Tools for Audio and Video Generation - Tools for Code Generation	**6 Hours**
Generative AI: Prompt Engineering Basics **Practical Component** Introduction to Prompt and Prompt Engineering - Best Practices for Prompt Creation - Common Prompt Engineering Tools - Hands on Lab: Getting to Know Our AI Prompting - Experimenting with Prompts - Naive Prompting and Persona Pattern. Prompt Engineering Techniques and Approaches - Text-to-Text Prompt Techniques - Interview Pattern Approach - Chain-of-Thought Approach - Tree-of-Thought Approach - Future of Human-Crafted Prompts - Text-to-Image Prompt Techniques - Hands-on Lab: Effective Text Prompts for Image Generation.	**7 Hours**
Project and Wrap Up **Practical Component** Graded Quiz Final Project: Generating Text, Images, and Code.	**9 Hours**

Theory Hours:	**0**	**Tutorial Hours:**	**0**	**Practical Hours:**	**30**	**Project Hours:**	**0**	**Total Hours:**	**30**

Learning Resources

Textbooks:

1. George F. Luger "Artificial Intelligence: Structures and Strategies for Complex Problem Solving" (6th Edition), Pearson, 2021.
2. Anna Jordan, Robert S. Menzies, Kristine P. Schwab, "AI-Powered Creativity: Generative AI and the Future of Content Creation" Routledge, 2023.

References:

1. https://platform.openai.com/docs/overview
2. https://towardsdatascience.com/
3. https://gemini.google.com/

Online Resource (Weblinks)

1. Introduction to Artificial Intelligence (AI) | Coursera
2. Generative AI: Introduction and Applications | Coursera
3. Generative AI: Prompt Engineering Basics | Coursera

Assessment (Practical course)			
MCQ, Mini project and viva-voce			
Course Curated by			
Expert(s) from Industry	**Expert(s) from Higher Education Institution**	**Internal Expert(s)**	
-	-	Dr. S. Sangeetha, Associate Professor Department of AI&DS	
Recommended by BoS on	16.08.2024		
Academic Council Approval	No: 27	**Date**	24.08.2024

24MEI101	ENGINEERING GRAPHICS (Common to AE, AU, CE, FT, ME, MR, TT)	L	T	P	J	C
		2	0	2	0	3
ES		SDG		4, 9, 11		

Pre-requisite courses	-	Data Book / Code book (If any)	-

Course Objectives:	
The purpose of taking this course is to:	
1	understand the importance of graphics in the design process, including visualization, communication, and documentation.
2	develop proficiency in constructing various curves, orthographic projections, and using drafting tools.
3	gain the ability to project and section simple solids and develop lateral surfaces and isometric projections.
4	learn to use AutoCAD for sketching, editing objects, and creating detailed engineering drawings.

Course Outcomes		
After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO 1	apply the construction of curves such as ellipses, parabolas, and hyperbolas to accurately visualize and communicate design ideas using drafting tools.	Ap
CO 2	analyze the projections of points, lines, and planes to determine true lengths and inclinations for effective representation of objects in design.	An
CO 3	evaluate the projections and sections of solids like prisms, pyramids, cylinders, and cones to create accurate sectional views and true shapes in engineering drawings.	An
CO 4	create developments of surfaces for simple solids and construct isometric projections to enhance the design process with three-dimensional visualizations.	An
CO 5	design free-hand sketches of orthographic views using AutoCAD.	Ap
CO 6	apply AutoCAD commands to demonstrate object selection and editing techniques, enabling precise modifications in engineering drawings.	Ap

Course Outcomes	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	Automotive Design and Manufacturing	Automotive Electrical Electronics	Automotive Technology and Management
1	2	2			2									
2		2		2						2				
3		2	2				2							

4	2		2		2									
5	2				2					2				
6	2				2					2				

Course Content	
PLANE CURVES, PROJECTION OF POINTS, LINES AND PLANES • Importance of graphics in design process, visualization, communication, documentation and drafting tools, Construction of curves - ellipse, parabola, and hyperbola by eccentricity method only. Orthographic projection of points. • Construction of cycloid — Construction of spirals - Construction of involutes of square and circle. • Drawing of tangents and normal to the above curves. • Projections of straight lines located in first quadrant - determination of true length and true inclinations. • Projections of plane surfaces - polygonal lamina and circular lamina, located in the first quadrant and inclined to one reference plane.	**6 Hours** **6 Hours**
PROJECTION AND SECTION OF SOLIDS • Projection of simple solids - prism, pyramid, cylinder and cone. Drawing views when the axis of the solid is inclined to one reference plane. • Sectioning of simple solids - prisms, pyramids, cylinder and cone. Obtaining sectional views and true shape when the axis of the solid is vertical and cutting plane inclined to one reference plane.	**6 Hours** **6 Hours**
DEVELOPMENT OF SURFACES, ISOMETRIC PROJECTIONS • Development of lateral surfaces of truncated prisms, pyramids, cylinders and cones. • Isometric projection, Isometric scale, Isometric views of simple solids, truncated prisms, pyramids, cylinders and cones.	**6 Hours** **6 Hours**
FREE-HAND SKETCHING AND INTRODUCTION TO AUTOCAD • Free hand sketching techniques, sketching of orthographic views from given pictorial views of objects, including free-hand dimensioning. Free hand sketching of isometric views from orthographic views. • Introduction to Drafting Software (AutoCAD) & its Basic Commands. Introduction to coordinate systems, object selection methods, selection of units and precession. Annotation and dimensions, Object properties.	**6 Hours** **6 Hours**
DRAWING ORGANIZATION AND HOUSE PROJECT AutoCAD - Sketching – line, circle, arc, polygon, rectangle and ellipse. Working with object snaps, layers and object properties. Editing the objects – copy, move, trim, extend, working with arrays, mirror, scale, hatch, fillet and chamfer. Isometric views of simple solid blocks.	**6 Hours** **6 Hours**

Theory	**Tutorial**	**Practical**	**Project**	**Total**
Hours: 30	**Hours: 0**	**Hours: 30**	**Hours: 0**	**Hours: 60**

Learning Resources
Textbooks:
1. Basant Agrawal and CM Agrawal, Engineering Drawing, McGraw-Hill, New Delhi, First Edition, 2008. 2. Venugopal K. and Prabhu Raja V., Engineering Graphics, New Age International (P) Limited, New Delhi, 2008.
References:
1. Nataraajan K.V., Engineering Drawing and Graphics, Dhanalakshmi Publisher, Chennai, 2005. 2. Warren J. Luzadder and Jon. M. Duff, Fundamentals of Engineering Drawing, Prentice Hall of India Pvt. Ltd., New Delhi, Eleventh Edition, 2005. 3. Gopalakirishna K.R., Engineering Drawing (Vol. I & II), Subhas Publications, 2001. 4. James Leach, AutoCAD 2017 Instructor, SDC Publications, 2016
Online Resources (Open sources):
1. https://www.khanacademy.org/math/differential-calculus 2. https://nptel.ac.in/courses/106105171 3. https://swayam.gov.in/nd1_noc19_cs42/preview

Assessment (Embedded course)
CAT, Activity and Learning Task(s), Mini project, MCQ, End Semester Examination (ESE) Lab Workbook, Experimental Cycle tests, viva-voce

Course Curated by			
Expert from Industry	**Expert from Higher Education Institutions**	**Internal Expert**	
Mr. G. Vergin Vino Design Engineer TANCAM, Chennai	Dr. V. Prabhuraja Professor Department of Mechanical Engineering PSG College of Technology, Coimbatore	Dr. K. M Senthil Kumar Associate Professor Department of Mechanical Engineering	
Recommended by BoS on	17.08.2024		
Academic Council Approval	No: 27	**Date**	24.08.2024

24MEI102	MANUFACTURING TECHNOLOGY (Common to AU, ME)	L	T	P	J	C
		3	0	2	0	4
ES		SDG	9, 12			

Pre-requisite courses	-	Data Book / Code book (If any)	-

Course Objectives:	
The purpose of taking this course is to:	
1	gain in-depth knowledge of various manufacturing processes including casting, welding, forming, powder metallurgy, and additive manufacturing.
2	develop the ability to identify, troubleshoot, and resolve defects in casting, welding, forming, and powder metallurgy processes.

Course Outcomes		
After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO1	apply fundamental knowledge of casting processes for quality castings	Ap
CO 2	analyse different welding techniques and their applications to select appropriate methods for joining various materials.	An
CO 3	analyse the principles of forming processes to design sheet metal products.	An
CO 4	demonstrate the ability to apply powder metallurgy techniques to refine metal powders.	Ap
CO 5	explore the principles and applications of additive manufacturing to understand its impact on modern manufacturing practices.	U
CO 6	execute experiments involving casting, welding, forming, powder metallurgy, and additive manufacturing to fabricate components, refine metal powders, assess their quality, and interpret the results for process improvement.	C

Course Outcomes	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	Automotive Design and Manufacturing	Automotive Electrical Electronics	Automotive Technology and Management
1	2			2								2		
2		2					2					2		
3			2									2		
4				2								2		
5					2		2					2		
6	2				2							2		

Course Content	
Casting Processes	

Overview of casting processes - significance in manufacturing - Types of casting processes: sand casting, investment casting, die casting - Applications and limitations - Mold materials and preparation - Pattern making and types of patterns - Core making and core materials - Minimizing defects: porosity, shrinkage, inclusions - Riser and gating system - Inspection methods: visual, radiographic, ultrasonic testing - Casting defects and their causes – Advance casting techniques - Permanent mold casting and centrifugal casting - Continuous casting - Case studies of innovative casting techniques. **Practical Component** **Sand Moulding Process:** To understand the sand moulding process and produce a mould for a component.	**9 Hours** **6 Hours**
Welding Techniques Basic principles of welding - Types of welding processes: MIG, TIG, arc welding - Applications and limitations - Equipment and consumables - Welding parameters and techniques - Safety measures and equipment handling – Advanced welding techniques - Resistance welding, laser welding, and electron beam welding - Advantages and applications - Common welding defects and their remedies - Inspection methods: visual, radiographic, ultrasonic - Standards in welding. **Practical Component** **Metal Arc Welding:** To perform metal arc welding, gas welding	**9 Hours** **6 Hours**
Forming Processes Overview of metal forming processes – Classification - bulk forming, sheet forming - Applications and benefits of forming processes - Sheet Metal Forming - Bending, shearing, and blanking processes - Deep drawing and its applications - Roll forming and spinning – Metal Forming - Formability and material properties – Forging, Rolling, Hydroforming, explosive forming, and superplastic forming - Applications and benefits - Case studies of sheet metal products - Common defects in forming processes - Techniques for minimizing defects - Inspection and quality control methods. **Practical Component** **Sheet Metal Forming:** To perform smithy and sheet metal forming operations.	**9 Hours** **6 Hours**
Powder Metallurgy Overview and significance of powder metallurgy – Advantages and limitations compared to traditional methods – Applications in various industries – Methods of powder production: atomization, reduction, electrolysis – Properties of metal powders – Compaction techniques: uniaxial pressing, isostatic pressing – Sintering – atmospheres and equipment – Applications in automotive, aerospace, and electronics – Case studies of powder metallurgy products – Common defects in powder metallurgy – Inspection and testing methods. **Practical Component** **Powder Metallurgy:** To refine a metal powder.	**9 Hours** **6 Hours**

Additive Manufacturing Overview of additive manufacturing (AM) technologies - Comparison with traditional manufacturing - Benefits and challenges of AM- Types of Additive Manufacturing Processes - Fused deposition modeling (FDM) - Stereolithography (SLA) - Selective laser sintering (SLS) and direct metal laser sintering (DMLS) - Materials for Additive Manufacturing - Polymer, metal, and ceramic materials - Material properties - Applications in aerospace, automotive, medical, and consumer products - Case studies of AM solutions.	**9 Hours**
Practical Component **Additive Manufacturing (3D Printing):** To explore additive manufacturing techniques like STL or FDM by producing a 3D printed component.	**6 Hours**

Theory	Tutorial	Practical	Project	Total
Hours: 45	Hours: 0	Hours: 30	Hours: 0	Hours: 75

Learning Resources
Textbooks
1. Hajra Choudhury, "Elements of Workshop Technology", Media Promotors Pvt. Ltd., Mumbai, 2001. 2. Rao, P. N., "Manufacturing Technology 4th Edition, (Vol. 1&2)", Tata McGraw Hill 2017. 3. P. C. Sharma, "Production Technology", S. Chand, New Delhi, 2007. 4. C. Hellier, Handbook of Non-Destructive Evaluation, McGraw-Hill Professional, 1st edition, 2001. 5. Jain R K., "Production Technology: Manufacturing Processes, Technology and Automation" Khanna Publication, 2012.
Reference books
1. Groover, M. P., Fundamentals of Modern Manufacturing: Materials, Processes, and Systems. John Wiley & Sons, 2016 2. Kalpakjian, S., & Schmid, S. R., Manufacturing Engineering and Technology. Pearson, 2013. 3. Degarmo, E. P., Black, J. T., & Kohser, R. A., Materials and Processes in Manufacturing. John Wiley & Sons, 2017. 4. Davies, A. C., The Science and Practice of Welding: Volume 1: Welding Science and Technology. Cambridge University Press, 2012. 5. Chua, C. K., Leong, K. F., & Lim, C. S., Rapid Prototyping: Principles and Applications. World Scientific, 2010.
Online Resources (Web Links)
1. https://www.edx.org/learn/manufacturing/massachusetts-institute-of-technology-fundamentals-of-manufacturing-processes 2. https://archive.nptel.ac.in/courses/112/107/112107145/ 3. https://onlinecourses.nptel.ac.in/noc24_me48/preview

Assessment (Embedded course)
CAT, Activity and Learning Task(s), Mini project, MCQ, End Semester Examination (ESE) Lab Workbook, Experimental Cycle tests, viva-voce

Course Curated by			
Expert from Industry	**Expert from Higher Education Institution**		**Internal Expert**
Mr. M. Thiagarajan, Manager, CAM Programming and Optimization, Eppinger Tooling Asia Private Limited, Coimbatore.	Dr. P. Dhanabal, Assistant Professor (Selection Grade), Department of Mechanical Engineering, PSG College of Technology, Coimbatore – 641 004.		Dr. B. N. Sreeharan, Assistant Professor – III, Department of Mechanical Engineering
Recommended by BoS on	17.08.2024		
Academic Council Approval	27	**Date**	24.08.2024

24INP102	INNOVATION PRACTICUM – 1 (Common to all Departments)	L	T	P	J	C
		0	0	2	0	1
ES		SDG	9, 11, 12			

Pre-requisite courses	-	Data Book / Code book (If any)	-

Course Objectives:

The purpose of taking this course is to:

1	analyse the effectiveness of systems thinking and problem-solving methodologies in applying data-driven insights for innovative solution design.
2	evaluate the impact of transdisciplinary collaboration on creating functional hardware prototypes through fabrication techniques.
3	understand the future trends and implications of technology in developing innovative products.

Course Outcomes:

After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO1	recall the fundamental principles of custom hardware design.	R
CO2	understand the appropriate tools and their applications for solving hardware-related problems.	U
CO3	apply systems engineering concepts to real-world hardware design challenges.	Ap

Course Outcomes	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	Automotive Design and Manufacturing	Automotive Electrical Electronics	Automotive Technology and Management
1	2		1											
2	2				1									
3		2	2	1										

Course Content

Engineering Fundamentals and Innovation Why engineering? The concept of street fight engineering - Real-world design process and problem-solving methodology - Data-driven insights and concept generation - Case studies of successful engineering innovations.	**3 Hours**

Transdisciplinary Systems and Manu'Futuring Transdisciplinary systems to accelerate innovation - Manu'Futuring: Technology in hardware manufacturing and manufacturing of hardware technologies - Future scopes with product case studies.	**6 Hours**
Building Custom Hardware How to build a basic custom hardware - Electronics fundamentals and components - Software for hardware control - Fabrication techniques.	**6 Hours**
System Thinking and Engineering Introduction to system thinking - Real world as a system - Concept of system engineering and its application – iLenSys.	**7 Hours**
Creativity Time and Tech Teardown Creativity exercise: Apply system thinking to a real-world problem - Tech teardown: Analyse a product or system to understand its engineering principles - Presentation: Present your creative project and tech teardown with an engaging title	**8 Hours**

Theory Hours:	Tutorial Hours:	Practical Hours:	Project Hours:	Total Hours:
0	0	30	0	30

Learning Resources
Textbooks:
1. Sanjoy Mahajan - Street Fighting Mathematics 2. Donald Knuth - The Art of Computer Programming 3. Think like a programmer: An introduction to creative problem solving 4. Thinking in Systems: A Primer
References:
1. Learning to code: How to think like a programmer 2. How to find innovative ideas: Ramesh Raskar's note 3. Case study: How Tesla changed the auto industry 4. Ultimate Guide: How to develop a new electronic hardware product
Online Resources (Weblinks)
1. https://www.ifixit.com/Teardown?srsltid=AfmBOorwzDG9RhJoL3L5tlZ_Dr4sVcey-vPC-pkKTj2E0mWJWtFYlikY 2. https://www.symmetryelectronics.com/technology-teardowns/

Assessment (Practical course)
Lab Workbook, Experimental Cycle tests, viva-voce

Course Curated by			
Expert from Industry	**Expert from Higher Education Institutions**		**Internal Expert**
Dr. Mahesh Veezhinathan Director - Innovation Practicum Associate VP - Forge.	-		Dr. Samuel Ratna Kumar P S Assistant Professor – III, Department Mechanical Engineering
Recommended by BoS on	17.08.2024		
Academic Council Approval	No: 27	**Date**	24.08.2024

24HSP111	HOLISTIC WELLNESS-1 (Common to all Department)	L	T	P	J	C
		0	0	2	0	1
HS		SDG	2, 3			

Pre-requisite courses	-	Data Book / Code book (If any)	-

Course Objectives:	
The purpose of taking this course is to:	
1	introduce first-year students to the foundational concepts of holistic wellness, emphasizing the integration of physical, mental, emotional, and Internal well-being.
2	create a balanced lifestyle that promotes overall health and happiness through practical activities.

Course Outcomes		
After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO 1	understand the basic principles of holistic wellness.	U
CO 2	apply strategies for maintaining physical health, including nutrition and exercise	Ap
CO 3	practice mindfulness techniques to enhance mental and emotional well-being.	Ap
CO 4	develop a personal wellness plan incorporating various aspects of holistic health.	C

Course Outcomes	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	Automotive Design and Manufacturing	Automotive Electrical Electronics	Automotive Technology and Management
1						2		1						
2						2								
3						1					3			
4						2					3			

4						2					3			

Course Content

INTRODUCTION TO HOLISTIC WELLNESS: • Overview of holistic wellness: physical, mental, emotional, and internal health. • The importance of balance in overall well-being. • Hands-on activity: Self-assessment of current wellness status.	**4 Hour**

PHYSICAL WELLNESS: • Importance of physical activity and exercise. • Understanding nutrition and its role in health. • Sleep hygiene and its impact on well-being. • Hands-on activity: Designing a personalized fitness and nutrition plan.	**14 Hours**
MENTAL AND EMOTIONAL WELLNESS: • Stress management techniques. • The role of Yoga, mindfulness and meditation in mental health. • Emotional intelligence and its impact on relationships. **Hands-on activity**: • Practicing Yoga, mindfulness and emotional regulation exercises	**6 Hours**
INTERNAL WELLNESS: • Exploring the concept of Internal wellness. • The role of purpose and meaning in life. • Introduction to meditation and reflective practices. • Hands-on activity: Developing a personal reflection, Yoga and meditation routine.	**4 Hours**
INTEGRATING WELLNESS PRACTICES: • Combining physical, mental, emotional, and Internal wellness practices into daily life. • Developing a balanced wellness plan. • Hands-on activity: Creating a comprehensive personal wellness plan.	**2 Hours**

Theory Hours:	0	Tutorial Hours:	0	Practical Hours:	30	Project Hours:	0	Total Hours:	30

Learning Resources
Textbooks:
1. Jayanna, Krishnamurthy., Science & Practice of Integrative Health & Wellbeing Lifestyle., White Falcon Publishing (2020). **2.** Rosenberg, Marshall Bertram., Nonviolent Communication: A Language of Life., Puddle Dancer Press, Encinitas, CA (2015).
References:
1. B.K.S Iyengar., Yoga: The Path to Holistic Health., Dorling Kindersley Limited, City of Publication (2001) 2. Goleman Daniel., Emotional Intelligence., Bloomsbury India, India, (2021). 3. James Allen., As a Man Thinketh., Maple Press, Noida, (2010) 4. Swami Budhanandha., Will power and its development., Advaita Ashrama Mayavati, Pithoragarh, Himalayas from its Publication Department, Calcutta. (2001) 5. Kalderdon Adizes Ichak., What Matters in Life: Lessons I Learned from Opening My Heart ., WS Press, Newtown, PA (2023)
Online Resources (Weblinks)
1. Learning Suryanamskar 2. Yoga for well-being 3. Nutritional Educational contents 4. Introduction to Psychology 5. Guided Meditation 6. Simplified physical exercises instructions 7. Simplified Physical Exercises 8. Life skills and value education 9. James Allen Library

Assessment (Practical course)
Participation, Practical activities and assignments, personal wellness plan and reflection.

Course Curated by		
Expert(s) from Industry	**Expert(s) from Higher Education Institution**	**Internal Expert(s)**
		Dr. Ezhilarasi Principal- KCT
Recommended by BoS on	16.08.2024	

Academic Council Approval	No: 27	**Date**	24.08.2024

24INP101	DESIGN THINKING (Common to all Department)	L	T	P	J	C
		0	0	2	0	1
ES		SDG	9			

Pre-requisite courses	-	Data Book / Code book (If any)	-

Course Objectives:	
The purpose of taking this course is to:	
1	introduces first-year engineering students to Design Thinking, focusing on practical, user-centered problem-solving techniques
2	empathize with users, generate ideas, and create models to test and refine their solutions
3	understand iteration, empathy, and critical reflection to cultivate a creative mindset

Course Outcomes		
After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO 1	apply problem-solving techniques and the Design Thinking process to engineering problems using simple models	Ap
CO 2	understand user needs through various empathy techniques and develop/refine models iteratively based on user insights.	U
CO 3	reflect critically on their learning journeys and the emotional demands of problem-solving. Collaborate effectively in teams to develop innovative solutions	Ap

Course Outcomes	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	Automotive Design and Manufacturing	Automotive Electrical Electronics	Automotive Technology and Management
1	1		2			2		2			1			
2	1							2			1			
3	1		2			2		1			1			

Course Content	
Introduction to Problem Solving and Ground Rules Introduction to problem-solving strategies without mentioning Design Thinking-Emphasize problem-solving attitudes, mindsets, and behaviours necessary for iterative problem solving (e.g., openness to failure, patience, empathy)-Set ground rules for the course, including incentives for creative risk-taking and penalties for non-participation or lack of reflection-Overview of the Design Thinking process and its importance.	**6 Hours**
Empathy and Problem Definition Techniques for understanding user needs, including observation, interviews, **surveys** and **focus groups-**Importance of secondary research as a complement for the above-mentioned methods-Introduction to empathy cycles: involve students in two empathy cycles before and after problem definition-Finetuning problem definition based on user insights.	**6 Hours**
Ideation and Concept Modelling Brainstorming ideas and selecting feasible solution-Creating concept modelling to visualize ideas-Include an empathy cycle after students propose solutions, allowing them to revisit and reshape their solutions based on further insights from users.	**6 Hours**
Prototyping and Testing with Models Building basic prototypes using simple materials (e.g., cardboard, clay)- Introduction to different prototyping methods (e.g., **low-fidelity** vs **high-fidelity models**) for different contexts: product design, space design, policy, and digital/e-commerce solutions-Conduct an empathy cycle after the prototype is developed to gather user feedback and refine the prototype.	**6 Hours**
Iteration and Final Modelling Project Students refine their prototypes based on feedback from the empathy cycle-Finalize prototypes for presentation based on consistent feedback loops.	**6 Hours**
Presentation, Reflection, and Learning Summaries Students present their final projects and reflect on their learning journeys, including how their understanding of problem-solving and empathy evolved during the course-**Learning Summary Activity:** Each student presents their individual journey and learning outcomes from the empathy cycles and iterations-Peer review and group discussions.	**6 Hours**

Theory Hours:	**0**	**Tutorial Hours:**	**0**	**Practical Hours:**	**30**	**Project Hours:**	**0**	**Total Hours:**	**30**

Learning Resources

Textbooks:

1. Handbook of Design Thinking, Christian Muller – Roterberg, Kindly Direct Publishing
2. The Art of Innovation, Tom Kalley
3. E Balaguruswamy (2022), Developing Thinking Skills (The way to Success), Khanna Book Publishing Company

Online Resources (Weblinks)
1. Survey and focus group design guides 2. Guidance on Designing, Administering and Analyzing Focus Groups and Interviews 3. Empathy mapping tools 4. How to Make a Concept Model 5. Brainstorming Techniques: 15 Creative Activities 6. 10 Brainstorming Techniques for Developing New Ideas 7. Brainstorming templates 8. 5 Common Low-Fidelity Prototypes and Their Best Practices 9. UX Prototypes: Low Fidelity vs. High Fidelity 10. Low-fidelity vs. High-fidelity Design Prototypes (and when to use which) Case study 1: Iterative Design and Prototype Testing of the NN/g Homepage Case study 2: Using iterative design to optimise the user flow of a product 11. Reflective practice toolkit

Assessment
Formative: Assignments, Mini project

Course Curated by			
Expert(s) from Industry	**Expert(s) from Higher Education Institutions**	**Internal Expert(s)**	
		Dr. Padhmanand Sudhagar R Department of Bio-Tech Dr. Arul H, Department of Physics	
Recommended by BoS on	16.08.2024		
Academic Council Approval	No: 27	**Date**	24.08.2024

Semester-II

24HST102	தமிழரும் தொழில்நுட்பமும்/ TAMILS AND TECHNOLOGY	L	T	P	J	C
		1	0	0	0	1
HS		SDG	4, 8			

Pre-requisite courses	-	Data Book / Code book (If any)	-

Course Objectives:

The purpose of taking this course is to:

1	தமிழர்களின் நெசவு மற்றும் பானைத் தொழில்நுட்பத்தை அறிமுகப்படுத்துதல், சங்க கால கட்டிட தொழில்நுட்பத்தை விளக்குதல், கோயில்கள் மற்றும் சிற்பக்கலைகளை ஆராய்தல். introducing weaving and pottery technology of Tamils -Explaining the building technology of the Sangam Period-Explore temples and sculptures.
2	கப்பல், இரும்பு, நாணயங்கள், மணி உருவாக்கும் தொழிற்சாலைகள், ஆகியவற்றை விளக்கம் செய்தல், தமிழகத்தின் தொல்லியல் சான்றுகளின் பழமையை உணர்த்துதல். explain Ship, Iron, Coins, Beads Making Factories. Realizing the Antiquity of Archaeological Evidence of Tamil Nadu
3	வேளாண்மை மற்றும் அறிவியல் தமிழைப் பற்றி அறிதல், இணையத்தில் தமிழின் தேவையை உணர்த்துதல்,தமிழ் மென்பொருள்களை அறிமுகம் செய்தல். knowledge of Agricultural and Scientific Tamil, Realizing the need for Tamil on the Internet, Introducing Tamil software.

Course Outcomes:

After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO 1	தமிழர்களின் நெசவு மற்றும் பானைத் தொழில்நுட்பத்தின் முக்கியத்துவத்தினை அறிந்து கொள்ளுதல். சங்ககால தமிழர் வளர்த்த அழகுக் கலைகளைத் தெரிந்து கொள்ளுதல். know the importance of weaving and pottery technology of Tamils-To know the Aesthetics arts developed by Sangam Tamils	U
CO 2	கப்பல் கட்டும் கலை, இரும்புத் தொழிற்சாலை, நாணயங்கள் அச்சடித்தல்,மணி உருவாக்கும் தொழிற்சாலைகள், சிலப்பதிகாரத்தில் உள்ள மணிகளின் வகையை அறிதல். knowledge of ship building, ironworks, coinage, minting, and beads making factories,Knowing the types of beads in Silapathikaram.	U
CO 3	வேளாண்மை மற்றும் நீர்ப்பாசன தொழில்நுட்பத்தை அறிந்து கொள்ளல். அறிவியல் தமிழ் மற்றும் கணினித் தமிழைப் புரிந்து கொள்ளுதல். know agriculture and irrigation technology. Understanding Scientific Tamil and Computer Tamil.	Ap

Course Outcomes	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	Automotive Design and Manufacturing	Automotive Electrical Electronics	Automotive Technology and Management
1	2		2				3	2	2		2			
2	2		2				3	2	2		2			
3	2		2				3	2	2		2			

Course Content	
நெசவு மற்றும் பானைத் தொழில்நுட்பம்: சங்க காலத்தில் நெசவுத் தொழில் - பானைத் தொழில்நுட்பம் - கருப்பு சிவப்பு பாண்டங்கள் - பாண்டங்களில் கீறல் குறியீடுகள். Weaving Industry during Sangam Age - Ceramic technology - Black and Red Ware Potteries (BRW)-Graffiti on Potteries.	**3 Hours**
வடிவமைப்பு மற்றும் கட்டிடத் தொழில்நுட்பம்: சங்க காலத்தில் வடிவமைப்பு மற்றும் கட்டுமானங்கள் ரூ சங்க காலத்தில் வீட்டுப் பொருட்களில் வடிவமைப்பு - சங்க காலத்தில் கட்டுமான பொருட்களும் நடுகல்லும் -சிலப்பதிகாரத்தில் மேடை அமைப்பு பற்றிய விவரங்கள் - மாமல்லபுரச் சிற்பங்களும், கோவில்களும் - சோழர் காலத்துப் பெருங்கோயில்கள் மற்றும் பிற வழிபாட்டுத் தலங்கள் - நாயக்கர் காலக் கோயில்கள் - மாதிரி கட்டமைப்புகள் பற்றி அறிதல், மதுரை மீனாட்சி அம்மன் ஆலயம் மற்றும் திருமலை நாயக்கர் மஹால் - செட்டிநாட்டு வீடுகள் - பிரிட்டிஷ் காலத்தில் சென்னையில் இந்தோ-சாரோசெனிக் கட்டிடக் கலை. Designing and Structural construction House & Designs in household materials during Sangam Age - Building materials and Hero stones of Sangam age Details of Stage Constructions in Silappathikaram - Sculptures and Temples of Mamallapuram - Great Temples of Cholas and other worship places - Temples of Nayaka Period - Type study (Madurai Meenakshi Temple)- Thirumalai Nayakar Mahal - Chetti Nadu Houses, Indo - Saracenic architecture at Madras during British Period.	**3 Hours**
உற்பத்தித் தொழில் நுட்பம்: கப்பல் கட்டும் கலை - உலோகவியல் - இரும்புத் தொழிற்சாலை - இரும்பை உருக்குதல், எஃகு - வரலாற்றுச் சான்றுகளாக செம்பு மற்றும் தங்க நாணயங்கள்- நாணயங்கள் அச்சடித்தல் - மணி உருவாக்கும் தொழிற்சாலைகள் - கல்மணிகள், கண்ணாடி மணிகள் - சுடுமண் மணிகள் - சங்கு மணிகள் - எலும்புத்துண்டுகள் - தொல்லியல் சான்றுகள் - சிலப்பதிகாரத்தில் மணிகளின் வகைகள்.	

Art of Ship Building - Metallurgical studies - Iron industry - Iron smelting, steel-Copper and gold- Coins as source of history - Minting of Coins - Beads making-industries Stone beads -Glass beads - Terracotta beads -Shell beads/ bone beats - Archeological evidence - Gem stone types described in Silappathikaram.	**3 Hours**
வேளாண்மை மற்றும் நீர்ப்பாசனத் தொழில் நுட்பம்: அணை, ஏரி, குளங்கள், மதகு - சோழர்காலக் குமுழித் தூம்பின் முக்கியத்துவம்- கால்நடை பராமரிப்பு - கால்நடைகளுக்காக வடிவமைக்கப்பட்ட கிணறுகள்- வேளாண்மை மற்றும் வேளாண்மைச் சார்ந்த செயல்பாடுகள் - கடல்சார் அறிவு - மீன்வளம் - முத்து மற்றும் முத்துக்குளித்தல் - பெருங்கடல் குறித்த பண்டைய அறிவு - அறிவுசார் சமூகம். Dam, Tank, ponds, Sluice, Significance of Kumizhi Thoompu of Chola Period, Animal Husbandry - Wells designed for cattle use - Agriculture and Agro Processing - Knowledge of Sea - Fisheries - Pearl - Conche diving - Ancient Knowledge of Ocean - Knowledge Specific Society.	**3 Hours**
அறிவியல் தமிழ் மற்றும் கணித்தமிழ்: அறிவியல் தமிழின் வளர்ச்சி - கணித்தமிழ் வளர்ச்சி - தமிழ் நூல்களை மின்பதிப்பு செய்தல் - தமிழ் மென்பொருட்கள் உருவாக்கம் - தமிழ் இணையக் கல்விக்கழகம் - தமிழ் மின் நூலகம் - இணையத்தில் தமிழ் அகராதிகள்- சொற்குவைத் திட்டம். Development of Scientific Tamil - Tamil computing- Digitalization of Tamil Books-Development of Tamil Software - Tamil Virtual Academy - Tamil Digital Library - Online Tamil Dictionaries - Sorkuvai Project.	**3 Hours**

Theory Hours: 15	Tutorial Hours: 0	Practical Hours: 0	Project Hours: 0	Total Hours: 15

Reference books

1. தமிழக வரலாறு மக்களும் பண்பாடும் கே.கே. பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
2. கணினித் தமிழ் - முனைவர் இல. சுந்தரம். (விகடன் பிரசுரம்).
3. கீழடி - வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு).
4. பொருநை - ஆற்றங்கரை நாகரிகம். (தொல்லியல் துறை வெளியீடு).
5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL-(in print)
6. Social Life of the Tamils the Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies.
7. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
8. The Contributions of the Tarnils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
9. Keeladi 'Sangam City Civilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & Tamil Nadu Textbook and Educational Services Corporation> Tamil Nadu)
10. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Published by: The Author)

11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Bookand Educational Services Corporation> Tamil Nadu) 12. Journey of Civilization Indus to Vaigai (R. Balakrishnan) (Published by: RMRL) - Reference Book.
Online Resources
1. https://www.youtube.com/watch?v=Gp1ratX2sOE&list=PLtyn2o7hocf40PtPibRqJTf_dQL3eOtLl 2. https://www.youtube.com/watch?v=jteRvnNiD6w
Assessment (Theory course)
SA 1, SA 2 , Activity and Learning Task(s), MCQ, End Semester Examination (ESE)

Course Curated by			
Expert(s) from Industry	**Expert(s) from Higher Education Institution**		**Internal Expert(s)**
Recommended by BoS on	16.08.2024		
Academic Council Approval	No: 27	**Date**	24.08.2024

24HST103	EFFECTIVE COMMUNICATION	L	T	P	J	C
		2	0	0	0	2
HS		SDG	4, 8			

Pre-requisite courses	-	Data Book / Code book (If any)	-

Course Objectives:

The purpose of taking this course is to

1	enhance students' abilities to communicate ideas effectively, both orally and in writing, by developing skills in organizing thoughts clearly and logically and expressing them through well-structured paragraphs and concise summaries.
2	enable students to critically evaluate and synthesize information from multiple sources and utilize suitable writing techniques and formats to produce professional-quality content tailored to various contexts.
3	foster active listening, critical reading, and reflective thinking, empowering students to create engaging, relevant, and informative content by applying effective communication strategies across diverse platforms.

Course Outcomes

After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO1	demonstrate proficiency in delivering ideas effectively, both in speaking and writing, with a deeper understanding of the content and the ability to convey complex ideas through well-structured paragraphs and summaries.	Ap
CO2	create and present original content by evaluating information from multiple sources and employing appropriate formats and writing strategies across various professional contexts.	C
CO3	produce engaging and informative content through active listening, reading, reflection, and effective communication skills.	E

Course Outcomes	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	Automotive Design and Manufacturing	Automotive Electrical Electronics	Automotive Technology and Management
1							2	2	3		3			
2							2	2	3		3			
3							2	2	3		3			

Course Content	
Text Analysis Composition of Coherent Paragraphs (Expository, Descriptive, Narrative, Evaluative) - Loud Reading (Reading Extracts will be given were students identify the main idea of paragraphs or sections and debrief)	**6 Hours**
Visual & Written Analysis Process writing (Drafting effective introduction, process and conclusion using appropriate transition words and phrases) - Describing Visuals (Line graph, Bar Chart, Flow Chart, Pie Chart, Table, Tree diagram) - Note Making & Summarizing	**6 Hours**
Professional Correspondence Crafting Professional Emails - Writing Instruction for Manuals – Reading technical documents (Reading extracts will be given to construct sentences from the new words found in the document)	**6 Hours**
Research and Documentation Library Reading (Identify at least three sources and extract information, Summarize the main ideas and key findings from each source, compile them findings into a brief report that includes the main points, sources, and relevance to the topic)- Report Writing (Title Page, Abstract, Introduction, Methodology, Results, Discussion, Conclusion and recommendation)	**6 Hours**
Talk Analysis and Podcast Skills Listening to and analyzing TED talks – Preparing Podcast-PRISM (Professional Rhetoric Improvement and Speech Mastery) to share facts, opinions and experiences - Writing Reviews on products.	**6 Hours**

Theory Hours: 30	Tutorial Hours: 0	Practical Hours: 0	Project Hours: 0	Total Hours: 30

Learning Resources
References:
1. Swamy, V. R. Narayana. Strengthen Your Writing. Orient Longman, 2003. 2. Sasikumar, V., and P. V. Dhamija. Spoken English: A Self-Learning Guide to Conversation Practice. Tata McGraw Hill, New Delhi (1993). 3. Maison, Margaret M. Examine Your English. Orient Longman, 1999. 4. Rizwi, Ashraf. Effective Technical Communication. Tata McGraw Hill, 2005. 5. Pickett, Nell Ann, and Ann A. Laster. Technical English: Writing, Reading, and Speaking. **6.** Harpercollins College Div, 1993.
Online Resources (Weblinks)
1. https://owl.purdue.edu/owl/general_writing/academic_writing/paragraphs_and_paragraphing/index.html 2. https://learnenglish.britishcouncil.org/skills/writing/upper-intermediate b2/describing-trends 3. https://hbr.org/2016/07/how-to-write-email-with-military-precision 4. https://owl.purdue.edu/owl/subject_specific_writing/professional_technical_writing/reports and_memos/index.html

Assessment (Theory course)
CAT, Activity and Learning Task(s), Mini project, MCQ, End Semester Examination (ESE)

Course Curated by			
Expert from Industry	**Expert(s) from Higher Education Institution**		**Internal Expert(s)**
Mr.Vijayan Ramanathan , Project manager, Toppan Merrill. Technologies, Coimbatore	Dr. Aninditha Sahoo, IIT, Madras Dr.P.R.Sujatha Priyadharshini, Anna University, Chennai Dr. E. Justin Ruben, CIT, Coimbatore		Dr. Arokia Lawrence Vijay Dr. Sreejana Dr. Tissaa Department of English
Recommended by BoS on	16.08.2024		
Academic Council Approval	No:27	**Date**	24.08.2024

24HST104	PROFESSIONAL COMMUNICATION (Common to all Departments)	L	T	P	J	C
		2	0	0	0	2
HS		SDG	4, 8			

Pre-requisite courses	-	Data Book / Code book (If any)	-

Course Objectives:

The purpose of taking this course is to

1	develop students' abilities to craft clear, concise, and well-structured technical content and professional communications
2	enhance students' communication skills in team settings
3	equip students with cross-cultural communication skills and effective listening techniques

Course Outcomes

After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO1	demonstrate proficiency in crafting clear, concise, and well-structured technical content and professional communications, including emails that meet industry standards.	Ap
CO2	communicate effectively in team settings, showcasing collaboration, conflict resolution, and leadership skills, while employing creative writing techniques to convey complex ideas.	An
CO3	apply principles of cross-cultural communication and effective listening techniques to engage successfully in diverse, globalized professional environments.	Ap

Course Outcomes	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	Automotive Design and Manufacturing	Automotive Electrical Electronics	Automotive Technology and Management
1						2	1	3	1		3			
2						2	3	3	2		3			
3						1	1	3	1		3			

Course Content

Mastering Professional Communication Industry-specific terminology (Business / Technical Register) - Crafting professional emails - Essential elements of an effective email (subject line, salutation, body, closing) - reading and responding to email communication – Networking Emails - Analyzing and interpreting technical texts (Loud Reading).	**6 Hours**

Navigating Digital Media Introduction to Digital media and online communication tools (instant messaging, video conferencing, social media, blogs, forums) - Listening and analyzing advanced audio materials - Creative & Blog Writing (General & Technical).	**6 Hours**
Technical Writing Techniques Writing Reflective Essays / Experience Sharing, Process writing, Transcoding graphics (interpreting technical texts), Writing Reviews (Research Articles & Books).	**6 Hours**
Building a Professional Digital Presence Creating Digital Profile - Overview of different digital platforms (LinkedIn, GitHub, personal websites) - Setting Up a LinkedIn Profile – Crafting a Video Resume – Digital Etiquette and Professionalism - Cross-cultural communication and diversity awareness.	**6 Hours**
Social Responsibility in Practice Environmental and social responsibilities - Case studies and real-world applications - Project Work - Writing Project reports.	**6 Hours**

Theory	Tutorial	Practical	Project	Total
Hours: 30	**Hours: 0**	**Hours: 0**	**Hours: 0**	**Hours: 30**

Learning Resources

Reference books

1. Baker, W., & Ishikawa, T. Transcultural Communication Through Global Englishes: An Advanced Textbook for Students. Routledge, 2021.
2. Bodnar, O., Fedak, S., Hinsirovska, I., Denysiuk, N., Perenchuk, O., Plavutska, I., ... & Shchur, N. English for Study and Work: A Coursebook In-class Activities. 2017.
3. Doff, A., Thaine, C., Puchta, H., Stranks, J., & Lewis-Jones, P. Cambridge English Empower Advanced Student's Book. Cambridge University Press, 2016.
4. Hewings, M., Thaine, C., & McCarthy, M. Cambridge Academic English C1 Advanced Student's Book: An Integrated Skills Course for EAP. Cambridge University Press, 2012.
5. Beer, D. F., & McMurrey, D. A. A Guide to Writing as an Engineer. John Wiley & Sons, 2019.

Online Resources (Web Links)

1. https://hbr.org/2016/07/how-to-write-email-with-military-precision
2. https://ocw.mit.edu/courses/comparative-media-studies-writing/21w-732-scientific-and-technical-communication-spring-2015/
3. https://www.coursera.org/learn/digital-media
4. https://owl.purdue.edu/owl/subject_specific_writing/professional_technical_writing/reports_and_memos/index.html

Assessment (Theory course)
CAT, Activity and Learning Task(s), Mini project, MCQ, End Semester Examination (ESE)

Course Curated by			
Expert from Industry	**Expert(s) from Higher Education Institution**		**Internal Expert(s)**
Mr.Vijayan Ramanathan , Project manager, Toppan Merrill. Technologies, Coimbatore	Dr. Aninditha Sahoo, IIT, Madras Dr.P.R.Sujatha Priyadharshini, Anna University, Chennai Dr. E. Justin Ruben, CIT, Coimbatore		Dr. Arokia Lawrence Vijay Dr. Hema Department of English
Recommended by BoS on	16.08.2024		
Academic Council Approval	No: 27	**Date**	24.08.2024

24MAI121	ADVANCED CALCULUS AND LAPLACE TRANSFORMS (Common to AE, AU, ME, MR)	L	T	P	J	C
		3	0	2	0	4
BS		SDG	7, 9			

Pre-requisite courses	24MAI111/ Linear Algebra and Calculus	Data Book / Codes books (If any)	-

Course Objectives:

The purpose of taking this course is to:

1	utilize gradient, divergence, and curl, along with Green's, Stokes', and Gauss' theorems to solve complex vector calculus problems.
2	focus on first order and higher-order linear ordinary differential equations, including Bernoulli's and Leibniz's equations, relevant to engineering contexts.
3	use Laplace transforms to solve linear ordinary differential equations of second order and understand the behavior of simple and periodic functions.
4	explore Cauchy-Riemann equations for analytic functions and construct these functions using the Milne-Thomson method
5	employ the residue theorem to determine complex integrals and resolve real definite integrals effectively.

Course Outcomes

After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO 1	apply gradient, divergence, and curl to solve vector calculus problems using Green's, Stokes', and Gauss' theorems.	Ap
CO 2	analyse first-order linear ordinary differential equations like Leibnitz's and Bernoulli's equations and higher-order linear homogeneous ordinary differential equations in engineering applications.	An
CO 3	apply the properties of Laplace transforms to solve simple and periodic functions	Ap
CO 4	apply Laplace transforms to solve linear ordinary differential equations of second order.	Ap
CO 5	analyse analytic functions using Cauchy-Riemann equations and construct analytic functions using Milne-Thomson method.	An
CO 6	determine complex integrals and apply the residue theorem to solve real definite integrals.	Ap

Course Outcomes	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	Automotive Design and Manufacturing	Automotive Electrical Electronics	Automotive Technology and Management
1	3	2			2									
2	2	3	1		1									
3	2	2			2									

4	2	2		1	2									
5	3	2		2	2									
6	3	2			2									

Course Content	
VECTOR CALCULUS Gradient, divergence, and curl, Line integrals, Green's theorem –Stoke's theorem – Gauss divergence theorem (without proofs) **Practical Component** • Evaluating gradient, divergence and curl. • Evaluating line integrals and work done. • Verifying Green's theorem in the plane.	**9 Hours** **9 Hours**
ORDINARY DIFFERENTIAL EQUATIONS Leibnitz's equation – Bernoulli's equation – Linear equations of higher order with constant coefficients – Euler's and Legendre's linear equations – Method of variation of parameters. **Practical Component** • Solving of second and higher order ordinary differential equations.	**9 Hours** **3 Hours**
LAPLACE TRANSFORMS Definition - Properties: Superposition, Shift in t or Time Delay, Shift in s, Time Derivatives, Time Integral – Initial Value Theorem – Final Value Theorem - Transform of periodic functions - Inverse transforms – Convolution theorem – Solution of linear ordinary differential equations of second order with constant coefficients. **Practical Component** • Evaluating Laplace transforms and inverse Laplace transforms of functions. • Applying the technique of Laplace transform to solve differential equations.	**9 Hours** **6 Hours**
ANALYTIC FUNCTIONS Functions of a complex variable – Analytic functions – Necessary and sufficient conditions in Cartesian coordinates, Cauchy – Riemann equations (excluding proofs) – Properties of analytic function – Construction of analytic function by Milne Thomson method **Practical Component** • Verifying the analyticity of a function. • Construction of analytic functions by Milne Thomson method.	**9 Hours** **6 Hours**
COMPLEX INTEGRATION Cauchy's integral theorem – Cauchy's integral formula –Taylor's and Laurent's series – Singularities and zeros –Residues –Residue theorem –Application of residue theorem for evaluation of real definite integrals. **Practical Component** • Verification of Cauchy's integral formula and integral theorem. • Evaluation of real definite integrals using Complex integration.	**9 Hours** **6 Hours**

Theory	**Tutorial**	**Practical**	**Project**	**Total**
Hours: 45	**Hours: 0**	**Hours: 30**	**Hours: 0**	**Hours: 75**

Learning Resources

Textbooks

1. Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 45thEdition, 2020.
2. Ramana B.V., "Higher Engineering Mathematics", Tata McGraw Hill Co. Ltd., New Delhi, 11th Reprint, 2018.
3. Kreyzig E., "Advanced Engineering Mathematics" International students' version, 10th Edition, John Wiley and sons, 2023.

Reference books

1. Veerarajan T., "Engineering Mathematics (for First Year)", Tata McGraw Hill Pub. Co. Ltd., New Delhi, Revised Edition, 2008.
2. Weir, MD, Hass J, Giordano FR, "Thomas' Calculus", Pearson education 15th Edition, 2022.
3. G.B. Thomas and R.L. Finney, "Calculus and Analytical Geometry", 11th Edition, Pearson Education, 2006.
4. James Stewart, "Calculus: Early Transcendentals", Cengage Learning, 9th Edition, New Delhi, 2020.

Online Resources (Weblinks)

1. **Multivariable Calculus by MIT OpenCourseWare (Free)**
   https://ocw.mit.edu/courses/mathematics/18-02sc-multivariable-calculus-fall-2010/
2. **Khan Academy: Multivariable Calculus (Free)**
   https://www.khanacademy.org/math/multivariable-calculus
3. **Coursera: Introduction to MATLAB Programming by Vanderbilt University**
   https://www.coursera.org/learn/matlab

Assessment

CAT, Activity and Learning Task(s), Mini project, MCQ, End Semester Examination (ESE) Lab Workbook, Experimental Cycle tests, viva-voce

Course Curated by

Expert(s) from Industry	Expert(s) from Higher Education Institution	Internal Expert(s)
Mr. Ramesh V.S., STEPS Knowledge Services Private Limited, Coimbatore. Mr. Jayakumar Venkatesan, Valles Marineris International Private Limited- Chennai. Mr. Imran Khan, GE Transportation Company, Bangalore.	Dr. T. Govindan, Government College of Engineering, Srirangam, Trichy. Dr. C. Porkodi, PSG College of Technology, Coimbatore. Dr. P. Paramanathan, Amrita Vishwa Vidyapeetham, Coimbatore.	Dr. S.MeenaPriyadarshini Dr.K.Maheswari Ms. A.Shamugavadivu Department of Mathematics

Recommended by BoS on	16.08.2024		
Academic Council Approval	No: 27	**Date**	24.08.2024

24CYI104	MATERIAL CHEMISTRY (Common to AE, AU, ME)	L	T	P	J	C
		3	0	2	0	4
BS		SDG	7, 9, 12			

Pre-requisite courses	-	Data Book / Code book (If any)	-

Course Objectives:

The purpose of taking this course is to:

1	understand the fundamental principles of nano chemistry and its applications in aerospace and automotive industries, focusing on size-dependent properties of nanomaterials.
2	explore alloys, phase diagrams, and materials processing techniques used in high-performance automotive and aerospace components.
3	analyze electrochemical principles and corrosion mechanisms with an emphasis on prevention strategies for engineering systems.
4	investigate advanced engineering materials such as composites, smart materials, and high-performance lubricants used in various mechanical systems.
5	study sustainable fuels, emission control technologies, and environmental impact assessment for aerospace and automotive applications.

