M.Tech – Automotive Electronics

Curriculum and Syllabus

2021-22

VISION STATEMENT OF VELLORE INSTITUTE OF TECHNOLOGY

Transforming life through excellence in education and research.

MISSION STATEMENT OF VELLORE INSTITUTE OF TECHNOLOGY

World class Education: Excellence in education, grounded in ethics andcritical thinking, for improvement of life.
Cutting edge Research: An innovation ecosystem to extend knowledge andsolve critical problems.
Impactful People: Happy, accountable, caring and effective workforce and students.
Rewarding Co-creations: Active collaboration with national & internationalindustries & universities for productivity and economic development.
Service to Society: Service to the region and world through knowledge and compassion.

VISION STATEMENT OF THE SCHOOL OF ELECTRONICS ENGINEERING

To be a leader by imparting in-depth knowledge in Electronics Engineering, nurturing engineers, technologists and researchers of highest competence, who would engage in sustainable development to cater the global needs of industry and society.

MISSION STATEMENT OF THE SCHOOL OF ELECTRONICS ENGINEERING

- Create and maintain an environment to excel in teaching, learning and applied research in the fields of electronics, communication engineering and allied disciplines which pioneer for sustainable growth.
- Equip our students with necessary knowledge and skills which enable themto be lifelong learners to solve practical problems and to improve the quality of human life

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PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

The graduates of the programme will be able to

PEO 1 Excel in professional career and/or higher education by acquiring solid foundation in science, mathematics and advanced communication engineering and technologies.

PEO 2 Develop and apply engineering solutions for solving contemporary, social and human issues with realistic constraints suitable for the present need through the use of modern tools.

PEO 3 Exhibit professional and ethical standards, effective communication skills, teamwork spirit, multidisciplinary and transdisciplinary approach for successful careers and to be able to compete globally, function as leaders, as entrepreneurs, and manage information efficiently and to engage in lifelong learning.

PROGRAMME OUTCOMES (POs)

On completion of the Programme the students will have the

PO_01: Having an ability to apply mathematics and science in engineering applications.

PO_02: Having an ability to design a component or a product applying all the relevant standards and with realistic constraints, including public health, safety, culture, society and environment

PO_03: Having an ability to design and conduct experiments, as well as to analyse and interpret data, and synthesis of information

PO_04: Having an ability to use techniques, skills, resources and modern engineering and IT tools necessary for engineering practice

PO_05: Having problem solving ability- to assess social issues (societal, health, safety, legal and cultural) and engineering problems

PO_06: Having adaptive thinking and adaptability in relation to environmental context and sustainable development

PO_07: Having a clear understanding of professional and ethical responsibility

PO_08: Having a good cognitive load management skills related to project management and finance

Programme Specific Outcomes

On completion of M.Tech. Automotive Electronics, graduates will be able to:

PSO1. Apply advanced concepts of Automotive Electronics to design and develop components and systems for applications in automotive systems.

PSO2. Use state-of-art hardware and software tools to experiment the automotive electronics systems to solve industry and real-world problems.

PSO3. Independently carry out research on diverse Automotive Electronics strategies to address practical problems and present a substantial technical report.

School of Electronics Engineering (SENSE)

M.Tech – Automotive Electronics

Curriculum and Course Content

[Curriculum for Applied Learning (CAL)]

S. No.	Category	Total number of credits
1	University Core (UC)	27
2	University Elective (UE)	06
3	Programme Core (PC)	19
4	Programme Elective (PE)	18
Total Credits		**70**

UNIVERSITY CORE

Course Code	Title	L	T	P	J	C
MAT 6001	Advanced Statistical Methods	2	0	2	0	3
ENG 5001 & 5002/ GER5001/FRE5001	Fundamentals of Communication Skills & Professional and Communication Skills/ Foreign Language	0	0	4	0	2
STS5001 & 5002	Soft Skills					2
SET5001 & 5002	SET Projects (2)					4
6099	Master's Thesis					16
	Total					27

UNIVERSITY ELECTIVE

Course Code	Title	L	T	P	J	C
	University Elective #					6
	Total					6

All courses offered by other M.Tech Prgrammes / PE of M.Tech (Automotive Electronics)

L – Lecture T- Tutorial P – Practical J – Project C - Credit

PROGRAMME CORE

Course Code	Course Title	L	T	P	J	C
ECE 5071	Sensors and Engine Management Systems	3	0	0	4	4
ECE 5072	Microcontrollers for Vehicular systems	3	0	2	0	4
ECE 5073	Vehicle Control Systems	3	0	0	0	3
ECE 5074	Automotive networking and protocols	3	0	2	0	4
ECE 5075	Electric and Electronic Power Systems for Vehicles	3	0	0	4	4
	Total					19