Course Outcomes

After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO 1	apply fundamental nano chemistry concepts to distinguish between nanoparticles, molecules, and bulk materials.	Ap
CO 2	analyze various synthesis methods, such as sol-gel and laser ablation, to identify their applications in nanomaterial production.	An
CO 3	apply the properties of carbon nanotubes and graphene to demonstrate their significance in aerospace and automotive applications.	Ap
CO 4	analyze phase diagrams to interpret key reactions in advanced alloy systems used in engineering.	Ap
CO 5	analyze different corrosion prevention techniques to determine the most effective methods for material protection in aerospace and automotive systems.	An
CO 6	evaluate new material combinations using 3D printing technologies for customized mechanical parts and aerospace components.	E

Course Outcomes	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	Automotive Design and Manufacturing	Automotive Electrical Electronics	Automotive Technology and Management
1	3	2			2		2				2			
2	3	2	2											
3	3			2			2							

4	3		2						2					
5							2			2	2			
6	2			3	1	1	2	2		2	1			

Course Content	
NANO CHEMISTRY Introduction to nano chemistry - Distinction between molecules, nanoparticles, and bulk materials - Size-dependent properties of nanomaterials. Synthesis methods: Sol-gel, solvothermal - chemical vapor deposition - laser ablation. Carbon nanotubes and Graphene: Applications in lightweight aerospace structures - automotive body panels - high-strength mechanical components. Nanowires and Nanocomposites: Applications in sensors for engine diagnostics, reinforced aircraft panels, and wear-resistant automotive coatings. **Practical Component:** • Preparation of Standard solutions. • Synthesis of Nanoparticle using Solvothermal Method. • Determination of conductance of nano coated objects	**9 Hours** **6 Hours**
ALLOYS, PHASE RULE AND MATERIALS PROCESSING **Alloys:** Introduction - Solid solutions, Substitutional and Interstitial alloys - Advanced alloys: Lightweight automotive frames (Advanced high-strength steels (AHSS)), and high-temperature engine components (Titanium Aluminides (TiAl)). **Phase diagrams:** Identification and Interpretation of Eutectic, Peritectic, Eutectoid, Peritectoid reactions in alloy systems for engineering applications **Powder Metallurgy:** Preparation and Applications in gears for automotive transmissions, aircraft brake components, and custom-shaped mechanical parts. **Additive manufacturing:** 3D printing of complex aerospace components, customized automotive parts, and rapid prototyping for mechanical systems - Process parameters and material properties. **Practical Component:** • Estimation of metal ion solution by Spectrophotometry • Estimation of copper content in brass by Complexometric method • Investigation of Phase Transitions in Ethylene Glycol ($C_2H_6O_2$) to understand its role as an Antifreeze and Coolant in Automotive Applications Through Phase Diagram Analysis	**9 Hours** **6 Hours**

ELECTRO CHEMISTRY AND CORROSION Electrochemical principles: Electrode potential and electrochemical series - Concentration cells and their applications in fuel cell sensors for vehicles. Corrosion: Chemical corrosion - Electrochemical corrosion - Forms of corrosion: Galvanic corrosion in multi-material aircraft structures - pitting corrosion in automotive exhaust systems - intergranular corrosion in heat-affected zones of welded mechanical components - stress corrosion cracking in aerospace fasteners – Factors Influencing Corrosion Corrosion prevention strategies: Cathodic protection for underground fuel tanks - Anodic protection for chemical storage vessels – Anodising - Protective coatings for aircraft exteriors and mechanical systems - Failure analysis and prevention **Practical Component:** • Determination of electrode potentials of the cell and construct feasible cell. • Measurement of rate of corrosion on zinc/mild steel by weight loss method • Estimation of metal ion solution using potentiometric titration	**9 Hours** **6 Hours**
ADVANCED ENGINEERING MATERIALS High-performance lubricants: Properties and Applications in high-temperature aircraft engines, long-life automotive transmissions, and precision mechanical bearings - Synthetic lubricants - Nano lubricants. Composite materials: Polymer matrix composites in aircraft fuselages - metal matrix composites in automotive brake rotors - ceramic matrix composites in gas turbine components - Fabrication techniques and mechanical properties. Smart materials: Shape memory alloys in aircraft actuators - piezoelectric materials in fuel injectors, - magnetorheological fluids in adaptive automotive suspensions. **Practical Component:** • Determination of Viscosity of Lubricants • Determination of cloud and pour point of Lubricants • Determination of Flash and Fire point of Lubricants	**9 Hours** **6 Hours**
SUSTAINABLE FUELS AND COMBUSTION TECHNOLOGY Introduction to alternative fuels: Biofuels for aviation - hydrogen fuel cells in automotive applications - natural gas for long-haul transportation - Advantages and challenges. Advanced biofuels: Cellulosic ethanol for automotive use - algal biofuels for aviation - synthetic biofuels for rocket propulsion - Hydrogen production, storage, and utilization in fuel cell vehicles Emission characteristics and control technologies (catalytic converters and particulate filters) - Environmental impact assessment of fuels in commercial aviation and automotive fleets - Regulations and standards for emissions control - Future trends. **Practical Component**: • Extraction of Biofuel from vegetable oil by saponification method. • Determination of Calorific Value of Biofuels. • Determination of Viscosity of Biofuel	**9 Hours** **6 Hours**

Theory Hours:	**45**	**Tutorial Hours:**	**0**	**Practical Hours:**	**30**	**Project Hours:**	**0**	**Total Hours:**	**75**

Learning Resources

References:

12. Sarkar, S. (2009). Fuels and combustion (3rd ed.). Orient Longman.
13. Dara, S. S., & Umare, S. S. (2014). A textbook of engineering chemistry. S. Chand and Company Limited.
14. Rao, S. S. (2010). Engineering materials: Properties and applications of metals and alloys. Narosa Publishing House.
15. Mukhopadhyay, A. K., & Pandey, K. N. (2010). Composite materials: Science and engineering. Narosa Publishing House.
16. Davies, G. J. (2012). Materials for automobile bodies (2nd ed.). Butterworth-Heinemann.
17. Demirbas, A. (2008). Biofuels: Securing the planet's future energy needs. Springer.
1. Roco, M. C., & Bainbridge, W. S. (2018). Nanotechnology research directions for societal needs in 2020: Retrospective and outlook. Springer.

Online Resources (Weblinks)

- https://www.youtube.com/watch?v=qDnzI05vvSc&list=PLMlC7Vx5awsenMs5y02xcW6i5NmdEIRGx
- https://www.youtube.com/watch?v=2rxbxNem1iI&list=PLyqSpQzTE6M_ON8uXt-PP8uX6hMWJeYSJ
- https://www.youtube.com/watch?v=mYGfyO3sPxk&list=PLyqSpQzTE6M9PegzhuWS5Vt4dffN_Rgy8&index=2
- https://www.youtube.com/watch?v=RYdbG4K6DwQ
- https://www.youtube.com/watch?v=Fyq4Q5yWDDU&list=PLyqSpQzTE6M927gXIZdVbbsyj9cmxam-b

Assessment (Embedded course)
CAT, Activity and Learning Task(s), MCQ, End Semester Examination (ESE) Lab Workbook, Experimental Cycle tests

Course Curated by

Expert(s) from Industry	Expert(s) from Higher Education Institution	Internal Expert(s)
Dr. Muthuraja Perumal General Manager - Research & Development Rohith Industries, APIIC Industrial Park, Andhra Pradesh	Dr. Venkatakrishnan Professor, School of Chemical Sciences Indian Institute of Technology (Mandi) Himachal Pradesh India	Dr. R. Mayildurai, Department of Chemistry

Recommended by BoS on	16.08.2024		
Academic Council Approval	No.27	**Date**	24.08.2024

24MET104	ENGINEERING MECHANICS (Common to AE, AU, CE, ME, MR)	L	T	P	J	C
		3	0	0	0	3
ES		SDG	9			

Pre-requisite courses	-	Data Book / Code book (If any)	-

Course Objectives:

The purpose of taking this course is to:

1	apply principles of equilibrium to analyse rigid body systems in 2D space
2	calculate geometry-dependent properties such as centroid and moments of inertia
3	analyse the effects of friction in mechanical systems
4	understand the kinematics and kinetics of rigid bodies in plane motion

Course Outcomes

After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO 1	analyze the principles of transmissibility and moments to determine equilibrium conditions in rigid bodies.	Ap
CO 2	evaluate the geometry-dependent properties like center of gravity and moment of inertia to assess their impact on mechanical systems	Ap
CO 3	examine the laws of friction to distinguish between different types of friction in practical scenarios.	An
CO 4	analyze and solve problems related to the kinematics of rigid bodies in plane motion	An
CO 5	apply Newton's laws and principles of kinetics to solve problems involving the motion of rigid bodies.	Ap

Course Outcomes	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	Automotive Design and Manufacturing	Automotive Electrical Electronics	Automotive Technology and Management
1	3					2								
2	3					2								
3	3					2								
4	3					2								
5	3					2								

Course Content	
STATICS OF RIGID BODIES Resolution of a Force into Components, Free body diagram. Equivalent systems of forces acting on a rigid body in 2D space: Principle of transmissibility – Moment of force about a point – Varignon's theorem – Moment of a couple – Equivalent couple – Moment of force about an axis – Coplanar non-concurrent forces acting on rigid bodies – Resultant and equilibrium – Resolution of a given force into force couple system – Equilibrium of a rigid bodies 2D space – Reactions and supports. Analysis of structures.	**9 Hours**
GEOMETRY DEPENDENT PROPERTIES Centre of gravity, Centre of mass and Centroid – Moment of Inertia of simple and complex areas – Transfer formula – Radius of gyration – Polar moment of inertia – Product of inertia - Mass moment of Inertia of simple solids, thin plates, composite bodies.	**9 Hours**
FRICTION Laws of friction – coefficient of friction – Dry friction – wedge friction – ladder friction – rolling resistance. Applications of friction by analytical approach in belt drives (open belt drive), clutches (plate and cone clutches), brakes (single shoe brake)	**9 Hours**
KINEMATICS OF RIGID BODIES - PLANE MOTION Kinematics of rigid bodies: Plane motion, translation and rotation General plane motion: Absolute velocity, relative velocity, instantaneous centre of rotation, absolute acceleration, relative acceleration.	**9 Hours**
KINETICS OF RIGID BODIES - PLANE MOTION Equations of motion of a rigid body - angular momentum, D'Alembert's principle; Principle of work and energy for a rigid body, work of forces acting on a rigid body, kinetic energy of a rigid body in plane motion, conservation of energy; Impulse-momentum principle for the plane motion of a rigid body; Overview of Lagrange's equations of motion.	**9 Hours**

Theory Hours: 45	Tutorial Hours: 0	Practical Hours: 0	Project Hours: 0	Total Hours: 45

Learning Resources

Textbooks

1. Ferdinand P. Beer, Jr. Johnston, E. Russell, Mechanics for Engineers: Statics and Dynamics, McGraw-Hill Inc.,US (1987).
2. Hibbeller, R.C., Engineering Mechanics: Statics, and Engineering Mechanics: Dynamics, 15th edition, Prentice Hall, 2022

Reference books

1. Beer, Ferdinand P., E. Russell Johnston, David Mazurek, Phillip Cornwell, and Brian Self. *Vector Mechanics for Engineers: Statics and Dynamics*. 2024 ed. New Delhi: Tata McGraw-Hill, 2024. ISBN 9781260710892.
2. .James L. Meriam, L. G. Kraige, J. N. Bolton: Engineering Mechanics Statics , 9th edition, Wiley student edition, 2020.
3. James L. Meriam, L. G. Kraige, J. N. Bolton: Engineering Mechanics: Dynamics, 9th edition, Wiley student edition, 2020.
4. P. Boresi & J. Schmidt, Engineering Mechanics: Statics and Dynamics, 1/e, Cengage learning, 2008.
5. Irving H. Shames, G. Krishna Mohana Rao, Engineering Mechanics - Statics and Dynamics, Fourth Edition – PHI / Pearson Education Asia Pvt. Ltd., 2006.
6. Rajasekaran S and Sankarasubramanian G, "Engineering Mechanics-Statics and Dynamics", Vikas Publishing House Pvt. Ltd., New Delhi, 2006

Assessment (Theory course)
CAT, Activity and Learning Task(s), Mini project, MCQ, End Semester Examination (ESE)

Course Curated by			
Expert from Industry	**Expert from Higher Education Institution**		**Internal Expert**
Mr. Babin. T, Design Engineer Lead |Mechanical Product Design Engineer-III at SLB, Singapore	Dr S Parimala Murugaveni Associate Professor, Department of Mechanical Engineering, Government College of Technology, Coimbatore.		Dr. N. Sangeetha, Associate Professor, Department of Mechanical Engineering
Recommended by BoS on	17.08.2024		
Academic Council Approval	No: 27	**Date**	24.08.2024

24CSI101	LOGICAL THINKING AND PROBLEM SOLVING (Common to all Programmes)	L	T	P	J	C
		3	0	2	0	4
BS		SDG	8, 9			

Pre-requisite courses	-	Data Book / Code book (If any)	-

Course Objectives:

The purpose of taking this course is to:

1	gain a comprehensive understanding of computing systems, including their classification, processing units, memory structures, storage hierarchies, and the essential functions and types of operating systems
2	develop strong logical and analytical thinking skills, enabling the systematic analysis and solution of computational problems using reasoning techniques, algorithms, and flowcharts.
3	acquire a solid foundation in C programming, mastering the use of data types, operators, control structures, and input/output operations to create efficient and effective programs.
4	apply advanced programming techniques, including the use of arrays, structures, pointers, and functions, to solve complex real-world problems with a focus on modular and efficient coding practices.

Course Outcomes

After successful completion of this course, the students shall be able to		evised Bloom's Taxonomy Levels (RBT)
CO1	understand the basic concepts of hardware, software, Operating systems, and the logic behind the functioning of the Computing systems.	U
CO2	apply logical thinking and reasoning to solve computing problems using tools like algorithms and flowcharts.	Ap
CO3	understand the structured programming paradigms, memory organization and how the language can be used as a tool to solve problems.	U
CO4	develop simple programs using data types, operators, control structures, pointers, and functions as appropriate in real world applications.	Ap

Course Outcomes	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	Automotive Design and Manufacturing	Automotive Electrical Electronics	Automotive Technology and Management
1	2													
2	3	2	1											
3		1												
4	3	2	1											

Course Content	
FUNDAMENTALS OF COMPUTERS AND COMPUTING Generations of computers, and classification of computers (supercomputers, mainframes, minicomputers, microcomputers). Processing Units (CPU, GPU, TPU), memory (RAM, ROM), storage devices and hierarchy, input / output and peripheral devices. System software, application software. Operating Systems - Functions (process management, memory management, file system management, device management, security), types of operating systems (desktop, mobile, networking, distributed, real-time, embedded)	**6 Hours**
Number Systems: Introduction to different number systems (binary, octal, decimal, hexadecimal), conversions between number systems, and binary arithmetic (addition, subtraction, multiplication, division). **Practical Component** Exploring hardware and software components	**4 Hours**
LOGICAL THINKING, REASONING AND TOOLS Problem Analysis – Logical Thinking vs Critical Thinking vs Design Thinking - Inference – Inductive Reasoning – Deductive Reasoning – **Logical Thinking Tools: Algorithms**: Definition and importance, characteristics of algorithms (finite, clear and unambiguous, well-defined inputs and outputs, feasible). Algorithm representation Techniques: Pseudocode, stepwise refinement, and top-down design. **Flowcharts**: Symbols used in flowcharts, creating flowcharts, and examples of flowchart-based problem-solving. **Practical Component** Algorithm writing and Flowcharts,	**8 Hours** **4 Hours**
PROGRAMMING PARADIGMS AND INTRODUCTION TO C PROGRAMMING **Programming Paradigms**: Structured programming - functional programming - object-oriented programming. **Introduction to C Programming**: History of C - features of C - structure of a C program – input / output statements. **Data Types**: Primitive data types (int, char, float, double) - derived data types, typecast. **Operators**: Arithmetic operators - relational operators - logical operators - bitwise operators - assignment operators - operator precedence. **Conditional Statements**: If - if-else - nested if - switch-case. **Looping Statements**: For loop - while loop - do-while loop. Pre-processor Directives and Command line arguments, Storage Classes. **Practical Component** Programs on Operator precedence, Decision Making, Iterations	**11 Hours** **10 Hours**
ARRAYS AND STRUCTURES **Collections**: Arrays – 2D Arrays – String Manipulation. **Structures and Unions**: Definition - declaration - accessing members - differences between structures and unions - applications. **Practical Component** Programs on Arrays, Structures, Union,	**10 Hours** **6 Hours**

POINTERS AND FUNCTIONS **Pointers**: Definition - declaration - pointer arithmetic - pointers and arrays. **Functions**: Definition - declaration - types of functions (user-defined, library functions) - parameter passing (by value, by reference) pointers and functions, recursion. **Practical Component** Pointers and Functions. Additional programs on Files to be discussed.	**10 Hours** **6 Hours**

Theory Hours: 45	Tutorial Hours: 0	Practical Hours: 30	Project Hours: 0	Total Hours: 75

Learning Resources
Textbooks:
1. Kanetkar, Yashavant. Let Us C. BPB Publications, New Delhi (2023). 2. Rajaraman, V. Fundamentals of Computers. PHI Learning, New Delhi (2020). 3. Dromey, R.G. How to Solve it by Computer. Prentice Hall International, New York (2008).
Reference
1. Cormen, Thomas H., Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein. Introduction to Algorithms. MIT Press, Cambridge (2022). 2. Balagurusamy, E. Programming in ANSI C. McGraw Hill Education, New York (2021). 3. Kernighan, Brian W., and Dennis M. Ritchie. The C Programming Language. Prentice Hall, New York (2017). 4. Patterson, David A., and John L. Hennessy. Computer Organization and Design: The Hardware/Software Interface. Morgan Kaufmann, San Francisco (2017).
Online Resources (Weblinks)
1. https://nptel.ac.in/courses/106105214 2. https://www.coursera.org/learn/computer-fundamentals 3. https://www.khanacademy.org/computing/computer-science/algorithms 4. https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-006-introduction-to-algorithms-fall-2011/ 5. https://www.geeksforgeeks.org/c-programming-language/

Assessment (Embedded course)
CAT, Activity and Learning Task(s), Mini project, MCQ, End Semester Examination (ESE) Lab Workbook, Experimental Cycle tests, viva-voce

Course Curated by			
Expert(s) from Industry	**Expert(s) from Higher Education Institution**		**Internal Expert(s)**
-	-		Dr. S. Kavitha, Department of Information Technology
Recommended by BoS on	16.08.2024		
Academic Council Approval	No: 27	**Date**	24.08.2024

24INP103	INNOVATION PRACTICUM – 2 (Common to All branches)	L	T	P	J	C
		0	0	2	0	1
ES		SDG	9, 11, 12			

Pre-requisite courses	-	Data Book / Code book (If any)	-

Course Objectives:

The purpose of taking this course is to:

1	equip students with essential tools and techniques for leveraging open-source technologies to develop proof-of-concepts and prototypes
2	provide hands-on experience and participants will gain a comprehensive understanding of the entire product development process
3	final prototyping, empowering them to transform their ideas into tangible outcomes

Course Outcomes

After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO 1	analyse the effectiveness of various electronic tools and techniques in product development processes	An
CO 2	develop and implement functional software prototypes using open-source tools	Ap
CO 3	design and fabricate 3D models using digital fabrication techniques	Ap

Course Outcomes	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	Automotive Design and Manufacturing	Automotive Electrical Electronics	Automotive Technology and Management
1	3	2	2	2	2									
2	2	2	2		2									
3	2	2	3	2	2									

Course Content	
INTRODUCTION TO OPEN-SOURCE TOOLS AND TECHNIQUES Explore the concept of open-source, its underlying principles and its contrast with proprietary software, Discuss the advantages of using open-source tools, such as lower costs, increased innovation, educational value, and community support, walk through to the commonly used open-source tools for electronics design (KiCad, FreeCAD), software development (Python, Eclipse), and fabrication (Cura, LinuxCNC).	**3 Hours**
ELECTRONICS FUNDAMENTALS AND TOOLS Introduction to basic electronic components (resistors, capacitors, transistors, etc.), Understanding of electronic circuits and their functions, Hands-on practice with CircuitJS and Falstad, Simulating and analysing electronic circuits, Introduction to Arduino and Raspberry Pi, exploring their capabilities and applications, Designing PCBs using KiCad and EasyEDA, Understanding PCB fabrication processes	**6 Hours**
SOFTWARE PROTOTYPING AND TOOLS Benefits of rapid prototyping in product development, Iterative design and testing, Wireframing tools (Balsamiq, Figma), UI design tools (Sketch, Figma), Programming languages (Python, JavaScript), Testing frameworks (Selenium), No-code platforms (Bubble, Adalo, Wix, AppGyver), Building functional prototypes without extensive coding	**6 Hours**
FABRICATION AND PROTOTYPING Overview of fabrication techniques (3D printing, laser cutting, CNC machining), Prototyping methods for physical products, using tools like Blender, TinkerCAD, or Fusion 360, Creating 3D models for physical prototypes, Hands-on experience with laser cutting and engraving, Understanding their applications and limitations	**7 Hours**
SIMULATION & DEMONSTRATION Integrated project demonstration, explaining the design process, technical choices, and outcomes, simulation showcase to demonstrate their understanding of various technical tools and prototyping techniques	**8 Hours**

Theory Hours:	**0**	**Tutorial Hours:**	**0**	**Practical Hours:**	**30**	**Project Hours:**	**0**	**Total Hours:**	**30**

Learning Resources
Textbooks:
1. Damir Godec, Joamin Gonzalez-Gutierrez, Axel Nordin, Eujin Pei, Julia Ureña Alcázar, A guide to additive manufacturing, Springer – 2022. https://doi.org/10.1007/978-3-031-05863-9 2. Introducing SolidWorks, Dassault Systems.
References:
1. Insight into Electronics 2. Microcontroller Programming with Arduino and Python 3. Fundamentals of 3D modelling
Online Resources (Weblinks)
1. Google Play store apps: a. https://play.google.com/store/apps/details?id=com.electronicslab b. https://play.google.com/store/apps/details?id=it.android.demi.elettronica 2. https://engservices-ece.sites.olt.ubc.ca/files/2020/01/SolidWorks-3D-Printing-Tutorial-R2.pdf

Assessment (Practical course)
Lab Workbook, Experimental Cycle tests, viva-voce

Course Curated by			
Expert from Industry	**Expert(s) from Higher Education Institution**		**Internal Expert**
Dr. Mahesh Veezhinathan Director - Innovation Practicum Associate VP - Forge. Innovation	-		Dr. Samuel Ratna Kumar P S Assistant Professor – III Department Mechanical Engineering
Recommended by BoS on	17.08.2024		
Academic Council Approval	No: 27	**Date**	24.08.2024

24HSP112	HOLISTIC WELLNESS-II (Common to all Department)	L	T	P	J	C
		0	0	2	0	1
HS		SDG	3, 4			

Pre-requisite courses	Holistic Wellness-I	Data Book / Code book (If any)	-

Course Objectives:	
The purpose of taking this course is to:	
1	build on the foundation laid in Holistic Wellness -I and deepening into the practices and principles of holistic wellness.
2	explore advanced techniques in mental, emotional, and spiritual well-being, with an emphasis on creating sustainable wellness habits.

Course Outcomes		
After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO 1	apply advanced techniques in mindfulness, meditation, and stress management.	Ap
CO 2	understand the role of community and social connections in wellness.	U
CO 3	develop resilience and adaptability in maintaining wellness.	E
CO 4	refine and sustain a personalized holistic wellness plan.	E

Course Outcomes	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	Automotive Design and Manufacturing	Automotive Electrical Electronics	Automotive Technology and Management
1						2		2						
2						2								
3						2					3			
4						2					3			

Course Content	
ADVANCED MINDFULLNESS AND MEDITATION: • Deepening mindfulness practices for enhanced mental clarity. • Exploring different forms of meditation (e.g., guided, transcendental, movement-based). • Hands-on activity: Daily meditation practice and journaling reflections.	**6 Hours**
EMOTIONAL RESILIENCE AND MENTAL HEALTH: • Building emotional resilience through positive psychology practices. • Cognitive-behavioural strategies for managing stress and anxiety. • Hands-on activity: Developing and practicing a resilience toolkit.	**6 Hours**

SOCIAL AND ENVIRONMENTAL WELLNESS: • The impact of social connections and community on wellness. • Creating a supportive environment for personal growth. • Hands-on activity: Building a community wellness project or group activity.	**6 Hours**
INTERNAL GROWTH AND PURPOSE: • Exploring the deeper aspects of internal wellness and self-actualization. • Reflective practices for discovering life purpose and meaning. • Hands-on activity: Creating a vision board or personal mission statement.	**6 Hours**
SUSTAINING WELLNESS PRACTICES: • Strategies for maintaining wellness habits over the long term. • Adapting wellness plans to life changes and challenges. • Hands-on activity: Revising and finalizing a long-term personal wellness plan.	**6 Hours**

Theory Hours: 0	**Tutorial Hours: 0**	**Practical Hours: 30**	**Project Hours:**	**Total Hours: 30**

Learning Resources

Textbooks:

1. Hanh, Thich Nhat. The Miracle of Mindfulness: An Introduction to the Practice of Meditation. Beacon Press, Boston (1975).
2. Tolle, Eckhart. The Power of Now: A Guide to Spiritual Enlightenment. New World Library, Novato (1997).
3. Patel, Kamlesh. Heartfulness Way: Heart-Based Meditations for Spiritual Transformation, Kamlesh Patel, 2018.

References:

1. Goleman Daniel., Emotional Intelligence., Bloomsbury India, India, (2021).
2. James Allen., As a Man Thinketh., Maple Press, Noida, (2010)
3. Swami Budhanandha., Will power and its development., Advaita Ashrama Mayavati, Pithoragarh, Himalayas from its Publication Department, Calcutta. (2001)
4. Rosenberg, Marshall Bertram., Nonviolent Communication: A Language of Life., Puddle Dancer Press, Encinitas, CA (2015).
5. Jayanna, Krishnamurthy., Science & Practice of Integrative Health & Wellbeing Lifestyle., White Falcon Publishing (2020).
6. Lipton, Bruce., The Biology of Belief 10th Anniversary Edition: Unleashing the Power of Consciousness, Matter & Miracles, Hay House, Carlsbad (2015).
7. Kalderdon Adizes Ichak., What Matters in Life: Lessons I Learned from Opening My Heart
8. ., WS Press, Newtown, PA(2023).
9. Murphy, Joseph., The Power of Your Subconscious Mind [Original Edition (Complete)], Prentice-Hall, Englewood Cliffs (1963).
10. Kamlesh D. Patel., Designing Destiny: The Heartfulness Way, Heartfulness Institute, Chennai (2021)

Online Resources (Weblinks)

- Introduction to Psychology
- Guided Meditation
- Life skills and value education
- James Allen Library

Assessment (Practical course)

Participation, Practical activities and assignments, personal wellness plan and reflection.

Course Curated by		
Expert(s) from Industry	**Expert(s) from Higher Education Institution**	**Internal Expert(s)**
		Dr. Ezhilarasi Principal- KCT

Recommended by BoS on			
Academic Council Approval	No: 27	**Date**	24.08.2024

SEMESTER III

24HSP005 HS	MASTERING CONVERSATIONS	L	T	P	J	C
		0	0	2	0	1
		SDG		8		

Pre-requisite courses - Nil	NIL	Data Book / Codes / Standards (If any)	Nil

Course Objectives:

The purpose of taking this course is to:

1	Demonstrate understanding of different perspectives by analyzing complex personal and professional situations.
2	Engage in thoughtful dialogue and discussions about complex, real-world issues, utilizing critical thinking to assess different viewpoints.
3	Apply role-playing as a tool to enhance understanding of workplace dynamics, conflict resolution, and team collaboration.

Course Outcomes:

After successful completion of this course, the students shall be able to		Bloom's Taxonomy Level (BTL)
CO 1	Empathize with and understand people in both professional and personal contexts, reflecting on situations from multiple perspectives and participating in activities that mirror career-related scenarios	K3
CO 2	Analyze and converse critically on complex subjects, demonstrating the ability to approach and deal with various social contexts effectively	K4
CO 3	Exhibit skills in role-playing and enacting given situations to navigate diverse social interactions and career-related contexts.	K6

Course Outcomes	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	Automotive Design and Manufacturing	Automotive Electrical Electronics	Automotive Technology and Management
1						3			3	2	3			
2									1	2				
3									3	2				

Course Content	
Practical Component / Roleplays Dynamics Introduction to Role play - Benefits of role plays - Importance of gesture, tone and modulation-Skill development through role play activities - Types of role plays -Conversation Building through communicative functions-Initiating a dialogue- Framing questions- Receiving feedback .	**6 Hours**
Practical Component /Roleplays on Social Skill Social Interactions: - (Ordering food at a restaurant- Making a reservation at a hotel-- Shopping at a store-- Attending a party or social gathering).Travel and Tourism:(Asking for directions- Booking a flight or hotel-- Exploring a new city-Interacting with local people).Community and Volunteering:(Participating in a charity event- Volunteering at a local organization- Discussing community issues- Organizing a community project)	**6 Hours**
Practical Component / Roleplays on Education and Technology Education and Personal Growth:(Setting goals-(Short term & Long term)-Creating a study plan- Participating in a workshop- Reflecting on personal growth) Technology and Online Interactions:(Participating in an online meeting-Creating a social media post- Writing an email or text message- Making an online purchase). Technology and Science:(Explaining a scientific concept-Discussing emerging technologies- participating in Hackathons- Presenting a research paper)	**6 Hours**
Practical Component / Roleplays on Strategic Insights Critical Thinking :(Evaluating a news article-solving a moral dilemma-Decision with incomplete information-Assessing a historical event).Problem-Solving:(Resolving a conflict- Negotiating a deal - Making a complaint-Apologizing for a mistake).Business and Entrepreneurship:(Pitching an idea-Negotiating a contract- Conducting a market Research- Presenting a product launch)	**6 Hours**
Practical Component / Roleplays on Cultural Exchange Cultural Exchange:(Sharing customs and traditions- Discussing cultural differences- Exploring historical events- Participating in a cultural festival) Media and Entertainment:(Event planning- Creating an advertisement-Digital Marketing-Conducting interviews- Creating news broadcast- Writing and Performing a script- Enacting one act plays). Arts and Culture:(Visiting an art gallery - Attending/ organizing a concert or play - Discussing literature- Creating a piece of art)	**6 Hours**
Theory Hours: **Tutorial Hours:** **Practical Hours: 30** **Project Hours:**	**Total Hours: 30**

Learning Resources

Reference books/ Web Links

1. Bonwell, C. C., & Eison, J. A. (1991). Active learning: Creating excitement in the classroom. Washington, DC: The George Washington University.
2. Harbour, E., & Connick, J. (2005). Role playing games and activities rules and tips. Retrieved from https://www.businessballs.com/roleplayinggames.htm
3. Lebaron, J., & Miller, D. (2005). The potential of jigsaw role playing to promote the social construction of knowledge in an online graduate education course. Retrieved from http://paws.wcu.edu/jlebaron/Jigsaw-FnlTCRpdf_050812.pdf
4. Davies, A. (2018). Teaching and learning through role-play: A practical guide. Maidenhead, UK: McGraw-Hill Education.
5. Young, K. C. (2016). The art of role play: Developing realistic scenarios for skill development. Boston, MA: Pearson.
6. Yardley-Matwiejczuk, K. M. (1997). Role play: Theory and practice. London, UK: SAGE Publications Ltd.

Online Resources (Weblinks)

https://www.niu.edu/citl/resources/guides/instructional-guide
https://positivepsychology.com/role-playing-scripts/

Assessment

Formative	Summative
Assignments / Mini project), Quiz, Lab	Quizzes and written assignments, Participation in group activities

Course Curated By

Expert(s) from Industry	Expert(s) from Higher Education Institutions	Internal Expert(s)
Mr.Vijayan Ramanathan , Project manager, Toppan Merrill. Technologies, Coimbatore	Dr. Aninditha Sahoo, IIT, Madras Dr.P.R.Sujatha Priyadharshini, Anna University Chennai Dr. E. Justin Ruben, CIT, Coimbatore	Dr. Arokia Lawrence Vijay Dr. Tissaa Tony

24MAT231	PARTIAL DIFFERENTIAL EQUATIONS AND TRANSFORMS TECHNIQUES (Common to AE, AU, CE, ME, MR)	L	T	P	J	C
		3	1	0	0	4
BS		SDG	7,9			

Pre-requisite courses	-	Data Book / Codes / Standards (If any)	NA

The purpose of taking this course is to:

1	Apply analytical methods to solve selected PDEs, including suitable method of characteristics.
2	Construct Fourier series expansions for functions defined on a finite interval.
3	Develop the ability to formulate and solve the one-dimensional wave equation and steady-state heat equation using analytical methods.
4	Introduce students to the mathematical formulation of the steady-state two-dimensional heat conduction equation in Cartesian coordinates.
5	Enable students to compute Fourier transforms of standard functions and understand their properties.
6	Apply the Z-transform technique to solve linear difference equations with constant coefficients.

Course Outcomes:

After successful completion of this course, the students shall be able to		**Bloom's Taxonomy Level (BTL)**
CO1	Solve certain types of partial differential equations.	Ap
CO2	Determine the Fourier Series and half range Fourier Series of a function.	Ap
CO3	Solve one dimensional wave equation, one dimensional heat equation in steady state using Fourier series.	Ap
CO4	Apply Fourier series to solve the steady state two-dimensional heat equation in cartesian coordinates.	Ap
CO5	Identify Fourier transform, Fourier sine and cosine transform of certain functions and use Parseval's identity to evaluate integrals.	Ap
CO6	Evaluate Z – transform of sequences and inverse Z – transform of functions and solve difference equations.	Ap

Course Outcomes	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	Automotive Design and Manufacturing	Automotive Electrical Electronics	Automotive Technology and Management
1	3	2												
2	3	2												
3	3	2												

4	3	1		2										
5	3	1		2										
6	3	1		2										

Course Content	
PARTIAL DIFFERENTIAL EQUATIONS Solution of PDE by direct integration - solution of standard types of first order partial differential equations (excluding reducible to standard types) - Lagrange's linear equation – Linear homogeneous partial differential equations of second order with constant coefficients.	**9 + 3 Hours**
FOURIER SERIES Dirichlet's conditions – Fourier series – Odd and Even functions – Half range sine series – Half range cosine series – Parseval's identity – Harmonic Analysis.	**9 + 3 Hours**
BOUNDARY VALUE PROBLEMS – ONE DIMENSIONAL EQUATIONS Classification of second order quasi linear partial differential equations – Solution of one-dimensional wave equation – Solution of one-dimensional heat equation (excluding insulated ends) – (Cartesian coordinates only).	**5 + 2 Hours**
BOUNDARY VALUE PROBLEMS – TWO DIMENSIONAL EQUATIONS Steady state solution of two-dimensional heat equation in infinite plate (Insulated edges excluded) – (Cartesian coordinates only)	**4 + 1 Hours**
FOURIER TRANSFORM Statement of Fourier integral theorem – Infinite Fourier transforms – Sine and Cosine Transforms – Properties (Proofs excluded)– Transforms of simple functions – Convolution theorem – Parseval's identity.	**9 + 3 Hours**
Z –TRANSFORM Z-transform - Properties (Proofs excluded) – Convolution theorem- Inverse Z – transform (by using partial fractions, residues and convolution theorem) – Solution of difference equations using Z - transform.	**9 + 3 Hours**
Theory Hours: 45 **Tutorial Hours: 15** **Practical Hours:** **Project Hours:** **Total Hours: 60**	
Learning Resources	
Textbooks	
1. Veerarajan T., "Transforms and Partial Differential Equations", Tata McGraw Hill Education Pvt. Ltd., New Delhi, edition 2016. 2. Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 45th Edition, 2024.	
Reference books/ Web Links	
1. Kandasamy P., Thilagavathy K. and Gunavathy K., "Engineering Mathematics Volume III", S. Chand & Company ltd., New Delhi, 2020 Revised 10th edition. 2. Ian Sneddon., "Elements of partial differential equations", McGraw – Hill, New Delhi, 2022. 3. Ramana B.V., "Higher Engineering Mathematics", Tata McGraw Hill Co. Ltd., New Delhi, 2018.	
Online Resources (Weblinks)	
1. Partial differential equations – https://www.classcentral.com/course/swayam-partial-differential-equations-17721 2. Fourier series – https://www.classcentral.com/subject/fourier-series 3. Fourier Transform - https://www.classcentral.com/subject/fourier-transform	

Assessment	
Formative	Summative
Assignments-Open Book Test/Quiz/Case Study Analysis/Group Presentation/Poster Preparation/Mathematical Models, .,	MCQ, SA- I, SA – II and End Semester Examination (ESE)

Course Curated By		
Expert(s) from Industry	**Expert(s) from Higher Education Institutions**	**Internal Expert(s)**
1. Mr. Ramesh V.S., STEPS Knowledge Services Private Limited, Coimbatore.	1. Dr. M. Sivakumar Assistant Professor Sr. Grade Vellore Institute of Technology, Vellore 2. Dr. Ramesh Babu Assistant Professor (SG) Amrita University Coimbatore, Tamil Nadu.	1. Ms. S. Sivasakthi 2. Dr. S. Meenapriyadarshini 3. Ms. A. Shanmughavadivu

Recommended by BoS on	25.4.2025		
Academic Council Approval		**Date**	

24AUI201	Automotive Chassis and Transmission	L	T	P	J	C
		3	0	2	0	4
PC		SDG	7, 9, 13			

Pre-requisite courses	—	Data Book / Code book (If any)	—

Course Objectives:

The purpose of taking this course is to:

1	provide foundational knowledge on the classification, construction, material selection, and load-bearing analysis of automotive frames and chassis layouts.
2	develop an understanding of the function, design, and application of clutches and various transmission systems in both ICEVs and EVs.
3	explore the design, function, and integration of driveline components such as propeller shafts, joints, axles, and differentials in vehicle power transmission.
4	examine the geometry, mechanisms, and characteristics of steering and suspension systems influencing vehicle stability and handling.
5	analyze the construction, working principles, and performance impact of braking systems, tyre types, and wheel assemblies in automotive applications.

Course Outcomes

After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO 1	Understand the function and construction of frames, driveline, transmission, steering, suspension, brakes, tyres, and wheels in vehicles.	U
CO 2	Describe different types of chassis layouts, gearboxes, clutches, axles, and suspension systems used in ICEVs and EVs.	Ap
CO 3	Perform basic calculations related to gear ratio, final drive ratio, spring rate, and braking efficiency.	Ap
CO 4	Compare different systems like driveline, suspension, and braking based on their impact on vehicle performance.	An
CO 5	Choose suitable frame, transmission, and suspension components for different types of vehicles.	An
CO 6	Evaluate the use of advanced systems like ABS, EPAS, and regenerative braking in modern vehicles.	E

Course Outcomes	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	Automotive Design and Manufacturing	Automotive Electrical Electronics	Automotive Technology and Management
1	3	2			2							3	2	

2	3	2			2							3	2	
3	2	3	2	2	3							2		
4	2	3	2	2	2	2						3	2	
5	2	2	3	2	3	2						3	2	2
6	2	2	2	2	3	2						2	3	3

Course Content

AUTOMOTIVE FRAMES Types of Chassis Layout concerning Power Plant Location and Drive for ICEVs, EVs, Automotive Frames - Material Selection and its Constructional Details, Various types, Different Loads acting on Frame, Testing of Automotive Frames. **Practical Component:** • Measurement of the automotive frames • Assessment of Frame bend	**7 Hours** **4 Hours**
TRANSMISSION AND GEARBOXES Requirement of transmission system, Clutches for ICEVs, EVs - Types and construction, Types of Transmission - Chain, Belt and gear drives, Types of gearboxes - ICEVs, EVs. Automatic transmission – Fluid coupling, Torque converter, planetary gear trains, CVT. **Practical Component:** • Calculation of different gear ratios • Demonstration of different types of clutches.	**9 Hours** **4 Hours**
DRIVE LINES AND AXLES Propeller Shaft - Design Considerations & Constructional Details, Universal Joints, Constant Velocity Joints, Hotchkiss Drive, Torque Tube Drive, Radius Rods and Stabilizers, Final drive - Different types, Multi-axled Vehicles. Differential - Working Principle and Constructional Details Non–Slip Differential, Differential Locks. Types of Front Axles and Stub Axles, Types of rear axles, axle housing, and loads acting on drive axles **Practical Component:** • Demonstration of front and rear axles • Identification of different driveline layouts • Calculation of final drive ratio	**9 Hours** **6 Hours**
STEERING AND SUSPENSION SYSTEM Front Wheel Geometry, Conditions for True Rolling Motion of Wheels during Steering, Steering Mechanisms, Steering Linkages, Different Types of Steering Gears, Slip Angle, Over Steer and Under Steer, Reversible and Irreversible Steering, Electronic Power Assisted Steering. Need for Suspension System, Types of Suspension Springs, Constructional details and Characteristics of Single Leaf, Multi Leaf, Coil, Torsion bar, Rubber, Pneumatic and Hydro –elastic Suspension Systems, Independent Suspension System, Shock Absorbers - Types and Constructional details. **Practical Component:** • Measurement of steering angle • Damping test on two-wheeler shock absorber • Selection of suitable suspension system for selected vehicle applications • Calculate the stiffness and spring rate for two wheelers	**10 Hours** **8 Hours**
BRAKING SYSTEM, TYRES AND WHEELS Theory of Automobile Braking, Stopping Distance Time and Braking Efficiency, Braking Torque, Effect of Weight Transfer during Braking, Constructional Details - Drum Brake & Disc Brake,	**10 Hours**

Hydraulic Braking System, Mechanical Braking System, Pneumatic Braking System, Power–Assisted Braking System, Servo Brakes, Retarders, Anti–Lock Braking System, Regenerative braking system, Exhaust braking system. Types of Wheels, Construction, Structure and Function, Wheel Dimensions. Structure and Function of Tyres, Types of Tyres, Materials, Tyre Section, specification and constructional details, Factors affecting Tyre Life, Quick Change Wheels, Special Wheels **Practical Component:** • Assessment of wheels and tyres. • Demonstrate the brake system terminology by identifying and labeling its primary components • Selection of suitable brake system for given vehicles	**8 Hours**

Theory Hours:	**45**	**Tutorial Hours:**		**Practical Hours:**	**30**	**Project Hours:**		**Total Hours:**	**75**

Learning Resources

Textbooks:

1. "Automotive Chassis-Brakes, Steering and Suspension", Tim Gilles, Thomson Delmer Learning, 2008
2. "Vehicle and Engine Technology (9th Edition)", Heinz Heisler, Butterworth-Heinemann, 2018, ISBN: 978-0-08-102798-4

References:

1. "Automotive Chassis and Body (4th Edition)", James E. Duffy, Delmar Cengage Learning, 2013, ISBN: 978-1-305-25344-4.
2. "Modern Vehicle Technology", Heinz Hazler, Butterworth, London, 2005. "Automobile Mechanics", Crowson, W.H., & Angline, D.L McGraw-Hill Book Company, 2009
3. " Automatic Transmissions and Transaxles (5th Edition)", Chris Johanson, James E. Duffy, Goodheart-Willcox, 2021, ISBN: 978-1-63563-827-1

Online Resources (Weblinks)

1. https://www.udemy.com/course/automotive-engineering-automobile-fundamentals-and-advanced/?couponCode=LEARNNOWPLANS
2. https://www.irjet.net/archives/V9/i6/IRJET-V9I6500.pdf

Assessment (Embedded course)

SA I and SA II Activity and Learning Task(s), Mini project, MCQ, End Semester Examination (ESE), Lab Workbook, Experimental Cycle tests, viva-voce

Course Curated by

Expert(s) from Industry	Expert(s) from Higher Education Institution	Internal Expert(s)
Mr. A. Sasikumar, Head – Powertrain, Jeyam Automotive Pvt Ltd., Coimbatore	Dr. D.Senthil Kumar, Associate Professor, Mechanical Engineering, Amrita School of Engineering, Coimbatore	Mr. T.Karthik Assistant Professor II Automobile Engineering, KCT

Recommended by BoS on	**03.05.2025**		
Academic Council Approval	**No:28**	**Date**	**26.06.2025**

24AUI202	Heat Power Engineering	L	T	P	J	C
		3	0	0	0	3
PC		SDG	7,9,12,13			

Pre-requisite courses	-	Data Book / Code book (If any)	Steam Table, Refrigeration Table, Psychrometric Chart

Course Objectives:

The purpose of taking this course is to:

1	understand energy, heat, and work in different thermodynamic systems.
2	study steam formation and its use in power cycles for energy production.
3	understand the second law of thermodynamics and changes in substances during heating and cooling.
4	explore the working of pumps, compressors, and analyze air standard cycles.
5	understand psychrometric processes and fundamentals of refrigeration and air conditioning.

Course Outcomes

After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO 1	Recall fundamental concepts, definitions, laws, and principles of thermodynamics related to heat, work, energy, properties of substances, cycles, and thermal systems.	R
CO 2	Explain the working principles of thermodynamic systems including steam and vapour power cycles, air-standard cycles, pumps, compressors, refrigeration, and air-conditioning systems.	U
CO 3	Apply the first and second laws of thermodynamics, property relations, steam tables, and psychrometric charts to solve numerical problems involving engines, power cycles, refrigeration, and air-conditioning	Ap
CO 4	Apply thermodynamic principles to evaluate the performance and efficiency of cycles, pumps, compressors, and refrigeration systems used in energy applications.	Ap
CO 5	Apply concepts of energy efficiency and entropy to assess refrigeration, air-conditioning, and automotive thermal systems with respect to sustainability and practical operation.	Ap

Course Outcomes	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	Automotive Design and Manufacturing	Automotive Electrical Electronics	Automotive Technology and Management

1	3	–	–	–	–	–	–	–	–	–	–	2	–	–
2	3	3	–	–	–	–	–	–	–	–	–	3	2	–
3	3	3	–	–	–	2	–	–	–	–	–	3	2	–
4	3	3	2	–	–	2	–	–	–	–	–	3	–	2
5	3	3	–	–	–	–	3	–	–	1	–	3	2	3
6														

Course Content	
FIRST LAWS OF THERMODYNAMICS System, thermodynamic equilibrium, zeroth law state, property, process, cycle, P-V & T-S diagrams, energy: work & heat, first law of thermodynamics, Concept of continuum, Perpetual motion machine, steady flow energy equation. Application of first law of thermodynamics to closed and open systems.	**11 Hours**
PROPERTIES OF STEAM AND VAPOUR POWER CYCLE Steam formation, properties of steam. Use of steam tables and Mollier chart, Ideal Rankine cycle, Reheat and regenerative cycle Rankine cycle.	**8 Hours**
SECOND LAWS OF THERMODYNAMICS Statements of second law of thermodynamics, heat engine, heat pump, refrigerator, Carnot cycle, Reversed Carnot cycle, Carnot theorem, entropy, Clausius inequality, Entropy generation principle.	**9 Hours**
AIR STANDARD CYCLES, PUMPS AND COMPRESSORS Assumption for air standard cycles, Otto, Diesel, and Dual cycles, Comparison of cycles. Reciprocating and centrifugal pumps – principles, work done, efficiencies. Single-stage and multi-stage compressors – work input and efficiency.	**8 Hours**
PSYCHROMETRY, REFRIGERATION AND AIR CONDITIONING Properties of air, Psychometric Processes, Types of refrigeration, Vapour compression and Vapour absorption refrigeration, Coefficient of Performance (COP), Properties of refrigerants, Summer, winter and Year-round Air conditioning. Introduction to Automotive air conditioning systems.	**9 Hours**

Theory Hours: 45	**Tutorial Hours:**	**Practical Hours: -**	**Project Hours:**	**Total Hours: 45**

Learning Resources

Textbooks:

1. Yunus A. Cengel and Michael A. Boles, Thermodynamics – An Engineering Approach., McGraw Hill Education; Eighth edition (1 July 2017).
2. Nag, P.K., Engineering Thermodynamics., McGraw Hill Education (2017).

References:

1. Michael J. Moran & Howard N. Shapiro., Fundamentals of Engineering Thermodynamics., Wiley.
2. J.P. Holman., Thermodynamics., McGraw-Hill.
3. Domkundwar & Arora ., A Course in Thermal Engineering., Dhanpat Rai Publications (2016).

Online Resources (Weblinks)

1. https://nptel.ac.in/courses/101104063
2. https://nptel.ac.in/courses/112103316

Assessment (Theory course)

SA I and SA II, Activity and Learning Task(s), Mini project, MCQ, End Semester Examination (ESE)

Course Curated by			
Expert(s) from Industry	**Expert(s) from Higher Education Institution**		**Internal Expert(s)**
Mr. A. Sasikumar, Head – Powertrain, Jeyam Automotive Pvt Ltd., Coimbatore	Dr.Karthikeyan. P, Professor, PSG Tech, Coimbatore		Dr Andrew Pon Abraham J D HoD, Automobile Engineering, KCT
Recommended by BoS on	**03.05.2025**		
Academic Council Approval	**No:28**	**Date:**	**26.06.2025**

24AUI203	Strength of Materials	L	T	P	J	C
		3	0	2	0	4
PC		SDG	9, 12			

Pre-requisite courses	NA	Data Book / Code book (If any)	NA

Course Objectives:

The purpose of taking this course is to:

1	Understand the basic concepts of stress, strain, and elastic behaviour of materials under axial, shear, bending, and torsional loads.
2	Develop analytical skills to calculate internal forces, bending moments, and shear forces in structural members, forming the basis for structural and mechanical analysis.
3	Gain problem-solving ability in evaluating stresses, strains, and deflections in beams, shafts, and columns using engineering principles.
4	Provide the foundation for evaluating the strength and stability of columns, thin-walled vessels, and thick cylinders under various loading conditions.
5	Build essential analytical skills for mechanical design by linking theoretical concepts to problem-solving in solid mechanics.

Course Outcomes

After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO 1	Recall the fundamental principles, definitions, and laws related to stress, strain, beam theory, torsion, deflection, and column strength for different structural members.	R
CO 2	Understand the mechanical behaviour of materials and structures under axial, bending, torsional, and compressive loads using appropriate theoretical concepts.	Un
CO 3	Apply standard equations and methods to determine internal forces, stresses, strains, and deflections in structural elements subjected to combined loading.	Ap
CO 4	Analyse the strength and deformation characteristics of beams, shafts.	An
CO 5	Apply buckling theories, effective length concepts, Euler's equations, and stress equations for thin and thick cylinders to calculate stresses, critical loads, and safe dimensions of columns and pressure vessels.	Ap
CO 6	Perform material and structural testing experiments such as tensile, impact, hardness, torsion, and deflection tests, and analyse the results to validate theoretical predictions.	E

Course Outcomes	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	Automotive Design and Manufacturing	Automotive Electrical Electronics	Automotive Technology and Management
1	3	2												
2	3	3										2		
3	3	3	2	2								3		
4	3	3	2	2					2			3		
5	3	2	2	2					2			3		
6	2	3		3					3	2		3		

Course Content

SIMPLE STRESSES AND STRAINS Stress, strain, axial loading (tension & compression), Impact Load, shear stress, Hooke's Law, elastic and plastic deformation, Stress–strain diagrams for ductile and brittle materials, Poisson's ratio and types of strain., Elastic constants and relationships (E, G, K, ν), Deformation of uniform and composite bars, Thermal stresses in simple and compound bars. **Practical Component:** • Experimentation on Tensile strength of Steel. • Experimentation on Compression strength of Wood. • Izod and Charpy. • Hardness Test- Brinell, Vickers and Rockwell.	**12 Hours** **15 Hours**
ANALYSIS OF BEAMS Types of beams, supports, and loading conditions, Concepts of shear force and bending moment, SFD and BMD for simply supported, cantilever, and overhanging beams, Theory of pure bending; bending stress equation, Shear stress distribution for standard beam sections (rectangular, circular, I, T), Section modulus, flexural rigidity. **Practical Component:** • Double Shear Test	**8 Hours** **3 Hours**
DEFLECTION OF BEAMS Introduction, curvature of bending beam, relation ship between slope, deflection and Radius of curvature. Slope and deflection: Double integration method, Macaulay's method & Moment-area method. **Practical Component:** • Deflection of Beam	**9 Hours** **3 Hours**
TORSION OF CIRCULAR SHAFTS Theory of pure torsion, Torsion equation. Torsional Stresses and Strains, Strength of a solid shaft and hollow shaft, Torsional rigidity, modulus of rupture. Power transmitted by shafts- pure torsion, pure bending and combined bending and torsion in circular shafts, composite Shafts.	**8 Hours**

Practical Component: • Torsion Test • Test on Springs- Closed and Open Coil.	**9 Hours**
COLUMNS AND CYLINDERS Columns: Buckling, effective length, slenderness ratio, Euler's theory for different end conditions, Thin cylinders and spheres: Hoop and longitudinal stresses, Thick-walled cylinders: Lame's equations for radial and hoop stress.	**8 Hours**

Theory Hours:	**45 Hrs**	**Tutorial Hours:**		**Practical Hours:**	**30 Hrs**	**Project Hours:**	**Total Hours:** **75 Hrs**

Learning Resources

Textbooks:

1. Shames, Irving H., Strength of Materials. Prentice Hall, Englewood Cliffs (2009).
2. Beer, Ferdinand P., Mechanics of Materials. McGraw-Hill Education, New York (2015).

References:

1. Nash, William A., and Potter, Merle C., Strength of Materials, Fifth Edition. McGraw-Hill Education, New York (2011).
2. Hibbeler, R.C. Mechanics of Materials, Tenth Edition. Pearson Education, Boston (2016).

Online Resources (Weblinks)

1. https://iitb.vlabs.co.in/discipline.html?discipline
2. https://ocw.mit.edu/courses/2-001-mechanics-materials-i-fall-2006/pages/lecture-notes/
3. https://ocw.mit.edu/courses/3-11-mechanics-of-materials-fall-1999/pages/modules/
4. NPTEL :: Civil Engineering - Strength of Materials
5. NPTEL :: Mechanical Engineering - Strength of Materials

Assessment (Embedded course)

SA I and SA II Activity and Learning Task(s), Mini project, MCQ, End Semester Examination (ESE), Lab Workbook, Experimental Cycle tests, viva-voce

Course Curated by

Expert(s) from Industry	Expert(s) from Higher Education Institution	Internal Expert(s)
Mr. Chandrasekaran, Director, Business Solution Architect, Automobile & Manufacturing, Capgemini, Chennai.	Dr Srijith Mohan Assistant Professor, Mechanical Engineering, NIT Trichy	Mr Arun B Assistant Professor II Automobile Engineering/KCT
Recommended by BoS on	**03.05.2025**	
Academic Council Approval	**No:28**	**Date** **26.06.2025**

24AUI204	Automotive Electronics	L	T	P	J	C
		2	0	0	2	3
PC		SDG	9			

Pre-requisite courses	---	Data Book / Code book (If any)	---

Course Objectives:

The purpose of taking this course is to:

1	Give insight of the basic concepts of automotive electronics and develop the application for Automotive
2	Identify common passive and active electronic components, understand their fundamental principles, and describe their typical applications within various automotive electronic systems, recognizing their importance in circuit function.
3	Understand the purpose, architecture, operation, and common types of Electronic Control Units (ECUs) in modern vehicles, including how they process various input signals and generate output signals to control vehicle functions.

Course Outcomes

After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO 1	Identify and explain the function and applications of passive electronic components used in automotive circuits	U
CO 2	Demonstrate the working and application of diodes, transistors, MOSFETs, and relays in automotive switching and regulation circuits.	Ap
CO 3	Construct power supply systems and filter circuits for automotive applications using passive and active electronic components.	Ap
CO 4	Develop circuits using analog, digital, and mixed-signal ICs for specific automotive electronic functions.	Ap
CO 5	Explain the Architecture, signals, and functionality of various types of ECUs in modern vehicles.	U
CO 6	Design and develop a functional automotive electronics prototype by integrating passive and active components, power circuits, and ICs, and evaluate its operation.	C

Course Outcomes	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	Automotive Design and Manufacturing	Automotive Electrical Electronics	Automotive Technology and Management
1	3	–	1	–	2	–	–	–	–	–	2	–	2	–

2	3	–	2	–	3	–	–	–	–	–	1	–	3	–
3	3	–	3	2	3	–	–	–	–	–	2	–	3	–
4	3	3	3	2	3	–	–	–	–	–	2	–	3	–
5	2	2	2	1	3	2	–	1	–	1	2	–	3	–
6	1	2	3	1	3	1	–	3	–	3	3	–	3	–

Course Content

BASIC PASSIVE ELECTRONIC COMPONENTS IN AUTOMOTIVE SYSTEMS **Introduction of Passive Components -** Resistors (R) **-** Principle, Types in Automotive - Fixed Resistors, Variable Resistors, Thermistors, Voltage Dependent Resistor. **Automotive Applications:** Voltage Divider – Voltage sensor, Throttle Position Sensor (TPS), Fuel Level Sensor, Current Limiting, Shunt Resistors. **Capacitors (C)** – Principle, Types in Automotive - Ceramic Capacitors, Electrolytic Capacitors. **Automotive Applications:** Bypass, Signal Conditioning - Timing Circuits, Energy Storage. **Inductors (L)** – Principle, Types in Automotive -Air Core, Iron Core. **Automotive Applications:** Filtering (EMI/RFI Suppression), Energy Storage. **Project Component:** • **Activity:** Build a voltage divider using two different fixed resistors (e.g., 1kΩ and 2.2kΩ) on a breadboard, powered by a fixed DC voltage (e.g., 5V or 12V). • **Activity:** Build a simple LC low-pass filter and High pass filter.	**6 Hours** **6 Hours**
BASIC ACTIVE ELECTRONIC COMPONENTS IN AUTOMOTIVE SYSTEMS **Diodes(D)** - Principle, Types in Automotive - Rectifier Diodes, Zener Diodes, Schottky Diodes. **Automotive Applications** – Reverse Polarity Protection, Freewheeling, Voltage Clamping / Overvoltage Protection, Visual Indication. **Transistors (BJT)** - Principle - Bipolar Junction Transistor. **Automotive Applications** - Switching Loads (Driving Actuators), Driving relays, Voltage Regulation. **Transistors (MOSFET)** – Principle **Automotive Applications** - Driving fuel injectors, High-Side & Low-Side Drivers. **Relays** – Principle - Types in Automotive - Standard automotive relays (ISO mini, micro relays), PCB relays. **Automotive Applications** - Switching High Current Loads, Power Distribution. **Project Component:** • **Activity:** Build a half-wave rectifier using one diode and a resistor load. • **Activity:** Build a simple Zener regulator circuit • **Activity:** Build a common-emitter NPN/PNP switch circuit • **Activity:** Drive the Gate of the MOSFET in the switch circuit with a PWM signal from a function generator or microcontroller. • **Activity:** Connect a variable DC power supply to the relay coil terminals and test the continuity of NO and NC with COM pin.	**6 Hours** **6 Hours**
AUTOMOTIVE POWER SUPPLY AND MANAGEMENT Introduction to power System Architecture: High-level flow from engine to electronic loads – AC to DC Conversion, Filter, Voltage regulation, Alternator Voltage Regulation (L9918), DC-DC Voltage Conversion. Power Management ICs - Line Regulation, Load Regulation **Project Component:** • **Activity:** Vehicle Power Flow Tracing (Conceptual & Observational) • **Activity:** Measuring Charging System Voltage	**6 Hours** **6 Hours**

• **Activity:** Analyzing a Buck Converter Module • **Activity:** Examining PMIC/SBC Datasheet & Features •	
INTEGRATED CIRCUITS IN AUTOMOTIVE SYSTEMS Introduction to ICs - Types of ICs in Automotive - **Analog ICs in Automotive** - Operational Amplifiers, Voltage Comparators, Audio Amplifiers, 555 Timer IC. **Digital ICs in Automotive**-,Logic Gates, Latches. **Mixed-Signal ICs in Automotive** - Analog-to-Digital Converters, Digital-to-Analog Converters, Digital Potentiometers. **Actuator Driver IC** – H-Bridge IC, Opto-isolator IC. **Project Component:** • **.Activity:** Build a threshold detector circuit. • **Activity:** Build an PWM signal generator using 555 Timer. • **Activity:** Build an ADC circuit using a parallel-output ADC IC, interface it with a potentiometer as the analog input source and observe the conversion of the analog voltage into a corresponding digital binary value displayed on LEDs. • **Activity:** Build a circuit using an optocoupler to demonstrate transferring a switch signal between two electrically isolated circuits, visually indicated by LEDs.	**6 Hours** **6 Hours**
AUTOMOTIVE ECU FUNDAMENTALS AND APPLICATIONS Introduction to ECUs - ECU Architecture - Embedded Controller, Memory, GPIO, Power Supply, Communication Interface, Output Driver Circuits, Housing and Connectors. ECU Input Signals – Analog, Digital, Frequency/PWM. ECU Output Signals - Switched Output, PWM Output. **Common Types of Automotive ECUs** - Engine Control Module (ECM), Body Control Module (BCM), Battery Management System (BMS). **Project Component:** **Activity: ECU Block Diagram Exercise** • **Task:** Design a simplified block diagram for a specific vehicle function controlled by an ECU. • **Procedure:** 1. Choose a function (Automatic Wipers, Radiator Fan Control, Anti-theft Alarm). 2. Identify the main ECU responsible (BCM for wipers/alarm, ECM for fan). 3. Identify necessary input sensors (Rain sensor, Engine Coolant Temp sensor, Door switches/motion sensor). Classify signal type (Analog/Digital/Freq). 4. Identify controlled actuators (Wiper motor, Fan motor/relay, Horn/Siren). Classify output type (Switched/PWM).	**6 Hours** **6 Hours**

Theory Hours:	**30 Hrs**	**Tutorial Hours:**	**Practical Hours:**	**Project Hours:**	**30 Hrs**	**Total Hours:**	**60 Hrs**

Learning Resources

Textbooks:

1. Ribbens, William B., *Understanding Automotive Electronics*, Butterworth-Heinemann, Oxford (2017).
2. Denton, Tom., *Automobile Electrical and Electronic Systems*, Routledge, London (2017).

References:

1. Bosch, Robert., *Automotive Handbook*, Wiley, Hoboken (2018).
2. Halderman, James D., *Automotive Electricity and Electronics*, Pearson, Boston (2016).
3. Delmar, Cengage Learning., *Today's Technician: Automotive Electricity and Electronics*, Cengage Learning, Boston (2014).
4. Malvino, Albert Paul., *Electronic Principles*, Tata McGraw-Hill, New Delhi (2015)

Online Resources (Weblinks)
1. Texas Instruments., “Automotive Solutions.”, *Corporate Website*, Texas Instruments, USA (Accessed 2025): https://www.ti.com/automotive. 2. STMicroelectronics., “Automotive Applications.”, *Corporate Website*, STMicroelectronics, Switzerland (Accessed 2025): https://www.st.com/en/applications/automotive.html.

Assessment (Embedded course)
SA I and SA II Activity and Learning Task(s), Mini project, MCQ, End Semester Examination (ESE), Lab Workbook, Experimental Cycle tests, viva-voce

Course Curated by			
Expert(s) from Industry	**Expert(s) from Higher Education Institution**		**Internal Expert(s)**
Mr.Suresh R, Manager - Hardware ZED Digital	Dr. Kanagalakshmi, Assistant Professor, ECE, NIT, Calicut		Mr. Prabhakaran A, Assistant Professor II, Automobile Engineering, KCT
Recommended by BoS on	**03.05.2025**		
Academic Council Approval	**No:28**	**Date**	**26.06.2025**

24AUP205	Design and Prototyping Laboratory	L	T	P	J	C
		0	0	2	0	1
PC		SDG	9			

Pre-requisite courses	—	Data Book / Code book (If any)	—

Course Objectives:

The purpose of taking this course is to:

1	familiarize students with 3D modelling techniques using CAD software.
2	develop skills in designing and preparing prototypes using 3D printing technologies.
3	introduce students to slicing, pre-processing, and the functioning of 3D printers.
4	enhance innovation and product development capabilities for real-world applications.
5	enable students to apply design principles to automotive and general-use components.

Course Outcomes

After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO 1	Interpret design principles and model simple automotive and household components.	U
CO 2	Create 3D models using CAD software for prototyping.	C
CO 3	Apply slicing and preprocessing tools to prepare files for 3D printing.	Ap
CO 4	Execute a 3D print using appropriate settings, supports, and material specifications.	Ap
CO 5	Design and fabricate an innovative product addressing user needs.	C

Course Outcomes	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	Automotive Design and Manufacturing	Automotive Electrical Electronics	Automotive Technology and Management
1	3	2	1	1	2			1			2	3		
2	3	2	3	2	3			2			2	3		
3	3	2	2	2	3			2			2	3		
4	3	2	3	2	3			2	2		2	3		
5	3	2	2	1	2	1	1	1	1	1	2	3		

Course Content	
DESIGNING – 3D MODELLING USING CAD 1. 3D Modelling of a Bumpers 2. 3D Modelling of a Ladder Frame 3. 3D Modelling of an Connecting Rod 4. 3D Modelling of a Suspension Spring 5. Design and Assembly of a Rear-view Mirror Casing 6. Design and Assembly of a Propeller shaft 7. Design and Assembly of a Screw Jack	**10Hours**
Prototyping – PREPROCESSING & 3D PRINTING 8. Slicing and Preprocessing Techniques using slicer software [Cura or PrusaSlicer] 9. Understanding Support Structures and Print Settings 10. Operating an FDM 3D Printer	**10Hours**
Mini Project Each student or student group (up to 4-5 members) must complete a mini project: • Design and 3D print a marketable prototype targeted at student users • Suggested ideas: *Phone stand, Table lamps, Bike handle mounts, Organizer trays* • Deliverables: ○ Design sketches ○ CAD model ○ Slicing and print file ○ Printed prototype ○ Project report with user need analysis and design justification	**10Hours**

Theory Hours:	Tutorial Hours:	Practical Hours: 30	Project Hours:	Total Hours: 30

Learning Resources

Textbooks:

1. James D. Bethune, Engineering Graphics with AutoCAD, Pearson, 2020
2. Rob Thompson, Manufacturing Processes for Design Professionals, Thames & Hudson, 2007.

References:

1. Dhawan, R.K., A Textbook of Machine Drawing, S. Chand Publishing, 2012.
2. Sidheswar, N., Kannaiah, P., and Sastry, V.V.S., Machine Drawing, Tata McGraw-Hill Education, 2008.
3. John, K.C., Machine Drawing, PHI Learning Pvt. Ltd., 2009.
4. Singh, Ajeet, Computer Aided Machine Drawing, Tata McGraw-Hill Education, 2012.
5. Giesecke, Frederick E., Mitchell, Alva, Spencer, Henry C., Dygdon, John T., and Novak, James E., Technical Drawing with Engineering Graphics, Pearson, 15th Edition, 2016.
6. Bethune, James D., Engineering Graphics with AutoCAD, Pearson, 2020.
7. Juvinall, Robert C., and Marshek, Kurt M., Fundamentals of Machine Component Design, Wiley, 6th Edition, 2017.

Online Resources (Weblinks)

1. "How to CAD Almost Anything" IAP course added to MIT OpenCourseWare - MIT AeroAstro
2. NPTEL :: Mechanical Engineering - Engineering Drawing
3. NPTEL :: Mechanical Engineering - Engineering Drawing
4. NPTEL :: Mechanical Engineering - NOC: Engineering drawing and computer graphics
5. Engineering drawing and computer graphics in Hindi - Course

Assessment (Practical course)

Lab Workbook, Experimental Cycle tests, viva-voce

Course Curated by			
Expert(s) from Industry	**Expert(s) from Higher Education Institution**		**Internal Expert(s)**
Mr. Hariharan G, Senior Software Engineer - Bosch Global Software Solutions, Coimbatore	Dr.P.Senthilkumar Associate professor, Automobile engineering, Madras Institute of technology		Mr. R. Kishore, Assistant Professor II Automobile Engineering, KCT
Recommended by BoS on	**03.05.2025**		
Academic Council Approval	**No:28**	**Date:**	**26.06.2025**

24INM201	Universal Human Values II: Understanding Harmony (Common to All Branches)	L	T	P	J	C
		1	0	0	0	1
HS		SDG	5,10,16			

Pre-requisite courses	UHV-I	Data Book / Code book (If any)	

Course Objectives:	
The purpose of taking this course is to:	
1	Introduce the concept and significance of value education in shaping a meaningful and fulfilling life.
2	Enable students to understand the human being as a co-existence of self and body and the harmony within.
3	Develop an understanding of harmony in relationships, family, and society.
4	Help students appreciate the interconnectedness and harmony in nature and existence.
5	Instill the importance of ethical behavior in personal, professional, and social contexts.

Course Outcomes		
After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO1	Understand the foundational concepts of value education and human aspirations.	U
CO2	Analyse the human being as a holistic entity comprising self and body.	An
CO3	Evaluate and cultivate harmonious relationships within the family and society.	E
CO4	Interpret the interconnectedness in nature and recognize harmony in existence.	U
CO5	Apply holistic understanding to professional ethics and sustainable living.	Ap

Course Outcomes	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	Automotive Design and Manufacturing	Automotive Electrical Electronics	Automotive Technology and Management
1		2	2	3	3	3	3	2	2		3			
2		2	2	3	3	3	3	2	2		3			
3		2	2	2	2	3	3	2	2		3			
4		2	2	2	2	3	3	2	2		3			
5		2	2	3	3	3	3	2	2		3			

Course Content	
Introduction to Value Education Value Education- Self-exploration as the Process for Value Education- Basic Human Aspirations and their Fulfilment- Right Understanding, Relationship and Physical Facility- Happiness and Prosperity – Current Scenario- Method to Fulfil the Basic Human Aspirations.	**3 Hours**
Harmony in the Human Being Human Being as Co-existence of the Self and the Body- Distinguishing between the Needs of the Self and the Body- The Body as an Instrument of the Self- Understanding Harmony in the Self- Harmony of the Self with the Body- Programs to Ensure Self-regulation and Health.	**3 Hours**
Harmony in the Family and Society Harmony in the Family –The Basic Unit of Human Interaction-'Trust' – The Foundational Value in Relationship-Respect – As the Right Evaluation- Other Values in Human-to-Human Relationship- Understanding Harmony in the SocietyLecture Vision for the Universal Human Order.	**3 Hours**
Harmony in the Nature (Existence) Understanding Harmony in Nature- Interconnectedness, Self-regulation and Mutual Fulfilment among the Four Orders of Nature- Realizing Existence as Co-existence at All Levels- The Holistic Perception of Harmony in Existence.	**3 Hours**
Implications of the Holistic Understanding- A Look at Professional Ethics Basis for Universal Human Values-Definitiveness of (Ethical) Human Conduct - professional Ethics in the Light of Right Understanding-A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order-Holistic Technologies, Production Systems-and Management Models-Typical Case Studies Strategies for Transition towards Value-based Life and Profession	**3 Hours**

Theory Hours: 15	Tutorial Hours:	Practical Hours:	Project Hours:	Total Hours: 15

Learning Resources

Textbooks:

1. Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, Excel Books, New Delhi, 2010.
2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.

References:

1. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, Jeevan Vidya:Publishers, 1999.

Online Resources (Weblinks)

https://www.uhv.org.in/uhv-ii

Assessment (Theory course)

SA I and SA II, Activity and Learning Task(s), MCQ, End Semester Examination (ESE)

Course Curated by			
Expert(s) from Industry	**Expert(s) from Higher Education Institution**	**Internal Expert(s)**	
	Sh. Umesh Jadhav, NCCIP (National Co-oridnation Committee)-AICTE	Dr.S.Sivakumar, Associate Professor, Automobile & Head /SFS Dr.R.Prakasam, Assistant Professor,Physics Mr.J.Sivaguru, Assistant Professor, Department of Mechatronics	
Recommended by BoS on	03-05-2025		
Academic Council Approval		**Date**	26-06-2025

24INP201	INNOVATION PRACTICUM - 3	L	T	P	J	C
		0	0	2	0	1
ES		SDG				

Pre-requisite courses		Data Book / Code book (If any)	NA

Course Objectives:

The purpose of taking this course is to:

1	Develop a deep understanding of the innovation process and apply customer-centric thinking to innovation
2	Evaluate the feasibility and viability of innovation ideas.
3	Optimise innovation projects for efficiency and effectiveness and communicate the ideas effectively.

Course Outcomes

After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO 1	Analyse the various stages of innovation and their interdependencies	An
CO 2	Create innovative solutions that address specific customer needs	E
CO 3	Evaluate the potential impact and risks of different innovation concepts and present them clearly and persuasively.	E

Course Outcomes	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	Automotive Design and Manufacturing	Automotive Electrical Electronics	Automotive Technology and Management
1														
2														
3														

Course Content

IDEA WORTH PROTOTYPING	06 Hours
Discuss potential risks and challenges associated with innovative ideas, Learn to refine and validate the initial concept, Develop a plan outlining key milestones and timelines for advancing from idea to prototype.	

FRAMING THE CHALLENGE Define the specific problem or opportunity that the innovation aims to address, understand customer needs and preferences, Identify the gaps in the market and potential obstacles to adoption, assess the potential market size, competition, and feasibility.	**04 Hours**
CRAFTING HIGH-VALUE SOLUTIONS Generate Minimum Usable Prototype (MUP) concepts that address the identified challenge that provide high value, evaluate the potential of each solution concept based on criteria like feasibility, viability, and desirability	**04 Hours**
OPTIMIZATION AND PLANNING PRACTICAL COMPONENT: Create Bill of Quantities (BOQ) and Bill of Materials (BOM) to estimate costs and resources, Develop a comprehensive innovation proposal outlining the innovation concept, goals, and benefits, Implement Lean principles to improve efficiency and reduce waste in the innovation process, Reflect on the activities to identify areas for improvement and learning.	**06 Hours**
PROJECT PRESENTATION Develop and deliver a compelling presentation of your minimum usable prototype (MUP) and innovation solution to effectively communicate its value and impact to a broader audience. Create a visually engaging presentation that clearly outlines the problem, the proposed solution, and the value of your minimum usable prototype. Utilise tools such as slides, infographics, and videos to enhance the visual appeal. Craft a compelling story around your innovation. Highlight the journey from problem identification to solution development, emphasising key insights and milestones.	**10 Hours**
Theory Hours: - Tutorial Hours: - Practical Hours: 30 Project Hours: - Total Hours:30	

Learning Resources

References:

1. https://formlabs.com/blog/ultimate-guide-to-prototyping-tools-for-hardware-and-product-desi gn/
2. https://docs.kicad-pcb.org/
3. https://www.tinkercad.com/learn/circuits
4. https://docs.github.com/en/free-pro- team@latest/actions/guides
5. Everything you need about value proposition:
6. https://blog.forgeforward.in/everything-you-need-to-know-about-value-proposition-7247493c9 40c
7. Test your Value Proposition:
8. http://businessmodelalchemist.com/2012/09/test-your-value-proposition-supercharge-lean-s tartup-and-custdev-principles.html
9. Valuation Risk versus Validation Risk in Product Innovations: https://blog.forgeforward.in/valuation-risk-versus-validation-risk-in-product-innovations-49f25 3ca8624
10. User Guide for Product Innovation Rubric:
11. https://blog.forgeforward.in/user-guide-for-product-innovation-rubric-857181b253dd
12. Innovation Risk Diagnostic — Product Innovation Rubric: https://blog.forgeforward.in/product-innovation-rubric-adf5ebdfd356
13. Evaluating Product Innovations — proof, potential, & progress:https://blog.forgeforward.in/evaluating-product-innovations-e8178e58b86e

Assessment (Practical course)			
Lab Workbook, Experimental Cycle tests, viva-voce			
Course Curated by			
Expert(s) from Industry	**Expert(s) from Higher Education Institution**	**Internal Expert(s)**	
		Dr.B.L.Lakshmi Meera VP & CPO, Forge.Innovation & Ventures	
Recommended by BoS on	03/ 05/ 2025		
Academic Council Approval	No.	**Date**	26.6.25

24AUJ206	Internship -I	L	T	P	J	C
		0	0	0	2	1
PRJ		SDG				

Pre-requisite courses		Data Book / Codes / Standards (If any)	

Course Objectives:	The purpose of taking this course is to
1	Provide awareness of current technologies, tools, and trends in Automotive industries through hands-on exposure and interaction with industry professionals.
2	equip students with an understanding of industrial safety protocols, engineering standards, and professional ethics
3	To enhance problem solving abilities and innovation through observation, interaction with industry professionals.

Course Outcomes:	After successful completion of this course, the students shall be able to	Bloom's Taxonomy Level (BTL)
CO 1	Apply the knowledge of automotive engineering to practical industrial task, projects and problem-solving scenarios	Ap
CO 2	Adhere to industrial safety norms, standards, and ethical practices relevant to engineering workplaces	Ap
CO 3	Understand the functioning and performance of automotive systems, equipment, control systems, and processes.	U
CO 4	Prepare technical documentation and effectively communicate project findings in both written and verbal formats.	An
CO 5	Demonstrate teamwork, adaptability, and professional behaviour while working in a multidisciplinary industrial environment	Ap

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11			
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	Automotive Design and Manufacturing	Automotive Electrical Electronics	Automotive Technology and Management
1	3	2	2	2	3				1		2	3	3	3
2	2	2			2	2	3		1		2	2	2	2
3	3	3	2	2	3			2	1		2	3	3	3
4	2	1	1	1	2			2	3		2	2	2	2
5	2	2	1			2	2	3	2	3	2	2	2	2

Assessment (Embedded course)
Presentation and Internship Report

Course Curated by			
Expert(s) from Industry	**Expert(s) from Higher Education Institution**	**Internal Expert(s)**	
		Dr.Andrew Pon Abraham HoD/ Automobile Engineering	
Recommended by BoS on			
Academic Council Approval		**Date**	

SEMESTER IV

24HSP006	Mastering Group Discussion and Presentation Skills	L	T	P	J	C
		0	0	2	0	1
HS		SDG	7,9,11,12,13			

Pre-requisite courses	Nil	Data Book / Code book (If any)	NA

Course Objectives:	
The purpose of taking this course is to:	
1	To equip learners with techniques for organizing and presenting ideas effectively, ensuring logical flow and engaging delivery through appropriate visual and verbal strategies.
2	To enhance students' ability to evaluate diverse viewpoints and articulate reasoned arguments, fostering meaningful participation in collaborative discussions.
3	To strengthen students' ability to adapt their speaking style and content to different audiences and contexts, utilizing digital tools for enhanced presentation effectiveness.

Course Outcomes		
After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO 1	Create and deliver structured presentations with a clear introduction, body, and conclusion, utilizing effective visual tools and appropriate pacing to enhance clarity and impact.	C
CO 2	Analyse issues from multiple perspectives, articulate ideas effectively within group discussions	An
CO 3	Deliver confident presentations and speeches in professional and social settings, leveraging digital tools and technologies to enhance quality and effectiveness.	Ap

Course Outcomes	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	Automotive Design and Manufacturing	Automotive Electrical Electronics	Automotive Technology and Management
1	1		2			1	2		3	3				
2	2		2			1	2		3	3				
3	3		2			1	2		3	3				

Course Content	
Introduction to Group Discussions - Key skills for effective participation - Phases in a GD - Conversational Phrases in GD. **Group Dynamics** - Understanding group roles and dynamics - Conflict resolution and management in groups - Techniques for fostering collaboration. **Presentations** - Introduction to Visual Aids and Technology in Presentations.	**6 Hours**
Delivery Techniques - Voice modulation and speech clarity - Body language and gestures – audience analysis. **Handling Q&A Sessions** - Preparing for audience questions - Techniques for handling difficult questions - Mock Presentation with Q&A sessions.	**6 Hours**
Factual Group Discussions: Focus on sharing and verifying accurate information on a given topic. Participants base their contributions on verifiable data and concrete evidence. **Opinion-based / Argumentative Group Discussion**: Encourages participants to express and defend their point of view on a topic. Evaluate different perspectives and build critical thinking skills.	**6 Hours**
Case Study Group Discussion: Involves analyzing the complexities, identifying key issues, and developing insights or solutions based on the group's collective knowledge. **Abstract Discussion**: Deals with intangible concepts, ideas, or themes without concrete reference points. Encourages creative thinking and theoretical exploration.	**6 Hours**
Impromptu Presentations: Participants speak on a given topic with little to no preparation. Helps develop quick thinking and effective communication skills. **Informative Presentation**: Aims to educate the audience on a specific topic by providing clear, factual information. The focus is on clarity, accuracy, and comprehensiveness. **Demonstrative Presentation**: Interactive sessions where participants engage in hands- on activities to learn practical skills. Often includes exercises, demonstrations, and collaborative tasks.	**6 Hours**

Theory Hours:	Tutorial Hours:	Practical Hours: 30	Project Hours:	Total Hours: 30

Learning Resources
Textbooks:
1. Galanes, G. J., Adams, K., & Brilhart, J. K. (2020). Effective group discussion: Theory and practice (15th ed.). McGraw-Hill Education. 2. Adams, K., & Galanes, G. (2018). Communicating in groups: Applications and skills, a practical guide (18th ed.). McGraw-Hill Education.
References:
1. Powell, M. (2010). Dynamic presentations student's book with audio CDs (2). 2. Cambridge University Press. 3. Reynolds, G. (2011). Presentation Zen: Simple ideas on presentation design and delivery. New Riders. 4. Ivy, D. K., & Backlund, P. (2018). Speak with confidence: A practical guide. Pearson. 5. Reynolds, G. (2019). Presentation Zen: Simple ideas on presentation design and delivery. New Riders.
Online Educational Resources:
1. https://www.coursera.org/learn/verbal-communications-and-presentation-skills

2. https://www.coursera.org/learn/present-with-purpose 3. https://www.coursera.org/learn/teamwork-skills-effective-communication

Assessment (Theory course)	
Formative	Summative
-----	1. Participation in group discussions (40%) 2. Individual presentations (40%) 3. Quizzes and written assignments (20%)

Course Curated by			
Expert(s) from Industry	**Expert(s) from Higher Education Institution**		**Internal Expert(s)**
Mr. Bhuvana Sundar Soorappaiah Program Manager Bosch, Coimbatore	Dr Kishore Selva Babu Head and Associate Professor Department of English and Cultural Studies Christ University Bangalore		Dr. J Srikala- AP III Dr. C Tissaa Tony - AP III Dr. S G Mohanraj – AP III Dr. S Sreejan – AP III Dr. R Hema – AP II Dr. A S Mythili - AP II
Recommended by BoS on	25/04/2025		
Academic Council Approval	Yes	**Date**	

24MAI241	NUMERICAL METHODS AND PROBABILITY (Common to AE, AU, CE, ME, MC)	L	T	P	J	C
		3	0	2	0	4
HS		SDG		8, 9		

Pre-requisite courses	Partial differential equations and Transforms Techniques	Data Book / Code book (If any)	Normal table

Course Objectives:	
The purpose of taking this course is to:	
1	Solve algebraic and transcendental equations where analytical solutions are impractical or impossible.
2	Develop the ability to solve engineering problems and other real-world applications using interpolation and integration methods for both data analysis and numerical solutions.
3	Critically analyse the performance of different numerical methods in terms of accuracy, stability, and computational efficiency for solving PDEs in practical engineering applications.
4	Apply probability theory to model and solve real-world problems involving uncertainty, risk analysis, and decision-making in engineering, business, and science.
5	Study and apply standard probability distributions, with emphasis on the Poisson and Normal distributions, including their properties, applications, and parameter interpretation.

Course Outcomes		
After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO1	Develop algorithmic and computational skills to implement these numerical techniques using programming or mathematical tools.	Ap
CO2	Analyze and compare the accuracy and efficiency of various interpolation and integration techniques in solving real-world numerical problems.	An
CO3	Implement numerical schemes and compute approximate solutions for both heat and wave equations using finite difference methods.	Ap
CO4	Implement and simulate the solution of 2D Laplace and Poisson equations using numerical algorithms on rectangular domains.	Ap
CO5	Analyze and model real-world problems involving uncertainty using fundamental probability concepts.	An
CO6	interpret and use distribution-related concepts in statistical modelling and data analysis.	An

Course Outcomes	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	Automotive Design and Manufacturing	Automotive Electrical Electronics	Automotive Technology and Management
1	2										1			
2	2										1			
3	2										2			
4	3	2									2			
5	3	2			2						2			
6	3	2			2						2			

Course Content

NUMERICAL SOLUTION OF ALGEBRAIC AND TRANSCENDENTAL EQUATIONS Linear interpolation method-Newton's method –Solution of linear system in engineering field by Gaussian elimination, Gauss Jordan method - Iterative method: Gauss Seidel method – Inverse of a matrix by Gauss Jordan method. **Practical Component** • Gauss Elimination & Inverse by Gauss Jordan method • Newton Raphson method.	**9 Hours** **6 Hours**
INTERPOLATION, NUMERICAL DIFFERENTIATION AND INTEGRATION Newton's forward, backward and divided difference interpolation – Approximation of derivatives using interpolation polynomials – Numerical integration using Trapezoidal and Simpson's rules(single integration) **Practical Component** • Newtons divided difference interpolation • Numerical integration by Simpsons rule	**9 Hours** **6 Hours**
SOLUTION OF BOUNDARY VALUE PROBLEMS Solution of one-dimensional heat equation using Bender Schmidt difference scheme – Solution of one-dimensional wave equation by explicit scheme. Finite difference techniques for the solution of two-dimensional Laplace's and Poisson's equations on rectangular domain. **Practical Component** • Solution of one-dimensional heat equation using Bender Schmidt method • Solution of one-dimensional wave equation by explicit scheme	**9 Hours** **6 Hours**

PROBABILITY THEORY Axioms of probability - Conditional probability – Total probability – Bayes' theorem **Practical Component** • Introduction to R Programming • Probability and Bayes' Theorem **in** R programming,	**9 Hours** **6 Hours**
RANDOM VARIABLES Random variable – Distribution function – properties – Probability mass function- Probability density function –Poisson and Normal distributions – Properties. **Practical Component** • Application of Poisson distribution • Application of normal distribution	**9 Hours** **6 Hours**

Theory Hours:	**45**	**Tutorial Hours:**		**Practical Hours:**	**30**	**Project Hours:**		**Total Hours:**	**75**

Learning Resources

Textbooks:

1. Steven C. Chapra and Raymond P. Canale., Numerical Methods for Engineers with Programming and Software Applications., McGraw-Hill, 7th Edition (2021).
2. Johnson R.A., Miller I and Freund J., Miller and Freund's Probability and Statistics for Engineers., Pearson Education, Asia 8th Edition (2015).

References:

1. Numerical Methods for Scientific and Engineering Computation by M.K. Jain, S.R.K.Iyengar and R.K. Jain, New Age International Publishers 2019.
2. Gupta S.C and Kapoor V.K, "Fundamentals of Mathematical Statistics", 11th extensively revised edition, Sultan Chand & Sons, 2020.
3. Conte S.D and Carl de Boor., Elementary Numerical Analysis - An Algorithmic Approach., McGraw-Hill (2018)
4. John H. Mathews and Kurtis D. Fink., Numerical Methods using MATLAB, Prentice Hall of India,4th Edition (2021).

Online Educational Resources:

1. Numerical Analysis: https://nptel.ac.in/courses/111106101
2. Probability and Statistics: https//nptel.ac.in/courses/111105041

Assessment (Theory course)	
Formative	Summative
Assignments-Open Book Test/Quiz/Case Study Analysis/Group Presentation/Poster Preparation/Mathematical Models, .,	MCQ, SA- I,SA – II and End Semester Examination (ESE)

Course Curated by

Expert(s) from Industry	Expert(s) from Higher Education Institution	Internal Expert(s)
Dr. R Vasu Business Excellence and Management Systems Consultant Specialisation in	Dr. M. Sivakumar, Assistant Professor Sr. Grade Vellore Institute of Technology, Vellore	Dr. S. Meena Priyadarshini

Process Excellence, Six Sigma Quality, Health Safety & Environment Systems Vice President (Retired) Brakes India.	Dr. Ramesh Babu Assistant Professor (SG) Amrita University Coimbatore, Tamil Nadu.		
Recommended by BoS on	25/04/2025		
Academic Council Approval	Yes	**Date**	

24AUI207	Automotive Powertrain	L	T	P	J	C
		2	0	2	0	3
Professional core		SDG	7,9,11,12,13			

Pre-requisite courses	24AUT202 & Heat Power Engineering	Data Book / Code book (If any)	NA

Course Objectives:	
The purpose of taking this course is to:	
1	To introduce the fundamental construction and components of internal combustion (IC) engines
2	To give insights on modern fuel injection systems like Multi-Point Fuel Injection (MPFI) and Common Rail Direct Injection (CRDI).
3	To enable students to understand the combustion processes in IC engines and evaluate how they affect engine performance, efficiency, and emissions
4	To familiarize students with alternate energy sources for automotive applications, focusing particularly on electric vehicle (EV) technologies and their powertrain architectures.
5	To provide insights into cooling and lubrication systems in both IC engines and EVs, highlighting the design and operational differences between conventional and electric powerplants

Course Outcomes		
After successful completion of this course, the students shall be able to		**Revised Bloom's Taxonomy Levels (RBT)**
CO 1	List the main parts of petrol and diesel engines, intake and exhaust systems, Turbocharging and supercharging methods.	R
CO 2	Examine the combustion process in SI and CI Engine for understanding the performance and emission characteristics.	U
CO 3	Explain how different engine types, fuel injection systems, ignition systems, and combustion chamber types in petrol and diesel engine	U
CO 4	Explain the basic working principles of Electric Vehicles, their classifications (BEV, HEV, PHEV),and recall various alternate fuels such as CNG, LPG, biodiesel, hydrogen and ethanol	U
CO 5	Choose and design the right cooling and lubrication systems for suitable engine and electric powertrain systems methods for better performance and efficiency	AP
CO 6	Demonstrate about finding of various fuel properties and analyse its performance, combustion and parameters in I.C engines	An

Course Outcomes	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	Automotive Design and Manufacturing	Automotive Electrical Electronics	Automotive Technology and Management
1	3	2	1	1	1	1						2	2	1
2	3	2	2	1	2	1						2	3	2
3	3	2	2	2	3	1						3	3	2
4	3	3	2	2	2	2						3	2	2
5	3	3	3	2	3	2						3	3	3
6	3	3	3	2	3	2						3	3	3

Course Content

ENGINE CONSTRUCTION AND ITS COMPONENT Four stroke SI and CI engines – Working principle - Constructional details of engine components, function, materials, Intake system components - intake manifold, Connecting Pipe, Exhaust system components – Exhaust manifold and exhaust pipe, Spark arresters - Exhaust mufflers, Types, operation-Supercharger and its types- Turbo charging methods – Engine exhaust manifold arrangements. **Practical Component** 2) Dismantling and Assembly of Two-wheeler Engine 3) Dismantling and Assembly of Four-wheeler Engine	**5 Hours** **6 Hours**
I.C ENGINE FUEL INDUCTION SYSTEMS Gasoline injection systems - throttle body injection, advanced GDI and multi point fuel injection system, Electronic ignition systems – distributor less ignition system, solid-state ignition system,Diesel injections system-Types: Direct and Indirect combustion chamber with its types-CRDI system: Construction and working. **Practical Component** 1) Study on various components of CRDI fuel injection system 2) Study on various components of MPFI fuel injection system	**6 Hours** **4 Hours**

COMBUSTION IN SI AND CI ENGINES Combustion process in IC engines, Stages of combustion in S.I and C.I engines, – Delay period and Flame propagation – Factors affecting delay period and Flame propagation - Abnormal combustion in S.I and C.I Engines- Theories of detonation, methods of controlling knock., Importance of air motion in C.I Engines – Swirl, squish and turbulence – Swirl ratio **Practical Component** 1) Experimental Investigation on Performance, combustion and emission characteristics of multi cylinder S.I Engine 2) Experimental investigation on performance and emission characteristics of Twin cylinder C.I engines 3) Experimental Investigation on effect of Injection pressure on performance, combustion and emission characteristics of Single cylinder D.I Diesel engines	**7 Hours** **10 Hours**
ALTERNATE ENERGY SOURCES AND ELECTRIC VEHICLES Need for alternate energy in automotive industry- Overview of Alternate Fuels: CNG, LPG, Biodiesel, Hydrogen, Ethanol- Introduction to Electric Vehicles- Types: BEVs, HEVs, PHEVs- Basic architecture of an electric powertrain- Battery types and basic Battery Management Systems- Motor types used in EVs- BLDC, PMSM, Induction Motor, Switched Reluctance Motor(SRM)	**6 Hours**
LUBRICATION AND COOLING SYSTEM Need for cooling system – Types of cooling system – Liquid cooled system: Thermosyphon system, Forced circulation system, pressure cooling system – properties of coolant, additives for coolants Need for lubrication system – Mist lubrication system, wet sump any dry sump lubrication – Properties of lubricants, consumption of oil, Electric vehicle cooling systems – Types of cooling system-Active cooling system: Air cooling, Liquid cooling-Passive cooling system: Phase change material cooling-Hybrid cooling system. **Practical Component:** 1) Determination of Viscosity of the given fuels 2) Determination of Flash and Fire points of fuels. 3) Determination of Cloud and Pour point of Fuels 4) Determination of Calorific valve of given fuels	**6 Hours** **10 Hours**

Self Learning Topics: (Hours: 5)

- Overview of combustion principles of various other combustion-based engines
- Turbocharger and super charger volumetric efficiency curves
- Cooling systems adopted in EV battery modules and motors
- Hybrid based cooling systems adopted in EV vehicles

Theory Hours:	**45**	**Tutorial Hours:**		**Practical Hours:**	**30**	**Project Hours:**		**Total Hours:**	**75**

Learning Resources

Textbooks:

1. V. Ganesan, Internal Combustion Engines, 4th ed., New Delhi, India: Tata McGraw-Hill Education, 2017.
2. J. B. Heywood, Internal Combustion Engine Fundamentals, New York, NY, USA: McGraw-Hill, 2017.
3. J. Larminie and J. Lowry, Electric Vehicle Technology Explained, 2nd ed., Hoboken, NJ, USA:Wiley, 2017.

References:

4. B. P. Pundir, IC Engines Combustion and Emissions, New Delhi, India: Narosa Publishers, 2010.
5. Mohankumar Subramaniam et al ", Experimental investigation on performance, combustion and emission characteristics of DI diesel engine using algae as a biodiesel, Energy Reports, Volume 6,2020, Pages 1382-1392
6. S.T.P. Purayil et al ,"Review of hydrogen–gasoline SI dual fuel engines: Engine performance and emission, Energy Reports, Volume 9,2023, Pages 4547-4573

Online Educational Resources:

1. https://unacademy.com/course/automobile-engineering-the-basics/IQ67QP2X
2. https://unacademy.com/course/course-on-internal-combustion-engine/OOSWCM7I
3. https://www.sciencedirect.com/science/article/pii/S2352484719310625
4. https://www.sciencedirect.com/science/article/pii/S2352484723002913
5. https://www.sciencedirect.com/science/article/pii/S1110016815000162

Assessment (Embedded course)

CAT, Activity and Learning Task(s)*, Mini project, MCQ, End Semester Examination (ESE)
Lab Workbook, Experimental Cycle tests, viva-voce, etc…

Course Curated by

Expert(s) from Industry	Expert(s) from Higher Education Institution	Internal Expert(s)
Mr.Sasikumar Head – Powertrain Jeyam Automotives Pvt. Ltd., Coimbatore	**Dr. P. Senthilkumar** Associate Professor/ Automobile Engineering Madras Institute of Technology, Chennai	**Dr. S Mohankumar**, Automobile Engineering

Recommended by BoS on	05/12/2025		
Academic Council Approval	Yes	**Date**	24/12/2025

24AUI208	Fluid Mechanics and Heat Transfer	L	T	P	J	C
		3	0	2	0	4
Professional Core		SDG	4,7,9,11,13			

Pre-requisite courses	24AUT202- Heat Power Engineering	Data Book / Codes / Standards (If any)	HMT Data book

Course Objectives:	The purpose of taking this course is to:
1	Impart fundamental knowledge of fluid properties, fluid statics, and heat transfer modes.
2	Enable students to analyze fluid flow and losses in automotive piping and thermal systems.
3	Develop competency in dimensional analysis and similitude for scaling automotive fluid systems.
4	Apply heat transfer principles to automotive engines, cooling systems, and thermal components.
5	Develop experimental and analytical skills for fluid flow and heat transfer measurements.

Course Outcomes:	After successful completion of this course, the students shall be able to	Bloom's Taxonomy Level (BTL)
CO 1	Explain the fundamental properties of fluids, the principles of fluid statics, and the mechanisms governing different modes of heat transfer.	U
CO 2	Explain principles of fluid motion, dimensional analysis, and heat transfer mechanisms.	U
CO 3	Apply fluid mechanics principles to analyze flow and losses in fluid systems.	Ap
CO 4	Apply heat conduction, convection, and radiation principles to solve thermal engineering problems.	Ap
CO 5	Analyze the effect of flow and thermal parameters on the performance of engineering components and systems.	An
CO 6	Evaluate experimental data to determine flow rate, friction factor, and heat transfer coefficients.	E

Course Outcomes	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	Automotive Design and Manufacturing	Automotive Electrical Electronics	Automotive Technology and Management
1	3	2	–	–	–	–	–	–	–	–	1	2	–	–
2	3	2	–	–	–	–	–	–	–	–	2	2	–	–

3	3	3	2	2	–	–	–	–	–	–	3	3	–	–
4	3	2	2	2	–	–	–	–	–	–	2	3	–	–
5	3	3	2	3	–	–	–	–	–	–	3	3	–	–
6	2	3	–	3	3	–	–	–	–	–	3	2	–	–

Course Content

PROPERTIES OF FLUIDS AND FLUID STATICS Properties of fluid, Newton's law of viscosity, compressibility, bulk modulus, surface tension, capillarity. Types of fluids and classification of fluid flow. Fluid statics: Pascal's law, hydrostatic law, pressure measurement (manometers, pressure gauges), buoyancy, meta-centre. **Tutorial** Numerical problems on pressure, buoyancy, and metacentric height. **Practical Component:** 1. Determination of metacentric height and buoyancy of floating bodies.	**6 Hours** **3 Hours** **3 Hours**
FLUID DYNAMICS AND FLOW THROUGH PIPES Fluid dynamics: Euler's equation of motion, Bernoulli's equation and its applications – Venturimeter, Orificemeter, Pitot tube. Flow Through Pipes**:** Laminar and turbulent flow, Reynolds number, major and minor losses, Darcy-Weisbach equation, hydraulic gradient and total energy lines. **Tutorial** Problems on flow measurement, losses, and pipe networks. **Practical Component:** 1. Verification of Bernoulli's theorem 2. Discharge coefficient measurements – Venturimeter and Orificemeter 3. Determination of friction factor in pipe flow	**6 Hours** **3 Hours** **12 Hours**
DIMENSIONAL AND MODEL ANALYSIS Dimensions and dimensional homogeneity, Buckingham π theorem, similitude and model laws, Dimensionless numbers (Re, Fr, Pr, Gr, Nu), distorted models and scale-up techniques. **Tutorial** Formulation of π-terms.	**6 Hours** **2 hours**
HEAT CONDUCTION Modes of heat transfer, Fourier's law of conduction, Steady-state conduction in slabs, cylinders, and spheres, Internal heat generation, Extended surfaces (fins), Transient conduction – lumped system analysis. **Tutorial** Numerical problems on conduction and fins. **Practical Component:** 1. Thermal conductivity using hot plate apparatus. 2. Thermal conductivity using lagged pipe apparatus.	**6 Hours** **3 hours** **6 Hours**
CONVECTION AND RADIATION Convection: Boundary layer, Forced convection over flat plates, cylinders, and spheres, internal pipe flow. Free convection correlations. Heat exchanger - parallel flow and counterflow, LMTD, effectiveness–NTU. Radiation: black and gray bodies, emissivity, shape factor algebra, radiation shields. **Tutorial** Problems on convection and heat exchanger performance.	**6 Hours** **4 Hours**

Practical Component: 1. Free and forced convection experiments. 2. Pin-fin heat transfer study. 3. Emissivity measurement using Stefan-Boltzmann apparatus.	**9 Hours**

Self Learning Topics: (Hours: 5 Hrs)

1. Understanding fluid behavior at rest and its physical properties.
2. Application of energy and momentum principles to moving fluids.
3. Scaling and similarity of fluid systems using dimensionless parameters.
4. Heat transfer through solids in automotive components.
5. Heat transfer between surfaces and fluids in automotive systems

Theory Hours:	**30**	**Tutorial Hours:**	**15**	**Practical Hours:**	**30**	**Project Hours:**	**-**	**Total Hours:**	**75**

Learning Resources*

Textbooks

1. Yunus A. Çengel & John M. Cimbala., Fluid Mechanics: Fundamentals and Applications., McGraw Hill; 4th edition (2017)
2. J. P. Holman., Heat Transfer., McGraw Hill Education (2017).

Reference books/ Web Links

1. Frank M. White., Fluid Mechanics., McGraw Hill; Standard Edition (2022)
2. Nag, P.K.,Heat and Mass Transfer., McGraw Hill Education; 3rd edition (2011).
3. Yunus A. Cengel ,Afshin J. Ghajar., Heat and Mass Transfer - Fundamentals and Applications, McGraw Hill; Sixth edition (2020)

Online Resources

1. https://www.coursera.org/learn/fluid-power
2. https://onlinecourses.nptel.ac.in/noc23_ch65/preview

Assessment (Embedded course)

CAT, Activity and Learning Task(s)*, Mini project, MCQ, End Semester Examination (ESE)
Lab Workbook, Experimental Cycle tests, viva-voce, etc

Course Curated by

Expert(s) from Industry	Expert(s) from Higher Education Institution	Internal Expert(s)
Mr.Sasikumar Head – Powertrain Jeyam Automotives Pvt. Ltd., Coimbatore	**Dr.Karthikeyan. P** Professor, Department of Automobile Engineering, PSG Tech, Coimbatore	**Dr Andrew Pon Abraham J D**, Automobile Engineering, **Dr Aravind SL** Automobile Engineering

Recommended by BoS on	05/12/2025		
Academic Council Approval	Yes	**Date**	24/12/2025

24AUI209	Automotive Embedded Systems	L	T	P	J	C
		2	0	0	2	3
Professional Core		SDG	7,9,11,12,13			

Pre-requisite courses	24AUI204 -Automotive Electronics	Data Book / Code book (If any)	Nil

Course Objectives:

The purpose of taking this course is to:

1	Introduce the foundational concepts of embedded systems, 8-bit microcontroller architecture, and firmware management for automotive applications.
2	Enable learners to develop embedded applications using Embedded C, GPIO, Timers, Interrupts, ADC, DAC, Relays, and LCD interfaces for automotive control systems
3	Familiarize students with communication protocols - UART, Bluetooth

Course Outcomes

After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO 1	Understand the characteristics of embedded systems and demonstrate basic firmware flashing techniques.	U
CO 2	Apply Embedded C for implementing automotive control logic.	Ap
CO 3	Understand the architecture of 8-bit microcontrollers and the functionality of GPIO, Timers, and Interrupts	U
CO 4	Apply microcontroller interfacing concepts to integrate ADC, DAC, relay, and LCD for real-world automotive embedded applications.	Ap
CO 5	Apply UART and Bluetooth communication protocols to enable data exchange between MCU-to-MCU and MCU-to-device interfaces.	Ap
CO 6	Design and implement a mini automotive embedded system project using microcontroller peripherals and communication interfaces to solve a real-world automotive problem and demonstrate its working.	C

Course Outcomes	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	Automotive Design and Manufacturing	Automotive Electrical Electronics	Automotive Technology and Management
1	2	–	–	–	–	2	–	–	–	–	–		2	
2	3	–	–	–	2	–	–	–	–	–	–		2	
3	3	–	1	–	3	2	–	–	–	–	–		2	

4	3	2	3	–	3	2	–	2	–	–	–		2	
5	1	3	2	–	2	–	–	1	–	–	–		2	
6	3	3	3	2	3	2	1	3	2	2	2		2	

Course Content

MODULE 1: INTRODUCTION TO EMBEDDED SYSTEMS Definition and characteristics of embedded systems, Embedded system design process Harvard vs. Von Neumann architecture, RISC vs. CISC processors - Classification: small, medium, standalone, real-time systems. Introduction to microcontrollers & microprocessor: Components of Microcontroller, types of memory- Register, Special function Register, ROM RAM, Flash Memory. Firmware: Firmware vs. Software & Flashing Methods: Traditional method & Self-Programming Methods **Practical Component:** Activity 1: Identify and usage of flashing Tools for Microcontroller 8051 Acitivity2: Study of Different IDE and Installation of Keil IDE & Proteus IDE Acitivity3: Flashing sample program using Flash magic.	**6 Hours** **6 Hours**
Module2: Basics of Embedded C Programming Introduction to Embedded C: Definition, Difference between C and Embedded C - Variables, Data Types & Operators in Embedded C - Structure of an Embedded C program- Control Statements in Embedded C: Decision-Making Statements, Looping Statements, Jump Statements - Functions & Modular Embedded C: Function declaration & calling – bit & byte Level Programming - Arrays and Pointers in Embedded C **Practice Activity** Activity 1 : Create first C program in Keil – Compile, Build & Generate HEX file Activity 2 : Demonstrate If-Else logic by simulating Brake Light logic. Activity 3: Function-based program: engine start(), engine_stop() – call functions from main() Activity 4: Use Arrays to store 10 temperature readings & compute average Activity 5: Pointer exercise – Access variable using pointer and modify value via pointer Activity 6 : Bit-level operations – Toggle a variable bit using AND/OR/XOR mask	**6 Hours** **6 Hours**
MODULE 3: INTRODUCTION TO 8-BIT MICROCONTROLLER Architecture of 8 Bit controller - Memory organization and segmentation - Reset circuits: Power & Reset Management, Oscillator circuits – Peripherals of microcontroller - GPIO, Timer/Counter and interrupts. **Practical Component** Activity 1: Blink LED with GPIO using both 8-bit microcontrollers Activity 2: Generate PWM signal using Timer Activity 3: External interrupt demonstration	**6 Hours** **6 Hours**
MODULE 4: INTERFACING WITH MICROCONTROLLER Interfacing ADC and DAC, Interfacing digital & analog sensors - H-bridge DC motor control-Interfacing LCD displays - Relay driver circuits - Motor speed control via PWM **Practical Component** Activity 1: Low Battery Warning Detection (LED/Buzzer) Activity 2: Control DC motor direction using H-bridge (L298N) Activity 3: Measure RPM of a Motor using IR sensor and interrupt	**6 Hours** **6 Hours**

MODULE 5: COMMUNICATION PROTOCOLS Classification of communication protocols – Wired Protocol: Functions of UART, Data frame format, Registers for UART Communication. Wireless Protocols – Bluetooth: Fundamentals, communication concept, Bluetooth module structure (HC-05/HC-06), Interfacing Bluetooth with Microcontroller.	**6 Hours**
Practical Component Activity 1: UART communication between two MCUs using MAX232 Activity 2: Bluetooth control of LED/motor using smartphone app	**6 Hours**

Self Learning Topics: (5 Hours)

- C Programming and Embedded C
- Microcontroller Architecture
- Automotive sensors and actuators
- PCB design for Electronic control unit development

Theory Hours:	**30**	**Tutorial Hours:**	**Practical Hours:**	**Project Hours:**	**30**	**Total Hours:**	**60**

Learning Resources

Textbooks:

1. Yalamanchili, Satheesh., Fundamentals of Automotive Embedded Systems, Wiley India, New Delhi (2022).
2. Ramesh, Gaonkar., Embedded Microcontroller and Embedded Systems, Penram International, Mumbai (2012).
3. Pont, Michael J., Embedded C, Pearson Education, New Delhi (2008).

References:

1. Shibu, K.V., Introduction to Embedded Systems, Tata McGraw-Hill, New Delhi (2009).
2. Navet, Nicolas and Simonot-Lion, Françoise., Automotive Embedded Systems Handbook, CRC Press, Boca Raton (2009).

Online Educational Resources:

1. https://www.freertos.org
2. https://www.microchip.com/design-centers/embedded-control
3. https://www.vector.com/int/en/products/products-a-z/software/autosar
4. https://nptel.ac.in/courses/108105102

Assessment (Embedded course)

CAT, Activity and Learning Task(s)*, Mini project, MCQ, End Semester Examination (ESE)
Lab Workbook, Experimental Cycle tests, viva-voce, etc…

Course Curated by			
Expert(s) from Industry	**Expert(s) from Higher Education Institution**		**Internal Expert(s)**
Mr. Suresh Hardware Manager Zed Digital, Coimbatore	**Dr.Senthil Kumar D** Associate Professor Amrita School of Engineering, Coimbatore		**Dr. A. Prabhakaran,** Automobile Engineering
Recommended by BoS on	05/12/2025		
Academic Council Approval	Yes	**Date**	24/12/2025

24AUT210	Design of Machine Elements	L	T	P	J	C
		2	1	0	0	3
PC		SDG	4,8			

Pre-requisite courses	24AUI203- Strength of Materials	Data Book / Codes / Standards (If any)	Design Data Book (PSG)

Course Objectives:	The purpose of taking this course is to:
1	Introduce the fundamental concepts of machine design, including design standards, material selection, and failure theories.
2	Develop the ability to analyze and design machine elements such as shafts, springs, gears, bearings, and welded joints under various loading conditions.
3	Enable students to apply concepts of static, dynamic, and fatigue loading in the safe and efficient design of mechanical components.
4	Familiarize students with the use of the Design Data Book as a standard reference for solving real-world design problems.
5	Encourage a systematic approach to mechanical design by integrating theoretical knowledge with practical engineering judgment

Course Outcomes:	After successful completion of this course, the students shall be able to	Bloom's Taxonomy Level (BTL)
CO 1	Apply design standards, material selection criteria, factor of safety, endurance limit concepts, and failure theories to solve mechanical design problems Using Design Data Books	Ap
CO 2	Design and calculate solid and hollow shafts and springs using strength, rigidity, and fatigue considerations. using Data Book.	Ap
CO 3	Apply gear tooth strength theories and design equations to design spur, helical, bevel, and worm gear systems.	Ap
CO 4	Calculate and determine load capacity, life, and lubrication requirements to design journal, ball, and roller bearings.	Ap
CO 5	Apply weld strength equations to design butt welds, fillet welds, and eccentrically loaded welded joints under static and fatigue loading.	Ap

Course Outcomes	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	Automotive Design and Manufacturing	Automotive Electrical Electronics	Automotive Technology and Management
1	3	2	2									3		
2	3	2	3	2	2						2	3		
3	3	2	3	2	2						2	3		
4	3	2	2	3							2	3		
5	3	2	2							2		3		

Course Content

INTRODUCTION Introduction to design, Standards in design (ISO, BIS, ASME), Classification of design – Selection of materials – Factors of safety in design- Stress concentration – Endurance limit of materials – Determination of endurance limit for ductile materials – Theories of failure -Maximum normal stress, Maximum shear stress, Distortion energy. **Tutorial Component:** Problems on factor of safety and stress concentration factor Problems on endurance limit Problems on Theories of failure	**6 Hours** **3 Hours**
DESIGN OF SHAFTS AND SPRINGS Design of shafts based on strength and rigidity – Design of hollow shafts. Types of springs and applications- Design of helical springs for static and fatigue loading, Leaf springs – design and material selection **Tutorial Component:** Problems on solid Shaft and Hollow shaft Problems on Shaft Problems on spring	**6 Hours** **3 Hours**
GEAR DESIGN Design considerations – strength of gear teeth – Lewis's equation – Terminology of gears Dynamic tooth load – Design of spur gears – helical gears – bevel gears and worm Gears. **Tutorial Component:** Problems on Spur Gear Problems on Bevel Gear Problems on Worm and Worm Wheel Gear	**6 Hours** **3 Hours**

DESIGN OF BEARINGS Design of journal bearings– Ball and Roller bearings – Types of Roller bearings – Bearing life – Static load capacity – Dynamic load capacity – Bearing material – Boundary lubrication – Oil flow and temperature rise. **Tutorial Component:** Problems on Journal Bearing Problems on Roller Bearing Problems on bearing life	**6 Hours** **3 Hours**
DESIGN OF WELD JOINTS Introduction- Types of welded joints- Basic weld symbols – Design of Butt Welds- design of fillet welds – design of tee joint – Strength of welded joints – eccentrically loaded welded joints- Fatigue strength of welded joints. **Tutorial Component:** Design of Butt Weld and fillet Weld Problems on Eccentrically loaded weld Problems on strength of Weld	**6 Hours** **3 Hours**

Theory Hours:	**30**	**Tutorial Hours:**	**15**	**Practical Hours:**		**Project Hours:**		**Total Hours:**	**45**

Learning Resources*

Textbooks

1. Bhandari, V.B., Design of Machine Elements., McGraw-Hill Education, (2010).
2. Sharma, C.S., and Purohit, K., Design of Machine Elements., Prentice-Hall of India, New Delhi (2003)
3. Jalaludeen, S. Md., Machine Design: Design of Machine Elements Volume-I., Anuradha Publications, New Delhi (2024)
4. Jalaludeen, S. Md., Machine Design Volume II: Design of Transmission Systems., Anuradha Publications, New Delhi (2018).
5. Vijayaraghavan, G.K., Design of Machine Elements., Lakshmi Publications, New Delhi (2015)

Reference books/ Web Links

1. Sharma, P.C., and Aggarwal, D.K., A Textbook of Machine Design., S.K. Kataria & Sons, (2013).
2. Shigley, Joseph E., and Mischke, Charles R., Mechanical Engineering Design., McGraw-Hill, (2004).
3. Hamrock, Bernard J., Schmid, Steven R., and Jacobson, Bo O., Fundamentals of Machine Elements., CRC Press, Boca Raton (2013)
4. Ashby, Michael F., Materials Selection in Mechanical Design., Butterworth-Heinemann, Boca Raton (2016)
5. Singh, Sadhu., Machine Design., Khanna Publishers, New Delhi (2015)

Online Resources

1. https://archive.nptel.ac.in/courses/112/105/112105125/
2. https://archive.nptel.ac.in/courses/112/105/112105124/
3. https://archive.nptel.ac.in/courses/112/106/112106137/

Assessment (Theory course)

CAT, Activity and Learning Task(s)*, Mini project, MCQ, End Semester Examination (ESE)

Course Curated by

Expert(s) from Industry	Expert(s) from Higher Education Institution	Internal Expert(s)
Mr. Hariprakash P Team Lead Herotec India, Coimbatore	**Dr.Karthikeyan. P** Professor PSG Tech, Coimbatore	Mr.B.Arun, Automobile Engineering
Recommended by BoS on	05/12/2025	
Academic Council Approval	Yes	**Date** 24/12/2025

24INM202	ENVIRONMENTAL SCIENCE AND SUSTAINABILITY (Common to All Branches)	L	T	P	J	C
		1	0	2	0	2
HS		SDG	6, 13, 15			

Pre-requisite courses	Nil	Data Book / Code book (If any)	NA

Course Objectives:	
The purpose of taking this course is to:	
1	To introduce the importance, types, and conservation strategies of natural resources, with a focus on sustainable practices in water and food management.
2	To understand the structure and function of ecosystems and biodiversity, and explore the need for conservation through the study of hotspots and global environmental concerns.
3	To examine the causes and effects of environmental degradation, including pollution and waste management, and to promote mitigation strategies for sustainable development.
4	To provide knowledge of the legal and institutional frameworks for environmental protection in India and globally, including critical environmental acts and enforcement challenges.
5	To explore conventional and alternative energy resources, and to assess methods for energy conservation and carbon footprint reduction through audits and sustainability measures.

Course Outcomes		
After successful completion of this course, the students shall be able to		**Revised Bloom's Taxonomy Levels (RBT)**
CO1	Apply the concept of natural resource conservation to demonstrate sustainable practices	Ap
CO2	Analyse the structure, function, and adaptive capacity of ecosystems to categorize threats and conservation strategies for biodiversity.	An
CO3	Analyse various forms of environmental degradation and propose management and preventive solutions.	An
CO4	Apply national environmental laws and frameworks in the personal and professional contexts	Ap
CO5	Design strategies using renewable energy principles to develop sustainable energy utilization plans through audits and footprint analysis to transfer a healthy environment for future generations.	Ap

Course Outcomes	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	Automotive Design and Manufacturing	Automotive Electrical Electronics	Automotive Technology and Management
1	2	–	–	–	–	2	3	–	1	–	–	–	–	–
2	2	2	–	–	–	2	3	1	–	–	–	–	–	–
3	2	3	–	2	–	3	3	1	–	–	–	–	–	–
4	–	2	–	–	–	3	3	3	1	2	2	–	–	–
5	2	2	3	2	2	3	3	–	1	2	2	–	–	–

Course Content

NATURAL RESOURCES **Introduction to Natural resources :** Types, significance, and conservation strategies **Water resources:** Utilization, management practices, and conservation strategies - rainwater harvesting methods.– Water distribution system audit **Food resources:** Challenges of food security in India - impact of modern agriculture, and environmental concerns related to fertilizers and pesticides. **Practical Component:** • Parameter Testing: Water / Effluent / Soil/Fertilizer • Simulation Experiments • Online Course	**3 Hours** **10 Hours**
ECOSYSTEM AND BIODIVERSITY **Ecosystem:** Structure and function of an ecosystem - ecosystem resilience and adaptive capacity **Biodiversity:** Values of biodiversity - Hot Spot of biodiversity (in the Himalayas, the Western Ghats, the Indo-Burma region, and the Gulf of Mannar) - Threats to biodiversity. **Conservation Strategies:** Emerging Issues in Biodiversity Conservation - Citizen science - In-situ and Ex-situ conservation of biodiversity. **Practical Component:** • Documentation of biodiversity in the campus	**3 Hours** **6 Hours**

ENVIRONMENTAL DEGRADATION AND MANAGEMENT **Pollution**: Causes, effects and control measures of Air pollution, Water pollution - Role of an individual in prevention of pollution **Waste management**: Circular Economy vs. Linear Economy - Disposal of solid wastes - Treatment of Liquid wastes **Disaster Management**: Mitigation strategies and Readiness **Practical Component:** • Waste Management and Resource recovery in Campus • Documentation of Environmental Data Resources and Monitoring Tools.	**3 Hours** **6 Hours**
LEGAL FRAMEWORK FOR ENVIRONMENTAL PROTECTION IN INDIA **Global and National Initiatives**: United Nations Sustainable Development Goals - Coastal Regulation Zone - Environmental impact assessment **Environmental Legislation in India**: Key Legal and Regulatory Terminology in India – Valuation of Ecosystem Services and integration of Acts in the workplace - Plastic Waste Management Rules - E-Waste Management Rules - Environment Protection Act – Air (Prevention and Control of Pollution) Act – Water (Prevention and control of Pollution) Act – Wildlife Protection Act – Forest Conservation Act **Implementation Challenges**: Issues involved in enforcement of environmental legislation **Practical Component:** • Online Course	**3 Hours** **2 Hours**
ENERGY MANAGEMENT **Energy Resources:** Energy Demand and Urban energy Challenges - Necessity of alternate energy methods - Renewable and Non- renewable energy resources - Carbon footprint and carbon credit – Sustainable energy utilization – Case study Energy Audits – Purpose, methodology, and common instruments used **Practical Component**: • Documentation of Energy usage through Carbon foot print calculation - Personal as well as Institutional	**3 Hours** **6 Hours**

Theory Hours:	**15**	**Tutorial Hours:**		**Practical Hours:**	**30**	**Project Hours:**		**Total Hours:**	**45**

Learning Resources
Textbooks:
References:
1. Bharucha, E. (2021). Textbook of environmental studies for undergraduate courses (3rd ed.). Orient BlackSwan / Universities Press - Hyderabad, India. 2. Miller, G. T., & Spoolman, S. E. (2014). Environmental science (14th ed.). Cengage India 3. Anubha Kaushik & C.P. Kaushik (2024). Perspectives in Environmental Studies (8th ed.). New Age International Publishers, New Delhi. 4. Masters, G. M., & Ela, W. P. (2013). Introduction to environmental engineering and science (3rd ed.). Pearson Education, New Delhi. 5. Leelakrishnan, P. (2018). Environmental law in India (3rd ed.). LexisNexis Butterworths, New Delhi.

6. Botkin, D. B., & Keller, E. A. (2014). Environmental science: Earth as a living planet (9th ed.). Wiley, Hoboken, NJ.
7. Armstrong, J. (2023). The future of energy: The 2023 guide to the energy transition. Independently published.
8. Easton, T. (Ed.). (2017). Taking sides: Clashing views on environmental issues (17th ed.). McGraw-Hill Education, New York, NY.
9. Ishwaran, N. (2022). Ecosystem services and economic valuation. New Delhi: TERI Press.

Online Educational Resources:

4. https://www.youtube.com/watch?v=j4Z6WmTnhRQ How to Conduct a Water Audit in Institutions
5. https://www.youtube.com/watch?v=_OKYio2Yk9U India's Food Security Challenge
6. https://www.youtube.com/watch?v=IjNT9Z2OLf4 India's Biodiversity Hotspots
7. https://www.youtube.com/watch?v=_c_sJIEJY4M What is Citizen Science?
8. https://www.youtube.com/watch?v=1HZR3GyzFZc What is a Circular Economy
9. https://www.youtube.com/watch?v=6_tLYyR_3Vo Environmental Law and Acts in India
10. https://www.youtube.com/watch?v=kGcrYkHwE80 Introduction to SDGs
11. https://www.youtube.com/watch?v=V eNSHdChA Conducting an Energy Audit
12. https://www.youtube.com/watch?v=dUqTt5Qrxn8 - What is Your Carbon Footprint?

Course Curated by

Expert(s) from Industry	Expert(s) from Higher Education Institution	Internal Expert(s)
Dr. Muthuraja Perumal General Manager - Research & Development Rohith Industries, APIIC Industrial Park, Andhra Pradesh	Dr. Mathivanan Packiarajan University of Michigan Ann Arbor, MI USA Dr. Venkatakrishnan Professor, School of Chemical Sciences Indian Institute of Technology (Mandi) Himachal Pradesh India	Faculty Of Chemistry Department of Chemistry

Recommended by BoS on	25/04/2025		
Academic Council Approval	Yes	**Date**	26-06-2025

24INM102	Indian knowledge Systems in Science and Engineering (Common to All branches)	L	T	P	J	C
		1	0	0	0	1
HS		SDG	5,16			

Pre- requisite courses	24INM001 Introduction to Indian Knowledge systems (IKS)	Data Book / Codes / Standards (If any)	

Course Objectives:	The purpose of taking this course is to:
1	Explore the Role of Traditional Knowledge in Basic Scientific Concepts
2	Know the science behind the establishment of traditional architecture
3	Revive ancient Indian aerospace, metallurgy and navigation technologies
4	Revitalize ancient textile traditions through sustainable practices, promoting eco-friendly materials
5	Explore and integrate ancient Indian medical systems like Ayurveda, Siddha & Rasa Shastra

Course Outcomes:	After successful completion of this course, the students shall be able to	Bloom's Taxonomy Level (BTL)
CO 1	Understanding Indigenous Knowledge Systems (IKS) in Science and Technology	U
CO 2	Apply Traditional Design Principles in Civil Engineering	Ap
CO 3	Explore of Ancient Aerospace Technologies for Aeronautical Engineering	E
CO 4	Know the sustainable traditional textile practices for ecofriendly atmosphere	R
CO 5	Gain knowledge of Ancient Medical Practices for Biotechnologists	U

Course Outcomes	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	Automotive Design and Manufacturing	Automotive Electrical Electronics	Automotive Technology and Management
1	2	2	2	2	1	2	3	1	2	1	3			
2	2	2	2	2	1	2	2	1	2	1	3			
3	2	2	2	2	1	2	2	1	2	1	3			
4	2	2	2	2	1	2	2	1	2	1	3			
5	2	2	2	2	1	2	2	1	2	1	3			

Course Content

IKS IN BASIC SCIENCES Study of ancient Indian concepts such as atomism (paramāṇu)- the five elements (Panchabhūta)- Exploration of alchemical practices, metallurgy-development of zero, decimal systems, algebra, and trigonometry - works by scholars such as Brahmagupta and Aryabhata- detailing planetary motions and timekeeping systems.	**3 Hours**
IKS IN CIVIL ENGINEERING Evolution from rock-cut caves to grand temples like Madurai Meenakshi and Brihadeeswarar.- Vastu Shastra- The Concept of "Mandala- Courtyard Design- Sacred Geometry- Panchabhuta- Chhatri- dome-shaped canopy- Prana Vayu- Shilpa Shastra- Sthapatya Veda- Kaalchakra- Brahmasthan.	**3 Hours**
IKS IN MECHANICAL ENGINEERING Exploration of ancient metallurgical techniques-including ore extraction-alloying, furnace design-Vimana (Flying Machines) - Shakti (Energy Source) -Aerospace materials- Vimana Shapes -Ancient Navigation- Vedic Astronomy- Flight Principles in Nature- Matrika Systems- Indian shipbuilding techniques and navigation methods.	**3 Hours**
IKS IN TEXTILE TECHNOLOGY Introduction to Ancient Indian Textiles- Cultural and Historical Context -Traditional Dyeing Techniques-Weaving Techniques and Patterns-Khadi- -Natural Fibers and Materials- Cotton,Silk,Wool and Jute-Sustainable Practices and Eco-Friendly Technologies-Organic Cotton Farming-Recycling and Repurposing.	**3 Hours**
IKS IN MEDICINE Ayurveda- Siddha Medicine- Rasa Shastra- Herbal Medicine- Nadi Pariksha-Chikitsa- Yoga and Pranayama- Surgical Techniques -Charaka Samhita - Sushruta Samhita— Panchagavya usage-Medicinal Plants and Herbal Remedies-Agricultural Practices and Crop Diversity-Sacred and Ritual Plants.	**3 Hours**

Theory Hours:	**15**	**Tutorial Hours:**		**Practical Hours:**		**Project Hours:**		**Total Hours:**	**15**

Learning Resources*

Textbooks

1. Indian Knowledge Systems: A Sustainable Approach: The Science of Self-Healing" by Vasant Lad, Excel India Publisher, 2024.
2. Indigenous Knowledge Systems: Towards a Holistic Inclusive Conservation, Satarupa Dutta
3. Majumder, Manohar Publishers & Distributors, 2019.

Reference books/ Web Links

1. Indian Knowledge System: Integrating Heritage with Engineering, Gagan Bansal, Deep Science Publishing, 2025Singh, Sadhu., Machine Design., Khanna Publishers, New Delhi (2015)

Online Resources

1. www.deepscienceresearch.com/dsr/catalog/book/70

Assessment (Theory course)
Presentation, MCQ, Assignment, Case Study and E Chart.

Course Curated by			
Expert(s) from Industry	**Expert(s) from Higher Education Institution**	**Internal Expert(s)**	
	Dr K Sangeetha, Professor and Head-Textile Department, IKS-Nodal officer, Bharathiar University, Coimbatore-46.	1 Dr.R. Prakasam, Assistant Professor, Department of Physics. Capt-A.R.Arul, Assistant Professor, Department of Physics	
Recommended by BoS on	25-04-2025		
Academic Council Approval		**Date**	26-06-2025

24INP202	INNOVATION PRACTICUM - 4	L	T	P	J	C
		0	0	2	0	1
ES		SDG				

Pre- requisite courses		Data Book / Codes / Standards (If any)	NA

Course Objectives:	The purpose of taking this course is to:
1	Learn and apply the Forge Innovation Handbook (FIH) to problem-solving.
2	Develop a minimum usable prototype (MUP) through iterative design, development, and testing.
3	Effectively demonstrate the developed MUP.

Course Outcomes:	After successful completion of this course, the students shall be able to	Bloom's Taxonomy Level (BTL)
CO 1	Proficiency in using the FIH to identify and solve problems.	Ap
CO 2	Experience in designing, building, and demonstrating a MUP.	E
CO 3	Improved ability to communicate and present project outcomes effectively.	E

Course Outcomes	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	Automotive Design and Manufacturing	Automotive Electrical Electronics	Automotive Technology and Management
1	3	2	2	2	2									
2			3	2			2		2					
3									2	3				

Course Content

INNOVATION FUNDAMENTALS Master Class 1: Explore the core concepts of product design and development. Master Class 2: Introduction to the Forge Innovation Handbook (FIH) and its applications. Workshop 1: Utilize the FIH Canvas to identify challenges, validate problems, understand user needs, and define pain points, gains, and value propositions.	**3 Hours**
ADVANCED PROTOTYPING TECHNIQUES Master Class 3: Rapid Prototyping Techniques -1 Master Class 4: Rapid Prototyping Techniques 2. Hack Time 1: Engage in hands-on experimentation to test core assumptions, refine the Proof of Concept (PoC). Incorporate rapid prototyping techniques and iterate on the design to enhance functionality.	**3 Hours**
INTELLECTUAL PROPERTY AND PROOF OF CONCEPT Master Class 5: Gain insights into intellectual property (IP) and prior art search. Hack Time 2: Develop and refine a working prototype. Build a Minimum Usable Prototype (MUP) based on feedback and iteration.	**3 Hours**
BUILD THE MINIMUM USABLE PROTOTYPE (MUP) Hack Time 3: Enhance the prototype through iterative improvements. Utilise feedback from mentoring sessions to make targeted adjustments and refinements, optimising the prototype's functionality and design based on practical insights. Hack Time 4: Develop the Minimum Usable Prototype (MUP). Build the final version of the MUP incorporating all iterative refinements. Ensure that it meets the defined criteria and is ready for comprehensive testing and presentation.	**3 Hours**
PERFECT PITCH AND PRODUCT SHOWCASE Hack Time 5: Conduct a final demonstration and technical testing of the prototype. Create a compelling pitch to articulate the value proposition and potential impact of the innovation, aimed at securing support or funding. Pitch Presentation and MUP Demonstration: Students showcase their completed prototype through a comprehensive demonstration, highlighting its key features and functionalities to Industry experts, incubators and investors. They deliver a compelling pitch that clearly communicates the innovation's impact, market potential, and benefits. This presentation aims to effectively convey the value of the prototype, engage potential stakeholders, and secure support or funding opportunities.	**3 Hours**

Theory Hours:	**Tutorial Hours:**	**Practical Hours:**	**15**	**Project Hours:**	**Total Hours:** **15**

Learning Resources*

Textbooks

1. Rapid Prototyping And Engineering Applications: A Toolbox For Prototype Development - Frank W.Liou, 2007
2. Rapid Prototyping Technology: Selection And Application - COOPER K. G, 2001

Reference books/ Web Links

2. Jazz Factory - All about Presentations and http://blog.jazzfactory.in/
3. Pretotyping Methodology - https://www.pretotyping.org/methodology.html
4. How to give a killer presentation - https://hbr.org/2013/06/how-to-give-a-killer-presentation
Evaluating Product Innovations — proof, potential, & progress:https://blog.forgeforward.in/evaluating-product-innovations-e8178e58b86e

Course Curated by			
Expert(s) from Industry	**Expert(s) from Higher Education Institution**	**Internal Expert(s)**	
		Dr.B.L.Lakshmi Meera VP & CPO, Forge.Innovation & Ventures	
Recommended by BoS on	25-04-2025		
Academic Council Approval		**Date**	26-06-2025

SEMESTER - V

24HSP007	BUILDING PROFESSIONAL READINESS	L	T	P	J	C
		0	0	2	0	1
HS		SDG	4&8			

Pre-requisite courses	Nil	Data Book / Codes / Standards (If any)	

Course Objectives**:	The purpose of taking this course is to:
1	To familiarize students with various interview formats and equip them with essential techniques for effectively handling personal, behavioural, stress, and panel interviews.
2	To develop self-awareness and career readiness by guiding students in analysing job roles, articulating career goals, and confidently presenting their skills and experiences.
3	To enhance students' adaptability in diverse career pathways by exploring alternative job opportunities, entrepreneurial ventures, and global career options beyond traditional engineering roles.

Course Outcomes***:	After successful completion of this course, the students shall be able to	Bloom's Taxonomy Level (BTL)
CO 1	**Effectively navigate various interview formats** by applying appropriate techniques for personal, behavioural, stress, and panel interviews, demonstrating confidence and professionalism in different interview scenarios.	Ap
CO 2	**Exhibit career readiness and self-awareness** by analysing job roles, articulating career aspirations, and presenting skills and experiences in alignment with employer expectations.	An
CO 3	**Evaluate and explore diverse career pathways** beyond traditional engineering roles, demonstrating adaptability in pursuing opportunities in entrepreneurship, global careers, public sector roles, and other emerging industries.	E

Course Outcomes	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	Automotive Design and Manufacturing	Automotive Electrical Electronics	Automotive Technology and Management
1						2	2	3	3		3			
2						2	2	3	3		3			
3						2	2	3	3		3			

Course Content

Career Awareness and Goal Setting
• Exploring Varied Career Options Beyond Engineering
  • Industry Roles
  • Startups and Entrepreneurial Ventures
  • Research Opportunities and Higher Education
  • Public Sector and Non-Profit Careers
• Self-Assessment and Personal Reflection
• Identifying Strengths, Weaknesses, Skills, and Career Aspirations
• Setting Short-Term and Long-Term Career Goals
	6 Hours

Fundamentals of Interview Preparation • Analysing Company Background and Understanding Job Roles • Aligning Career Goals with Job Opportunities • Professional Etiquette and Appearance • Interview Dress Code, Grooming, and First Impression • Resume and Digital Profile Readiness • Types of interviews: personal, behavioural, stress, virtual, and panel	**6 Hours**
Behavioural Interviews – Responding with Purpose • Introduction to behavioural interviews: What and Why? • Common behavioural interview questions • The STAR technique (Situation – Task – Action – Result) • Identifying and reflecting on past experiences • Mapping soft skills to behavioural questions • Practicing concise storytelling • Active listening and adapting responses	**6 Hours**
Stress Interviews – Performing Under Challenging Situations • Understanding stress interviews: Purpose and setting • Types of stress tactics (rapid-fire questions, silence, disagreement, interruptions) • Strategies to stay composed and confident • Emotional regulation and response control • Maintaining clarity, tone, and respect under pressure • Practicing assertive and professional body language • Turning pressure moments into strengths	**6 Hours**
Panel Interviews • What is a panel interview? Structure and expectations • Understanding panel roles (HR, technical, managerial) • Techniques for engaging with a diverse panel • Managing eye contact, addressing questions, and body posture • Preparing multi-perspective answers • Handling follow-up or cross-questions • Strategies for closing the interview with impact	**6 Hours**
Theory Hours: - Tutorial Hours: - Practical Hours: 30 Project Hours: - Total Hours: 30	

Learning Resources

Reference books/ Web Links

1. Amos, J. (2004). Handling Tough Job Interviews: Be Prepared, Perform Well, Get the Job. United Kingdom: How To Books.
2. Clark, A. (2019). Cracking the Behavioral Interview Code!!! How to Answer Behavioral Interview Questions and Answer with a Preparation Guide + 20 Most Popular Behavioral Interview Questions and Answers.. (n.p.): Amazon Digital Services LLC - KDP Print US.
3. Collins, A. (2015). HR Interview Secrets: How to Ace Your Next Human Resources Interview, Dazzle Your Interviewers and LAND the JOB YOU WANT!. United States: Success in HR Publishing.
4. Downes, C. (2008). Cambridge English for Job-hunting Student's Book with Audio CDs (2). Germany: Cambridge University Press.
5. Hatcher, S. (2015). Group Interview Preparation: Learn How to Use Group Discussion to Your Advantage and Be Comfortable, Confident, and Likeable While Standing Out in a Group Interview. (n.p.): CreateSpace Independent Publishing Platform.
6. McKay, D. R. (2013). The Everything Job Interview Question Book: The Best Answers to the Toughest Interview Questions. United States: Adams Media.
7. Ryan, R. (2016). 60 Seconds and You're Hired!: Revised Edition. United States: Penguin Publishing Group.
8. Winter, S. (2020). Job Interview Preparation and Conversation Skills 2-in-1 Book: Learn How to Crush Your Next Job Interview and Develop A Magnetic Charisma to Enhance Your Communication Skills. United States: Native Publish

Online Resources

1. https://www.coursera.org/projects/preparation-for-job-interviews
2. https://www.coursera.org/projects/accomplishment-star-techniques-for-job-interviews
3. https://www.coursera.org/specializations/english-interview-resume

Assessment

Formative	Summative
-----	1. Participation in Mock interviews (80%) 2. Career Readiness Portfolio Submission (20%)

Course Curated By

Expert(s) from Industry	Expert(s) from Higher Education Institutions	Internal Expert(s)
Mr. Bhuvana Sundar Soorappaiah Program Manager Bosch, Coimbatore	Dr Kishore Selva Babu Head and Associate Professor Department of English and Cultural Studies Christ University Bangalore-560029	Dr. J Srikala- AP III Dr. C Tissaa Tony - AP III Dr. S G Mohanraj – AP III Dr. S Sreejan – AP III Dr. R Hema – AP II Dr. A S Mythili - AP II

Approved by: BoS Chairman	With Signature and date
BoS Approval date:	**25.04.2025**

24AUI301	Mechanics of Machines	L	T	P	J	C
		3	0	2	0	4
PC		SDG	4, 8			

Pre-requisite courses	Nil	Data Book / Codes / Standards (If any)	NA

Course Objectives:	The purpose of taking this course is to:
1	Analyse automotive mechanisms (slider-crank, suspension linkages) using kinematic principles and simulation tools.
2	Apply cam profile design to automotive valve train systems and modern VVT applications.
3	Study automotive gear trains including manual gearbox, planetary sets for EV/hybrid drives, and differentials.
4	Evaluate balancing of rotating and reciprocating masses in multi-cylinder engines, linking to NVH and refinement engineering.
5	Apply vibration theory to automotive systems, integrating NVH analysis and suspension dynamics using computer-aided tools.

Course Outcomes:	After successful completion of this course, the students shall be able to	Bloom's Taxonomy Level (BTL)
CO 1	Calculate velocity and acceleration of automotive mechanisms (slider-crank, suspension linkages) using analytical and simulation methods.	Ap
CO 2	Design cam profiles for valve train systems and evaluate their impact on engine performance.	An
CO 3	Analyse gear trains in automotive transmissions and EV drives.	An
CO 4	Solve balancing problems in multi-cylinder engines and evaluate NVH balance quality.	Ap
CO 5	Evaluate vibrations in automotive systems and apply isolation principles using simulation tools.	E

Course Outcomes	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team	Communication	Project Management and Finance	Life-Long Learning	Automotive Design and Manufacturing	Automotive Electrical Electronics	Automotive and Technology
1	3	3	2	3	2	–	–	–	–	–	3	3	–	3
2	3	3	3	2	2	–	–	2	–	–	3	3	–	3
3	3	3	3	3	2	–	–	–	–	–	2	3	2	3
4	3	3	2	2	2	–	1	2	–	–	3	3	2	3
5	3	3	3	3	2	1	1	2	–	–	2	3	3	3

Course Content

BASICS OF MECHANISMS Kinematic link, pair and chain – Gruebler's criteria – DOF analysis. Automotive slider-crank: connecting rod geometry, bore-stroke ratio, compression ratio effects. Four-bar suspension linkage: double-wishbone kinematics, camber/toe variation during jounce/rebound. **PRACTICAL COMPONENT:** Simulation-based analysis of slider-crank and suspension linkages; plotting camber/toe variation curves.	**9 Hours** **6 Hours**
DESIGN OF CAM PROFILE Types of cams and followers; follower motions (uniform, SHM, cycloidal, constant acceleration/deceleration). Automotive valve train cam design: lift, duration, overlap; effect on volumetric efficiency and torque curve. Variable Valve Timing (VVT) concepts	**9 Hours**

PRACTICAL COMPONENT: Cam profile construction and valve train motion analysis using simulation tools.	**6 Hours**
KINEMATICS OF GEAR TRAINS Spur and helical gear nomenclature; classification of gear trains. Automotive manual gearbox: gear ratio selection, synchroniser function, performance trade-offs EV/Hybrid drive planetary gear . Differential gear train: cornering behaviour, Limited Slip Differential (LSD), torque vectoring in EVs. **PRACTICAL COMPONENT:** Gear train simulation (manual gearbox, planetary gear sets, differential analysis).	**9 Hours** **6 Hours**
BALANCING Static and dynamic balancing; whirling and critical speed of shafts. Balancing reciprocating masses in multi-cylinder engines (inline, V6, V8). Engine NVH and ISO balance quality grades (G1, G2.5, G6.3). Crankshaft counterweight design and manufacturing considerations. Driveshaft critical speed and NVH in passenger cars. **PRACTICAL COMPONENT:** Balancing of multi-cylinder engines with firing order study; driveshaft critical speed analysis.	**9 Hours** **6 Hours**
VIBRATIONS Free, forced, and damped vibrations of single DOF systems. Automotive NVH sources: engine, transmission, road, wind; transfer path analysis. Engine mount design: rubber vs hydraulic mounts; transmissibility calculations; active mounts. EV NVH challenges: gear whine, electromagnetic noise. **PRACTICAL COMPONENT:** Suspension dynamics (quarter-car model simulation); vibration isolation study; NVH case study with frequency-domain analysis.	**9 Hours** **6 Hours**

Theory Hours:	**45**	**Tutorial Hours:**		**Practical Hours:**	**30**	**Project Hours:**		**Total Hours:**	**75**

Learning Resources

Textbooks

1. Theory of Machines and Mechanisms - Shigley J.E., Pennock G.R., Uicker J.J., 5th Edition, Oxford University Press, 2017.
2. Theory of Machines - Rattan S.S., Tata McGraw-Hill Publishing Company Ltd., New Delhi, 2014.
3. Kinematics and Dynamics of Machinery - Robert L. Norton, Tata McGraw-Hill, 2009.
4. Theory of Machines - Khurmi R.S and Gupta J.K. 14th Revised Edition, S. Chand and Company Ltd., New Delhi, 2005.
5. Theory of Machines - Ballaney P.L., 3rd Edition, Khanna Publishers, New Delhi, 2004.

Reference books/ Web Links

1. Machinery's Handbook – Oberg E., Jones F., et al., 32nd Edition (2024), Industrial Press, New York — standard handbook covering gears, machine elements, materials, design data ISBN-13: 978-0831150327.
2. Marks' Standard Handbook for Mechanical Engineers – Marks L.S., 12th Edition, McGraw-Hill Education, 2017.
3. Engineering Vibration – Inman D.J. – 4th Edition (or latest available) – Pearson Education, 2013
4. Standard Handbook of Machine Design – Shigley J.E., Mischke C.R. (Editors) – 3rd Edition – McGraw-Hill Professional, 2004).
5. Handbook of Gear Design – Maitra G.M., 2nd Edition (or latest), relevant publisher

Online Resources

1. https://nptel.ac.in/courses/112104121
2. https://nptel.ac.in/courses/112104114

Assessment (Embedded course)

SA I and SA II Activity and Learning Task(s), Mini project, MCQ, End Semester Examination (ESE), Lab Workbook, Experimental Cycle tests, viva-voce

Course Curated By

Expert(s) from Industry	Expert(s) from Higher Education Institutions	Internal Expert(s)
		Dr Andrew J D

24AUI302	Automotive Electrical Systems	L	T	P	J	C
		2	0	2	0	3
PC		SDG	7, 9, 12, 13			

Pre-requisite courses	Nil	Data Book / Codes / Standards (If any)	Nil

Course Objectives:	The purpose of taking this course is to:
1.	Provide a comprehensive understanding of automotive electrical systems including batteries (conventional and EV-grade), starting/charging, lighting, signalling, and advanced wiring standards.
2.	Equip students with practical skills in diagnosing and troubleshooting automotive electrical systems using OBD-II scan tools, CAN bus analysers, and multimeters.
3.	Introduce CAN/LIN bus communication protocols with hands-on PCAN analyser and automotive ECU connectivity for in-vehicle network diagnostics.
4.	Familiarise students with 48V mild hybrid electrical architecture, AUTOSAR layered software architecture, and V2X/OTA connectivity concepts in modern vehicles.
5.	Introduce automotive cybersecurity (ISO/SAE 21434) and functional safety (ISO 26262) awareness in the context of connected and autonomous vehicle electrical systems.

Course Outcomes:	After successful completion of this course, the students shall be able to	Bloom's Taxonomy Level (BTL)
CO 1	Explain battery technologies (lead-acid, Li-ion, NiMH), testing methods, BMS integration, and maintenance practices for conventional and electric vehicles.	U
CO 2	Analyse starting and charging systems including smart alternators, integrated starter-generators, DC-DC converters, and 48V mild hybrid electrical architecture components.	An
CO 3	Apply knowledge to test and troubleshoot automotive electrical systems using OBD-II scan tools, CAN bus analysers, and diagnostic protocols (UDS/KWP2000 awareness).	Ap
CO 4	Design and evaluate automotive lighting, signalling, ADAS-integrated wiring systems, and harness layouts complying with USCAR standards and automotive electrical design rules.	Ev
CO 5	Analyse instrumentation, infotainment, V2X connectivity, OTA update mechanisms, and cybersecurity (ISO/SAE 21434) in modern connected vehicle electrical architectures.	An

CO 6	Perform testing, diagnostics, CAN bus monitoring, and system integration of automotive electrical systems in the laboratory environment.	C

Course Outcomes	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team	Communication	Project Management and Finance	Life-Long Learning	Automotive Design and Manufacturing	Automotive Electrical Electronics	Automotive Technology and
1	3	2			2						2	3		
2	3	3	2	2	3						2	3	3	
3	3	3	3	2	3				2		2	3	3	2
4	3	3	3	2	3				2	1	2	3	3	3
5	3	3	2	2	3	1	2	1	2	1	2	2	3	2
6	3	3	3	3	3	2	1		3	2	3	3	3	3

Course Content

BATTERIES Battery Technology - Types of automotive batteries (lead-acid, Li-ion, NMC, NiMH), Battery construction, operation and charging methods, Battery testing and maintenance, battery testing equipment's - Charge/Discharge Testing Systems, Cell, Module, and Pack Testing Equipment, Handheld Battery Testers. Li-ion battery pack architecture for BEV/PHEV: cell, module, pack hierarchy; cell balancing (passive and active); pack voltage and capacity calculation for EV range estimation. Battery Management System (BMS) overview: State of Charge (SoC) estimation (Coulomb counting, OCV method); State of Health (SoH); cell temperature monitoring; protection circuits. Thermal management of automotive battery pack: liquid cooling vs air cooling; thermal runaway propagation and prevention; battery fire safety (AIS-137 EV safety standard awareness) **Practical Component** • Testing battery voltage and capacity • Performing battery maintenance procedures • EV battery pack SoC estimation using Coulomb counting algorithm (MATLAB/Python simulation	**5 Hours** **8 Hours**

STARTING AND CHARGING SYSTEMS **Starting System** - Starters and solenoids, Ignition switches and circuits, Starter motor operation, design considerations for starting systems, Common starting system problems **Charging System** - Alternators and generators, Voltage regulators, Charging system operation, design considerations for charging systems, fault diagnosis, Introduction to Smart alternators, integrated starter-generators, DC-DC converters, inverters for hybrid/electric vehicles **48V mild hybrid electrical architecture:** 48V battery + DCDC converter + belt-starter generator (BSG); boost recuperation system; fuel consumption reduction mechanism — industry relevance (Mercedes EQ Boost, Audi mild hybrid) **Regenerative braking electrical system:** bidirectional DC-DC converter; brake-by-wire integration; energy recuperation during deceleration — EV/HEV context **Practical Component** • Testing starter motors and solenoids • Testing alternators and voltage regulators • 48V mild hybrid system simulation (MATLAB Simulink model of BSG + 12V battery + DCDC); Regenerative braking energy recovery calculation	**7 Hours** **8 Hours**
LIGHTING, SIGNALLING AND WIRING STANDARDS **Automotive Lighting Systems** -headlights, taillights, interior lighting, and advanced technologies such as LED, HID, adaptive, matrix, and laser lighting **Signalling Systems** - Turn signals, hazard lights, and brake lights, adaptive brake lights, dynamic turn signals, ADAS integrated lighting, adaptive front lighting system (AFS), Camera based glare free- high beam **Automotive wiring** - layout, high-speed harness design, wire selection, routing, and insulation, USCAR Connectors, terminals, and standards **Automotive wiring harness design -** zone architecture vs centralised harness; connector sealing standards (IP67/IP69K); wire sizing for high-current EV harness; flat wire harness (FWH) awareness **Practical Component** • Diagnose headlight and indicator faults; • Test adaptive lighting circuit • Test circuits and switches • Design wiring layout, crimping, routing, insulation practices, build automotive sub-harness using USCAR terminals and sealing • CAN bus live data reading using PCAN USB - read vehicle speed, engine RPM, throttle position from OBD-II port	**8 Hours** **10 Hours**

INSTRUMENTATION, INFOTAINMENT & CONNECTIVITY **Instrumentation**: Introduction to digital instrument clusters, TFT displays, and Head-Up Displays (HUD) including augmented reality features **Infotainment:** Overview of automotive infotainment systems such as Android Auto, Apple CarPlay, and Over-the-Air (OTA) updates. **Connectivity**: Fundamentals of in-vehicle connectivity (OTA, V2X, cloud) cybersecurity, and functional safety standards (ISO 26262) in modern vehicles.	**5 Hours**
ADVANCED DIAGNOSTICS & EMERGING TECHNOLOGIES **OBD-II & ECU Basics**: Fault codes, electronic control units, read fault codes using scanner; analyse ECU data **High-Voltage Safety:** EV/Hybrid systems, battery management systems, Powertrain electrification, regenerative braking **Autonomous & ADAS Integration:** Sensor fusion, radar/LiDAR power systems **EOBD/OBD-II diagnostic commands:** Mode 01–09 service structure; PIDs (engine load, coolant temp, O2 sensor, vehicle speed); reading live data vs freeze frame; readiness monitors for emission test **EV high-voltage safety**: IEC 60664 isolation class; HV interlock loop (HVIL); personal protective equipment (Class 0 rubber gloves); safe HV system de-energisation procedure; AIS-038 HV safety standard awareness **Practical Component** • Read fault codes using scanner • Analyze ECU data • Advanced OBD-II diagnostics — connect scan tool; read DTCs, live PIDs, freeze frame; clear codes; interpret readiness monitors; • EV high-voltage safety demonstration: HVIL, PPE donning, de-energisation procedure; AIS-038 compliance	**5 Hours** **4 Hours**

Theory Hours:	**30**	**Tutorial Hours:**	**0**	**Practical Hours:**	**30**	**Project Hours:**	**0**	**Total Hours:**	**60**

Learning Resources*

Textbooks

1. Erjavec, Jack., Automotive Technology: A systems approach., Delmar Thomson learning, New York, III edition, (2005).
2. Denton, Tom., Automobile Electrical and Electronic Systems., Routledge Publishers, London, III edition, (2004)
3. Robert Bosch GmbH, Automotive Handbook, Wiley, Germany, X edition, (2018)
4. Ronald K. Jurgen, *Automotive Electronics Handbook*, McGraw-Hill, II edition, (1999)

Reference books/ Web Links
1. Martin, Tracy., How to Diagnose and Repair Automotive Electrical Systems., Motorbooks Workshop, Minneapolis (2005). 2. Candela, Tony., Automotive Wiring and Electrical Systems., CarTech Inc., North Branch (2009). 3. Halderman, James D., Automotive Electrical and Engine Performance., Pearson, New York (2016). 4. Santini, Al., Automotive Electricity and Electronics., Cengage Learning, Boston (2013). 5. Haynes, John., Automotive Electrical Manual., Haynes Publishing, Newbury Park (1990).
Online Resources and Databooks/codes
1. https://autotrainingcentre.com/automotive-online-training/online-electrical-fundamentals/ 2. https://eleccircs.com/free-automotive-electrical-wiring-diagrams 3. https://autotrainingcentre.com/automotive-online-training/online-electrical-advanced/ 4. ISO 26262: Functional Safety for Road Vehicles 5. USCAR: Standards for Connectors and Terminals 6. https://www.bosch-mobility.com 7. https://www.ni.com/en/solutions/transportation.html

Assessment (Embedded course)
SA I and SA II Activity and Learning Task(s), MCQ, End Semester Examination (ESE), Lab Workbook, Experimental Cycle tests

Course Curated By		
Expert(s) from Industry	**Expert(s) from Higher Education Institutions**	**Internal Expert(s)**
Mr. Sangeeth Gunalan, Stellantis, Canada	Dr. Elammaran Jayamani Swinburne University, Malaysia	Dr.Thenmozhi G KCT

Approved by: BoS Chairman	With Signature and date
BoS Approval date:	

24AUI303	Finite Element Analysis for Automotive Engineering	L	T	P	J	C
		3	0	2	0	4
PC		SDG	4,7,9,11,13			

Pre-requisite courses	Nil	Data Book / Codes / Standards (If any)	NA

Course Objectives:	The purpose of taking this course is to:
1	Introduce fundamental concepts, formulations, and procedure of the Finite Element Method for automotive structural and thermal applications.
2	Enable learners to formulate FE models for structural mechanics, heat transfer, and fluid-thermal interactions relevant to automotive components.
3	Develop the ability to derive and apply FE equations for 1D, 2D, and 3D elements in automotive structural analysis.
4	Analyse crash FEA (explicit dynamics), NVH modal analysis, and fatigue FEA for automotive components — skills demanded by automotive OEMs and Tier-1 suppliers.
5	Apply topology optimisation and non-linear FEA for lightweight automotive structure design and advanced material behaviour in plastic, rubber, and composite automotive parts.
6	Familiarise students with ANSYS APDL and ANSYS Workbench CAE tools to simulate and solve real-world automotive engineering problems.

Course Outcomes***:	After successful completion of this course, the students shall be able to	Bloom's Taxonomy Level (BTL)
CO 1	Recognise the concepts, history, and applications of finite element method in automotive structural, thermal, and crash engineering.	R
CO 2	Formulate finite element techniques for automotive design problems using minimum potential energy, Rayleigh-Ritz, and Galerkin approaches.	U
CO 3	Devise and solve FE equations for 1D and 2D automotive elements (bar, beam, CST, quad); apply to automotive structural (frame, bracket) and heat transfer (exhaust, brake disc) problems.	Ap
CO 4	Analyse and solve heat transfer and static structural problems for automotive components using ANSYS APDL and Workbench with accurate boundary condition application.	An

CO 5	Apply crash FEA (explicit dynamics), NVH modal analysis, fatigue FEA, and topology optimisation concepts to automotive structural design using ANSYS Workbench.	Ev
CO 6	Perform and document full simulation workflows for automotive components (piston, knuckle, BIW joint, brake disc, roll cage) using ANSYS Workbench CAE environment.	C

Course Outcomes	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team	Communication	Project Management and Finance	Life-Long Learning	Automotive Design and Manufacturing	Automotive Electrical Electronics	Automotive Technology and
1	3	2	2	2	3							3		
2	3	2	2	2	3							3		
3	3	2	2	2	3							3		
4	3	2	2	2	3							3		
5	3	2	2	2	3							3		
6	3	2	2	2	3							3		

Course Content	
FINITE ELEMENT METHODS Historical background, comparison of FEA With Exact Solution methods, relevance of FEA to design problems, Procedure, Advantages, disadvantages and applications, Theory of minimum potential energy, Rayleigh ritz and Galerkin method. FEA in automotive industry: structural analysis (BIW stiffness, suspension arm), crash (Bharat NCAP frontal barrier), NVH (modal analysis, acoustic radiation), thermal (brake disc, exhaust), fatigue (wheel, knuckle) — motivating industry applications. **Practical Component** 1) Introduction to ANSYS APDL 2) Cantilever beam with point load at free end	**9 Hours** **6 Hours**
ONE-DIMENSIONAL PROBLEMS FE modelling, Types of elements, shape functions, general stiffness matrix derivation, Stiffness matrix (2noded 1-D element), Assembly of stiffness matrix,	**9 Hours**

Force vectors, Application of Boundary conditions, FE Analysis of simple bars, coordinate systems used in FEA. trusses – stiffness matrix and numericals. 1D automotive application. **Practical Component** 1) Structural Analysis of Frames Using Truss Elements	 **6 Hours**
TWO DIMENSIONAL PROBLEMS & HEAT TRANSFER ANALYSIS Constant Strain Triangle-Shape function-strain displacement relations-numericals. Governing equations for conduction and convection, heat transfer analysis of composite walls. Case studies on applications of heat transfer analysis on different automobile parts **Practical Component** 1) Static Structural Analysis Using 2D Elements 2) Heat Transfer Analysis using 1D Elements 3) Heat Transfer Analysis using 2D Elements	**9 Hours** **6 Hours**
ISOPARAMETRIC ELEMENTS & NONLINEAR ANALYSIS Iso-parametric formulation - Iso, Sub and Super parametric element formulation – Shape function of 2-D isoparametric quadrilateral element, numericals. Non-linear analysis in FEA – examples and applications in automotive sector (Theory only). Geometric non-linearity in automotive: large deformation analysis of thin sheet metal panel under stamp load; snap-through buckling of automotive roof panel. **Practical Component** 1) Introduction to ANSYS Workbench 2) Buckling Analysis of Connecting rod 3) Torsional Analysis of bar	**9 Hours** **6 Hours**
APPLICATIONS OF FEA IN AUTOMOTIVE ENGINEERING Roll cage analysis - Rotor thermal analysis - Hub analysis - Knuckle analysis - Brake pedal analysis- Bump analysis (Theory only). Crash FEA (explicit dynamics awareness): frontal barrier crash (Bharat NCAP AIS-138 test procedure). **Practical Component** 1) Structural and Thermal Analysis any automotive part (Piston, Exhaust pipe, Engine components etc…)	**9 Hours** **6 Hours**

Theory Hours:	**45**	**Tutorial Hours:**	**0**	**Practical Hours:**	**30**	**Project Hours:**	**0**	**Total Hours:**	75

Learning Resources
Textbooks
1. Chandrupatla, T. R., & Belegundu, A. D. (2022). *Introduction to finite elements in engineering* (5th ed.). Cambridge University Press

2. Logan, D. L. (2022). *A first course in the finite element method* (7th ed., SI version). Cengage Learning.
3. Rao, S. S. (2017). *The finite element method in engineering* (6th ed.). Butterworth-Heinemann/Elsevier

Reference books/ Web Links

1. Rajasekaran, S. (2006). Finite element analysis in engineering design. S. Chand & Co Ltd
2. Reddy, J. N. (2019). *An introduction to the finite element method* (4th ed.). McGraw-Hill Education

Online Resources

1. https://ocw.mit.edu/courses/2-092-finite-element-analysis-of-solids-and-fluids-i-fall-2009/?utm_source=chatgpt.com
2. https://onlinecourses.nptel.ac.in/noc21_me109/preview
3. https://www.open.edu/openlearn/science-maths-technology/introduction-finite-element-analysis/content-section-0?utm_source=chatgpt.com

Assessment (Embedded course)

SA I and SA II Activity and Learning Task(s), Mini project, MCQ, End Semester Examination (ESE), Lab Workbook, Experimental Cycle tests, viva-voce

Course Curated By

Expert(s) from Industry	Expert(s) from Higher Education Institutions	Internal Expert(s)
Mrs. Saranya G Nair Head -Design, Bajaj Motors, Pune	Dr. Sreejith Mohan, Assistant Professor, Department of Mechanical Engineering, NIT-Trichy	Dr. Aravind S L Ap-III, Auto

Approved by: BoS Chairman	With Signature and date
BoS Approval date:	

24AUT304	VEHICLE BODY ENGINEERING	L	T	P	J	C
		2	0	0	0	2
PC		SDG	9			

Pre-requisite courses	24AUI201 Automotive Chassis and Transmission	Data Book / Codes / Standards (If any)	Bharat NCAP/AIS-138

Course Objectives:	The purpose of taking this course is to:
1	Provide foundational knowledge on vehicle body classifications, structures, BIW terminology, and material selection for conventional and electric vehicles.
2	Introduce aerodynamic principles, wind tunnel testing, Cd target process, and underbody airflow management for vehicle body performance.
3	Enable analysis of loads, crash energy management (crumple zones), Bharat NCAP and AIS-138 safety regulations, and crashworthiness design principles.
4	Develop familiarity with occupant ergonomics, pedestrian safety (Euro NCAP/Bharat NCAP pedestrian protocol), ADAS-related body geometry constraints, and safety system packaging.
5	Introduce EV-specific body engineering considerations: battery enclosure structural integration, floor pan design, and lightweight body strategy for range extension.

Course Outcomes:	After successful completion of this course, the students shall be able to	Bloom's Taxonomy Level (BTL)
CO 1	Classify vehicle body types, identify BIW terminologies, construction methods, and apply material selection criteria for conventional and EV body structures.	U
CO 2	Select appropriate materials (AHSS, aluminium, CFRP composites, plastics) and trim systems for vehicle body structures based on crash energy absorption, weight, and manufacturability.	Ap
CO 3	Analyse aerodynamic forces, drag coefficient (Cd) reduction methodology, underbody airflow, and wind tunnel testing principles for vehicle body optimisation.	An
CO 4	Evaluate loads, BIW stiffness targets (torsional and bending), crash energy management principles, crumple zone design, and Bharat NCAP/AIS-138 crash test procedure requirements.	An
CO 5	Apply occupant ergonomics, pedestrian safety (AIS-138 pedestrian protocol), ADAS body geometry constraints, and EV body structural integration principles to vehicle body design.	Ap

Course Outcomes	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team	Communication	Project Management and Finance	Life-Long Learning	Automotive Design and Manufacturing	Automotive Electrical Electronics	Automotive Technology and
1	3	2	1		2						1	3	1	1
2	3	2	2		2						1	3		1
3	3	3	2	2	3						1	3		1
4	3	3	2	2	2	2	1				1	3		2
5	2	2	3		2	3	2	1			1	2	1	2

Course Content	
VEHICLE BODY CLASSIFICATION & TERMINOLOGY Vehicle body configurations and classifications – Hatchback, Sedan, SUV, MPV, Coupe, Convertible, Van, LCV and HCV – Body-in-White (BIW) concepts, body nomenclature and structural members – Conventional frame, monocoque and semi-monocoque construction – Vehicle packaging, occupant space and visibility requirements – Crash load paths and body crashworthiness – EV body architectures, skateboard platforms and battery enclosure integration – Multi-material body design, joining technologies and lightweighting strategies – Surface modelling fundamentals, styling considerations, aesthetics and aerodynamic integration.	**6 Hours**
BODY MATERIALS & TRIM SYSTEMS Automotive body materials – Steel, AHSS, aluminium alloys, plastics, GRP, FRP and composites – Material selection based on strength, stiffness, manufacturability and crash performance – Interior trim systems, dashboards, seating and roof liners – Corrosion protection and coating technologies – Advanced High Strength Steels (DP, TRIP and hot-stamped steels) – Aluminium body structures, alloy selection and superplastic forming – CFRP materials, manufacturing processes and automotive applications – Multi-material body case studies – Automotive painting systems and EV battery enclosure corrosion protection.	**6 Hours**
VEHICLE AERODYNAMICS Fundamentals of vehicle aerodynamics – Drag, lift, side force and aerodynamic moments – Streamlining and drag reduction techniques – Wind tunnel testing, flow	**6 Hours**

visualization and aerodynamic development process – Computational Fluid Dynamics (CFD) for automotive applications – Pressure distribution, wake characteristics and Reynolds number effects – Underbody aerodynamics, air diffusers and wheel arch ventilation – Active aerodynamic systems including spoilers and grille shutters – EV-specific aerodynamic features such as flush door handles, camera mirrors and optimized wheel designs for enhanced driving range.	
FRAME LOADS, STRUCTURE & CRASHWORTHINESS Vehicle structural loads – Static, dynamic, impact, torsional and bending loads – Frame members, load paths and structural stiffness – Energy absorption mechanisms and crash management principles – Crumple zones, intrusion beams and rollover protection structures – Crash regulations, testing procedures and BIW stiffness targets – NVH implications of structural design – India NCAP assessment protocols and pedestrian protection requirements – Active and passive safety integration, pedestrian airbags and Autonomous Emergency Braking (AEB-P) – Rollover safety, roof crush resistance and occupant protection criteria.	**6 Hours**
VEHICLE ERGONOMICS & SAFETY SYSTEMS Vehicle ergonomics and occupant packaging – Seating design, H-point, reach envelopes, comfort and visibility standards – Interior layout and control placement – Seat belts, airbags, child safety systems and pedestrian protection measures – Human-machine interaction and driver-centric design considerations – ADAS sensor integration within vehicle body structures – Camera, radar and sensor packaging requirements – Fascia material considerations for signal transmission – Safety-driven body design for modern intelligent and connected vehicles.	**6 Hours**

Theory Hours:	**30**	**Tutorial Hours:**	**-**	**Practical Hours:**	**-**	**Project Hours:**	**-**	**Total Hours:**	**30**

Learning Resources

Textbooks

1. Body Engineering Design and Construction of Motor Vehicle Bodywork - Sydney F page., Chapman & Hall Ltd, London, 1967
2. Vehicle Body Engineering - Giles J Pawlowsky., Business books limited, 1989
3. Vehicle Body Layout and Analysis - John Fenton., Mechanical Engg. Publication ltd,
4. London, 1980
5. Automotive Chassis & Body - P. L. Kohli., Papyrus Publishing House, New Delhi.
6. Automotive Chassis - Crouse W. H. &Anglin D. L., McGraw-Hill Int. Book Co.

Reference books

1. Vehicle Body Building and Drawing - Braithwaite, J.B., Heinemann Educational Books Ltd., London, 1997
2. The Passenger Car Body - Dieler Anselm., SAE International and Vogel Verlag, 2000
3. Materials for Automobile Bodies - Geoff Davies., Butterworth-Heinemann, 2012
4. The Repair of Vehicle Bodies - A. Robinson, W. A. Livesey., Butterworth-Heinemann Ltd, 2018

5. Aerodynamics of Road Vehicles - Wolf-Heinrich Hucho., Published by SAE International, USA, 1998
6. Vehicle Aerodynamics - Dr. V. Sumantran and Dr. Gino Sovram., SAE International, USA, 1994

Online Resources

1. https://ocw.mit.edu/courses/aeronautics-and-astronautics/16-100-aerodynamics-fall-2005/
2. https://www.mech.kth.se/courses/5C1211/Intro07.pdf
3. https://nptel.ac.in/syllabus/125106002/
4. https://www.plm.automation.siemens.com/global/en/industries/automotivetransportation/automotive-body-design.html
5. http://www.hindujatech.com/product-engineering/vehicle-engineering/body-engineering/
6. http://fmcet.in/AUTO/AT2451_uw.pdf

Assessment

Mini-project, Activity, and Case study sessions within theory hours. S
Students are encouraged to use 3D modelling software for self-study surface modelling.

Course Curated By

Expert(s) from Industry	Expert(s) from Higher Education Institutions	Internal Expert(s)
		Mr.Kishore R Ap-II, Auto

Approved by: BoS Chairman	With Signature and date
BoS Approval date:	

24AUT305	AI for Automotive Systems Development	L	T	P	J	C
		0	0	2	0	1
PC		SDG	9			

Pre-requisite courses	Nil	Data Book / Codes / Standards (If any)	

Course Objectives:	The purpose of taking this course is to:
1	Introduce students to Edge AI concepts and the AI model development workflow for automotive embedded systems using Python and embedded hardware platforms.
2	Enable students to acquire automotive sensor data (vibration, temperature, pedal input) and develop structured datasets with basic preprocessing for AI model training.
3	Develop intelligent automotive applications using Edge AI techniques, with awareness of TensorFlow Lite deployment and object detection concepts for ADAS context.

Course Outcomes:	After successful completion of this course, the students shall be able to	Bloom's Taxonomy Level (BTL)
CO 1	Acquire and preprocess, automotive sensor data for intelligent vehicle system development using Python and embedded platforms.	Ap
CO 2	Develop, train, validate, and deploy basic Edge AI classification models for automotive applications using embedded deployment tools.	Ap
CO 3	Design simple intelligent automotive systems for driver behaviour and vehicle condition monitoring	Ap

Course Outcomes	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team	Communication	Project Management and Finance	Life-Long Learning	Automotive Design and Manufacturing	Automotive Electrical Electronics	Automotive Technology and
1	3	2		2	3								2	

2	2	3	2		3								3	2
3	2	3	3		3				2		2		3	2

Course Content	
Introduction to Artificial Intelligence – Basics of Machine Learning (classification, regression) – AI Model Development Workflow – Introduction to Edge AI – Hardware Requirements for Edge AI Implementation – Embedded Hardware-Software Requirements – Environment Setup and Basic Project Creation – Embedded development environment setup – Basic program development – Build and compile process – Code flashing to hardware – Serial monitor / debugging basics – Python for Automotive AI: numpy and pandas for sensor data handling; matplotlib for visualisation; scikit-learn overview – Why Python is the industry standard for automotive ML development	8 hrs
Sensor Data Acquisition – Analog signal acquisition – ADC configuration – Sensor interfacing – Reading analog values – Serial data display – Sensor calibration basics – Automotive Sensor Data Types: IMU/accelerometer (vibration, road surface); temperature sensor; pedal position sensor (driver behaviour); overview of data characteristics for AI model input	6 hrs
Data Collection for Edge AI Model – Real-time data acquisition – Dataset creation and Data labelling – Data storage and preprocessing basics – Automotive Dataset Labelling: structured labelling for driver behaviour (aggressive, normal, gentle based on pedal signal); road surface classification (smooth, pothole); importance of label quality for safety AI applications	6 hrs
Basic Edge AI Model Creation – Introduction to classification models – Dataset loading – Model training – Model validation – Model export – Python ML Pipeline for Automotive: scikit-learn Random Forest classifier for driver behaviour classification; confusion matrix interpretation; precision and recall as automotive safety metrics; cross-validation for model generalisation	6 hrs
Edge AI Model Deployment – AI model import – Code generation – Model integration – Real-time inference – Embedded deployment – TensorFlow Lite for Automotive Edge AI: model quantisation overview (float32 to int8); model size reduction for embedded targets; inference on STM32– YOLO Object Detection Awareness: YOLO architecture introduction (bounding box, class probability); pre-trained model inference demo using Python and OpenCV	4 hrs

List of Experiments:	
1.	Environment set up, project creation and execution
2.	Python for automotive AI: numpy/pandas sensor data processing; matplotlib time-series visualisation
3.	Acquiring sensor data (IMU accelerometer, temperature) and monitoring via serial interface
4.	Preparation of dataset for AI model: data collection, labelling for driver behaviour (aggressive/normal/gentle)
5.	Development of basic Edge AI model using embedded classification workflow
6.	Python ML pipeline: scikit-learn Random Forest for driver behaviour classification; confusion matrix; evaluate precision and recall
7.	Hardware deployment of AI model on embedded system with TFLite quantisation overview
8.	Development of Edge AI-Based Vehicle Vibration Monitoring System
9.	Development of Edge AI-Based Temperature-Driven Vehicle Condition Monitoring System
10.	YOLO object detection demo: pre-trained model inference (Python + OpenCV); detect vehicle and pedestrian

Theory Hours:		**Tutorial Hours:**		**Practical Hours:**	**30**	**Project Hours:**		**Total Hours:**	**30**

Learning Resources
Textbooks
1. Situnayake, D. and Plunkett, J., AI at the Edge: Solving Real-World Problems with Embedded Machine Learning, O'Reilly Media, Sebastopol (2023). 2. Iodice, G. M., TinyML Cookbook: Practical Recipes for Implementing Machine Learning on Embedded Systems, Packt Publishing, Birmingham (2022).

3. Buidin, R. and Mariasiu, F., Introduction to Artificial Intelligence in Automotive Engineering, Routledge, London (2022).
4. Raschka, S. and Mirjalili, V., Python Machine Learning, Packt Publishing, Birmingham (3rd ed., 2019). [Added: Python ML pipeline for automotive context]

Reference books / Web Links

1. Theobald, O., Machine Learning for Absolute Beginners, Independently Published, London (2017).
2. Burkov, A., The Hundred-Page Machine Learning Book, Andriy Burkov Publishing, Quebec (2019).

Online Resources

3. TinyML Foundation Learning Resources — https://tinymlx.github.io
4. Edge Impulse Documentation — https://www.edgeimpulse.com
5. STM32 Edge AI Developer Resources — https://stm32ai.st.com
6. Arduino Edge AI Learning — https://docs.arduino.cc
7. scikit-learn User Guide — https://scikit-learn.org/stable/user_guide.html [Added: Python ML pipeline]
8. TensorFlow Lite for Microcontrollers — https://www.tensorflow.org/lite/microcontrollers [Added: TFLite deployment]
9. YOLO / Ultralytics Documentation — https://docs.ultralytics.com [Added: ADAS object detection awareness]
10. Coursera Embedded Machine Learning Course — https://coursera.org
11. Harvard TinyML Course — https://edx.org

Assessment (Embedded course)
SA I and SA II Activity and Learning Task(s), Mini project, MCQ, End Semester Examination (ESE), Lab Workbook, Experimental Cycle tests, viva-voce

Course Curated By		
Expert(s) from Industry	**Expert(s) from Higher Education Institutions**	**Internal Expert(s)**
		Mr. Arun B Ap-II, Auto

Approved by: BoS Chairman	With Signature and date
BoS Approval date:	

24AUJ306	Internship -II/Mini-project	L	T	P	J	C
		0	0	0	4	2
PRJ		SDG	7, 9, 12, 13			

Pre-requisite courses	Internship - I	Data Book / Codes / Standards (If any)	

Course Objectives:	The purpose of taking this course is to
1	Provide awareness of current technologies, tools, and trends in Automotive industries through hands-on exposure and interaction with industry professionals.
2	equip students with an understanding of industrial safety protocols, engineering standards, and professional ethics
3	To enhance problem solving abilities and innovation through observation, interaction with industry professionals.

Course Outcomes:	After successful completion of this course, the students shall be able to	Bloom's Taxonomy Level (BTL)
CO 1	Apply the knowledge of automotive engineering to practical industrial task, projects and problem-solving scenarios	Ap
CO 2	Adhere to industrial safety norms, standards, and ethical practices relevant to engineering workplaces	Ap
CO 3	Evaluate the functioning and performance of automotive systems, equipment, control systems, and processes.	E
CO 4	Prepare technical documentation and effectively communicate project findings in both written and verbal formats.	An
CO 5	Demonstrate teamwork, adaptability, and professional behaviour while working in a multidisciplinary industrial environment	Ap

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11			
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	Automotive Design and Manufacturing	Automotive Electrical Electronics	Automotive Technology and Management
1	3	2	2	2	3				1	3	2	3	3	3
2	2	2			2	2	3		1	3	2	2	2	2
3	3	3	2	2	3			2	1	3	2	3	3	3
4	2	1	1	1	2			2	3	3	2	2	2	2
5	2	2	1			2	2	3	2	3	2	2	2	2

Assessment
Presentation and Internship/project Report

Course Curated by			
Expert(s) from Industry	**Expert(s) from Higher Education Institution**	**Internal Expert(s)**	
		Dr.Andrew Pon Abraham HoD/ Automobile Engineering	
Recommended by BoS on			
Academic Council Approval		**Date**	

24INM301 MC	CONSTITUTION OF INDIA	L	T	P	J	C
		2	0	0	0	0
		SDG				

Pre-requisite courses		Data Book / Code book (If any)	

Course Outcomes

After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO1	Gain Knowledge about the Constitutional Law of India	R
CO2	Understand the Fundamental Rights and Duties of a citizen	U
CO3	Apply the concept of Federal structure of Indian Government	Ap
CO4	Analyze the Amendments and Emergency provisions in the Constitution	An
CO5	Develop a holistic approach in their life as a Citizen of India	E

Course Outcomes	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	Automotive Design and Manufacturing	Automotive Electrical Electronics	Automotive Technology and Management
1						2			1					
2						3		3						
3									2	3				
4								1	2					
5						2		2						
6														

Course Content

INTRODUCTION TO INDIAN CONSTITUTION Meaning of the constitution law and constitutionalism - Historical perspective of the Constitution - Salient features and characteristics of the Constitution of India	**04 Hours**
FUNDAMENTAL RIGHTS Scheme of the fundamental rights - Right to Equality - Fundamental Right under Article 19 - Scope of the Right to Life and Liberty - Fundamental Duties and its legal status – Directive Principles of State Policy – Its importance and implementation	**08 Hours**
FEDERAL STRUCTURE Federal structure and distribution of legislative and financial powers between the Union	**08 Hours**

and the States - Parliamentary Form of Government in India - The constitutional powers and status of the President of India	
AMENDMENT TO CONSTITUTION Amendment of the Constitutional Powers and Procedure - The historical perspectives of the constitutional amendments in India	**06 Hours**
EMERGENCY PROVISIONS National Emergency, President Rule, Financial Emergency Local Self Government – Constitutional Scheme in India	**04 Hours**

Theory Hours:	30	**Tutorial Hours:**		**Practical Hours:**		**Project Hours:**	0	**Total Hours:**	30

Learning Resources

Textbooks:

References:

1. Constitution of India - Ministry of Law & Justice – PDF format awmin.nic.in/coi/coiason29july08.pdf\
2. Introduction to the Constitution of India by Durgadas Basu
3. The Constitution of India – Google free material - www.constitution.org/cons/india/const.html
4. Parliament of India – PDF formatdownload.nos.org/srsec317newE/317EL11.pdf
5. The Role of the President of India – By Prof. Balkrishna
6. Local Government in India – E Book - Pradeep Sachdeva https://books.google.com/books/.../Local_Government_in_In...

Course Curated by

Expert(s) from Industry	**Expert(s) from Higher Education Institution**	**Internal Expert(s)**

Recommended by BoS on			
Academic Council Approval	No.	**Date**	

SEMESTER VI

24AUI307	Vehicle Dynamics	L	T	P	J	C
		3	0	2	0	4
PC		SDG	9			

Pre-requisite courses	Mechanics of Machines	Data Book / Codes / Standards (If any)	NIL

Course Objectives:	The purpose of taking this course is to
1	Provide students with a strong theoretical and practical understanding of the fundamental principles governing vehicle motion, including longitudinal, lateral, and vertical dynamics.
2	Enable students to model, analyse, and evaluate key vehicle subsystems—such as tires, suspension, steering, and braking systems—and understand their influence on ride, handling, and stability.
3	Build the competency required to diagnose vehicle dynamics issues, propose engineering solutions, and apply theoretical concepts to real-world automotive design, testing, and performance optimization.

Course Outcomes:	After successful completion of this course, the students shall be able to	Bloom's Taxonomy Level (BTL)
CO 1	Recall fundamental concepts of tire mechanics, vehicle axis systems, vibrations, steering geometry, stability, and automotive noise	R
CO 2	Explain the principles governing longitudinal, vertical, lateral dynamics, tire force generation, suspension behaviour, and vehicle stability/noise characteristics.	U
CO 3	Apply dynamic equations, free-body diagrams, vibration models, and handling principles to solve basic vehicle dynamics problems.	Ap
CO 4	Analyze tire forces, acceleration/braking behaviour, suspension response, steering characteristics, and stability conditions under various operating scenarios	An
CO 5	Evaluate vehicle performance, handling behaviour, vibration isolation, braking/steering effectiveness, and noise control methods using engineering judgement	E
CO 6	Perform asimulations on braking, acceleration, suspension systems, steering, handling, roll stability, and measure vehicle noise to analyse overall dynamic behaviour.	E

Course Outcomes	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	Automotive Design and Manufacturing	Automotive Electrical Electronics	Automotive Technology and Management
1	3													
2	3	2										2		
3	3	3	2	2								3		
4	3	3	3	2								3		
5	3	3	3	2							2	3		
6	3	3	2	3	3				2	2		3		

Course Content

TIRE Tires: construction- SAE tire Axis system - - Slip, Grip and Rolling Resistance - Tire Construction and Force Development - Contact Patch and Pressure Distribution.- Contact Geometry: Tire Deflection, Static Contact point, Length of Contact Point Patch, Dynamic Rolling Radius- Steady State Forces and Torques: Wheel Load, Tipping Torque, Rolling Resistance Longitudinal Force and Longitudinal Slip, Lateral Force Generation: Lateral Force and self-Aligning Torque- Combined Force: Combined Slip, Approximation Force.	**09 Hours**
LONGITUDINAL DYNAMICS Introduction: Earth Fixed Axis System and SAE Vehicle Axis System, Forces and Moments. Vehicle Load Distribution position of CG - gradability- Acceleration - Free body diagram of accelerating vehicle, maximum transferable tractive force- tractive effort and reactions for different drive, Deceleration - free body diagram of decelerating vehicle, maximum decelerating rates, stopping distance, maximum braking force, Vehicle performance. **Practical Component** Simulation of braking and accelerating characteristics of a four-wheeler passenger car	**09 Hours** **04 Hours**
VERTICAL DYNAMICS Vibration – introduction, types, terminologies, source of vibration, human response, Degrees of freedom-single, two and multi degrees of freedom system, free, forced and damped vibration, magnification factor, transmissibility, vibration absorbers, pitch and bounce motion, oscillation centres, Suspension- types, active and semi active suspension, sprung mass and un-sprung mass, calculation of effective spring rate. **Practical Component** Simulation of Mc Pherson strut suspension system Simulation of a telescopic suspension system Modelling and simulation of Quarter car, Half car and Full car.	**09 Hours** **12 Hours**

LATERAL DYNAMICS Vehicle control-low speed cornering and static steering – Ackerman steering geometry, steady-state cornering- steering factors, vehicle control parameters (understeer, neutral steer and over steer) steady state handling – lateral acceleration gain , characteristic speed, yaw velocity gain and critical speed- effect of braking on vehicle handling and constant radius testing and fish hook measurement testing. **Practical Component** Simulation of a Rack and Pinion Steering system Simulation of Cornering characteristics of a four-wheeler passenger car.	**09 Hours** **04 Hours**
VEHICLE STABILITY AND NOISE Stability of a vehicle – on slope, on curve and banked road Noise- Introduction, properties of sound, sound level designation and measurement techniques- sound isolation and absorption-silencer and mufflers. **Practical Component** Simulation test for roll stability of a four-wheeler passenger car. Driving Simulation of a passenger car in ISO Lane change and 3D road Tail Pipe Noise Measurement of Stationery Vehicle	**09 Hours** **10 Hours**

Theory Hours:45	Tutorial Hours:	Practical Hours:30	Project Hours:	Total Hours:75

Learning Resources*

Textbooks

1. Gillespie, Thomas D., *Fundamentals of Vehicle Dynamics, Revised Edition.*, SAE International, Warrendale, PA (2021).
2. Rill, Georg; Arrieta Castro, Abel., Road Vehicle Dynamics: Fundamentals and Modeling with MATLAB®, CRC Press, Boca Raton (2020).

Reference books/ Web Links

1. Schramm, Dieter; Hiller, Manfred; Bardini, Roberto., *Vehicle Dynamics: Modeling and Simulation, 2nd Edition.*, Springer, Berlin / Heidelberg (2018).
2. Lenzo, Basilio (ed.), *Vehicle Dynamics: Fundamentals and Ultimate Trends.*, Springer, Cham (2022).
3. Jazar, Reza N., *Vehicle Dynamics: Theory and Application, 3rd Edition.*, Springer, New York (2018).

Online Resources

1. Dr.R Krishnakumar,Vehicle Dynamics, NPTEL course https://nptel.ac.in/courses/107106080/
2. eMobility Academy — Fundamentals of Vehicle Dynamics

Assessment (Embedded course)
SA I and SA II Activity and Learning Task(s), Mini project, MCQ, End Semester Examination (ESE), Lab Workbook, Experimental Cycle tests, viva-voce

Course Curated By		
Expert(s) from Industry	**Expert(s) from Higher Education Institutions**	**Internal Expert(s)**

Approved by: BoS Chairman	With Signature and date
BoS Approval date:	

24AUT308	Hybrid and Electric Vehicles	L	T	P	J	C
		3	0	0	0	3
PC		SDG	7, 9, 11, 13			

Pre-requisite courses	NIL	Data Book / Codes / Standards (If any)	NIL

Course Objectives:	The purpose of taking this course is to:
1	To provide an in-depth understanding of the principles and technologies involved in hybrid and electric vehicles.
2	To explore the design and operation of electric drivetrains and energy storage systems.
3	To examine the configurations and control strategies of electric and hybrid vehicles.
4	To analyze the environmental and economic impacts of hybrid and electric vehicles.
5	To develop skills in the simulation and modeling of hybrid and electric vehicle systems.

Course Outcomes***:	After successful completion of this course, the students shall be able to	Bloom's Taxonomy Level (BTL)
CO 1	Demonstrate the knowledge of electric powertrain components and battery technologies used in hybrid and electric vehicles.	R, U
CO 2	Analyze and compare different configurations and control strategies of electric and hybrid vehicles.	A, E
CO 3	Apply safety practices and standards in handling high-voltage systems and designing hybrid and electric vehicles.	Ap
CO 4	Design and simulate hybrid vehicle architectures, including series, parallel, and series-parallel configurations.	Ap
CO 5	Evaluate the environmental and economic impacts of hybrid and electric vehicles, considering future trends and advancements.	A, E

Course Outcomes	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	Automotive Design and Manufacturing	Automotive Electrical Electronics	Automotive Technology and Management
1	3	2	-	-	2	1	-	-	-	-	2	2	3	-
2	3	3	2	1	2	2	-	-	-	-	2	2	3	1
3	2	2	2	-	3	3	3	-	-	-	2	1	3	2

4	3	3	3	2	3	2	-	-	-	1	2	3	3	2
5	2	3	2	2	2	3	3	-	1	2	3	2	2	3

Course Content

ELECTRIC PROPULSION SYSTEMS Drive systems for EV & HEV, DC Motor drives, Induction Motor drives, Permanent Magnet Motor drives, Switch Reluctance Motor drives, drive system efficiency - Control System principles, Speed and Torque control, Power electronic converters for HEV, Regenerative Braking. Sizing the propulsion motor and introduction to power electronic converters	**9 Hours**
ENERGY STORAGE SYSTEMS Requirements in Hybrid and Electric Vehicles, Types of batteries – lead acid batteries, nickel-based batteries, and lithium-based batteries, advanced battery technologies, Technical characteristics, battery pack design, battery management system, Introduction to Ultra capacitors, fuel cells, solar cells and its application to vehicles	**9 Hours**
ELECTRIC VEHICLES History of electric vehicles, social importance of electric mobility, performance of e-vehicles - tractive effort and transmission requirements, vehicle performance, energy consumption, Specifications - System Components, Electric drive-trains topologies, power flow control in electric drive-train, fuel efficiency analysis	**9 Hours**
HYBRID VEHICLES History of hybrid vehicles, social and environmental importance of hybrid vehicles, Hybrid Electric Drivetrain architecture – series, parallel, series-parallel and complex - basic concept of hybrid traction, architecture - merits and challenges, power flow control in hybrid drive-train topologies, fuel efficiency analysis.	**9 Hours**
HEV PERFORMANCE Design of a Hybrid Electric Vehicle (HEV), Design of a Battery Electric Vehicle (BEV), Vehicle Simulation, Comparison of ICEV and HEV, Well-to-Wheel Analysis.	**9 Hours**

Theory Hours:	**45**	**Tutorial Hours:**	**0**	**Practical Hours:**	**0**	**Project Hours:**	**0**	**Total Hours:**	**45**

Learning Resources

Textbooks

1. Erjavec, Jack., Automotive Technology: A systems approach., Delmar Thomson learning, New York, III edition, (2005).
2. Husain, Iqbal., Electric and Hybrid Vehicles: Design Fundamentals., CRC Press, Boca Raton (2011).
3. Ehsani, Mehrdad., Modern Electric, Hybrid Electric, and Fuel Cell Vehicles: Fundamentals, Theory, and Design., CRC Press, Boca Raton (2018).

Reference books/ Web Links

1. Larminie, James., Electric Vehicle Technology Explained., Wiley, Chichester (2012).
2. Chan, C.C., Modern Electric Vehicle Technology., Oxford University Press, Oxford (2001).
3. Denton, Tom., Electric and Hybrid Vehicles., Routledge, New York (2020)

Online Resources / Standards

1. https://autotrainingcentre.com/automotive-online-training/online-electrical-advanced/
2. https://autotrainingcentre.com/automotive-online-training/online-electrical-fundamentals/
3. https://eleccircs.com/free-automotive-electrical-wiring-diagrams
4. Assessment of Safety Standards for Automotive Electronic Control Systems
5. Safety and Compliance Standards in Automotive Electronics
6. Automotive Electronics Testing for Safe, Reliable Vehicles - Keysight
7. Understanding Automotive Electrical Connector Standards

Assessment (Theory course)

SA I and SA II, Activity and Learning Task(s), Mini project, MCQ, End Semester Examination (ESE)

Course Curated By

Expert(s) from Industry	Expert(s) from Higher Education Institutions	Internal Expert(s)

Approved by: BoS Chairman	With Signature and date
BoS Approval date:	

24AUI309	Modelling and Simulation of Automotive Systems	L	T	P	J	C
		3	0	2	0	4
PC		SDG	9			

Pre-requisite courses	Numerical Methods Automotive Powertrain	Data Book / Codes / Standards (If any)	-

Course Objectives:	The purpose of taking this course is to:
1	Understand modelling principles and simulation techniques for engineering systems.
2	Develop mathematical models of automotive subsystems.
3	Apply simulation tools for analyzing dynamic automotive behavior.
4	Integrate theoretical concepts with simulation-based practical learning.
5	Evaluate and optimize automotive system performance.

Course Outcomes:	After successful completion of this course, the students shall be able to	Bloom's Taxonomy Level (BTL)
CO 1	Explain modelling concepts and simulation approaches	U
CO 2	Develop mathematical models of automotive systems	U
CO 3	Apply Simulink for system simulation	Ap
CO 4	Analyze dynamic response of automotive subsystems	An
CO 5	Evaluate system performance and optimize parameters	E
CO 6	Integrate simulation tools for real-world automotive applications	E

Course Outcomes	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	Automotive Design and Manufacturing	Automotive Electrical Electronics	Automotive Technology and Management
1	3	2	-	-	-							2	-	-
2	3	3	2	-	2							3	-	-
3	2	3	2	2	3							3	2	-
4	2	3	3	3	2							3	2	2
5	2	3	3	3	3							3	3	3
6	3	2	-	-	-							2	-	-

Course Content

INTRODUCTION TO MODELLING AND SIMULATION	6 Hours
Definition and need for modelling- Types of models: Physical, Mathematical, Empirical	

System approach and system boundaries - Continuous and discrete systems- Simulation basics and steps **Practical Component** • MATLAB basics: workspace, scripts • Simulation of simple first-order system • Visualization of system response	**6 Hours**
MATHEMATICAL MODELLING OF AUTOMOTIVE SYSTEMS Linear and nonlinear systems- Lumped parameter systems- Differential equation modelling- Transfer function and state-space models- Mechanical system modelling (mass-spring-damper), Electrical modelling **Practical Component** • Modelling mass-spring-damper in Simulink • Solving differential equations using MATLAB • Transfer function response analysis	**6 Hours** **6 Hours**
VEHICLE SUBSYSTEM MODELLING Engine modelling (torque-speed characteristics)- Transmission modelling- Suspension modelling- Brake system modelling- Tire modelling basics **Practical Component** • Engine performance curve simulation • Suspension system response simulation • Brake force modelling	**6 Hours** **6 Hours**
SIMULATION TOOLS AND TECHNIQUES MATLAB advanced features - Simulink blocks and libraries - Dynamic system simulation - Parameter variation and sensitivity **Practical Component** • Building complete Simulink models • Parameter tuning and comparison • Plotting and analyzing simulation results	**6 Hours** **6 Hours**
AUTOMOTIVE SYSTEM SIMULATION APPLICATIONS Longitudinal vehicle dynamics - Fuel consumption modelling- Ride and handling basics - Optimization techniques **Practical Component** • Vehicle acceleration simulation • Fuel efficiency modelling • Case study simulation (real vehicle model)	**6 Hours** **6 Hours**

Theory Hours:	**30**	**Tutorial Hours:**	**-**	**Practical Hours:**	**30**	**Project Hours:**	**-**	**Total Hours:**	60

Learning Resources

Textbooks

1. Gordon, G., *System Simulation*, 2nd Edition, Prentice Hall, **2019**.
2. Ogata, K., *Modern Control Engineering*, 5th Edition, Pearson, **2010**.

Reference books/ Web Links

1. Rajamani, R., *Vehicle Dynamics and Control*, Springer, **2012**.
2. Rao, S.S., *Mechanical Vibrations*, Pearson, **2017**

Online Resources
1. https://nptel.ac.in/courses/112/106 2. https://www.coursera.org/learn/control-systems

Assessment (Embedded course)
CAT, Activity and Learning Task(s)*, Mini project, MCQ, End Semester Examination (ESE) Lab Workbook, Experimental Cycle tests, viva-voce, etc

Course Curated by			
Expert(s) from Industry	**Expert(s) from Higher Education Institution**	**Internal Expert(s)**	
Recommended by BoS on			
Academic Council Approval		**Date**	

24AUT310	Automotive Emissions and Control Techniques	L	T	P	J	C
		3	0	0	0	3
PC		SDG	13			

Pre-requisite courses	Heat Power Engineering Automotive Powertrain Environmental Science	Data Book / Codes / Standards (If any)	-

Course Objectives:	The purpose of taking this course is to
1	Understand formation of pollutants in IC engines.
2	Analyze emission characteristics of SI and CI engines.
3	Study emission control technologies and after-treatment systems.
4	Evaluate emission measurement techniques and standards.
5	Understand automotive waste generation and management techniques.

Course Outcomes:	After successful completion of this course, the students shall be able to	Bloom's Taxonomy Level (BTL)
CO 1	Explain pollutant formation and environmental impact	U
CO 2	Analyze emission formation in SI engines	An
CO 3	Analyze emission formation in CI engines	An
CO 4	Evaluate emission control technologies and measurement techniques	E
CO 5	Analyze automotive waste generation and disposal methods	An
CO 6	Evaluate waste management and recycling techniques in automotive sector	E

Course Outcomes	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	Automotive Design and Manufacturing	Automotive Electrical Electronics	Automotive Technology and Management
1	3	2	-	-	-	3	2	-	-	-	1	1	2	1
2	3	3	2	-	-	2	-	-	-	-	1	2	2	1
3	3	3	2	-	-	2	-	-	-	-	1	2	2	1
4	3	3	3	2	2	3	2	-	-	-	1	2	3	2
5	2	3	2	2	1	3	2	-	-	-	2	2	2	3
6	2	3	3	2	1	3	3	-	-	-	2	2	2	3

Course Content

POLLUTANT FORMATION AND EFFECT ON ENVIRONMENT Pollutants – sources – formation – effects of pollution on environment - human – transient operational effects on pollution – Regulated –- Emission Standards-Euro, Bharat Stage & Legislative Norms.	**7 Hours**
EMISSION FORMATION IN S.I ENGINES Pollution formation in SI Engines – HC and CO formation in SI engines – NO formation in SI engines – Smoke emissions from SI engines – Effect of operating and design variables on emission formation.	**7 Hours**
EMISSION FORMATION IN CI ENGINES Pollutant Formation In CI Engines – Smoke emission and its types in diesel engines – NOx emission and its types from diesel engines-– Particulate emission in diesel engines- Effect of operating and design variables on emission formation.	**7 Hours**
EMISSION CONTROL AND MEASUREMENT TECHNIQUES Design Of Engine, Optimum Selection Of Operating Variables For Control Of Emissions- EGR, SCR, Lean DeNOx catalyst-Thermal Reactors, Secondary Air Injection, Water Injection.- After Treatment: Catalytic Converters, Catalysts, CO_2 Emission Reduction- Diesel Particulate Filter- Fuel Modifications. Emission Standards, Driving Cycles - USA, Japan, Euro And India.– NDIR analyzer – Flame ionization detectors – Chemiluminescent analyzer – Dilution tunnel – Gas chromatograph – Smoke meters –SHED test.	**12 Hours**
AUTOMOTIVE WASTES Introduction-Types of Automobile waste-Electrical waste, Battery waste, Copper elements-Electronic circuit wastes-Tyre wastes-Mechanical wastes, Body panel, Chassis components.	**6 Hours**
WASTE DISPOSAL AND MANAGEMENT TECHNIQUES Battery disposal procedure, management of battery waste, Steps involved in recycling batteries, Hydrometallurgical process, Hydrometallurgical process, Mercury distillation-Tyre disposal techniques, Battery recycling techniques.	**6 Hours**

Theory Hours:45	**Tutorial Hours:**	**-**	**Practical Hours:**	**-**	**Project Hours:**	**-**	**Total Hours:45**

Learning Resources

Textbooks

1. Heywood, J.B., *Internal Combustion Engine Fundamentals*, McGraw Hill, **2018**.
2. Ganesan, V., *Internal Combustion Engines*, McGraw Hill, **2012**.

Reference books/ Web Links

1. Pulkrabek, W.W., *Engineering Fundamentals of the Internal Combustion Engine*, Pearson, **2004**.
2. Bosch, *Automotive Handbook*, Wiley, **2018**.

Online Resources

1. NPTEL – IC Engines and Emission Control

Assessment (Embedded course)
SA I and SA II Activity and Learning Task(s), Mini project, MCQ, End Semester Examination (ESE), Lab Workbook, Experimental Cycle tests, viva-voce

Course Curated by			
Expert(s) from Industry	**Expert(s) from Higher Education Institution**	**Internal Expert(s)**	
Recommended by BoS on			
Academic Council Approval		**Date**	

SEMESTER VII

24AUI401	Vehicle Maintenance and Diagnostics	L	T	P	J	C
		2	0	2	0	3
PC		SDG	3,9&13			

Pre-requisite courses	Nil	Data Book / Codes / Standards (If any)	NA

Course Objectives:	The purpose of taking this course is to
1	Understand vehicle maintenance practices and workshop procedures.
2	Learn common faults in Tire, engine, electrical, chassis, and body systems.
3	Develop basic skills for vehicle inspection, troubleshooting, and servicing.

Course Outcomes:	After successful completion of this course, the students shall be able to	Bloom's Taxonomy Level (BTL)
CO 1	Explain basic vehicle maintenance needs, service schedules, and workshop procedures.	K2
CO 2	Describe common engine faults and methods used to inspect and troubleshoot them.	K2
CO 3	Explain the condition-checking procedures for battery, starting, charging, and electronic systems.	K2
CO 4	Describe common faults and general repair steps for chassis, driveline, suspension, brake, and body components.	K2
CO 5	Explain wheel and tire conditions and outline basic corrective actions for alignment and balancing.	K2
CO 6	Perform diagnostic tests and servicing operations on major vehicle systems using workshop tools and equipment.	K4

Course Outcomes	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	Automotive Design and Manufacturing	Automotive Electrical Electronics	Automotive Technology and Management
1	2	1			1					1	1	1	3	
2	2	2	1	1	2							1	3	
3	2	1	1	1	2							1	3	
4	2	2	1	1	2							1	3	
5	1	1			2								3	
6	3	2	2	2	3	1		1	2	1	1	2	3	

Course Content

VEHICLE MAINTENANCE BASICS & WORKSHOP PRACTICE Vehicle maintenance covers the need, importance and types of service such as preventive, breakdown and scheduled maintenance – OEM service schedules and standard work procedures – job cards, inspection sheets, digital service records and road-test reports – workshop layout, service bay workflow, 5S, KAIZEN and safety practices – tools and equipment used in modern service stations – basics of OBD-II diagnostics for reading fault codes – EV workshop safety including high-voltage identification, insulated tools, PPE and LOTO procedures. **Practical Component** **Experiment 1:** Study of workshop layout, safety rules, PPE, tools and equipment **Experiment 2:** Preparation of job card, vehicle inspection checklist and service report	**6 Hours** **6 Hours**
ENGINE & POWERTRAIN MAINTENANCE Engine maintenance includes dismantling, cleaning and inspection of major components such as cylinder head, piston–connecting rod assembly, crankshaft and valve mechanisms – assembly using torque specifications and clearance checks – ECU-based tune-up including idle correction and sensor validation – interpretation of engine performance issues such as vibration, noise and power loss – maintenance of clutch, manual gearbox, propeller shaft and differential – OBD/ECU diagnostics using live-data and freeze-frame information for engine and driveline fault identification. **Practical Component** **Experiment 3:** Engine subsystem dismantling, inspection and assembly (cylinder head, piston–rod, valve train) **Experiment 4:** ECU/OBD-II diagnostic procedure – reading DTCs, live data and freeze-frame **Experiment 5:** Battery testing, starter motor diagnosis and alternator charging system evaluation	**8 Hours** **9 Hours**
ELECTRICAL, ELECTRONICS & HVAC MAINTENANCE Electrical maintenance includes battery load tests, starter and alternator diagnostics, lighting checks and electrical circuit protection – wiring harness inspection and connector diagnostics – maintenance of sensors, actuators and ECU-controlled subsystems – introduction to CAN-based diagnostics – EV electrical architecture including traction motor, inverter, DC-DC converter and onboard charger – EV cooling circuit checks and charging-port inspection – HVAC servicing including refrigerant recovery, leak testing, pressure measurements and compressor evaluation. **Practical Component** **Experiment 6:** Troubleshooting of lighting circuits, fuses/relays and wiring harness **Experiment 7:** HVAC/AC system diagnosis – pressure readings, leak detection and cooling performance test	**8 Hours** **6 Hours**
ELECTRICAL, ELECTRONICS & HVAC MAINTENANCE Electrical maintenance includes battery load tests, starter and alternator diagnostics, lighting checks and electrical circuit protection – wiring harness inspection and connector diagnostics – maintenance of sensors, actuators and ECU-controlled subsystems – introduction to CAN-based diagnostics – EV electrical architecture including traction motor, inverter, DC-DC converter and onboard charger – EV cooling **circuit**	**8 Hours**

checks and charging-port inspection – HVAC servicing including refrigerant recovery, leak testing, pressure measurements and compressor evaluation. **Practical Component** **Experiment 6:** Troubleshooting of lighting circuits, fuses/relays and wiring harness **Experiment 7:** HVAC/AC system diagnosis – pressure readings, leak detection and cooling performance test	**6 Hours**
CHASSIS, BRAKES, SUSPENSION, STEERING, WHEELS & BODY SYSTEMS Chassis maintenance includes inspection of suspension components, steering system performance and lubrication of linkages – brake maintenance including hydraulic checks, brake bleeding, pad replacement and basic ABS diagnostics – minor body repairs, corrosion protection and door/window actuator servicing – EV regenerative braking characteristics and suspension/tyre wear due to EV weight distribution – tyre construction, wear patterns and wheel balancing – wheel alignment principles including camber, caster, KPI and toe – TPMS operation and on-road performance evaluation through braking, acceleration and efficiency checks. **Experiment 8:** Brake system inspection – hydraulic line check, brake bleeding and pad/shoe replacement **Experiment 9:** Suspension & steering inspection – free play, bushings, linkages and wear analysis **Experiment 10:** Tyre & wheel maintenance – removal, refitting, balancing and 3D wheel alignment (camber, caster, KPI, toe)	**8 Hours** **9 Hours**

Theory Hours:30	Tutorial Hours:	Practical Hours:30	Project Hours:	Total Hours:60

Learning Resources*

Textbooks

1. Devaraj, R., Automotive Maintenance and Servicing. McGraw Hill Education, New Delhi (2021)
2. Giri, N. K., Automobile Mechanics. Khanna Publishers, New Delhi (2019).
3. Kirpal Singh, Automobile Engineering – Volume II. Standard Publishers Distributors, New Delhi (2020).
4. Tom Denton, Automotive Technician Training – Textbook Level 3. Routledge, London (2021)

Reference books/ Web Links

1. **Denton, Tom.**, *Automotive Technology: Vehicle Maintenance and Repair*. Routledge, London (2020).
2. **Denton, Tom.**, "Electrical Systems Diagnosis." *Automotive Electrical and Electronic Systems*, Routledge, London (2021): pp. 115–170.
3. **Bosch, Robert.**, "OBD and Diagnostics." *Bosch Automotive Handbook*, 10th Ed., Springer Vieweg, Berlin (2021). DOI: https://doi.org/10.1007/978-3-658-29738-0
4. **Tata Motors Training Division.**, "Vehicle Service Procedures." Technical Report No. TMTD/23/VS. Tata Motors Ltd., Pune, Maharashtra (2023). DOI: —
5. **Wong, J. Y.**, "Brake System Fundamentals." *Journal of Automotive Engineering*, Vol. 48 No. 3 (2020): pp. 325–349. DOI: — URL: https://www.sae.org/
6. **SAE International.**, "Advanced Vehicle Service Methods." *Proceedings of SAE Automotive Service Symposium 2022*, Paper #2022-01-0045. Detroit, USA, 2022. DOI: https://doi.org/10.4271/2022-01-0045

Online Resources

1. https://www.ase.com
2. https://www.boschautoparts.com

3. https://nptel.ac.in/courses/112/106
4. https://www.sae.org/
5. https://www.hyundai.com
6. https://www.bosch-mobility.com
7. https://www.toyota-global.com
8. https://www.mitchell1.com
9. https://www.obd-codes.com
10. https://www.autodata-group.com
11. https://www.siam.in
12. https://www.atherenergy.com

Assessment (Embedded course)
SA I and SA II Activity and Learning Task(s), Mini project, MCQ, End Semester Examination (ESE), Lab Workbook, Experimental Cycle tests, viva-voce

Course Curated By		
Expert(s) from Industry	**Expert(s) from Higher Education Institutions**	**Internal Expert(s)**
	[Name, Institution]	Mr. G. Rajkumar, Department of Automobile Engineering, KCT

Approved by: BoS Chairman	With Signature and date
BoS Approval date:	

24AUI402	Total Quality and Project Management	L	T	P	J	C
		3	0	0	0	3
PC		SDG				

Pre-requisite courses	-	Data Book / Codes / Standards (If any)	-

Course Objectives:	The purpose of taking this course is to
1	Understand the principles and philosophies of Total Quality Management.
2	Apply TQM tools and statistical techniques for quality improvement.
3	Explore lean and Six Sigma methodologies for productivity enhancement.
4	Understand organizational structures and project management practices.
5	Develop skills in project planning, scheduling, and cost analysis.

Course Outcomes:	After successful completion of this course, the students shall be able to	Bloom's Taxonomy Level (BTL)
CO 1	Relate quality concepts and philosophies of TQM	U
CO 2	Apply TQM tools as a means to improve quality	Ap
CO 3	Select Lean Six Sigma tools for improving productivity	Ap
CO 4	Categorize the structure of the organization	U
CO 5	Identify competency in project planning and scheduling	Ap
CO 6	Develop network models and analyze cost accounting	Ap

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11			
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	Automotive Design and Manufacturing	Automotive Electrical Electronics	Automotive Technology and Management
1	2	2	-	-	-	-	-	3	3	3	3	-	-	2
2	2	2	1	-	3	-	-	3	3	3	3	1	-	2
3	2	2	1	-	3	-	-	3	3	3	3	1	-	2
4	-	2	2	-	-	-	-	3	3	3	3	-	-	2
5	2	2	2	-	1	-	-	3	3	3	3	1	-	3
6	-	2	2	1	3	-	-	3	3	3	3	2	-	3

Course Content

TQM PRINCIPLES Definition of Quality, Dimensions of Quality, Quality Costs, Top Management Commitment, Quality Council, Quality Statements, Barriers to TQM Implementation, Contributions of Deming, Juran and Crosby, Team Building. Customer Satisfaction – Customer Perception of Quality, Customer Complaints, Service Quality, Customer Retention, Continuous Process Improvement, 5S, Kaizen, Just-In-Time.	
TQM TOOLS & STATISTICAL TECHNIQUES Seven Quality Tools, New Management Tools, Statistical Fundamentals, Concept of Six Sigma, Quality Policy Deployment (QPD), Quality Function Deployment (QFD), Benchmarking, Taguchi Loss Function.	
QUALITY SYSTEMS Need for ISO 9000 and Quality Systems, ISO 9001 Standards, Implementation, Documentation, Quality Auditing, ISO 14001 Environmental Management Systems.	
PROJECT ORGANIZATION AND MANAGEMENT Project Characteristics, Project Life Cycle, Project Identification, Organization Structures, Resource Allocation, Work Breakdown Structure (WBS), Contracts and Types, Project Direction.	
PLANNING, SCHEDULING AND NETWORK MODELS PERT & CPM, Cost Optimization, Crashing, Network Updating, Line of Balance (LOB), Linear Programming, Project Appraisal, Cost Analysis, Financial Projections, Enterprise-wide Project Management.	

Self-Learning Topics (5 Hrs)

- Industry case studies on Six Sigma implementation
- Project management software (MS Project, Primavera)
- ISO certification procedures in automotive industries

Theory Hours:	**45**	**Tutorial Hours:**	**Practical Hours:30**	**Project Hours:**	**Total Hours:**	**45**

Learning Resources

Textbooks

1. Dale H. Besterfield et al., *Total Quality Management*, 3rd Edition, Pearson, 2011.
2. K. Nagarajan, *Project Management*, New Age International, 2012.

Reference books/ Web Links

1. D.R. Kiran, *Total Quality Management*, Butterworth-Heinemann, 2016.
2. Harvey Maylor, *Project Management*, Prentice Hall, 2010.
3. Erik W. Larson, *Project Management: The Managerial Process*, Tata McGraw Hill, 2006.
4. Joseph Phillips, *PMP Study Guide*, McGraw Hill, 2013.

Online Resources

1. https://nptel.ac.in/courses/110106141
2. https://www.coursera.org/learn/six-sigma

Assessment (Theory)

SA I and SA II Activity and Learning Task(s), MCQ, End Semester Examination (ESE)

Course Curated By		
Expert(s) from Industry	**Expert(s) from Higher Education Institutions**	**Internal Expert(s)**
	[Name, Institution]	[Name, Department]

Approved by: BoS Chairman	With Signature and date
BoS Approval date:	

PROFESSIONAL ELECTIVES

Automotive Design & Manufacturing

24AUE001	Design of Engine Components	L	T	P	J	C
		2	0	2	0	3
PE		SDG	9			

Pre-requisite courses	Strength of Materials Design of Machine Elements Automotive Powertrain	Data Book / Codes / Standards (If any)	PSG Design Data Book

Course Objectives:	The purpose of taking this course is to
1	Understand design principles of IC engine components.
2	Apply material selection and design procedures for engine parts.
3	Analyze stresses and loads in engine components.
4	Design key engine components such as piston, crankshaft, and clutch.
5	Integrate analytical design with simulation and validation tools.

Course Outcomes:	After successful completion of this course, the students shall be able to	Bloom's Taxonomy Level (BTL)
CO 1	Explain design considerations and material selection for engine components	U
CO 2	Design cylinder, piston and piston assembly components	Ap
CO 3	Analyze and design connecting rod and crankshaft systems	An
CO 4	Design clutch systems based on torque and energy requirements	An
CO 5	Design valve and valve train mechanisms	An
CO 6	Apply CAD/CAE tools for modelling and validation of engine components	E

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11			
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	Automotive Design and Manufacturing	Automotive Electrical Electronics	Automotive Technology and Management
1	3	2	-	-	-	-	-	-	-	-	-	2	-	-
2	3	3	2	-	2	-	-	-	-	-	-	3	-	-
3	2	3	3	2	2	-	-	-	-	-	-	3	-	2
4	2	3	3	2	2	-	-	-	-	-	-	3	2	2
5	2	3	3	3	2	-	-	-	-	-	-	3	2	3
6	2	2	3	3	3	-	-	-	-	-	-	3	3	3

Course Content

DESIGN OF CYLINDER AND PISTON Choice of materials for cylinder and piston - Design assumptions and procedures - Design of cylinder - Design of piston, piston pin and piston rings. **Practical Component** • Design calculation of piston dimensions using data book • CAD modelling of piston and cylinder • Thermal and stress analysis using CAE tools	**6 Hours** **6 Hours**
DESIGN OF CONNECTING ROD Determination of minimum length of connecting rod - Design of small end and big end- Shank design and buckling considerations- Design of cap bolts **Practical Component** • Analytical stress calculations • CAD modelling of connecting rod • Buckling and stress analysis using simulation tools	**6 Hours** **6 Hours**
DESIGN OF CRANKSHAFT Balancing of IC engines- Significance of firing order - Material selection for crankshaft - Design under bending and torsion - Balancing weight calculations - Design of crank arms (short and long) - Front and rear-end details. **Practical Component** • Crankshaft modelling using CAD • Static and fatigue analysis using CAE • Balancing simulation and visualization	**6 Hours** **6 Hours**
DESIGN OF CLUTCH Design of single plate clutch - Multi-plate clutch - Centrifugal clutch and cone clutch - Torque capacity calculations - Energy dissipation - Design of clutch components. **Practical Component** • Torque capacity calculation using MATLAB • Clutch assembly modelling • Performance simulation under load conditions	**6 Hours** **6 Hours**
DESIGN OF VALVES AND VALVE TRAIN Design aspects of intake and exhaust manifolds- Design of inlet and exhaust valves- Valve springs, tappets and valve train- Cam profile design- Camshaft design - Rocker arm design **Practical Component** • Cam profile generation using MATLAB • Valve mechanism simulation • CAD modelling of valve train components	**6 Hours** **6 Hours**

Self Learning Topics: (Hours: 5 Hrs)

1. Advanced lightweight engine components
2. Hybrid powertrain component design
3. Digital twin in engine design
4. AI-based design optimization

Theory Hours:	30	Tutorial Hours:	-	Practical Hours:	30	Project Hours:	-	Total Hours:	60

Learning Resources
Textbooks
1. V.B. Bhandari, Design of Machine Elements, 3rd Edition, McGraw Hill, 2017 2. R.S. Khurmi & J.K. Gupta, Machine Design, S. Chand, 2019
Reference books/ Web Links
1. Maleev, V.L., Internal Combustion Engines, McGraw Hill, 2010 2. Heywood, J.B., Internal Combustion Engine Fundamentals, McGraw Hill, 2018
Online Resources
1. https://nptel.ac.in/courses/112105125 2. https://ocw.mit.edu/courses/2-72-elements-of-mechanical-design-spring-2009/ 3. https://www.mooc-list.com/course/machine-design-part-i-coursera

Assessment (Embedded course)
SA I and SA II Activity and Learning Task(s), Mini project, MCQ, End Semester Examination (ESE), Lab Workbook, Experimental Cycle tests, viva-voce

Course Curated by			
Expert(s) from Industry	**Expert(s) from Higher Education Institution**	**Internal Expert(s)**	
Recommended by BoS on			
Academic Council Approval		**Date**	

24AUE002	Design of Chassis Components	L	T	P	J	C
		2	0	2	0	3
PE		SDG	9			

Pre-requisite courses	• Strength of Materials • Design of Machine Elements • Automotive Chassis and Transmission	Data Book / Codes / Standards (If any)	Design Data Book

Course Objectives:	The purpose of taking this course is to
1	Understand design principles of automotive chassis components.
2	Analyze loads and stresses acting on chassis systems.
3	Design key chassis components such as frame, suspension, axle, and steering.
4	Apply design standards and material selection in chassis design.
5	Integrate analytical design with CAD/CAE-based validation.

Course Outcomes:	After successful completion of this course, the students shall be able to	Bloom's Taxonomy Level (BTL)
CO 1	Explain design considerations of chassis components	U
CO 2	Design automotive frame and structural members	Ap
CO 3	Analyze and design suspension systems	An
CO 4	Design steering and axle systems	An
CO 5	Evaluate chassis performance under dynamic loads	E
CO 6	Develop and validate chassis components using CAD/CAE tools	E

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11			
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	Automotive Design and Manufacturing	Automotive Electrical Electronics	Automotive Technology and Management
1	3	2	-	-	-	-	-	-	-	-	-	2	-	-
2	3	3	2	-	2	-	-	-	-	-	-	3	-	-
3	2	3	3	2	2	-	-	-	-	-	-	3	2	2
4	2	3	3	2	2	-	-	-	-	-	-	3	2	2
5	2	3	3	3	3	-	-	-	-	-	-	3	2	3
6	2	2	3	3	3	-	-	-	-	-	-	3	3	3

Course Content

DESIGN OF VEHICLE FRAME Types of chassis frames - Loads acting on chassis frame - Bending and torsional stresses - Design of ladder frame and cross members - Material selection **Practical Component** • Frame load calculations • CAD modelling of ladder frame • Static analysis using CAE tools	**6 Hours** **6 Hours**
DESIGN OF SUSPENSION SYSTEM Types of suspension systems - Design of leaf spring - Design of coil spring - Shock absorber basics. **Practical Component** • Spring design calculations • Suspension modelling using CAD • Ride simulation using MATLAB/ADAMS	**6 Hours** **6 Hours**
DESIGN OF AXLES Types of axles - Load distribution - Design of front axle - Design of rear axle and axle shaft **Practical Component** • Axle stress calculations • CAD modelling of axle • Torsional stress simulation	**6 Hours** **6 Hours**
DESIGN OF STEERING SYSTEM Steering geometry - Ackermann mechanism - Design of steering linkages - Steering gear design **Practical Component** • Steering geometry calculations • CAD modelling of steering system • Simulation of steering motion	**6 Hours** **6 Hours**
DESIGN OF BRAKING SYSTEM Types of brakes - Design of drum brake - Design of disc brake - Braking force distribution - Heat dissipation in brakes **Practical Component** • Brake force calculations • Brake system modelling • Thermal analysis using CAE	**6 Hours** **6 Hours**

Self Learning Topics: (Hours: 5 Hrs)

- Active suspension systems
- Electric vehicle chassis design
- Advanced braking systems (ABS, ESC)
- Lightweight chassis materials

Theory Hours:	30	**Tutorial Hours:**		**Practical Hours:**	30	**Project Hours:**		**Total Hours:**	60

Learning Resources
Textbooks
1. V.B. Bhandari, *Design of Machine Elements*, McGraw Hill, 2017 2. Gillespie, T.D., *Fundamentals of Vehicle Dynamics*, SAE, 1992
Reference books/ Web Links
1. Wong, J.Y., *Theory of Ground Vehicles*, Wiley, 2008 2. Rajamani, R., *Vehicle Dynamics and Control*, Springer, 2012
Online Resources
1. https://nptel.ac.in/courses/107106088 2. https://ocw.mit.edu/course-lists/transportation-vehicles/ 3. Fundamentals of Automotive Systems - Course

Assessment (Embedded course)
SA I and SA II Activity and Learning Task(s), Mini project, MCQ, End Semester Examination (ESE), Lab Workbook, Experimental Cycle tests, viva-voce

Course Curated by			
Expert(s) from Industry	**Expert(s) from Higher Education Institution**		**Internal Expert(s)**
Recommended by BoS on			
Academic Council Approval		**Date**	

24AUE003	Automotive Computational Fluid Dynamics	L	T	P	J	C
		2	0	2	0	3
PE		SDG	7, 9, 11, 13			

Pre-requisite courses	Fluid Mechanics and Heat Transfer Heat Power Engineering	Data Book / Codes / Standards (If any)	-

Course Objectives:	The purpose of taking this course is to
1	Understand the fundamentals of fluid flow and numerical methods in CFD.
2	Apply computational techniques to analyze automotive flow systems.
3	Model aerodynamic characteristics of vehicles using CFD tools.
4	Analyze heat transfer and flow behavior in automotive systems.
5	Develop simulation skills using industry-relevant CFD software.

Course Outcomes:	After successful completion of this course, the students shall be able to	Bloom's Taxonomy Level (BTL)
CO 1	Explain governing equations and numerical methods used in CFD	U
CO 2	Apply discretization techniques for solving fluid flow problems	Ap
CO 3	Model and simulate external aerodynamic flow over vehicles	Ap
CO 4	Analyze internal flows in automotive components	A
CO 5	Evaluate thermal and flow performance using CFD tools	E
CO 6	Develop CFD-based solutions for automotive engineering problems	Ap

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11			
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	Automotive Design and Manufacturing	Automotive Electrical Electronics	Automotive Technology and Management
1	3	2	-	-	-	-	-	-	-	-	2	2	-	-
2	3	3	2	2	3	-	-	-	-	-	2	3	-	-
3	2	3	3	2	3	-	-	-	-	-	2	3	1	-
4	2	3	2	2	3	-	-	-	-	-	2	3	1	-
5	2	3	2	2	3	-	-	-	-	-	3	3	2	-
6	2	3	3	2	3	-	-	2	2	2	3	3	2	2

Course Content

INTRODUCTION TO CFD & GOVERNING EQUATIONS Introduction to CFD – Need and applications in automotive engineering – Continuity, Momentum, and Energy equations – Navier-Stokes equations – Classification of flows – Boundary conditions – Introduction to turbulence modeling. **Practical Component:** • Introduction to CFD software • Geometry import and domain creation	**6 Hours** **6 Hours**
NUMERICAL METHODS IN CFD Discretization techniques – Finite Difference, Finite Volume, Finite Element methods – Grid generation – Structured and unstructured meshes – Stability, convergence, and error analysis. **Practical Component:** • Mesh generation for automotive geometry • Grid independence study	**6 Hours** **6 Hours**
EXTERNAL AERODYNAMICS OF VEHICLES Aerodynamic drag and lift – Flow over bluff bodies – Boundary layer separation – Wind tunnel simulation – Drag reduction techniques – Vehicle aerodynamics. **Practical Component:** • Simulation of flow over car body • Drag and lift coefficient calculation	**6 Hours** **6 Hours**
INTERNAL FLOW ANALYSIS Flow in intake and exhaust systems – Combustion chamber flow – Cooling systems – Radiator and HVAC flow – Multiphase flow basics. **Practical Component:** • Intake manifold simulation • Velocity and pressure distribution analysis	**6 Hours** **6 Hours**
HEAT TRANSFER & ADVANCED CFD APPLICATIONS (6 Hrs) Conduction, convection, and radiation modeling – Turbulence models (k-ε, k-ω) – Multiphase and reactive flows – Optimization using CFD. **Practical Component:** • Thermal analysis of radiator or battery cooling system • Post-processing and result interpretation	**6 Hours** **6 Hours**

Self-Learning Topics: (Hours: 5 Hrs)

- Electric vehicle thermal management using CFD
- Aerodynamic optimization using AI-based CFD
- Case studies on Formula 1 aerodynamics

Theory Hours:	30	**Tutorial Hours:**		**Practical Hours:**	30	**Project Hours:**		**Total Hours:**	60

Learning Resources
Textbooks
1. Versteeg, H.K. & Malalasekera, W., *An Introduction to Computational Fluid Dynamics*, Pearson, 2007. 2. Anderson, J.D., *Computational Fluid Dynamics: The Basics with Applications*, McGraw-Hill, 1995
Reference books/ Web Links
1. Ferziger, J.H. & Perić, M., *Computational Methods for Fluid Dynamics*, Springer, 2002. 2. John D. Anderson, *Fundamentals of Aerodynamics*, McGraw Hill, 2011. 3. ANSYS Fluent User Guide (latest version)
Online Resources
1. https://nptel.ac.in/courses/112104030 2. https://www.coursera.org/learn/computational-fluid-dynamics

Assessment (Embedded course)
SA I and SA II Activity and Learning Task(s), Mini project, MCQ, End Semester Examination (ESE), Lab Workbook, Experimental Cycle tests, viva-voce

Course Curated by			
Expert(s) from Industry	**Expert(s) from Higher Education Institution**	**Internal Expert(s)**	
Recommended by BoS on			
Academic Council Approval		**Date**	

24AUE004	Measurements and Metrology	L	T	P	J	C
		2	0	2	0	3
PE		SDG	9,12			

Pre-requisite courses	Engineering Physics	Data Book / Codes / Standards (If any)	-

Course Objectives:	The purpose of taking this course is to
1	Understand the principles of measurement systems and instrumentation.
2	Analyze errors, calibration, and uncertainty in measurements.
3	Apply dimensional and geometrical measurement techniques.
4	Understand advanced metrology tools and inspection systems.
5	Develop skills in measurement techniques for automotive applications.

Course Outcomes:	After successful completion of this course, the students shall be able to	Bloom's Taxonomy Level (BTL)
CO 1	Explain measurement principles, standards, and instrumentation systems	U
CO 2	Analyze measurement errors and uncertainty in engineering measurements	A
CO 3	Apply dimensional and geometrical measurement techniques	Ap
CO 4	Use modern metrology instruments for industrial inspection	Ap
CO 5	Evaluate measurement systems and calibration procedures	E
CO 6	Develop measurement-based solutions for automotive engineering applications	Ap

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11			
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	Automotive Design and Manufacturing	Automotive Electrical Electronics	Automotive Technology and Management
1	3	2	-	-	-	-	-	-	-	-	2	2	-	-
2	3	3	2	2	2	-	-	-	-	-	2	2	-	-
3	2	3	3	2	3	-	-	-	-	-	2	3	-	-

4	2	3	2	2	3	-	-	-	-	-	2	3	1	-
5	2	3	2	2	3	-	-	-	-	-	3	3	2	-
6	2	3	3	2	3	-	-	2	2	2	3	3	2	2

Course Content

BASICS OF MEASUREMENTS AND INSTRUMENTATION Measurement systems – Elements of measurement system – Static and dynamic characteristics – Standards of measurement – SI units – Calibration – Sensors and transducers – Classification and selection. **Practical Component:** • Calibration of measuring instruments • Study of sensors and transducers	**6 Hours** **6 Hours**
ERRORS AND UNCERTAINTY ANALYSIS Types of errors – Systematic and random errors – Accuracy, precision, sensitivity – Statistical analysis – Uncertainty propagation – Data acquisition systems. **Practical Component:** • Error analysis using experimental data • Data acquisition using digital instruments	**6 Hours** **6 Hours**
DIMENSIONAL METROLOGY Linear and angular measurements – Vernier caliper, micrometer, slip gauges – Comparators – Limit gauges – Surface finish measurement. **Practical Component:** • Measurement using vernier, micrometer • Surface roughness measurement	**6 Hours** **6 Hours**
ADVANCED METROLOGY Coordinate Measuring Machine (CMM) – Optical measurement systems – Laser interferometry – Machine vision – Non-contact measurement techniques. **Practical Component:** • CMM demonstration • Optical measurement analysis	**6 Hours** **6 Hours**
AUTOMOTIVE METROLOGY AND QUALITY CONTROL Measurement in automotive components – GD&T (Geometric Dimensioning and Tolerancing) – Inspection methods – Statistical Quality Control – Automation in metrology. **Practical Component:** • GD&T interpretation • Inspection of automotive components	**6 Hours** **6 Hours**

Self-Learning Topics: (Hours: 5 Hrs)

1. Industry 4.0 and smart metrology systems
2. AI-based inspection systems
3. Case studies in automotive quality control

Theory Hours:	30	Tutorial Hours:		Practical Hours:	30	Project Hours:		Total Hours:	60

Learning Resources
Textbooks
1. N.V. Raghavendra & L. Krishnamurthy, *Engineering Metrology and Measurements*, Oxford, 2013. 2. B.C. Nakra & K.K. Choudhary, *Instrumentation, Measurement and Analysis*, Tata McGraw-Hill, 2009.
Reference books/ Web Links
1. Jain R.K., *Engineering Metrology*, Khanna Publishers, 2012. 2. Doebelin E.O., *Measurement Systems*, McGraw-Hill, 2011.
Online Resources
1. https://nptel.ac.in/courses/112105168 2. https://www.coursera.org/learn/measurement-systems

Assessment (Embedded course)
SA I and SA II Activity and Learning Task(s), Mini project, MCQ, End Semester Examination (ESE), Lab Workbook, Experimental Cycle tests, viva-voce

Course Curated by			
Expert(s) from Industry	**Expert(s) from Higher Education Institution**	**Internal Expert(s)**	
Recommended by BoS on			
Academic Council Approval		**Date**	

24AUE005	Geometrical Dimensioning and Tolerance	L	T	P	J	C
		2	0	2	0	3
PE		SDG	9			

Pre-requisite courses	24MEI101- Engineering Graphics 24MEI102 - Manufacturing Technology	Data Book / Codes / Standards (If any)	ASME Y14.5 Standard

Course Objectives:	The purpose of taking this course is to:
1	Provide foundational and advanced knowledge of GD&T and engineering tolerances used in automotive design, referencing ASME Y14.5-2018 and ISO GPS standards
2	Develop skills in interpreting, applying, and validating GD&T using industry-standard engineering practices.
3	Enable students to perform form, orientation, profile, runout, and location tolerance analysis on automotive components, applying tolerance stack-up analysis using the Excel RSS method.
4	Build competence in manual and coordinate measurement inspection techniques, surface texture analysis, and basic profile testing.
5	Equip students with abilities to verify design intent, evaluate statistical process capabilities (SPC/MSA), and construct production control tracking for automotive systems.

Course Outcomes:	After successful completion of this course, the students shall be able to	Bloom's Taxonomy Level (BTL)
CO 1	Explain concepts of dimensional tolerancing, datum systems, and GD&T symbols per ASME Y14.5-2018 and ISO GPS standards used in automotive design.	U
CO 2	Apply GD&T rules to define form, orientation, location, and runout controls for automotive components on industrial drawings.	Ap
CO 3	Analyze functional relationships and tolerance stack-up (worst-case and RSS methods using Excel) in automotive assemblies.	An
CO 4	Inspect components using Vernier instruments, micrometers, manual CMM probing, profile projectors, and surface roughness tester metrics.	Ap
CO 5	Evaluate GD&T compliance through measurement reports, Process Capability(C_{pk} / P_{pk}) and Gauge R&R metrics under IATF 16949 quality context.	E

CO 6	Create standard GD&T-based manufacturing documentation, Design FMEAs, and industrial Control Plans for automotive components using industrial CAD tools.	C

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11			
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team	Communication	Project Management and Finance	Life-Long Learning	Automotive Design and Manufacturing	Automotive Electrical Electronics	Automotive Technology and
1	3	2									2	2		1
2	3	3	3	2	3				2		2	3		2
3	3	3	3	3	2	2			2		3	3		3
4	2	2	1	3	3			3	2	1	2	3		2
5	2	3	2	3	3	2	2	2	2	2	3	3		3
6	2	2	3		3			3	3	3	3	3	3	

Course Content

MODULE 1: INTRODUCTION TO TOLERANCING & GD&T Need for GD&T, Fit, tolerance, allowance. Datum reference frames, GD&T in the automotive product development context, feature hierarchy, Basic dimensions, MMC, LMC, RFS. ASME Y14.5-2018 edition specification: core updates from 2009 edition including Dynamic Profile tolerance, Continuous Feature modifier, Independent modifier (I). Measurement Uncertainty baseline: GUM (Guide to the Expression of Uncertainty in Measurement) Type A and Type B parameters, expanded uncertainty validation ($U = k.u_c$).	**6 Hours**
Practical Component 1. Manual Inspection & Gauge Calibration: Hands-on operation with digital Vernier calipers, micrometres, and height gauges to evaluate basic linear and angular part dimensions. 2. Measurement Uncertainty Charting: Applying GUM principles to establish Type A and Type B error bounds on manual component inspection data. 3. Internal Bore Characterization: Hands-on evaluation of internal cylinder metrics using high precision bore gauges and depth gauges.	**6 Hours**

MODULE 2: FORM TOLERANCES & MEASUREMENT METHODS Straightness, Flatness, Circularity, Cylindricity. Application in engine components (pistons, shafts, crank pins). ISO 21920:2021 surface texture functional metrics: Material ratio Abbott-Firestone curve, R_{pk} (reduced peak height), R_{vk} (reduced valley depth), and R_k (core roughness depth) for precision boundaries. Rationale on why R_a alone is insufficient for honing quality specification. Automotive form tolerance case studies using real OEM drawing baseline specifications. **Practical Component** 1. Functional Surface Profilometry (ISO 21920:2021): Operation of a stylus surface roughness tester on an engine cylinder bore specimen to plot and interpret the Abbott-Firestone curve R_{pk}, T_{vk} & R_k profiles). 2. Form Evaluation using Roundness Testers: Setup and verification of circularity and cylindricity variations on an automotive crankshaft main journal specimen.	**6 Hours** **6 Hours**
MODULE 3: ORIENTATION & LOCATION TOLERANCES Perpendicularity, Parallelism, Angularity, Position tolerance, concentricity, symmetry. Tolerance stack-up analysis structured assembly methodology: Worst-Case (WC) vs. Root Sum Square (RSS) statistical variation models. Calculation criteria setup for a multi-part assembly (e.g., suspension layout, steering, or gearbox stacks). **Practical Component** 1. Coordinate Metrology Workpiece Alignment: Execution of manual CMM probing sequences to perform physical-to-digital coordinate frame registration and datum system tracking. 2. Excel RSS Variation Modeling: Building a localized statistical tolerance stack-up script using Worst-Case (WC) and Root Sum Square (RSS) methods for a multi-part automotive powertrain block.	**6 Hours** **6 Hours**
MODULE 4: RUNOUT, PROFILE & FUNCTIONAL RELATIONSHIPS Circular runout, total runout, Profile of line, profile of surface. Functional dimensioning in automotive systems (cams, rotors, discs). Industrial drawing literacy exercise: structural interpretation of real-style crankshaft/powertrain drawings mapping runout, position, and feature control frames from Tier-1 suppliers. **Practical Component** 1. Dynamic Geometrical Runout Mapping: Fixturing rotating elements on bench centers to track circular and total runout tolerances via precise dial test indicators. 2. Optical Micro-Form Tracking: Utilizing a digital profile projector for non-contact profile evaluation and edge-tracing of automotive cam profiles and connecting rod contours.	**6 Hours** **6 Hours**

MODULE 5: ADVANCED METROLOGY, SPC & IATF 16949 COMPLIANCE Coordinate Measuring Machines (CMM) hardware configurations, Vision measurement systems, Form testers, contour tracers, and basic digital metrology workflows. Statistical Process Control (SPC): *Xbar-R* control charts construction, *UCL/LCL* equations, C_{pk} and P_{pk} calculation under IATF 16949 mandatory quality requirements (benchmark C_{pk} >-1.67). Measurement System Analysis (MSA): AIAG MSA 4th edition Gauge Repeatability and Reproducibility (GR&R) parameters and thresholds. AIAG Core Tools Framework: APQP phases, Design FMEA (DFMEA), and production Control Plan architectures. **Practical Component** 1. Statistical Quality Analytics (SPC Lab): Constructing active Xbar-R control charts and running automated Process Capability simulations (C_{pk} and P_{pk}) inside JASP/Minitab using component production datasets. 2. Measurement System Validation (MSA Lab): Cross-tabulating multi-appraiser manual and CMM measurement inputs to complete a formal AIAG Gauge R&R data matrix. 3. Design Documentation Capstone Assembly: Generating an industrial-ready 2D manufacturing blueprint embedded with ASME Y14.5-2018 annotations coupled with its operational AIAG DFMEA matrix and active production Control Plan.	**6 Hours** **6 Hours**

Theory Hours:	**30**	**Tutorial Hours:**		**Practical Hours:**	**30**	**Project Hours:**		**Total Hours:**	**60**

Learning Resources
Textbooks
1. Krulikowski, A., *Fundamentals of Geometric Dimensioning & Tolerancing*, Cengage Learning (2021). 2. Mohsen, A., *Engineering Metrology and Measurements*, Oxford University Press (2019).
Reference books/ Web Links
1. ASME Y14.5 – Dimensioning and Tolerancing Standard. 2. AIAG Core Tools Manual Frameworks (SPC, MSA, FMEA reference editions). 3. Galyer & Shotbolt, Engineering Drawing and Design, Jaico Publications. 4. Shigley, J., Mechanical Engineering Design, McGraw-Hill. 5. Cox, Metrology in Industry, Springer..
Online Resources
1. NPTEL Course Profile: https://onlinecourses.nptel.ac.in/noc24_me140/preview 2. Udemy Certification Track: CMM (Coordinate Measuring Machine) for Beginners. 3. Udemy Certification Track: Metrology - a GD&T approach.

Assessment (Embedded course)
SA I and SA II Activity and Learning Task(s), Mini project, MCQ, End Semester Examination (ESE), Lab Workbook, Experimental Cycle tests, viva-voce

Course Curated By		
Expert(s) from Industry	**Expert(s) from Higher Education Institutions**	**Internal Expert(s)**
		Mr. G.Rajkumar Ap-II, Auto

Approved by: BoS Chairman	With Signature and date
BoS Approval date:	

24AUE006	Composite Materials for Automotive Applications	L	T	P	J	C
		2	0	2	0	3
PE		SDG	7,9,12,13			

Pre-requisite courses	NIL	Data Book / Codes / Standards (If any)	NA

Course Objectives:	The purpose of taking this course is to:
1	To provide fundamental knowledge on composite materials, their classifications, constituents, and fabrication techniques including hand lay-up.
2	To provide fundamental knowledge on composite materials, their classifications, constituents, and fabrication techniques including hand lay-up.
3	To develop understanding of polymer matrix composites (PMCs), including reinforcement materials, processing methods, and industrial applications.
4	To impart knowledge on metal matrix composites (MMCs) and ceramic matrix composites (CMCs), focusing on material selection, processing techniques, and performance characteristics.
5	To enhance practical skills in fabrication techniques of composites such as hand lay-up, 3D printing, casting, and other advanced manufacturing processes.
6	To familiarize students with testing and characterization methods for evaluating mechanical and thermal properties of composite materials.

Course Outcomes:	After successful completion of this course, the students shall be able to	Bloom's Taxonomy Level (BTL)
CO 1	Recall the fundamentals, need, classification, properties, advantages and disadvantages of composite materials	R
CO 2	Understand the types of reinforcement materials, matrix materials, and processing techniques used in polymer matrix composites	U
CO 3	Apply fabrication techniques such as hand lay-up, molding, casting, and 3D printing to develop composite materials.	Ap
CO 4	Analyze the processing methods and performance characteristics of metal matrix and ceramic matrix composites for engineering applications	An
CO 5	Evaluate mechanical and thermal properties of composites using standard testing methods such as UTM, DSC, and TGA	Ev
CO 6	Design and develop composite materials with appropriate selection of matrix, reinforcement, and processing techniques for specific applications.	C

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11			
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	Automotive Design and Manufacturing	Automotive Electrical Electronics	Automotive Technology and Management
1	3	2	2									3		
2	3	2	2									3		
3	3	2	2									3		
4	3	2	2									3		
5	3	2	2		3							3		
6	3	2	2		3							3		

Course Content

Introduction and Classifications Fundamentals of composites- Need for composites- Classification, Advantages, Disadvantages, Properties and Particulate of composites-Fibre reinforced Composite-Hand Lay up technique Practical Component: 1) Hand Lay-up Technique of fabrication of Composite Material	**6 Hours** **3 Hours**
Polymer Matrix Composites Reinforcement material-Fibres- Glass fibre, Carbon fibre-Processing- Aramid fibre and Boron fibre-Properties and Application- Polymer matrix material-Thermosetting resins, thermoplastic resins- Fillers-Additives- Pre-Processed Material- Molding compound-Prepegs-PMC processes- Spray up processes- Compression molding, Injection molding Pultrusion, Filament winding- Properties of PMCs- Automotive Application of PMCs. **Practical Component:** 1) Fabrication of PMC's using 3-D Printing	**6 Hours** **6 Hours**
Metal Matrix Composites Metallic Matrix Matrix- Selection of reinforcement- Processing of MMC- Liquid state processes- Stir Casting, Squeeze Casting- Melt Infiltration- Spray deposition- Solid state processes- Powder Metallurgy technique- Hot Pressing- Diffusion Bonding- Automotive Application of MMCs. **Practical Component:** 1) Fabrication of MMC's	**6 Hours** **6 Hours**
Ceramic Matrix Composites Ceramic Matrix Material- Ceramic Particle Based Processes- Cold Compaction- Slurry Impregnation- Sol-gel Processing- Reaction Bonding Processes- In Situ Ceramic	**6 Hours**

Composite Processing- Melt Processing- Polymer Infiltration and Pyrolysis- Properties of CMCs- Automotive Application of CMCs **Practical Component:** 1) Fabrication of CMC's	**6 Hours**
Testing and Characterisation Methods of Composite Materials Mechanical Characterisation- Tensile testing, Impact testing, Hardness testing, Flexural testing. Thermal Testing – Differential Scanning Calorimetry (DSC), Thermogravimetric Analysis (TGA) **Practical Component:** 1) Mechanical testing of Fabricated Composites using UTM and 3-Point Bending Testing Equipment 2) Thermal testing of fabricated composites using DSC and TGA	**6 Hours** **9 Hours**

Theory Hours:	**30**	**Tutorial Hours:**	**0**	**Practical Hours:**	**30**	**Project Hours:**	**0**	**Total Hours:**	**60**

Learning Resources*
Textbooks
1. Krishnan K Chawla, Composite Materials: Science and Engineering, International Edition, Springer, 2019. 2. Mallick, P.K. and Newman.S, Composite Materials Technology, Hanser Publishers, 2003. 3. ASM Handbook – Composites, Vol-21, 2001
Reference books/ Web Links
1. Debdatta Ratna and Bikash Chandra Chakraborty, Polymer Matrix Composite Materials: Structural and Functional Applications, 1st Edition, Walter de Gruyter GmbH & Co KG, 2023
Online Resources
1. https://nptel.ac.in/courses/101106038 2. https://onlinecourses.nptel.ac.in/noc22_me87/preview

Assessment	
Formative	Summative
Assignments, Quiz, Lab	SA- I, SA– II and End Semester Examination (ESE)

Course Curated by			
Expert(s) from Industry	**Expert(s) from Higher Education Institution**		**Internal Expert(s)**
	Dr. Arun S, Assistant Professor, Department of Mechanical Engineering, NIT-Calicut		Dr. Aravind S L Ap-III, Auto
Recommended by BoS on			
Academic Council Approval		**Date**	

24AUE007	Automotive Components Manufacturing	L	T	P	J	C
		3	0	0	0	3
PE		SDG				

Pre-requisite courses	Manufacturing Technology	Data Book / Codes / Standards (If any)	Nil

Course Objectives:	The purpose of taking this course is to
1	understand manufacturing processes of automotive engine, transmission, and body components.
2	analyze casting, forging, machining, and heat treatment processes.
3	study advanced manufacturing methods for automotive applications.
4	explore material processing for polymer and composite components.
5	develop knowledge in surface coating and finishing techniques.

Course Outcomes:	After successful completion of this course, the students shall be able to	Bloom's Taxonomy Level (BTL)
CO 1	Explain manufacturing processes of engine components	U
CO 2	Analyze manufacturing techniques of transmission components	A
CO 3	Apply forming and machining processes in automotive manufacturing	Ap
CO 4	Demonstrate manufacturing of body and polymer components	Ap
CO 5	Evaluate coating and finishing techniques for automotive parts	E
CO 6	Explain manufacturing processes of engine components	U

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11			
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	Automotive Design and Manufacturing	Automotive Electrical Electronics	Automotive Technology and Management
1	3	2	-	-	-	-	-	-	-	-	2	3	-	-
2	3	3	2	2	2	-	-	-	-	-	2	3	-	-
3	3	3	3	2	3	-	-	-	-	-	2	3	-	-
4	2	3	2	2	3	-	-	-	-	-	2	3	1	-
5	2	3	2	2	3	-	-	-	-	-	3	3	2	-

Course Content

ENGINE COMPONENTS Casting of engine block – conventional and expendable pattern methods – Casting of cylinder heads and cylinder liners – Manufacturing of crankshaft, connecting rod and gudgeon pin by forging and casting – Machining operations and heat treatment. Casting of piston – gravity casting and squeeze casting – Machining, finishing processes and piston ring manufacturing. Upset forging of valves – Heat treatment and surface improvement techniques. Manufacturing of engine bearings.	**10 Hours**
TRANSMISSION COMPONENTS – I Manufacturing of friction plates using conventional blanking and fine blanking. Manufacture of composite friction linings – Phenol formaldehyde moulding process. Casting of gearbox casing. Precision forging of gears – Gear hobbing, shaping – Powder metallurgy – Orbital forming of spur, helical, bevel and hypoid gears – Heat treatment and finishing.	**10 Hours**
TRANSMISSION COMPONENTS – II Manufacturing of propeller shaft – Continuous casting, extrusion, heat treatment and surface hardening – Composite propeller shaft manufacturing. Forging of rear axle – Casting of rear axle casing. Manufacturing of wheels and brake drums.	**10 Hours**
BODY COMPONENTS Thermoforming and hydroforming – Press forming of body panels. Welding of body panels – Resistance welding, spot welding, seam welding. Injection moulding – Instrument panel and bumper manufacturing – Reinforced reaction injection moulding. Manufacture of metal and polymer panels – Adhesives and sealants. Manufacturing of springs – Wrap forming of coil springs, leaf springs and composite leaf springs.	**10 Hours**
SURFACE COATINGS Chemical Vapour Deposition (CVD), Physical Vapour Deposition (PVD), sol-gel processing. Surface finishing processes – Spraying, plating and painting in paint booths.	**10 Hours**

Self-Learning Topics: (Hours: 5 Hrs)

- Smart manufacturing and digital twin in automotive production
- Lightweight materials and manufacturing techniques
- Case studies on modern automotive manufacturing plants

Theory Hours:	45	**Tutorial Hours:**	-	**Practical Hours:**	-	**Project Hours:**	-	**Total Hours:**	**45**

Learning Resources

Textbooks

1. Kalpakjian S., *Manufacturing Engineering and Technology*, Pearson, 2014.
2. Groover M.P., *Fundamentals of Modern Manufacturing*, Wiley, 2015.

Reference books/ Web Links

1. Black J.T., *DeGarmo's Materials and Processes in Manufacturing*, Wiley, 2016.

2. P.C. Sharma, *Production Engineering*, S. Chand, 2012.
Online Resources
1. https://nptel.ac.in/courses/112107144

Assessment (Embedded course)
SA I and SA II Activity and Learning Task(s), MCQ, End Semester Examination (ESE),

Course Curated by			
Expert(s) from Industry	**Expert(s) from Higher Education Institution**		**Internal Expert(s)**
Recommended by BoS on			
Academic Council Approval		**Date**	

24AUE008	Design for Manufacture and Assembly (DFMA)	L	T	P	J	C
		3	0	0	0	3
PE		SDG				

Pre-requisite courses	Manufacturing Technology	Data Book / Codes / Standards (If any)	-

Course Objectives:	The purpose of taking this course is to
1	understand design aspects and their influence on manufacturing processes.
2	learn material selection and process planning for economical production.
3	acquire knowledge of tolerances and their role in manufacturing and assembly.
4	understand geometric dimensioning and tolerance representation.
5	develop knowledge of assembly design, compliance, and interference analysis.

Course Outcomes:	After successful completion of this course, the students shall be able to	Bloom's Taxonomy Level (BTL)
CO 1	Outline design aspects for selection of materials and manufacturing processes	U
CO 2	Identify design considerations for machining and metal joining processes	U
CO 3	Apply design knowledge in metal casting and forging processes	Ap
CO 4	Demonstrate understanding of Geometric Dimensioning and Tolerancing (GD&T)	Ap
CO 5	Identify requirements for mechanical documentation and process planning	U
CO 6	Apply compliance and interference analysis in assembly design	Ap

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11			
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	Automotive Design and Manufacturing	Automotive Electrical Electronics	Automotive Technology and Management
1	3	3	3	3	-	-	-	2	-	3	-	2	2	-
2	3	2	2	2	-	-	-	2	2	-	-	2	3	-
3	2	2	2	2	-	-	-	2	-	-	-	2	3	-
4	3	3	3	2	-	-	-	2	3	-	-	3	2	-

5	2	-	-	-	2	-	-	2	-	-	-	2	-	-
6	3	3	3	2	-	-	-	2	-	-	-	3	2	-

Course Content

DFM APPROACH, MATERIAL SELECTION AND SUBSTITUTION Design for Manufacture (DFM) approach – DFM guidelines – Standardization – Group Technology – Value Engineering – Material selection and substitution based on cost and performance considerations.	**9 Hours**
GEOMETRIC DIMENSIONING AND TOLERANCE (GD&T) Process capability – Process capability metrics (Cp, Cpk) – Cost aspects – Feature tolerances – Geometric tolerances – Surface finish – Relationship between tolerance grades and machining processes – Cumulative tolerances – Sure fit law – Normal and truncated normal distribution – Six Sigma concept.	**9 Hours**
TOLERANCE CHARTING TECHNIQUES Operation sequence for shaft-type components – Process planning – Preparation of process drawings – Tolerance worksheets – Centrality analysis – Case studies and examples.	**9 Hours**
DESIGN FOR MANUFACTURE Design features for machining – Datum features (functional and manufacturing) – Machining considerations – Redesign for manufacturability – Design of castings (parting line, cores) – Redesign using weldments – Welding symbols – Case studies.	**9 Hours**
SELECTIVE ASSEMBLY Interchangeable and selective assembly – Grouping of components – Model I and Model II assembly methods – Tolerance distribution – Control of axial play – Secondary machining operations – Laminated shims – Case studies.	**9 Hours**

Self-Learning Topics: (Hours: 5 Hrs)

- Digital manufacturing and design optimization
- AI-based tolerance analysis
- Case studies in automotive product design

Theory Hours:	45	**Tutorial Hours:**		**Practical Hours:**		**Project Hours:**		**Total Hours:**	**45**

Learning Resources

Textbooks

1. Bralla, J.G., *Design for Manufacturability Handbook*, McGraw-Hill, 1998.
2. Boothroyd G., Dewhurst P., Knight W., *Product Design for Manufacture and Assembly*, CRC Press, 2002.

Reference books/ Web Links

1. Dieter G.E., Schmidt L.C., *Engineering Design*, McGraw-Hill, 2009.
2. Zeid I., *CAD/CAM Theory and Practice*, Tata McGraw-Hill, 2009.

Online Resources

1. https://www.sme.org

Assessment (Theory)
SA I and SA II Activity and Learning Task(s), , MCQ, End Semester Examination (ESE)

Course Curated by			
Expert(s) from Industry	**Expert(s) from Higher Education Institution**		**Internal Expert(s)**
Recommended by BoS on			
Academic Council Approval		**Date**	

24AUE009	Additive Manufacturing and Tooling	L	T	P	J	C
		2	0	2	0	3
PE		SDG				

Pre-requisite courses	Manufacturing Technology	Data Book / Codes / Standards (If any)	-

Course Objectives:	The purpose of taking this course is to
1	understand the principles and classification of additive manufacturing processes.
2	analyze materials, process parameters, and design considerations in AM.
3	explore tooling applications using additive manufacturing.
4	study post-processing and quality aspects of AM parts.
5	develop practical skills using 3D printing and rapid tooling techniques.

Course Outcomes:	After successful completion of this course, the students shall be able to	Bloom's Taxonomy Level (BTL)
CO 1	Explain principles and processes of additive manufacturing	U
CO 2	Analyze materials and process parameters in AM systems	A
CO 3	Apply AM techniques for prototyping and tooling applications	Ap
CO 4	Demonstrate design for additive manufacturing (DfAM) concepts	Ap
CO 5	Evaluate post-processing and quality aspects of AM components	E
CO 6	Develop solutions using AM for automotive applications	Ap

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11			
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	Automotive Design and Manufacturing	Automotive Electrical Electronics	Automotive Technology and Management
1	3	2	-	-	-	-	-	-	-	-	2	2	-	-
2	3	3	2	2	2	-	-	-	-	-	2	3	-	-
3	3	3	3	2	3	-	-	-	-	-	2	3	1	-
4	2	3	3	2	3	-	-	-	-	-	2	3	1	-
5	2	3	2	2	3	-	-	-	-	-	3	3	2	-
6	2	3	3	2	3	-	-	2	2	2	3	3	2	2

Course Content

INTRODUCTION TO ADDITIVE MANUFACTURING Overview of additive manufacturing – Classification of AM processes – Rapid prototyping principles – Comparison with conventional manufacturing – AM process chain – Applications in automotive and aerospace industries. **Practical Component:** • Introduction to 3D printers and slicing software • Basic 3D model preparation	**6 Hours** **6 Hours**
ADDITIVE MANUFACTURING PROCESSES Vat photopolymerization (SLA), Material extrusion (FDM), Powder bed fusion (SLS/SLM), Binder jetting, Directed energy deposition – Process parameters and limitations. **Practical Component:** • Printing using FDM process • Parameter variation study (layer thickness, infill, speed)	**6 Hours** **6 Hours**
MATERIALS AND DESIGN FOR AM (DfAM) Materials used in AM – Polymers, metals, composites – Design guidelines for AM – Topology optimization – Lattice structures – Support structures and orientation. **Practical Component:** • Design and optimization of components for AM • CAD modelling for 3D printing	**6 Hours** **6 Hours**
TOOLING USING ADDITIVE MANUFACTURING Rapid tooling – Direct and indirect tooling – Mould inserts and dies – Conformal cooling channels – Hybrid manufacturing processes – Applications in automotive tooling. **Practical Component:** • Design and fabrication of simple tooling components • Case study on mould/tool using AM	**6 Hours** **6 Hours**
POST-PROCESSING AND QUALITY CONTROL Post-processing techniques – Heat treatment, machining, surface finishing – Inspection methods – Defects in AM parts – Testing and quality control – Standards and certification. **Practical Component:** • Surface finishing and post-processing • Measurement and inspection of printed parts	**6 Hours** **6 Hours**

Self-Learning Topics: (Hours: 5 Hrs)

- Metal additive manufacturing in automotive industries
- AI-driven design optimization for AM
- Sustainability in additive manufacturing

Theory Hours:	30	**Tutorial Hours:**		**Practical Hours:**	30	**Project Hours:**		**Total Hours:**	60

Learning Resources

Textbooks

1. Ian Gibson, David Rosen, Brent Stucker, *Additive Manufacturing Technologies*, Springer, 2015
2. Andreas Gebhardt, *Understanding Additive Manufacturing*, Hanser, 2012.

Reference books/ Web Links

4. Chua C.K., Leong K.F., Lim C.S., *Rapid Prototyping: Principles and Applications*, World Scientific, 2010.
5. Liou F., *Rapid Prototyping and Engineering Applications*, CRC Press, 2007.

Online Resources

1. https://nptel.ac.in/courses/112104304
2. https://www.coursera.org/learn/additive-manufacturing

Assessment (Embedded course)
SA I and SA II Activity and Learning Task(s), Mini project, MCQ, End Semester Examination (ESE), Lab Workbook, Experimental Cycle tests, viva-voce

Course Curated by			
Expert(s) from Industry	**Expert(s) from Higher Education Institution**	**Internal Expert(s)**	
Recommended by BoS on			
Academic Council Approval		**Date**	

24AUE010	Digital Manufacturing	L	T	P	J	C
		3	0	0	0	3
PE		SDG	9, 11, 12			

Pre-requisite courses	Manufacturing Technology	Data Book / Codes / Standards (If any)	

Course Objectives:	The purpose of taking this course is to
1	the concepts and architecture of digital manufacturing systems.
2	analyze the role of automation, IoT, and data analytics in manufacturing.
3	study digital twins and simulation in manufacturing processes.
4	explore smart factory concepts and cyber-physical systems.
5	develop knowledge of integrated digital manufacturing systems.

Course Outcomes:	After successful completion of this course, the students shall be able to	Bloom's Taxonomy Level (BTL)
CO 1	Explain digital manufacturing concepts and system architecture	U
CO 2	Analyze the role of automation, IoT, and data analytics in manufacturing	A
CO 3	Apply digital tools for manufacturing simulation and optimization	Ap
CO 4	Demonstrate understanding of digital twins and cyber-physical systems	Ap
CO 5	Evaluate smart factory operations and integration strategies	E
CO 6	Develop solutions using digital manufacturing technologies in automotive applications	Ap

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11			
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	Automotive Design and Manufacturing	Automotive Electrical Electronics	Automotive Technology and Management
1	3	2	-	-	-	-	-	-	-	-	2	2	-	-
2	3	3	2	2	3	-	-	-	-	-	2	3	-	-
3	3	3	3	2	3	-	-	-	-	-	2	3	-	-
4	2	3	3	2	3	-	-	-	-	-	2	3	-	-
5	2	3	2	2	3	-	-	-	-	-	3	3	-	2

6	2	3	3	2	3	-	-	2	2	2	3	3	-	2

Course Content

INTRODUCTION TO DIGITAL MANUFACTURING Digital manufacturing – Definition and evolution – Industry 4.0 – Smart manufacturing systems – Digital thread and digital continuity – Integration of CAD, CAM, and PLM – Applications in automotive industries.	**9 Hours**
AUTOMATION AND INDUSTRIAL IoT Industrial automation – Sensors and actuators – PLC and SCADA systems – Industrial IoT (IIoT) – Data acquisition and communication protocols – Cloud computing in manufacturing.	**9 Hours**
DATA ANALYTICS AND MANUFACTURING OPTIMIZATION Big data in manufacturing – Data analytics techniques – Predictive maintenance – Machine learning basics – Process optimization – Decision-making using data.	**9 Hours**
DIGITAL TWINS AND CYBER-PHYSICAL SYSTEMS Digital twin concepts – Modeling and simulation – Cyber-physical systems (CPS) – Virtual commissioning – Real-time monitoring and control – Applications in automotive manufacturing.	**9 Hours**
SMART FACTORIES AND FUTURE MANUFACTURING) Smart factory architecture – Flexible manufacturing systems – Human-machine interaction – Robotics and automation – Sustainability in manufacturing – Challenges and future trends.	**9 Hours**

Self-Learning Topics: (Hours: 5 Hrs)

- AI-driven manufacturing systems
- Blockchain in supply chain and manufacturing
- Case studies on smart automotive plan

Theory Hours:	45	**Tutorial Hours:**	-	**Practical Hours:**	-	**Project Hours:**	-	**Total Hours:**	**45**

Learning Resources

Textbooks

1. Alasdair Gilchrist, *Industry 4.0: The Industrial Internet of Things*, Apress, 2016.
2. Zude Zhou et al., *Digital Manufacturing and Smart Manufacturing Systems*, Springer, 2018.

Reference books/ Web Links

1. Groover M.P., *Automation, Production Systems, and Computer-Integrated Manufacturing*, Pearson, 2015.
2. Tao F., Qi Q., *Digital Twin Driven Smart Manufacturing*, Academic Press, 2019.

Online Resources

1. https://www.coursera.org/learn/smart-manufacturing

Assessment (Theory)
SA I and SA II Activity and Learning Task(s), MCQ, End Semester Examination (ESE)

Course Curated by			
Expert(s) from Industry	**Expert(s) from Higher Education Institution**		**Internal Expert(s)**
Recommended by BoS on			
Academic Council Approval		**Date**	

AUTOMOTIVE ELECTRICAL AND ELECTRONICS

24AUE011	Labview-Based Automotive Instrumentation and Virtual Prototyping	L	T	P	J	C
		2	0	2	0	3
PE		SDG	9			

Pre- requisite courses		Data Book / Codes / Standards (If any)	

Course Objectives:	The purpose of taking this course is to:
1	Understand LabVIEW programming for automotive applications
2	Develop virtual instruments for vehicle data visualization
3	Interface automotive sensors and communication protocols
4	Design and validate digital instrument clusters

Course Outcomes:	After successful completion of this course, the students shall be able to	Bloom's Taxonomy Level (BTL)
CO 1	Explain the fundamentals of LabVIEW and automotive instrumentation systems	U
CO 2	Develop basic and intermediate Virtual Instruments (VIs) for automotive parameters	Ap
CO 3	Interface automotive sensors and perform data acquisition using LabVIEW	Ap
CO 4	Implement automotive communication protocols (CAN/LIN) in LabVIEW environment	An
CO 5	Design and evaluate digital instrument cluster GUI with real-time features	E
CO 6	Build and demonstrate a functional instrument cluster system using LabVIEW	C

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11			
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	Automotive Design and Manufacturing	Automotive Electrical Electronics	Automotive Technology and Management
1	3	2	-	-	2						2	3	-	
2	3	3	2	2	3						2	3	2	
3	3	3	3	2	3				1		2	3	3	2
4	3	3	3	2	3				1		2	3	3	2
5	3	3	3	3	3				2	1	2	3	3	3
6	3	3	3	3	3				2	2	3	3	3	3

Course Content

INTRODUCTION TO LABVIEW & AUTOMOTIVE INSTRUMENTATION Introduction to graphical programming, LabVIEW environment: front panel, block diagram, Dataflow programming paradigm, Virtual Instruments (VIs): structure and execution, Automotive instrumentation overview, Analog vs digital instrument clusters, Vehicle parameters: speed, RPM, temperature, fuel **Practical** • **Basic Virtual Instrument (VI) Development:** Creating basic Vis, Numeric indicators, gauges, charts • **Speedometer Simulation:** Simulation of speedometer & tachometer	**6 Hours** **6 Hours**
DATA ACQUISITION & SENSOR INTERFACING Automotive sensors: speed, pressure, temperature, fuel level, Signal conditioning techniques, Data acquisition systems (DAQ), NI-DAQ architecture Interfacing sensors with LabVIEW, Real-time data acquisition and visualization **Practical** • **Sensor Data Acquisition using DAQ:** Acquire simulated/real temperature signal using DAQ Assistant • **Fuel Level Monitoring System:** Develop a VI to simulate fuel level sensor and implement threshold indication (low fuel alert)	**6 Hours** **6 Hours**
AUTOMOTIVE COMMUNICATION PROTOCOLS (CAN/LIN) In-vehicle communication networks, CAN protocol: architecture, frame, structure, arbitration, LIN protocol fundamentals, Diagnostics and	**6 Hours**

communication flow, LabVIEW interfacing using NI-XNET, Data transmission and monitoring **Practical** • **CAN Message Transmission:** Create CAN frames and transmit vehicle parameters and using LabVIEW CAN toolkit for communication • **CAN Message Reception & Decoding:** Receive CAN messages and decode and display parameters (speed, RPM)	**6 Hours**
GUI DESIGN FOR DIGITAL INSTRUMENT CLUSTERS Human-Machine Interface (HMI) principles, Dashboard layout and ergonomics, Graphical elements: gauges, indicators, warning lights, multi-parameter display design, Alarm and alert systems, User experience and safety considerations **Practical** • **Warning & Alert System:** Implement warning indicators (engine, fuel, temperature) with visual/audio alerts based on thresholds • **Dashboard GUI Design:** Design a digital dashboard with multiple indicators and integrate speed, RPM, and fuel displays	**6 Hours** **6 Hours**
TESTING, VALIDATION & AUTOMATION Automotive testing standards and requirements, Functional validation of instrument clusters, Automated testing using LabVIEW, Fault detection and diagnostics, Case studies: digital cockpit systems **Practical** • **Automated Testing of Instrument Cluster:** Develop automated test sequence for dashboard to validate parameter limits and system response	**6 Hours** **6 Hours**

Theory Hours:	**30**	**Tutorial Hours:**		**Practical Hours:**	**30**	**Project Hours:**		**Total Hours:**	**60**

Learning Resources
Textbooks
• Gary Johnson, LabVIEW Graphical Programming, McGraw-Hill • Robert Bosch GmbH, Automotive Electronics Handbook
Reference books/ Web Links
• National Instruments, *LabVIEW User Manual* • Konrad Reif, *Automotive Mechatronics*, Springer • William Ribbens, *Understanding Automotive Electronics*

- NI Technical White Papers

Online Resources

- LabVIEW Data Acquisition and Instrument Control Masterclass.
- Data Acquisition Using NI-DAQmx and Python Course Overview - NI
- Certified LabVIEW Associate Developer (CLAD)

Assessment (Theory course)
Continuous Assessment Test, Model Lab, End semester exam, Presentation, MCQ, Assignment, Case Study

Course Curated by			
Expert(s) from Industry	**Expert(s) from Higher Education Institution**		**Internal Expert(s)**
Mr. Ramesh Krishnan Narayanan MD, MaxEye Technologies, Bangalore			Dr. Thenmozhi G
Recommended by BoS on			
Academic Council Approval		**Date**	

24AUE012	Power Electronics for Electric Vehicles	L	T	P	J	C
		2	0	2	0	3
PE		SDG	7, 9			

Pre- requisite courses	-	Data Book / Codes / Standards (If any)	

Course Objectives:	The purpose of taking this course is to:
1	understand power semiconductor devices used in EV applications
2	analyze DC-DC converters and inverters for electric vehicles
3	design and simulate EV power electronic systems using MATLAB
4	implement hardware prototypes for power conversion systems
5	evaluate performance of EV powertrain electronics

Course Outcomes:	After successful completion of this course, the students shall be able to	Bloom's Taxonomy Level (BTL)
CO 1	Understand the role and characteristics of power semiconductor devices used in electric vehicles.	U
CO 2	Understand AC-DC converter operation and apply power factor correction techniques to improve efficiency in EV systems.	Ap
CO 3	Apply DC-DC converter topologies to meet the power requirements of electric vehicle subsystems.	Ap
CO 4	Implement inverter control strategies and evaluate their impact on EV motor drive performance.	E
CO 5	Analyze and assess the suitability of power electronic devices and converter configurations for various EV applications.	An
CO 6	Build the converters for EVs and evaluate the performance of EV power electronic systems	C

	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11			
Course Outcomes (CO)	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	PSO-1	PSO-2	PSO-3
1	3	2	-	-	2						2	3	-	

2	3	3	2	2	3						2	3	2	
3	3	3	3	2	3				1		2	3	3	2
4	3	3	3	2	3				1		2	3	3	2
5	3	3	3	3	3				2	1	2	3	3	3
6	3	3	3	3	3				2	2	3	3	3	3

Course Content

POWER SEMICONDUCTOR DEVICES FOR EVs Introduction to power electronics, Power diodes, MOSFET, IGBT – characteristics, Switching losses and efficiency, Device selection for EV applications, Study of SiC & GaN devices in EVs	**6 Hours**
Practical (Hardware/Simulation) • Characteristics of MOSFET/IGBT and Switching behaviour observation using Hardware • Switching Loss analysis using Matlab	**6 Hours**
AC-DC CONVERTERS Rectification techniques - single phase and three phase rectifiers. Power factor correction techniques in ac – dc converters and electric vehicle charging systems, its importance.	**6 Hours**
Practical (Hardware/Simulation) • Single-Phase Half-Wave & Full-Wave Rectifier • Bridge Rectifier with Filter	**6 Hours**
DC-DC CONVERTERS FOR ELECTRIC VEHICLES Importance of DC-DC conversion in electric vehicles, Types of dc-dc converters – Buck converter, Boost converter and buck-boost converter, Integration of dc-dc converters to various vehicle systems.	**6 Hours**
Practical (Hardware/Simulation) • Simulation of DC-DC converters using Matlab • Buck/Boost converter hardware setup and output voltage control	**6 Hours**
DC- AC CONVERTERS Introduction to Inverters, Types of inverters – single phase and three phase inverters, PWM techniques. Inverter control strategies - Voltage control strategies, current control strategies, Space vector modulation.	**6 Hours**

Practical (Hardware/Simulation) • PWM signal generation • Inverter simulation using Simulink	**6 Hours**
INVERTERS FOR MOTOR DRIVES AND OTHER SYSTEMS IN ELECTRIC VEHICLES Inverter requirements for EV motor drives, motor control techniques in EVs, Challenges and solutions in EV inverter design. Inverters for auxiliary systems in EVs, inverter requirements for energy storage systems. **Practical (Hardware/Simulation)** • Inverter circuit implementation • EV drive simulation	**6 Hours** **6 Hours**

Theory Hours: 30	**Tutorial Hours:**	**Practical Hours: 30**	**Project Hours:**	**Total Hours: 60**

Learning Resources*

Textbooks

- Ned Mohan., *Power Electronics: Converters, Applications and Design*, Wiley
- Muhammad Rashid., *Power Electronics Handbook*, Elsevier
- Bose, B. K. (2020). Power electronics and motor drives: advances and trends

Reference books/ Web Links

- Erickson & Maksimovic., *Fundamentals of Power Electronics*
- Krishnan., *Electric Motor Drives*
- Ehsani et al., *Modern Electric, Hybrid Electric Vehicles*
- MATLAB Documentation – Simulink
- Abu-Rub, H., Malinowski, M., & Al-Haddad, K. (2014). *Power electronics for renewable energy systems, transportation and industrial applications*. John Wiley & Sons
- Emadi, A. (Ed.). (2017). *Handbook of automotive power electronics and motor drives*. CRC press

Online Resources

- NPTEL Power Electronics Lectures nptel.ac.in/courses/108105066
- https://www.mathworks.com/discovery/power-electronics-simulation.html
- EV Powertrain Explained EV Powertrain Explained | Complete Electric Vehicle System Architecture (FWD, RWD, AWD, VCU & More)

Assessment (Theory course)

Continuous Assessment Test, Model Lab, End semester exam, Presentation, MCQ, Assignment, Case Study

Course Curated by			
Expert(s) from Industry	**Expert(s) from Higher Education Institution**		**Internal Expert(s)**
Mr.Veeramanikandan, CEO, Feromite	Dr.Karthikeyan A PSG Tech		Dr. Thenmozhi G Associate Professor/KCT
Recommended by BoS on			
Academic Council Approval		**Date**	

24AUE013	Model-Based Design for ARM Cortex-M4	L	T	P	J	C
		2	0	2	0	3
PE		SDG	9			

Pre-requisite courses		Data Book / Codes / Standards (If any)	NIL

Course Objectives:	The purpose of taking this course is to
1	Introduce model-based embedded development workflow and its advantages over traditional coding approaches.
2	Enable automatic code generation using Simulink Embedded Coder for ARM Cortex microcontrollers.
3	Develop GPIO modeling using Simulink blocks for digital input and output peripherals.
4	Implement real-world embedded applications using model-based design approach on ARM Cortex-M4.
5	Deploy Simulink generated code to STM32 (ARM Cortex-M4) hardware and validate functionality.

Course Outcomes:	After successful completion of this course, the students shall be able to	Bloom's Taxonomy Level (BTL)
CO 1	Explain the model-based embedded system workflow and distinguish it from traditional development.	U
CO 2	Develop Simulink models for embedded system simulation and analysis on ARM Cortex-M4 platform.	Ap
CO 3	Generate embedded C code automatically using Simulink Embedded Coder for ARM Cortex-M4.	Ap
CO 4	Model GPIO peripherals such as digital inputs and outputs using Simulink STM32/ARM Cortex blocks.	Ap
CO 5	Implement UART serial communication and perform sensor data logging and debugging via serial monitor on ARM Cortex-M4.	Ap
CO 6	Design and develop a complete embedded application integrating multiple peripherals and serial communication on ARM Cortex-M4.	C

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11			
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	Automotive Design and Manufacturing	Automotive Electrical Electronics	Automotive Technology and Management
1	3				2						2		2	
2	2		3		3						1		3	
3	2	2	3		3						1		3	
4	2	2	2	2	3						1		2	
5	2	2	3	3	3				1		1		3	
6	2	2	3	2	3			2	1	2	2		3	2

Course Content	
MODULE 1: MODEL-BASED DEVELOPMENT USING SIMULINK **Model-Based Design Workflow:** Development method of embedded system- Traditional vs Model-Based Development, V-Model Development Cycle, Benefits of Model-Based Design **Simulink Overview:** Simulink Environment and Toolboxes, Block Libraries, Signal Flow and Data Types, Simulation Parameters **Code Generation Concepts:** Embedded Coder Overview, Code Generation Settings, Target Hardware Configuration **Practical Component:** 1. Simulink environment setup and basic model creation 2. Simulation of a simple signal processing model	**6 Hours** **6 Hours**
MODULE 2: ARM CORTEX-M4 SIMULINK ENVIRONMENT SETUP **ARM Cortex-M4 Architecture:** Cortex-M4 Core Features, STM32 Peripherals Overview, Clock Configuration, Memory Map **Simulink STM32/ARM Cortex Blocks:** STM32 Hardware Support Package, Block Library for ARM Cortex-M4, Peripheral Blocks Overview **Hardware Configuration:** CubeMX Integration, Pin Mapping, Clock and Peripheral Setup in Simulink **Practical Component:** 1. STM32 (ARM Cortex-M4) hardware support package installation and configuration 2. STM32 board connection and first hardware deployment via Simulink	**6 Hours** **6 Hours**
MODULE 3: GPIO MODELING ON ARM CORTEX-M4 **Digital Input Modeling:** GPIO Input Block, Switch and Button Interfacing, Debounce Logic in Simulink **Digital Output Modeling:** GPIO Output Block, LED and Actuator Control, Output Signal Conditioning **LED Control Application:** LED Blink Model, PWM for Brightness Control, Pattern-Based LED Sequence **Practical Component:** 1. LED blink model deployment on ARM Cortex-M4 (STM32) 2. Switch input reading and LED output control via Simulink	**6 Hours** **6 Hours**

MODULE 4: MODEL-BASED CODE GENERATION AND DEPLOYMENT **Embedded Coder:** Code Generation Report, Optimized C Code, MISRA-C Compliance Options **Code Generation Workflow:** Build Settings, Generated File Structure, Integration with STM32 HAL (ARM Cortex) **Deployment to ARM Cortex-M4:** Flash Programming, Run-Time Testing, Code Verification on Hardware **Practical Component:** 1. Code generation from Simulink model targeting ARM Cortex-M4 2. Flashing and verifying generated code on STM32 hardware	**6 Hours** **6 Hours**
MODULE 5: SERIAL COMMUNICATION **UART Communication:** Serial Communication Basics, Data Transmission **Debugging via Serial Monitor:** Serial Monitor Setup, Real-time Data Visualization, Log Analysis **Practical Component:** 1. UART Communication 2. Serial Data Transmission 3. Sensor Data Logging	**6 Hours** **6 Hours**

Theory Hours:	30	**Tutorial Hours:**	-	**Practical Hours:**	30	**Project Hours:**	-	**Total Hours:**	60

Learning Resources

Textbooks

1. Asadi, F. and Pongswatd, S.,Programming the ARM® Cortex®-M4-based STM32F4 Microcontrollers with Simulink Synthesis Lectures on Digital Circuits and Systems, Morgan & Claypool Publishers, USA (2021).
2. Nicolescu, G. and Mosterman, P. J. (Eds.), *Model-Based Design for Embedded Systems*, CRC Press, Taylor & Francis Group, Boca Raton, FL (2009).
3. Patankar, P. and Kulkarni, S., *MATLAB and Simulink In-Depth: Model-Based Design with Simulink and Stateflow*, Apress, USA (2017).
4. Yiu, J., The Definitive Guide to ARM Cortex-M3 and Cortex-M4 Processors., 3rd ed., Newnes, Oxford (2014).
5. Jain, S. and Kapshe, S., *Modeling and Simulation using MATLAB-Simulink*, Wiley India Pvt. Ltd., New Delhi (2015).

Reference books/ Web Links

1. Petkov, P. H., Slavov, T. N. and Kralev, J. K., *Design of Embedded Robust Control Systems Using MATLAB/Simulink*, The Institution of Engineering and Technology (IET), London (2018).
2. Chaturvedi, D. K., *Modeling and Simulation of Systems Using MATLAB and Simulink*, CRC Press, Taylor & Francis Group, USA (2017).
3. STMicroelectronics., STM32 Reference Manual RM0390 (ARM Cortex-M4)., STMicroelectronics, Geneva (2023).
4. MathWorks., Embedded Coder User's Guide., MathWorks Inc., Natick (2023).
5. Zhu, J., Model-Based Design Using MATLAB and Simulink., Springer, Berlin (2018).

Online Resources

1. https://in.mathworks.com/learn/tutorials/simulink-onramp.html
2. https://www.st.com/en/development-tools/stm32-software-development-tools.html

Assessment (Embedded course)
SA I and SA II Activity and Learning Task(s), Mini project, MCQ, End Semester Examination (ESE), Lab Workbook, Experimental Cycle tests, viva-voce

Course Curated by			
Expert(s) from Industry	**Expert(s) from Higher Education Institution**	**Internal Expert(s)**	
		Mr Arun B and Dr A Prabhakaran	
Recommended by BoS on			
Academic Council Approval		**Date**	

24AUE014	Modern Automotive Architecture	L	T	P	J	C
		2	0	0	2	3
PE		SDG	9, 11			

Pre-requisite courses		Data Book / Codes / Standards (If any)	

Course Objectives:	The purpose of taking this course is to
1	Understand evolution of modern automotive architectures including SDV
2	Analyze zonal architectures and in-vehicle communication systems
3	Apply AUTOSAR frameworks in automotive software design
4	Evaluate connectivity, OTA, and cybersecurity in vehicles
5	Design integrated automotive systems using modern architecture concepts

Course Outcomes:	After successful completion of this course, the students shall be able to	Bloom's Taxonomy Level (BTL)
CO 1	Explain software-defined vehicle concepts and architecture evolution	U
CO 2	Analyze zonal architectures and automotive communication systems	An
CO 3	Apply AUTOSAR architecture for ECU software design	Ap
CO 4	Evaluate connected vehicle systems, OTA, and cybersecurity mechanisms	E
CO 5	Design integrated modern automotive architectures with safety and scalability	C
CO 6	Develop and validate automotive subsystems using tools and simulations	Ap

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11			
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	Automotive Design and Manufacturing	Automotive Electrical Electronics	Automotive Technology and Management
1	3	2	-	-	-	-	-	-	-	-	2	-	2	-
2	3	3	2	-	2	-	-	-	-	-	2	-	2	-
3	3	3	3	2	2	-	-	-	2	-	2	-	3	-
4	2	3	3	2	3	-	2	-	2	-	2	-	3	-
5	3	3	3	3	3	2	3	2	2	2	2	-	3	2
6	2	2	3	3	3	-	-	2	2	2	2	-	3	2

Course Content

Module 1: SOFTWARE-DEFINED VEHICLE (SDV) CONCEPTS Evolution: Traditional: Software-defined vehicles - Centralized vs distributed vs zonal ECUs - Functional domains: ADAS, Infotainment, Powertrain, Body - SDV benefits: scalability, flexibility, OTA capability - Communication requirements: bandwidth, latency, reliability **Practical Component:** Activity 1: SDV architecture modeling Acitivity2: Case study: Tesla SDV platform Acitivity3: Functional domain mapping **Self-study Component:** 1. Industry trends in SDV 2. Comparison of OEM architectures	**3 Hours** **6 Hours**
Module 2: ZONAL ARCHITECTURE & VEHICLE COMMUNICATION Zonal ECU concept and architecture - Zone classification: front, rear, left, right, central - Protocols: CAN-FD, LIN, Automotive Ethernet - Domain vs zonal controllers - Safety, redundancy, fault tolerance **Practical Component:** Activity 1: CAN/LIN communication setup Acitivity2: Network topology design Acitivity3: Zonal architecture simulation **Self-study Component:** 1. Automotive Ethernet deep dive 2. Case studies on zonal OEM platforms	**3 Hours** **6 Hours**
Module 3: AUTOSAR ARCHITECTURE AUTOSAR objectives: standardization, safety - Classic AUTOSAR: Application, RTE, BSW, MCAL - Adaptive AUTOSAR: POSIX, HPC systems - Software components & interfaces -ECU lifecycle and updates **Practical Component:** Activity 1: AUTOSAR stack implementation Acitivity2: ECU configuration tools Acitivity3: Software deployment simulation **Self-study Component:** 1. AUTOSAR documentation study 2. Adaptive AUTOSAR case studies	**3 Hours** **6 Hours**
Module 4: CONNECTED VEHICLES, OTA & CYBERSECURITY Connected vehicles: V2X communication -Telematics and cloud integration - OTA updates: firmware & software - Edge vs cloud computing - Cybersecurity: threats, vulnerabilities - Standards: ISO 21434, UNECE WP.29 - Encryption, authentication, IDS **Practical Component:** Activity 1: V2X communication simulation Acitivity2: OTA update prototype Acitivity3: Cybersecurity threat modeling **Self-study Component:** 1. Tesla OTA case study 2. Automotive cyber-attack analysis	**3 Hours** **6 Hours**

Module 5: INTEGRATION OF MODERN VEHICLE SYSTEMS Integration of SDV, Zonal, AUTOSAR - Sensor-actuator mapping to zones - Communication strategies and redundancy - ECU workflow: specification, firmware, testing - End-to-end system architecture **Practical Component:** Activity 1: Integrated vehicle architecture design Acitivity2: System-level simulation Acitivity3: Mini-project development **Self-study Component:** 1. Full vehicle architecture case study 2. System integration challenges	**3 Hours** **6 Hours**

Theory Hours:		**Tutorial Hours:**	15	**Practical Hours:**		**Project Hours:**	30	**Total Hours:**	45

Learning Resources

Textbooks

3. Ehsani, Mehrdad., *Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design*, CRC Press, Boca Raton (2018).
4. Rajamani, Rajesh., *Vehicle Dynamics and Control*, Springer, New York (2012).
5. Reif, Konrad., *Automotive Mechatronics: Automotive Networking, Driving Stability Systems, Electronics*, Springer Vieweg, Wiesbaden (2015).

Reference books/ Web Links

3. Robert Bosch GmbH., *Automotive Handbook*, Wiley, Chichester (2018).
4. Wolf, Marko., Weimerskirch, André., Paar, Christof., *Security in Automotive Networks*, Springer, Heidelberg (2013).
5. AUTOSAR Consortium., *AUTOSAR Specifications and Technical Documents*, AUTOSAR Organization (2022).
6. Navet, Nicolas., Simonot-Lion, Françoise., *Automotive Embedded Systems Handbook*, CRC Press, Boca Raton (2008).
7. Grzemba, Andreas., *Automotive Ethernet: The Definitive Guide*, Springer Vieweg, Wiesbaden (2014).

Online Resources

4. https://swayam.gov.in *(Electric Vehicles and Automotive Systems Courses)*
5. https://www.coursera.org/specializations/self-driving-cars *(Self-Driving Cars – University of Toronto)*
6. https://www.edx.org/learn/automotive *(Automotive Systems Courses)*
7. https://www.autosar.org *(AUTOSAR official documentation and standards)*
8. https://developer.nvidia.com/drive *(NVIDIA DRIVE platform for autonomous vehicles)*
9. https://www.mathworks.com/solutions/automotive.html *(MATLAB Automotive Solutions)*
10. https://www.vector.com *(Automotive networking & AUTOSAR tools)*
11. https://www.bosch-mobility.com *(Automotive technology insights and whitepapers)*

Assessment (Embedded course)
SA I and SA II Activity and Learning Task(s), Mini project, MCQ, End Semester Examination (ESE), Lab Workbook, Experimental Cycle tests, viva-voce

Course Curated by			
Expert(s) from Industry	**Expert(s) from Higher Education Institution**		**Internal Expert(s)**
Mr. **Siju Urppa Kandi** Bosch , Coimbatore			Dr. A. Prabhakaran, Assistant Professor , KCT
Recommended by BoS on			
Academic Council Approval		**Date**	

24AUE015	Automotive Embedded Software Design	L	T	P	J	C
		2	0	0	2	3
PE		SDG	9			

Pre-requisite courses		Data Book / Codes / Standards (If any)	

Course Objectives:	The purpose of taking this course is to
1	Understand ARM Cortex-M4 architecture for embedded software development
2	Develop GPIO drivers and implement interrupt handling using NVIC
3	Implement peripheral drivers (GPIO, ADC, DAC, UART, SPI, CAN)
4	Design interrupt-driven real-time systems using NVIC
5	Build scalable and reusable embedded software architectures

Course Outcomes:	After successful completion of this course, the students shall be able to	Bloom's Taxonomy Level (BTL)
CO 1	Explain ARM Cortex-M4 architecture and memory organization	U
CO 2	Develop GPIO drivers and implement interrupt handling using NVIC	Ap
CO 3	Design and implement ADC and DAC drivers for data acquisition and signal generation	Ap
CO 4	Develop UART and SPI communication drivers for embedded data exchange	Ap
CO 5	Design CAN-based communication and modular embedded software architecture	C
CO 6	Evaluate and debug embedded device drivers using testing, performance analysis, and coding standards for automotive applications	E

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11			
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	Automotive Design and Manufacturing	Automotive Electrical Electronics	Automotive Technology and Management
1	3	2	-	-	1	-	-	-	-	-	2	-	3	2
2	3	3	2	-	3	-	-	-	-	-	2	-	3	-
3	3	3	3	2	3	-	-	1	-	-	2	-	3	-
4	3	3	2	3	3	-	-	-	-	-	2	-	3	-
5	3	3	3	3	3	1	-	2	1	1	3	-	3	-
6	3	3	3	3	3	2	-	3	3	2	2	-	3	2

Course Content

Module 1: ARM Cortex-M4 Architecture & Software Foundations ARM Cortex-M4 core architecture - Programmer's model (Registers, Stack, PSR) - Memory organization (Flash, SRAM, Peripheral space) - Bus interfaces (AHB/APB concept) - Startup code, linker script basics - Bare-metal programming model **Practical Component:** Activity 1: Toolchain setup (GCC/Keil/STM32Cube IDE) Acitivity2: Writing startup code Acitivity3: Memory-mapped register access **Self-study Component:** 1. Cortex-M4 TRM study 2. Assembly vs C interaction	**3 Hours** **6 Hours**
Module 2: GPIO Driver Development & NVIC Memory-mapped I/O concepts - GPIO driver design (input/output/alternate modes) - Bit manipulation techniques - NVIC architecture - Interrupt vector table & ISR design - Interrupt latency and prioritization **Practical Component:** Activity 1: Generic GPIO driver (config, read, write) Acitivity2: Interrupt-based input handling **Self-study Component:** 1. Exception handling	**3 Hours** **6 Hours**
Module 3: ADC & DAC Driver Development ADC principles and driver design, Sampling, resolution, triggering - DAC fundamentals - Data conversion techniques - Polling vs interrupt-based drivers. **Practical Component:** Activity 1: ADC driver implementation Acitivity2: Continuous and single conversion modes Acitivity3: DAC output driver **Self-study Component:** 1. Driver APIs design 2. Buffer management	**3 Hours** **6 Hours**
Module 4: Communication Driver Development (UART & SPI) UART driver architecture - Baud rate generation - Blocking vs non-blocking communication - SPI protocol and driver design - Full-duplex communication **Practical Component:** Activity 1: UART driver (TX/RX, interrupt mode) Acitivity2: SPI driver implementation Acitivity3: Data exchange simulation **Self-study Component:** 1. Tesla OTA case study 2. Automotive cyber-attack analysis	**3 Hours** **6 Hours**
Module 5: CAN Driver Development CAN protocol fundamentals , Frame structure, arbitration - CAN driver architecture - Embedded software layers (HAL vs MCAL concept) – CAN Protocol driver design - Driver reusability and modularity **Practical Component:** Activity 1: CAN driver implementation (basic Tx/Rx logic) Acitivity2: Interrupt-driven communication **Self-study Component:** 1. MISRA-C guidelines	**3 Hours** **6 Hours**

Theory Hours:	30	Tutorial Hours:		Practical Hours:		Project Hours:	30	Total Hours:	60

Learning Resources

Textbooks

1. Yiu, Joseph., *The Definitive Guide to ARM Cortex-M3 and Cortex-M4 Processors*, Elsevier, Oxford (2014).
2. Valvano, Jonathan W., *Embedded Systems: Real-Time Interfacing to ARM Cortex-M Microcontrollers*, McGraw-Hill, New York (2017).

Reference books/ Web Links

1. Furber, Steve., *ARM System-on-Chip Architecture*, Addison-Wesley, Boston (2013).
2. Barr, Michael., and Massa, Anthony., *Programming Embedded Systems: With C and GNU Development Tools*, O'Reilly Media, Sebastopol (2006).
3. Navet, Nicolas., and Simonot-Lion, Francoise., *Automotive Embedded Systems Handbook*, CRC Press, Boca Raton (2009).
4. MISRA., *MISRA-C: Guidelines for the Use of the C Language in Critical Systems*, MISRA Consortium, UK (2012).

Online Resources

1. ARM Ltd., *Cortex-M4 Processor Technical Reference Manual*, Available at: https://developer.arm.com/documentation (Accessed 2026).
2. NPTEL., *Embedded Systems Design*, Indian Institute of Technology, Available at: https://nptel.ac.in/courses/108102045
3. SWAYAM., *Microcontroller and Embedded System Design*, Government of India Platform, Available at: https://swayam.gov.in
4. Coursera., *Embedded Systems Software and Development Environments*, University of Colorado Boulder, Available at: https://www.coursera.org
5. MISRA Consortium., *MISRA-C Coding Guidelines Overview*, Available at: https://www.misra.org.uk

Assessment (Embedded course)

SA I and SA II Activity and Learning Task(s), Mini project, MCQ, End Semester Examination (ESE), Lab Workbook, Experimental Cycle tests, viva-voce

Course Curated by

Expert(s) from Industry	Expert(s) from Higher Education Institution	Internal Expert(s)
Mr. R. Suresh, CLDS Pvt ltd.		Dr. A. Prabhakaran Assistant Professor, KCT

Recommended by BoS on			
Academic Council Approval		Date	

24AUE016	Development of Automotive ECU	L	T	P	J	C
		2	0	2	0	3
PE		SDG	9			

Pre-requisite courses	Automotive Embedded Systems	Data Book / Codes / Standards (If any)	

Course Objectives:	The purpose of taking this course is to
1	understand the architecture and design of automotive Electronic Control Units (ECU).
2	learn hardware and software integration in embedded automotive systems.
3	study communication protocols used in automotive networking.
4	explore ECU applications in engine and vehicle control systems.
5	develop practical skills in ECU programming, interfacing, and testing.

Course Outcomes:	After successful completion of this course, the students shall be able to	Bloom's Taxonomy Level (BTL)
CO 1	Explain ECU design concepts, architecture, and development models	U
CO 2	Analyze ECU hardware and software architecture for automotive applications	An
CO 3	Apply embedded programming and interfacing techniques in ECU systems	Ap
CO 4	Demonstrate communication protocols and ECU networking in automotive systems	Ap
CO 5	Evaluate ECU testing methodologies and standards	E
CO 6	Develop basic ECU applications for automotive systems	Ap

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11			
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	Automotive Design and Manufacturing	Automotive Electrical Electronics	Automotive Technology and Management
1	3	2	-	-	-	-	-	-	-	-	2	2	3	-
2	3	3	2	2	3	-	-	-	-	-	2	2	3	-
3	2	3	3	2	3	-	-	-	-	-	2	2	3	1
4	2	3	3	2	3	-	-	-	-	-	2	2	3	1

5	2	3	2	2	3	-	-	-	-	-	3	2	3	2
6	2	3	3	2	3	-	-	2	2	2	3	3	3	2

Course Content

INTRODUCTION TO ECU AND ARCHITECTURE Introduction to Electronic Control Unit (ECU) – Need and evolution of ECU in automotive systems – ECU design concepts – Design complexities – V-model for ECU development. ECU architecture – System architecture – Hardware architecture – System feature listing – Hardware component selection – Circuit design – Hardware interfaces and peripherals. **Practical Component:** • Study of ECU input signals (Discrete, Frequency, Analog) • Output signals (Switch, PWM, Frequency) • Interfacing basic sensors and actuators with microcontroller	**6 Hours** **6 Hours**
SOFTWARE ARCHITECTURE AND PROGRAMMING Operating systems in embedded systems – Device drivers – Application software (Filtering, diagnostics, monitoring, testing) – Embedded security. ECU programming – Embedded system programming concepts – Hardware and software interfacing. **Practical Component:** • Embedded programming using toolchain and IDE • Simulation and debugging of embedded applications	**6 Hours** **6 Hours**
COMMUNICATION PROTOCOLS AND ECU NETWORKING Serial communication protocols – SPI, I2C – Automotive communication protocols – CAN, LIN, FlexRay – ECU networking architecture. IoT and cloud integration in automotive systems. ECU testing – Automotive testing standards – HIL, SIL – EMI/EMC analysis. **Practical Component:** • CAN communication using CAN analyzer • On-Board Diagnostics (OBD) data acquisition	**6 Hours** **6 Hours**
DIESEL ENGINE MANAGEMENT SYSTEM ECU Diesel Engine Management System (DEMS) – Introduction and functional blocks – Microcontroller TC27X – GTM and ADC modules. Driver circuits – LSS driver, relay driver, H-bridge, lamp driver, injector driver – Applications of DEMS. **Practical Component:** • Study of DEMS modules • Implementation of driver circuits and signal interfacing	**6 Hours** **6 Hours**
CASE STUDIES OF AUTOMOTIVE ECU APPLICATIONS ECM – Engine Control Module EBCM – Electronic Brake Control Module PCM – Powertrain Control Module VCM – Vehicle Control Module BCM – Body Control Module BMS – Battery Management System **Practical Component:** • Case study analysis of ECU applications • Functional block diagram preparation and simulation	**6 Hours** **6 Hours**

Self-Learning Topics: (Hours: 5 Hrs)

- AUTOSAR architecture and middleware
- AI-based automotive control systems
- Cybersecurity in automotive ECUs

Theory Hours:	30	Tutorial Hours:	-	Practical Hours:	30	Project Hours:	-	Total Hours:	60

Learning Resources
Textbooks
1. Ronald K. Jurgen, *Automotive Electronics Handbook*, McGraw-Hill, 2011. 2. Nicolas Navet & Francoise Simonot-Lion, *Automotive Embedded Systems Handbook*, CRC Press, 2009.
Reference books/ Web Links
1. Konrad Etschberger, *Controller Area Network*, IXXAT Press, 2001. 2. Raj Kamal, *Embedded Systems*, McGraw-Hill, 2017.
Online Resources
1. https://www.coursera.org/learn/automotive-embedded-systems

Assessment (Embedded course)
SA I and SA II Activity and Learning Task(s), Mini project, MCQ, End Semester Examination (ESE), Lab Workbook, Experimental Cycle tests, viva-voce

Course Curated by			
Expert(s) from Industry	**Expert(s) from Higher Education Institution**	**Internal Expert(s)**	
Recommended by BoS on			
Academic Council Approval		**Date**	

AUTOMOTIVE TECHNOLOGY AND MOBILITY MANAGEMENT

24AUE017	Vehicle Testing & Validation	L	T	P	J	C
		3	0	0	0	3
PE		SDG	7,9,11,12,13			

Pre-requisite courses	Vehicle body engineering, Automotive Powertrain	Data Book / Codes / Standards (If any)	NA

Course Objectives:	The purpose of taking this course is to:
1	understand the fundamentals of automotive measurement systems and instrumentation.
2	study vehicle structural testing methods including vibration and crash analysis
3	learn engine performance testing and fuel economy evaluation techniques.
4	analyse steering, suspension, and vehicle stability characteristics.
5	understand testing procedures of transmission, brakes, and wheel systems.

Course Outcomes:	After successful completion of this course, the students shall be able to	Bloom's Taxonomy Level (BTL)
CO 1	Explain the fundamentals of automotive measurement systems and instrumentation.	U
CO 2	Analyse vehicle structural testing methods including vibration and crash analysis	An
CO 3	Apply engine performance testing techniques and evaluate fuel economy parameters	Ap
CO 4	Examine steering, suspension, and vehicle stability characteristics	An
CO 5	Illustrate testing procedures of transmission, braking, and wheel systems	U

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11			
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	Automotive Design and Manufacturing	Automotive Electrical Electronics	Automotive Technology and Management
1	3	2	1	1	1	1	0	0	0	0	0	0	2	2
2	3	2	2	1	2	1	0	0	0	0	0	0	2	3
3	3	2	2	2	3	1	0	0	0	0	0	0	3	3

4	3	3	2	2	2	2	0	0	0	0	0	0	3	2
5	3	3	3	2	3	2	0	0	0	0	0	0	3	3

Course Content

INTRODUCTION TO MEASUREMENT SYSTEMS Introduction - static and dynamic measurement - closed and open loop system - Requirements and characteristics.	**7 Hours**
VIBRATION MEASUREMENT AND VEHICLE BODY STRENGTH ANALYSIS Instrument – Accelerometer and signal conditioning, Graphical presentation. Dynamic simulation sled testing, methodology, Vehicle acceleration measurement and Documentation. Dolly roll over test, dolly role over fixture, photographic / video coverage, instrumentation. Vehicle roof strength test – test procedure and test measurements. Door system crush test - procedure and measurements.	**9 Hours**
ENGINE TESTING & FUEL ECONOMY I.S Code for Engine testing – Laboratory testing: Basic engine parameters, Measurement of BHP, IHP, Engine testing on dynamometers, different types of dynamometers. Field Testing: Type I & II, test route selection, vehicle test speeds, cargo weights, driver selection, test data form, calculations. Test on rough terrain, pot holes with laden and unladen conditions	**9 Hours**
VEHICLE STEERING, SUSPENSION AND STABILITY TEST Analysis of constant radius test, constant steer angle test, constant speed variable radius test, constant speed variable steer angle test, response gain test. Measurement of dimensional and geometric characteristics, measurement of centre of gravity position, measurement of moments and products of inertia, measurement of suspension kinematic characteristics, measurement of suspension elastic and coulomb friction characteristics, measurement of shock absorber characteristics.	**10 Hours**
WHEELS AND TRANSMISSION AND BRAKE PERFORMANCE TEST Friction Clutches - Diagnosing of Slippage, Drag, Binding and Vibration - Performance of Automatic Transmission Systems Dynamic cornering fatigue, dynamic radial fatigue tests – procedure, bending moment and radial load calculations. Impact test – road hazard impact test	**10 Hours**

for wheel and tyre assemblies, test procedures, failure criteria and performance criteria. Bumpers - types of tests, pendulum test, fixed collision barrier test, procedure, performance criteria. Air and hydraulic brake test, air brake actuator, valves test, performance requirements. Parking brake – drawbar pull test, grade holding test.	

Theory Hours:	**45**	**Tutorial Hours:**	**Practical Hours:**	**Project Hours:**	**Total Hours:**	75	

Learning Resources*
Textbooks
1. VCrouse W H and Anglin D L., "Automotive Mechanics"' Tata McGraw Hill Publishing Company, 2004 2. Rangan, Mani and Sharma, "Instrumentation", Tata McGraw Hill Publishers, New Delhi, 2004 3. Stockel M W, "Auto Mechanics Fundamentals", Good Heart-Wilcox Co., Inc., 2000 4. Jain R K "Mechanical and Industrial Measurements", Khanna Publishers, Delhi, 1999. 5. Martyr A. J, Plint M. A, "Engine Testing Theory and Practice", 3rd edition, Butterworth-Heinemann, 2007.
Reference books/ Web Links
1. Ken Pickerill, "Automotive Engineering Engine Performance Shop Manual", Cengage Learning, 2010 2. SAE Hand book, Vol. 3, SAE Publications, 2000 3. Tim Gilles, "Automotive Service"' Delmar Publishers, 1998. 4. Beckwith TG and Buck N L, "Mechanical Measurements", Addition Wesley Publishing Company Limited, 1995 5. Giles J. G, "Vehicle Operation & Performance". Crouse. W. H, Anglin. D. L, "Motor Vehicle Inspection", McGraw Hill, 1978.
Online Resources
1. https://nptel.ac.in/courses/108105064 2. https://www.youtube.com/watch?v=o3f6iAcyBgQ 3. https://www.youtube.com/watch?v=ZUtViyPp7oM&t=3s 4. https://www.youtube.com/watch?v=WrScvpRzavI 5. https://www.youtube.com/watch?v=6dhn0IWkhPk 6. https://www.nhtsa.gov/road-safety/crashworthiness 7. https://nptel.ac.in/courses/112106187

Assessment	
Formative	Summative
Assignments / Mini project), Quiz, Lab	CAT- I, CAT – II and End Semester Examination (ESE)

Course Curated By		
Expert(s) from Industry	**Expert(s) from Higher Education Institutions**	**Internal Expert(s)**
Dr.Ramadhass,Director GARC	Sasikumar, Jeyam Automotives	

Approved by: BoS Chairman	With Signature and date
BoS Approval date:	

24AUE018	Machine Learning for Automotive Applications	L	T	P	J	C
		2	0	2	0	3
PE		SDG	7,9,11,12,13			

Pre-requisite courses	Nil	Data Book / Codes / Standards (If any)	NA

Course Objectives:	The purpose of taking this course is to:
1	Understand the fundamentals of machine learning and its workflow in automotive systems.
2	Apply data preprocessing and feature engineering techniques to automotive datasets
3	Analyze and select suitable machine learning models for automotive applications.
4	To Implement supervised and unsupervised learning techniques using automotive case studies.
5	To Explore advanced applications of machine learning in intelligent and autonomous vehicles

Course Outcomes:	After successful completion of this course, the students shall be able to	Bloom's Taxonomy Level (BTL)
CO 1	Explain ML concepts and CRISP-ML workflow in automotive context	U
CO 2	Apply data preprocessing techniques on vehicle datasets	Ap
CO 3	Select appropriate ML algorithms for automotive problems	AP
CO 4	Implement ML models for real-world automotive applications	AN
CO 5	Evaluate model performance and improve accuracy	Ev
CO 6	Analyse ML applications in EVs, ADAS, and autonomous systems	An

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11			
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	Automotive Design and Manufacturing	Automotive Electrical Electronics	Automotive Technology and Management
1	2	2	1	1									1	2
2		3	2	2	3								2	3
3		3	3	2	2								2	3
4		2	3	3	3				1	1			3	3
5		2	3	3	2							2	2	2
6	1		2		2	2	2	1	1			2	2	3

Course Content

INTRODUCTION TO MACHINE LEARNING CRISP ML- Cross-Industry Standard Process for Data Mining, Project Management methodology -Stages of Analytics - Descriptive, Predictive, Prescriptive. Data types - Continuous, Discrete, Categorical, Count, Qualitative, Quantitative Balanced versus Imbalanced datasets Cross Sectional versus Time Series vs Panel / Longitudinal Data Batch Processing vs Real Time Processing Structured versus Unstructured vs Semi-Structured Data Big vs Not-Big Data and its identification and application **Mini Activity:** Identify ML use cases in EV or IC engine systems	**6 Hours** **6 Hours**
DATA CLEANING AND PREPROCESSING Exploratory data analytics - Mean, Median, Mode, Measure of Skewness, Kurtosis, Spread of the Data, Data preprocessing techniques- Outlier Analysis, Missing Values Imputation Techniques, Transformations, Normalization / Standardization, Discretization Sampling techniques for handling Balanced vs. Imbalanced Datasets. Python for machine learning applications, Machine Learning Library functions **Pratical** 1) Identify the Clean vehicle sensor dataset and do a data interpretation study on it **2)** Plot engine parameters vs time and infer the relationship between them	**6 Hours** **6 Hours**
LINEAR REGRESSION ALGORITHMS Introduction to Supervised Learning algorithms and types -Linear Regression- Simple linear regression, multiple linear regression, Logistic regression, Decision tree, Random Forest, KNN, Ensemble Techniques-Bagging, boosting and Adaboost, Support vector machines **Practical Component** 1) Predict fuel efficiency 2) Classify vehicle fault conditions	**6 Hours** **6 Hours**
UNSUPERVISED AND DEEP LEARNING ALGORITHMS Introduction to Unsupervised learning algorithms- Clustering Techniques- Hierarchical Clustering / Agglomerative Clustering • Dendrogram Measure of distance, Kmeans, Recommendation engines, Introduction to Perceptron Algorithm-Building blocks of neural network, Deep Learning Black box technique-Support Vector Machine, Neural network, Convolution neural network **Practical Component** 1) Cluster driving patterns 2) Basic image classification using CNN	**6 Hours** **6 Hours**

APPLICATION IN AUTOMOTIVE DOMAIN Fault diagnostics-Electric vehicle applications-State of Charge predication, State of health predication, Emissions Reduction and Fuel Efficiency, Driver Behaviour Analysis, Autonomous cars, Predictive Maintenance, Image and Object Recognition	**6 Hours**
Practical Component 1) Build SOC prediction model **2)** Case study on predictive maintenance	**6 Hours**

Theory Hours:	**30**	**Tutorial Hours:**	**Practical Hours:**	**30**	**Project Hours:**	**Total Hours:**	60

Learning Resources
Textbooks
4. Kelleher et al., Fundamentals of Machine Learning, MIT Press, 2015 5. Witten et al., Data Mining: Practical ML Tools, Morgan Kaufmann, 2016
Reference books/ Web Links
1) Chen et al., Deep Learning for Autonomous Vehicles, Elsevier, 2020 2) Goodfellow et al., Deep Learning, MIT Press, 2016
Online Resources
1) NPTEL: Machine Learning (IIT Madras / IIT Kharagpur) 2) Coursera: Andrew Ng ML Course 3) MATLAB Automotive ML Toolbox 4) Kaggle Automotive Datasets 5) GitHub: Self-driving car projects

Assessment	
Formative	Summative
Assignments / Mini project), Quiz, Lab	CAT- I, CAT – II and End Semester Examination (ESE)

Course Curated By		
Expert(s) from Industry	**Expert(s) from Higher Education Institutions**	**Internal Expert(s)**

Approved by: BoS Chairman	With Signature and date
BoS Approval date:	

24AUE019	Off Road Vehicles	L	T	P	J	C
		2	0	2	0	3
PE		SDG				

Pre-requisite courses	Automotive Chassis and Transmissions	Data Book / Codes / Standards (If any)	-

Course Objectives:	The purpose of taking this course is to
1	Understand layout and design requirements of off-road vehicles.
2	Analyze tractor systems and agricultural vehicle mechanisms.
3	Study construction and operation of earth-moving machines.
4	Examine military and special utility vehicles.
5	Evaluate vehicle subsystems, hydraulics, and emerging technologies in off-road vehicles.

Course Outcomes:	After successful completion of this course, the students shall be able to	Bloom's Taxonomy Level (BTL)
CO 1	Explain layout, classification, and requirements of off-road vehicles	U
CO 2	Analyze tractor systems including transmission, steering, and hydraulics	An
CO 3	Apply knowledge of construction and operation of earth-moving machines	Ap
CO 4	Evaluate design and working of military and special utility vehicles	E
CO 5	Analyze braking, steering, and hydraulic systems of off-road vehicles	An
CO 6	Apply design and safety considerations incorporating modern trends in off-road vehicles	Ap

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11			
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	Automotive Design and Manufacturing	Automotive Electrical Electronics	Automotive Technology and Management
1	3	2	-	-	-	-	-	-	-	-	2	-	-	2

2	3	3	2	2	2	-	-	-	-	-	2	-	-	3
3	3	3	3	2	3	-	-	-	-	-	2	-	-	3
4	2	3	2	2	3	-	-	-	-	-	3	-	1	3
5	2	3	2	2	3	-	-	-	-	-	2	-	1	3
6	2	3	3	2	3	-	-	2	2	2	3	-	2	3

Course Content

LAYOUT AND REQUIREMENTS Requirements of off-road vehicles – Classification – Construction layout – Drive systems – Capacity based on ARAI – Frame design – Engine location – Types of wheels – Transmission systems – Multi-axle vehicles and applications.	**7 Hours**
TRACTORS (9 Hrs) Classification of tractors – Layout of wheeled tractors – Power transmission systems – Steering systems – Accessories – Hydraulic control systems – Power take-off unit – Special implements.	**7 Hours**
EARTH MOVING MACHINES (9 Hrs) Dumpers – Types, body construction, transmission – Loaders (single bucket, multi-bucket, rotary, backhoe) – Dozers and utilities – Excavators – Scrapers, dragline, self-powered types – Special implements – Power and capacity of machines.	**9 Hours**
MILITARY AND SPECIAL UTILITY VEHICLES (9 Hrs) Construction and features of tankers, gun carriers, transport vehicles – Oil tankers – Articulated vehicles – Ambulance and fire-fighting vehicles. Mobile cranes – Stability, design features, control systems, safety devices.	**9 Hours**
VEHICLE SYSTEMS AND EMERGING TRENDS (9 Hrs) Brake systems – OCDB and dry disc caliper brakes – Body hoist hydraulics – Hydro-pneumatic suspension – Power steering systems. Kinematics of loaders and bulldozers – Safety systems – Dumper warning systems – Design aspects of dumper body, loader bucket, and sprinkler tank. **Emerging Trends:** Electric and hybrid off-road vehicles – Autonomous construction and agricultural machinery – IoT-based fleet monitoring – Digital twin simulation – Smart hydraulics and advanced materials.	**13 Hours**

Self-Learning Topics: (Hours: 5 Hrs)

- Autonomous and AI-based off-road vehicles
- Electrification of construction equipment
- Digital twin applications in heavy vehicles
- Smart hydraulic and mechatronic systems
- Sustainable off-road vehicle technologies

Theory Hours:	45	Tutorial Hours:		Practical Hours:		Project Hours:		Total Hours:	45

Learning Resources
Textbooks
1. Wong J.Y., Theory of Ground Vehicles, Wiley, 2008. 2. Bekker M.G., *Introduction to Terrain-Vehicle Systems*, University of Michigan Press, 1969.
Reference books/ Web Links
1. "Road making machinery", Abrosimov.K. Bran berg.A and Katayer.K., MIR Publishers,Moscow, 1971 2. Liljedahl J.B., Tractors and Their Power Units, Wiley, 2004.
Online Resources
1. https://www.sae.org

Assessment (Embedded course)
SA I and SA II Activity and Learning Task(s), Mini project, MCQ, End Semester Examination (ESE), Lab Workbook, Experimental Cycle tests, viva-voce

Course Curated by			
Expert(s) from Industry	**Expert(s) from Higher Education Institution**	**Internal Expert(s)**	
Recommended by BoS on			
Academic Council Approval		**Date**	

24AUE020	Vehicle Transport Management	L	T	P	J	C
		3	0	0	0	3
PE		SDG	9, 11, 12			

Pre-requisite courses	-	Data Book / Codes / Standards (If any)	

Course Objectives:	The purpose of taking this course is to
1	Understand the principles of vehicle transport systems and logistics.
2	Analyze fleet operations, maintenance, and cost management.
3	Study transport regulations and safety standards.
4	Evaluate modern technologies in transport management.
5	Develop managerial skills for efficient transport system operations.

Course Outcomes:	After successful completion of this course, the students shall be able to	Bloom's Taxonomy Level (BTL)
CO 1	Explain vehicle transport systems and operational requirements	U
CO 2	Analyze fleet management, maintenance, and cost factors	An
CO 3	Apply transport regulations and safety standards in operations	Ap
CO 4	Evaluate logistics and supply chain integration in transport systems	E
CO 5	Analyze intelligent transport systems and emerging technologies	An
CO 6	Develop transport management strategies for efficiency and sustainability	Ap

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11			
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	Automotive Design and Manufacturing	Automotive Electrical Electronics	Automotive Technology and Management
1	3	2	-	-	-	-	-	-	-	-	2	-	-	2
2	3	3	2	2	2	-	-	-	-	-	2	-	-	2
3	2	3	2	2	3	-	-	-	-	-	2	-	-	3
4	2	3	3	2	3	-	-	-	-	-	3	-	1	3
5	2	3	2	2	3	-	-	-	-	-	2	-	2	3
6	2	3	3	2	3	-	-	2	2	2	3	-	2	3

Course Content

INTRODUCTION TO TRANSPORT SYSTEMS (9 Hrs) Transport system – Classification – Road transport characteristics – Transport demand and supply – Vehicle scheduling – Routing and dispatching – Role of transport in economic development.	**8 Hours**
FLEET MANAGEMENT AND MAINTENANCE (9 Hrs) Fleet organization – Vehicle selection – Fleet size determination – Maintenance strategies – Preventive and breakdown maintenance – Spare parts management – Workshop layout.	**8 Hours**
TRANSPORT ECONOMICS AND COSTING (9 Hrs) Operating cost of vehicles – Fixed and running costs – Depreciation – Fuel economy – Cost optimization – Financial planning in transport operations.	**8 Hours**
TRANSPORT REGULATIONS AND SAFETY (9 Hrs) Motor Vehicle Act – Licensing and permits – Vehicle registration – Insurance – Road safety standards – Accident analysis – Safety management systems.	**9 Hours**
INTELLIGENT TRANSPORT SYSTEMS AND EMERGING TRENDS (9 Hrs) Intelligent Transport Systems (ITS) – GPS-based tracking – Telematics – Traffic management systems – Smart logistics – Digital fleet management. **Emerging Trends:** Electric and connected vehicles – Autonomous transport systems – IoT in fleet management – AI-based route optimization – Sustainable transport solutions.	**12 Hours**

Self-Learning Topics: (Hours: 5 Hrs)

- Smart city transport systems
- Electric mobility and fleet electrification
- AI in logistics and transport optimization
- Blockchain in transport supply chains
- Green and sustainable transport systems

Theory Hours:	45	**Tutorial Hours:**	0	**Practical Hours:**	0	**Project Hours:**	0	**Total Hours:**	45

Learning Resources

Textbooks

1. Kadiyali L.R., *Traffic Engineering and Transport Planning*, Khanna Publishers, 2013
2. Papacostas C.S., Prevedouros P.D., *Transportation Engineering and Planning*, Pearson, 2001.

Reference books/ Web Links

1. Khanna S.K., Justo C.E.G., *Highway Engineering*, Nem Chand & Bros, 2011.
2. Government of India Transport Policy Documents

Online Resources

1. https://www.its.dot.go

Assessment (Theorycourse)
SA I and SA II Activity and Learning Task(s), MCQ, End Semester Examination (ESE),

Course Curated by			
Expert(s) from Industry	**Expert(s) from Higher Education Institution**		**Internal Expert(s)**
Recommended by BoS on			
Academic Council Approval		**Date**	

24AUE021	Entrepreneurship Development	L	T	P	J	C
		2	0	2	0	3
PE		SDG	8,9			

Pre-requisite courses	-	Data Book / Codes / Standards (If any)	-

Course Objectives:	The purpose of taking this course is to
1	Understand the fundamentals of entrepreneurship and startup ecosystem.
2	Develop skills for identifying and evaluating business opportunities.
3	Learn business planning, financing, and management strategies.
4	Analyze legal, ethical, and regulatory aspects of entrepreneurship.
5	Develop entrepreneurial mindset and innovation capability.

Course Outcomes:	After successful completion of this course, the students shall be able to	Bloom's Taxonomy Level (BTL)
CO 1	Explain entrepreneurial concepts and startup ecosystem	U
CO 2	Analyze business opportunities and market feasibility	An
CO 3	Apply business planning and financial management techniques	Ap
CO 4	Evaluate legal, ethical, and regulatory frameworks for startups	E
CO 5	Analyze innovation and technology-based entrepreneurship	An
CO 6	Develop a business model and startup plan	Ap

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11			
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	Automotive Design and Manufacturing	Automotive Electrical Electronics	Automotive Technology and Management
1	2	2	-	-	-	2	2	2	2	-	3	-	-	2
2	2	3	2	2	2	2	-	2	2	2	3	-	-	2
3	2	3	3	2	2	2	-	2	3	3	3	-	-	3
4	2	2	2	2	-	3	3	2	2	-	3	-	-	2
5	2	3	2	2	2	2	-	2	2	-	3	2	2	3
6	2	3	3	2	3	2	-	3	3	3	3	2	2	3

Course Content

INTRODUCTION TO ENTREPRENEURSHIP (9 Hrs) Entrepreneurship – Definition and characteristics – Types of entrepreneurs – Role of entrepreneurship in economic development – Startup ecosystem – Government initiatives (Startup India, Make in India).	**8 Hours**
BUSINESS OPPORTUNITY AND MARKET ANALYSIS (9 Hrs) Opportunity identification – Idea generation techniques – Market research – Demand analysis – Feasibility study – Risk analysis.	**8 Hours**
BUSINESS PLANNING AND FINANCE (9 Hrs) Business plan preparation – Components of business plan – Financial planning – Sources of finance – Venture capital, angel investors – Costing and budgeting.	**8 Hours**
LEGAL AND ETHICAL ASPECTS (9 Hrs) Legal requirements for startups – Company registration – Intellectual Property Rights (IPR) – Patents, trademarks – Ethical issues in business.	**9 Hours**
INNOVATION AND EMERGING TRENDS IN ENTREPRENEURSHIP (9 Hrs) Innovation and creativity – Technology-based entrepreneurship – Digital startups – E-commerce and platform economy – Sustainability in entrepreneurship. **Emerging Trends:** AI startups – Green entrepreneurship – Industry 4.0-based startups – Automotive startups (EV, mobility services) – Lean startup methodology.	**12 Hours**

Self-Learning Topics: (Hours: 5 Hrs)

- Case studies of successful startups (Tesla, Ola, Ather Energy)
- Business model canvas development
- Social entrepreneurship
- Women entrepreneurship initiatives
- Global startup ecosystems

Theory Hours:	45	**Tutorial Hours:**	-	**Practical Hours:**	-	**Project Hours:**	-	**Total Hours:**	45

Learning Resources
Textbooks
1. Hisrich R.D., Peters M.P., Shepherd D.A., *Entrepreneurship*, McGraw-Hill, 2017. 2. Khanka S.S., *Entrepreneurial Development*, S. Chand, 2013.
Reference books/ Web Links
1. Drucker P., *Innovation and Entrepreneurship*, Harper Business, 2006. 2. Government of India Startup Portal
Online Resources
1. https://www.startupindia.gov.in
Assessment (Theorycourse)
SA I and SA II Activity and Learning Task(s), MCQ, End Semester Examination (ESE),

Course Curated by			
Expert(s) from Industry	**Expert(s) from Higher Education Institution**		**Internal Expert(s)**
Recommended by BoS on			
Academic Council Approval		**Date**	

24AUE022	Product Design and Development	L	T	P	J	C
		2	0	2	0	3
PE		SDG	9			

Pre-requisite courses	Design of Machine Elements	Data Book / Codes / Standards (If any)	Nil

Course Objectives:	The purpose of taking this course is to
1	Understand the product development process from idea to commercialization.
2	Apply engineering design methods, creativity techniques, and customer requirement analysis.
3	Develop concept generation and evaluation skills using modern design tools.
4	Integrate manufacturing, cost, sustainability, and ergonomics considerations into product design.
5	Build and test functional prototypes through hands-on design projects.

Course Outcomes:	After successful completion of this course, the students shall be able to	Bloom's Taxonomy Level (BTL)
CO 1	Explain the structured product development process and market requirement analysis	U
CO 2	Apply product design methodologies and creativity techniques to generate concepts	Ap
CO 3	Analyze product design alternatives using engineering evaluation methods	An
CO 4	Develop detailed product designs using CAD and prototyping tools	Ap
CO 5	Evaluate product feasibility considering manufacturing, cost, and sustainability	E

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11			
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	Automotive Design and Manufacturing	Automotive Electrical Electronics	Automotive Technology and Management
1	3	2	1	-	-	-	-	-	-	-	1	2	-	-
2	2	3	3	1	2	-	-	-	-	-	-	3	1	-
3	2	3	3	2	2	-	-	-	-	-	-	3	3	-
4	2	2	3	2	3	-	-	-	-	-	-	3	3	-
5	2	2	3	1	2	2	2	-	-	-	1	1	3	-

Course Content

PRODUCT DEVELOPMENT PROCESS Introduction to product design, Product life cycle, Product development stages, Market research, Customer requirement analysis, Quality Function Deployment (QFD), Product planning and product strategy **Practical Component** • Identification of customer needs for a product • Preparing House of Quality (QFD) • Product benchmarking	**5 Hours** **5 Hours**
CONCEPT GENERATION AND CREATIVITY Creativity and innovation, Brainstorming techniques, TRIZ methodology, Morphological analysis, Concept screening and scoring, Design thinking approach **Practical Component** • Brainstorming workshop • Morphological chart development • Concept selection using decision matrix	**5 Hours** **5 Hours**
PRODUCT ARCHITECTURE AND DESIGN Product architecture, Functional decomposition, Modular product design, Industrial design considerations, Ergonomics in product design **Practical Component** • Functional decomposition of a product • Product architecture modeling • Ergonomic analysis	**5 Hours** **5 Hours**
PRODUCT MODELLING AND PROTOTYPING CAD modeling for product design, Rapid prototyping techniques, 3D printing and additive manufacturing, Prototype testing and iteration **Practical Component** • CAD modelling using SolidWorks / Fusion 360 • Rapid prototype creation using 3D printing • Prototype testing	**5 Hours** **5 Hours**
DESIGN FOR MANUFACTURING AND SUSTAINABILITY Design for Manufacturing (DFM), Design for Assembly (DFA), Cost estimation in product design, Sustainability and eco-design, Life Cycle Assessment (LCA) **Practical Component** • Manufacturing feasibility analysis • Cost estimation for product design • Eco-design assessment	**5 Hours** **5 Hours**
PRODUCT DEVELOPMENT PROJECT Product prototyping, Testing and validation, Documentation and technical presentation, Product commercialization strategies. **Practical Component** • Mini Product Development Project • Prototype fabrication • Product demonstration	**5 Hours** **5 Hours**

Theory Hours:	30	**Tutorial Hours:**		**Practical Hours:**	30	**Project Hours:**		**Total Hours:**	**60**

Learning Resources

Textbooks

6. Ulrich, Karl., Eppinger, Steven., Product Design and Development, McGraw Hill, New York (2016).
7. Otto, Kevin., Wood, Kristin., Product Design: Techniques in Reverse Engineering and New Product Development, Prentice Hall (2014).

Reference books/ Web Links

8. Pahl, G., Beitz, W., Engineering Design: A Systematic Approach, Springer (2013).
9. Roozenburg, N., Eekels, J., Product Design: Fundamentals and Methods, Wiley (2010).
10. Boothroyd, G., Dewhurst, P., Knight, W., Product Design for Manufacture and Assembly, CRC Press (2011).
11. Otto, Kevin., "Product Architecture Design", Journal of Mechanical Design.

Online Resources

1. https://nptel.ac.in/courses/112107217
2. https://swayam.gov.in
3. https://ocw.mit.edu/courses/product-design

Assessment (Embedded course)

SA I and SA II Activity and Learning Task(s), Mini project, MCQ, End Semester Examination (ESE), Lab Workbook, Experimental Cycle tests, viva-voce

Course Curated by

Expert(s) from Industry	Expert(s) from Higher Education Institution	Internal Expert(s)

Recommended by BoS on			
Academic Council Approval		**Date**	

24AUE023	Product Lifecycle Management	L	T	P	J	C
		2	0	2	0	3
PE		SDG				

Pre-requisite courses	-	Data Book / Codes / Standards (If any)	-

Course Objectives:	The purpose of taking this course is to
1	Understand the concepts and lifecycle stages of Product Lifecycle Management (PLM).
2	Learn PLM processes, workflows, and system architecture.
3	Develop skills in collaborative product development and digital engineering.
4	Apply PLM tools for data management, design, and change control.
5	Analyze PLM strategies and industrial implementation practices.

Course Outcomes:	After successful completion of this course, the students shall be able to	Bloom's Taxonomy Level (BTL)
CO 1	Explain PLM concepts, lifecycle models, and benefits	U
CO 2	Analyze PLM processes and workflows	An
CO 3	Apply collaborative product development techniques	Ap
CO 4	Analyze PLM system architecture and data management	An
CO 5	Evaluate PLM strategies and implementation frameworks	E
CO 6	Apply PLM tools for product development and lifecycle management	Ap

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11			
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	Automotive Design and Manufacturing	Automotive Electrical Electronics	Automotive Technology and Management
1	2	2	-	-	-	2	-	2	2	-	3	2	-	2
2	2	3	2	2	2	2	-	2	2	2	3	2	-	2
3	2	3	3	2	3	2	-	2	3	2	3	3	-	3
4	2	3	2	3	2	2	-	2	2	2	3	2	2	3
5	2	2	2	2	-	3	3	2	2	-	3	2	2	3
6	2	3	3	3	3	2	-	3	3	3	3	3	2	3

Course Content

INTRODUCTION TO PRODUCT LIFECYCLE MANAGEMENT (6 Hrs) Definition – PLM lifecycle model – Threads of PLM – Need, opportunities, and benefits – Views, components, and phases – Feasibility study – Visioning. **Practical Component:** • Introduction to PLM tools interface • Lifecycle mapping of an automotive component	**6 Hours** **6 Hours**
PLM CONCEPTS, PROCESSES AND WORKFLOW (6 Hrs) Characteristics of PLM – Environment driving PLM – PLM elements and drivers – Conceptualization, design, development, validation, production, and support phases. **Practical Component:** • Task creation and workflow assignment • Product development workflow simulation	**6 Hours** **6 Hours**
COLLABORATIVE PRODUCT DEVELOPMENT (6 Hrs) Engineering vaulting – Product reuse – Smart parts – Engineering change management – BOM and process consistency – Digital mock-up and prototyping – Virtual validation – Marketing integration. **Practical Component:** • Managing CAD files and design revisions • Engineering change management simulation • Viewing and marking 3D models	**6 Hours** **6 Hours**
SYSTEM ARCHITECTURE (6 Hrs) Types of product data – PLM systems – Features – System architecture – Product information models – Functionalities of PLM systems. **Practical Component:** • Building product information models • Data structuring and metadata management	**6 Hours** **6 Hours**
PLM STRATEGY AND INDUSTRIAL IMPLEMENTATION (6 Hrs) PLM strategy – Impact on business – Implementation roadmap – PLM initiatives – Infrastructure assessment – Evaluation of current systems and applications. **Practical Component:** • Case study: Automotive PLM implementation • Customization of PLM workflows	**6 Hours** **6 Hours**

Self-Learning Topics: (Hours: 5 Hrs)

- Digital Twin in PLM
- Industry 4.0 integration
- Cloud-based PLM systems
- AI-driven product lifecycle optimization
- Automotive digital thread and smart manufacturing

Theory Hours:	30	**Tutorial Hours:**	-	**Practical Hours:**	30	**Project Hours:**	-	**Total Hours:**	60

Learning Resources
Textbooks
1. Stark J., *Product Lifecycle Management*, Springer, 2015. 2. Saaksvuori A., Immonen A., *Product Lifecycle Management*, Springer, 2008.
Reference books/ Web Links
1. Grieves M., *Product Lifecycle Management: Driving the Next Generation of Lean Thinking*, McGraw Hill 2. Siemens PLM Learning Resources
Online Resources
1. https://plm.automation.siemens.com

Assessment (Embedded course)
SA I and SA II Activity and Learning Task(s), Mini project, MCQ, End Semester Examination (ESE), Lab Workbook, Experimental Cycle tests, viva-voce

Course Curated by			
Expert(s) from Industry	**Expert(s) from Higher Education Institution**		**Internal Expert(s)**
Recommended by BoS on			
Academic Council Approval		**Date**	

FCLF EMERGING TRACK

24INO***	BMS for EV Applications	L	T	P	J	C
		0	0	2	0	1
OE		SDG	9, 12			

Pre-requisite courses	Automotive Electrical Systems Automotive Electronics	Data Book / Codes / Standards (If any)	

Course Objectives:	The purpose of taking this course is to
1	Develop practical understanding of Battery Management Systems in EVs
2	Gain hands-on experience in battery monitoring and control
3	Analyze battery parameters such as SOC, SOH, and temperature
4	Apply BMS hardware and simulation tools
5	Enable safe and efficient battery operation in EV applications

Course Outcomes:	After successful completion of this course, the students shall be able to	Bloom's Taxonomy Level (BTL)
CO1	Interpret BMS architecture and battery characteristics	U
CO2	Apply BMS tools for monitoring battery parameters	Ap
CO3	Analyze battery performance and safety parameters	An
CO4	Evaluate and implement BMS strategies for EV systems	E

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11			
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	Automotive Design and Manufacturing	Automotive Electrical Electronics	Automotive Technology and Management
CO1	3	2	-	-	-	-	-	-	-	-	2	2	-	-
CO2	3	3	2	-	3	-	-	-	-	-	2	3	2	-
CO3	2	3	2	3	3	-	-	-	-	-	2	3	2	-
CO4	2	2	3	2	3	-	2				2	3	2	2

Course Content	
INTRODUCTION TO BMS & BATTERIES EV battery types (Li-ion, LFP, NMC), BMS architecture and functions, Safety requirements, Identification of battery pack components, Measurement of voltage and current, Study of battery datasheets	**6 Hours**
BATTERY PARAMETER MONITORING State of Charge (SOC), State of Health (SOH), Temperature monitoring, Voltage and current sensing using sensors, SOC estimation using basic methods, Temperature measurement using sensors	**6 Hours**
CELL BALANCING TECHNIQUES Passive and active balancing, Importance of balancing, Implementation of passive balancing circuit, Monitoring cell voltage differences, Analysis of balancing performance	**6 Hours**
BMS HARDWARE & COMMUNICATION BMS hardware components, Communication protocols (CAN basics), Interfacing BMS module with microcontroller, Data acquisition and logging, CAN communication basics	**6 Hours**
BMS SIMULATION & APPLICATION BMS algorithms overview, Safety and fault detection, Simulation of BMS using MATLAB/Simulink, Fault detection (overvoltage, overheating), Mini project: BMS for EV battery pack	**6 Hours**

Theory Hours:		**Tutorial Hours:**		**Practical Hours:**	**30**	**Project Hours:**		**Total Hours:**	**30**

Learning Resources
Textbooks
1. Plett, G.L., Battery Management Systems, Artech House 2. Hannan, M.A., Battery Management Systems for EVs, Wiley
Reference books/ Web Links
1. Linden, D., *Handbook of Batteries*, McGraw-Hill 2. SAE Standards on EV Batteries 3. IEEE Papers on BMS Technology
Online Resources
1. https://www.mathworks.com/solutions/electrification/battery-management-system.html 2. https://matlabacademy.mathworks.com/details/battery-systems-with-simulink 3. https://www.mathworks.com/products/simscape-battery.html

4. https://www.mathworks.com/help/physmod/sps/ug/battery-state-of-charge-estimation.html
5. https://www.mathworks.com/help/physmod/simscape/ug/lithium-ion-battery-model.html
6. https://www.youtube.com/results?search_query=matlab+bms+simulation
7. https://www.youtube.com/results?search_query=soc+estimation+matlab

Assessment (Practical course)
Lab Workbook, Experimental Cycle tests, viva-voce

Course Curated by			
Expert(s) from Industry	**Expert(s) from Higher Education Institution**	**Internal Expert(s)**	
		Dr.Thenmozhi G Associate Professor/KCT	
Recommended by BoS on			
Academic Council Approval		**Date**	

24INO***	DESIGN OF AUTOMOTIVE ECU	L	T	P	J	C
		0	0	2	0	1
OE		SDG	9, 11			

Pre-requisite courses		Data Book / Codes / Standards (If any)	

Course Objectives:	The purpose of taking this course is to
1	Develop practical knowledge of ECU architecture and design
2	Gain hands-on experience in microcontroller-based systems
3	Understand automotive communication protocols
4	Apply embedded programming for vehicle control
5	Enable development of simple automotive ECU systems

Course Outcomes:	After successful completion of this course, the students shall be able to	Bloom's Taxonomy Level (BTL)
CO1	Interpret ECU architecture and automotive electronics	U
CO2	Apply microcontrollers for ECU design	Ap
CO3	Analyze automotive signals and communication (CAN)	An
CO4	Develop and test a basic automotive ECU prototype	C

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11			
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	Automotive Design and Manufacturing	Automotive Electrical Electronics	Automotive Technology and Management
CO1	3	2	-	-	-	-	-	-	-	-	2	2	-	-
CO2	3	3	2	-	3	-	-	-	-	-	2	3	2	-
CO3	2	3	2	3	3	-	-	-	-	-	2	3	2	-
CO4	2	2	3	2	3	-	2				2	3	2	2

Course Content	
INTRODUCTION TO ECU SYSTEMS ECU architecture – Hardware & Software, Types of ECUs in automobiles Sensors and actuators integration, Signal flow in automotive systems, ECU hardware study, Block diagram preparation, Signal identification	**6 Hours**
MICROCONTROLLER-BASED ECU DESIGN Microcontroller fundamentals – I/O, ADC, PWM, Embedded system, architecture Automotive microcontroller applications, Programming using Arduino, Sensor interfacing (temperature, position), Actuator control (motor, relay)	**6 Hours**
AUTOMOTIVE COMMUNICATION (CAN) CAN protocol fundamentals, CAN architecture and data frames, Automotive communication systems, CAN module interfacing, Data transmission and reception, Fault diagnosis	**7 Hours**
ECU SOFTWARE & CONTROL LOGIC Control strategies – Open loop, Closed loop, Real-time processing in ECUs Signal conditioning, Control logic implementation, Signal processing, System testing	**6 Hours**
ECU PROTOTYPING & VALIDATION ECU testing and validation, Automotive standards overview, System reliability considerations, – ECU development, Sensor-actuator integration, Performance testing and validation	**6 Hours**

Theory Hours:		**Tutorial Hours:**		**Practical Hours:**	**30**	**Project Hours:**		**Total Hours:**	**30**

Learning Resources
Textbooks
1. Denton, T., *Automobile Electrical and Electronic Systems*, Routledge 2. Ribbens, W., *Understanding Automotive Electronics*, Elsevier
Reference books/ Web Links
1. Bosch, *Automotive Handbook* 2. CAN Protocol Documentation 3. SAE Papers on ECU Design 4. Embedded Systems Design Manuals

Online Resources
8. https://www.csselectronics.com/pages/can-bus-simple-intro-tutorial

Assessment (Practical course)
Lab Workbook, Experimental Cycle tests, viva-voce

Course Curated by			
Expert(s) from Industry	**Expert(s) from Higher Education Institution**	**Internal Expert(s)**	
		Dr.Thenmozhi G Associate Professor/KCT	
Recommended by BoS on			
Academic Council Approval		**Date**	

24INO***	CAE MESHING FOR AUTOMOTIVE APPLICATIONS	L	T	P	J	C
		0	0	2	0	1
OE		SDG	9, 11			

Pre-requisite courses		Data Book / Codes / Standards (If any)	

Course Objectives:	The purpose of taking this course is to
1	develop hands-on skills in meshing techniques for CAE applications
2	understand different mesh types and quality criteria
3	apply meshing tools for automotive components
4	analyze mesh quality and improve simulation accuracy
5	enable preparation of models for FEA/CFD analysis

Course Outcomes:	After successful completion of this course, the students shall be able to	Bloom's Taxonomy Level (BTL)
CO1	Interpret meshing concepts and requirements in CAE	U
CO2	Apply meshing techniques using CAE tools	Ap
CO3	Analyze mesh quality and its impact on simulation	An
CO4	Develop optimized meshes for automotive components	C

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11			
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	Automotive Design and Manufacturing	Automotive Electrical Electronics	Automotive Technology and Management
CO1	3	2	-	-	-	-	-	-	-	-	2	2	-	-
CO2	3	3	2	-	3	-	-	-	-	-	2	3	2	-
CO3	2	3	2	3	3	-	-	-	-	-	2	3	2	-
CO4	2	2	3	2	3	-	2				2	3	2	2

Course Content	
INTRODUCTION TO CAE MESHING Role of meshing in CAE, Types of elements (1D, 2D, 3D), Mesh types: structured vs unstructured, Introduction to meshing tools (ANSYS / Hyper Mesh), Importing CAD models, Basic geometry clean-up	**7 Hours**
2D MESHING TECHNIQUES Shell elements and applications, Meshing strategies, Surface meshing (triangular, quadrilateral), Meshing of automotive panels, Mesh refinement techniques	**7 Hours**
3D MESHING TECHNIQUES Solid elements (tetra, hexa), Volume meshing, Tetrahedral meshing Hexa meshing (basic), Meshing of engine/bracket components	**8 Hours**
MESH QUALITY & OPTIMIZATION Quality parameters (aspect ratio, skewness, Jacobian), Impact on simulation accuracy, Checking mesh quality, Mesh correction techniques, Optimization of mesh parameters	**7 Hours**
AUTOMOTIVE APPLICATIONS Meshing requirements for structural & CFD analysis, Industry standards, Meshing of automotive component (chassis/suspension), Preparation for FEA/CFD, Mini project: Complete meshing workflow	**6 Hours**

Theory Hours:		**Tutorial Hours:**		**Practical Hours:**	**30**	**Project Hours:**		**Total Hours:**	**30**

Learning Resources
Textbooks
1. Cook, R.D., *Concepts and Applications of Finite Element Analysis*, Wiley 2. Liu, G.R., *The Finite Element Method*, Butterworth-Heinemann
Reference books/ Web Links
1. ANSYS Meshing User Guide 2. HyperMesh Documentation 3. SAE Papers on Automotive CAE 4. CFD Meshing Best Practices
Online Resources
1. https://innovationspace.ansys.com/courses/courses/ansys-mechanical-meshing/ 2. https://learn.altair.com/

3. https://www.youtube.com/results?search_query=hypermesh+tutorial

Assessment (Practical course)
Lab Workbook, Experimental Cycle tests, viva-voce

Course Curated by			
Expert(s) from Industry	**Expert(s) from Higher Education Institution**	**Internal Expert(s)**	
		Dr.Thenmozhi G Associate Professor/KCT	
Recommended by BoS on			
Academic Council Approval		**Date**	

24INO***	AUTOTRONICS	L	T	P	J	C
		0	0	2	0	1
OE		SDG	9, 12			

Pre-requisite courses	Automotive Electrical Systems Automotive Electronics	Data Book / Codes / Standards (If any)	

Course Objectives:	The purpose of taking this course is to
1	develop practical knowledge of automotive electronics systems
2	understand sensors, actuators, and ECU functioning
3	gain hands-on experience in automotive embedded systems
4	analyze automotive electronic signals and control strategies
5	enable implementation of simple autotronic systems

Course Outcomes:	After successful completion of this course, the students shall be able to	Bloom's Taxonomy Level (BTL)
CO1	Interpret automotive electronic systems and components	U
CO2	Apply sensors and actuators in automotive applications	Ap
CO3	Analyze ECU signals and communication systems	An
CO4	Develop simple autotronic control systems	C

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11			
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	Automotive Design and Manufacturing	Automotive Electrical Electronics	Automotive Technology and Management
CO1	3	2	-	-	-	-	-	-	-	-	2	2	-	-
CO2	3	3	2	-	3	-	-	-	-	-	2	3	2	-
CO3	2	3	2	3	3	-	-	-	-	-	2	3	2	-
CO4	2	2	3	2	3	-	2				2	3	2	2

Course Content

INTRODUCTION TO AUTOTRONICS Automotive electronics overview, Evolution of autotronics, Electronic control systems in vehicles, Identification of electronic components in vehicles, Study of wiring diagrams, Basic circuit testing	**8 Hours**
AUTOMOTIVE SENSORS & ACTUATORS Types of sensors (temperature, pressure, position), Actuators (motors, solenoids, injectors), Interfacing sensors (temperature, proximity), Actuator control using microcontroller, Signal measurement using multimeter/oscilloscope	**8 Hours**
ELECTRONIC CONTROL UNIT ECU architecture and functions, Input-output signal processing, ECU signal analysis (simulated or real), Interfacing ECU with sensors, Data acquisition and monitoring	**9 Hours**
AUTOMOTIVE COMMUNICATION SYSTEMS CAN protocol basics, Automotive networking, CAN communication demonstration, Data transmission between modules, Fault diagnosis using tools	**8 Hours**
EMBEDDED AUTOTRONIC APPLICATION Embedded systems in vehicles, Control strategies, Arduino/ESP32-based automotive application, Mini project (e.g., automatic headlamp / temperature control), System testing and validation	**6 Hours**

Theory Hours:		**Tutorial Hours:**		**Practical Hours:**	**30**	**Project Hours:**		**Total Hours:**	**30**

Learning Resources

Textbooks

1. Denton, T., *Automobile Electrical and Electronic Systems*, Routledge
2. Bosch, *Automotive Handbook*, Wiley

Reference books/ Web Links

1. Ribbens, W., *Understanding Automotive Electronics*
2. SAE Technical Papers on Automotive Electronics
3. Automotive ECU and CAN protocol manuals

Online Resources

4. https://nptel.ac.in/courses/108/106/108106170/
5. https://www.csselectronics.com/pages/can-bus-simple-intro-tutorial
6. https://www.analog.com/en/education/education-library/automotive-sensor-basics.html

Assessment (Practical course)
Lab Workbook, Experimental Cycle tests, viva-voce

Course Curated by			
Expert(s) from Industry	**Expert(s) from Higher Education Institution**	**Internal Expert(s)**	
		Dr.Thenmozhi G Associate Professor/KCT	
Recommended by BoS on			
Academic Council Approval		**Date**	

FCLF TECHNICAL TRACK

24INO***	MULTIBODY DYNAMICS SIMULATION USING MATLAB	L	T	P	J	C
		0	0	2	0	1
OE		SDG	9, 12			

Pre-requisite courses	Mechanics of Machines	Data Book / Codes / Standards (If any)	

Course Objectives:	The purpose of taking this course is to
1	develop hands-on skills in multibody modeling using MATLAB Simscape Multibody
2	understand kinematic and dynamic simulation of mechanical systems
3	apply MATLAB tools for vehicle subsystem simulation
4	analyze motion, forces, and system behavior
5	enable validation and optimization of automotive systems

Course Outcomes:	After successful completion of this course, the students shall be able to	Bloom's Taxonomy Level (BTL)
CO1	Interpret multibody system concepts and MATLAB modeling approach	U
CO2	Apply Simscape Multibody tools to create dynamic models	Ap
CO3	Analyze kinematic and dynamic responses using simulation outputs	An
CO4	Evaluate and optimize automotive systems using MATLAB models	E

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11			
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	Automotive Design and Manufacturing	Automotive Electrical Electronics	Automotive Technology and Management
CO1	3	2	-	-	-	-	-	-	-	-	2	2	-	-
CO2	3	3	2	-	3	-	-	-	-	-	2	3	2	-
CO3	2	3	2	3	3	-	-	-	-	-	2	3	2	-
CO4	2	2	3	2	3	-	2				2	3	2	2

Course Content	
INTRODUCTION TO MATLAB MBD Overview of MATLAB & Simulink, Introduction to Simscape Multibody, Applications in automotive systems, Creating simple multibody model, Importing CAD models	**6 Hours**
MULTIBODY MODELING Rigid bodies, frames, and transformations, Joint types and constraints, Creation of simple rigid body system, modelling simple mechanisms (linkages), Applying joints (revolute, prismatic) Defining motion inputs	**6 Hours**
KINEMATIC SIMULATION Position, velocity, acceleration analysis, Motion visualization, Simulation of four-bar mechanism, Slider-crank mechanism, Visualization using Mechanics Explorer	**6 Hours**
DYNAMIC ANALYSIS Forces, torques, inertia, Equations of motion, applying forces and torques, Dynamic simulation with applied forces, Extracting force/torque data	**6 Hours**
AUTOMOTIVE SYSTEM APPLICATION Suspension system basics, Vehicle dynamics concepts, Modeling suspension system in Simscape, Ride response simulation, Parameter variation and optimization	**6 Hours**

Theory Hours:		**Tutorial Hours:**		**Practical Hours:**	**30**	**Project Hours:**		**Total Hours:**	**30**

Learning Resources
Textbooks
1. MathWorks Documentation, *Simscape Multibody User Guide* 2. Shabana, A.A., *Dynamics of Multibody Systems*, Cambridge
Reference books/ Web Links
3. MATLAB Online Resources (MathWorks) 4. Gillespie, T.D., *Fundamentals of Vehicle Dynamics* 5. Norton, R.L., *Design of Machinery* 6. SAE Papers on Vehicle Simulation
Online Resources
7. Simscape Multibody training (MathWorks Onramp / learning portal): https://matlabacademy.mathworks.com/details/simscape-multibody-onramp

Assessment (Practical course)
Lab Workbook, Experimental Cycle tests, viva-voce

Course Curated by			
Expert(s) from Industry	**Expert(s) from Higher Education Institution**	**Internal Expert(s)**	
		Dr.Thenmozhi G Associate Professor/KCT	
Recommended by BoS on			
Academic Council Approval		**Date**	

24INO***	AUTOMOTIVE STYLING	L	T	P	J	C
		0	0	2	0	1
OE		SDG	9,11			

Pre-requisite courses	-	Data Book / Code book (If any)	-

Course Objectives:	
The purpose of taking this course is to:	
1	develop creative and aesthetic skills in automotive design
2	understand principles of vehicle styling and form development
3	gain hands-on experience in sketching and digital styling tools
4	apply ergonomic and functional considerations in design
5	enable concept development and visualization of vehicles

Course Outcomes		
After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO1	Interpret automotive styling principles and design elements	U
CO2	Apply sketching techniques to create vehicle concepts	Ap
CO3	Analyze form, proportion, and ergonomics in vehicle design	An
CO4	Develop and present automotive styling concepts using tools	C

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11			
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	Automotive Design and Manufacturing	Automotive Electrical Electronics	Automotive Technology and Management
CO1	3	2	-	-	-	-	-	-	-	-	2	2	-	-
CO2	3	3	2	-	3	-	-	-	-	-	2	3	2	-
CO3	2	3	2	3	3	-	-	-	-	-	2	3	2	-
CO4	2	2	3	2	3	-	2				2	3	2	2

Course Content	
INTRODUCTION TO AUTOMOTIVE STYLING Evolution of automotive design, Styling vs engineering design, Elements of design: line, shape, form, Sketching basic geometric forms, Vehicle silhouette sketching, Study of existing car designs	**6 Hours**
FREEHAND SKETCHING TECHNIQUES Proportion and perspective, Light and shadow concepts, 2D sketching of cars (side, front views), Perspective drawing (3D sketches), Shading and rendering techniques	**6 Hours**
FORM DEVELOPMENT & ERGONOMICS Vehicle proportions and packaging, Human factors in design, Sketching interior layouts, Ergonomic positioning (driver seat, controls), Form refinement exercises	**6 Hours**
DIGITAL AUTOMOTIVE STYLING Introduction to digital design tools, Surface modelling basics, basic modelling using CAD tools (Alias/Fusion 360/Blender), digital rendering of vehicle concept, applying colors and materials	**6 Hours**
CONCEPT DEVELOPMENT & PRESENTATION Concept design process, design communication techniques, Final vehicle concept sketch/model development, design presentation (portfolio/slide), peer review and feedback	**6 Hours**

Theory Hours:	**0**	**Tutorial Hours:**	**0**	**Practical Hours:**	**30**	**Project Hours:**	**0**	**Total Hours:**	**30**

Learning Resources
Textbooks:
1 Eissen, K., *Sketching: Drawing Techniques for Product Designers*, BIS Publishers 2 Hales, C., *Automotive Design and Production*, SAE
References:
1 McKelvey, R., *Automotive Design*, Laurence King 2 Journals on Automotive Styling & Industrial Design 3 Online tutorials (Autodesk, Blender)
Online Resources (Weblinks)
1 https://www.udemy.com/course/car-design-and-sketching/ 2 https://www.skillshare.com/en/classes/Car-Design-Basics/ 3 https://www.nid.edu/programmes/transportation-and-automobile-design
Assessment (Practical course)
Lab Workbook, Experimental Cycle tests, viva-voce

Course Curated by			
Expert(s) from Industry	**Expert(s) from Higher Education Institution**		**Internal Expert(s)**
			Dr.Thenmozhi G
Recommended by BoS on			
Academic Council Approval		**Date**	

24INO***	EV MOTOR DESIGN AND SIMULATION	L	T	P	J	C
		0	0	2	0	1
OE		SDG	7, 9			

Pre-requisite courses		Data Book / Codes / Standards (If any)	

Course Objectives:	The purpose of taking this course is to
1	develop hands-on skills in EV motor design using simulation tools
2	understand electromagnetic modelling of motors
3	apply design parameters using MotorSolve/Maxwell
4	analyze motor performance through simulation
5	enable design optimization for EV applications

Course Outcomes:	After successful completion of this course, the students shall be able to	Bloom's Taxonomy Level (BTL)
CO1	Interpret EV motor design requirements and specifications	U
CO2	Apply MotorSolve/Maxwell tools to model EV motors	Ap
CO3	Analyze electromagnetic performance characteristics	An
CO4	Evaluate and optimize motor design for EV applications	E

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11			
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	Automotive Design and Manufacturing	Automotive Electrical Electronics	Automotive Technology and Management
CO1	3	2	-	-	-	-	-	-	-	-	2	2	-	-
CO2	3	3	2	-	3	-	-	-	-	-	2	3	2	-
CO3	2	3	2	2	3	-	-	-	-	-	2	3	2	-
CO4	2	2	3	2	3	-	2				2	3	2	2

Course Content	
INTRODUCTION TO EV MOTOR DESIGN SOFTWARE Overview of MotorSolve, ANSYS Maxwell, Types of EV motors (BLDC, PMSM, IM), Design workflow in simulation tools, Software interface exploration, Creating basic motor templates, Inputting design specifications	**6 Hours**
GEOMETRY MODELING OF EV MOTORS Motor geometry parameters, Stator, rotor, winding configurations, Creating 2D motor geometry, Slot/pole configuration setup, Material assignment	**6 Hours**
ELECTROMAGNETIC SIMULATION Magnetic field distribution, Flux density and EMF generation, Running electromagnetic simulation, Flux plot visualization, Back EMF analysis	**6 Hours**
PERFORMANCE ANALYSIS Torque, efficiency, losses, Torque-speed curve generation, Efficiency mapping, Loss analysis (core, copper)	**6 Hours**
DESIGN OPTIMIZATION & VALIDATION Optimization techniques, Design constraints for EV motors, Parameter variation (air gap, turns, materials), Performance optimization, Final design validation	**6 Hours**

Theory Hours:		**Tutorial Hours:**		**Practical Hours:**	**30**	**Project Hours:**		**Total Hours:**	**30**

Learning Resources
Textbooks
1. Hanselman, D., Brushless Permanent Magnet Motor Design, McGraw-Hill 2. Pyrhonen, J., Design of Rotating Electrical Machines, Wiley
Reference books/ Web Links
1. ANSYS Maxwell User Guide 2. MotorSolve Documentation (Infolytica) 3. Boldea, I., *Electric Machines and Drives* 4. IEEE Papers on EV Motor Simulation MATLAB Online Resources (MathWorks)
Online Resources
8. https://innovationspace.ansys.com/courses/courses/electromagnetics-maxwell/

9. https://innovationspace.ansys.com/courses/courses/electric-machine-design-using-rmxprt/
10. https://www.youtube.com/results?search_query=ansys+maxwell+motor+design

Assessment (Practical course)
Lab Workbook, Experimental Cycle tests, viva-voce

Course Curated by			
Expert(s) from Industry	**Expert(s) from Higher Education Institution**	**Internal Expert(s)**	
		Dr.Thenmozhi G Associate Professor/KCT	
Recommended by BoS on			
Academic Council Approval		**Date**	