PROGRAMME ELECTIVES – 18 Credits

S. No.	Course Code	Course Title	L	T	P	J	C
1	ECE 6071	Data Acquisition and Signal Conditioning	3	0	2	0	4
2	ECE 6072	Automotive Power Electronics and motor drives	3	0	2	0	4
3	ECE 6073	AUTOSAR and ISO Standards for Automotive Systems	2	0	0	0	2
4	ECE 6074	Alternative Drives, Traction and controls	3	0	0	4	4
5	ECE 6075	Soft Computing Techniques for Automotive Applications	3	0	0	4	4
6	ECE 6076	Automotive EMI and EMC standards	3	0	0	0	3
7	ECE 6077	Vehicular information and communication systems	3	0	0	4	4
8	ECE 6078	Parallel Programming using Multicores and Graphical Programming Units	3	0	0	4	4
9	ECE 6069	Digital Signal Processing and its Applications	3	0	2	0	4
10	ECE 6079	Open source hardware and software system design	3	0	0	4	4
11	ECE 6080	Machine Vision System for Automotive	3	0	2	0	4
12	ECE 6081	Automotive Fault diagnostics	3	2	0	0	4
13	ECE 6082	Emission control and diagnosis	3	0	0	4	4
14	ECE 6083	Vehicle safety systems	2	0	0	0	2
15	ECE 6084	Vehicle bodies	2	0	0	0	2
16	ECE 6085	Engine peripherals	2	0	0	4	3
17	ECE 6086	Vehicle security and comfort systems	3	0	0	4	4
		Total					**60**

L – Lecture T- Tutorial P – Practical J – Project C – Credit

University Core

MAT6001	ADVANCED STATISTICAL METHODS	L	T	P	J	C
		2	0	2	0	3

Pre-requisite	None	Syllabus Version
		2.0

Course Objectives

1. To provide students with a framework that will help them choose the appropriate descriptive statistics in various data analysis situations.
2. To analyse distributions and relationships of real-time data.
3. To apply estimation and testing methods to make inference and modelling techniques for decision making using various techniques including multivariate analysis.

Expected Course Outcome

At the end of the course the students are expected to

[1] understand the concept of correlation and regression model and able to interpret the effect of variables, regression coefficients, coefficient of determination.

[2] make appropriate decisions using inferential statistical tools that are central to experimental research.

[3] understand the statistical forecasting methods and model fitting by graphical interpretation of time series data.

[4] construct standard experimental designs and describe what statistical models can be estimated using the data.

[5] demonstrate R programming for statistical data

Module:1	Basic Statistical Tools for Analysis:	4 hours

Summary Statistics, Correlation and Regression, Concept of R^2 and Adjusted R^2 and Partial and Multiple Correlation, Fitting of simple and Multiple Linear regression, Explanation and Assumptions of Regression Diagnostics

Module:2	Statistical inference :	9 hours

Basic Concepts, Normal distribution-Area properties, Steps in tests of significance –large sample tests-Z tests for Means and Proportions, Small sample tests –t-test for Means, F test for Equality of Variances, Chi-square test for independence of Attributes.

Module:3	Modelling and Forecasting Methods:	9 hours

Introduction: Concept of Linear and Non Liner Forecasting model ,Concepts of Trend, Exponential Smoothing, Linear and Compound Growth model, Fitting of Logistic curve and their Applications, Moving Averages, Forecasting accuracy tests.

Probability models for time series: Concepts of AR, ARMA and ARIMA models.

Module:4	Design of Experiments:	6 hours

Analysis of variance – one and two way classifications – Principle of design of experiments, CRD – RBD – LSD, Concepts of 2^2 and 2^3 factorial experiments.

Module:5	Contemporary Issues:	2 hours

Industry Expert Lecture

	Total Lecture hours:	30 hours

Text Book(s)				
1.	Applied Statistics and Probability for Engineers, Douglas C. Montgomery George C. Runger, 6th edition, John Wiley & Sons (2016),			
2	Time Series Analysis and Its Applications With R Examples, Shumway, Robert H., Stoffer, David S., 4th edition, Springer publications (2017)			
Reference Books				
1.	The Elements of Statistical Learning: Data Mining, Inference, and Prediction, Trevor Hastie and Robert Tibshirani, 2nd Edition, Springer Series, (2017)			
2	Introduction to Probability and Statistics: Principles and Applications for Engineering and the Computing Sciences, J. Susan Milton and Jesse Arnold, McGraw Hill education (2017)			
Mode of Evaluation				
Digital Assignments, Quiz, Continuous Assessments, Final Assessment Test				
List of Challenging Experiments (Indicative)				
1.	Computing Summary Statistics using real time data			3 hours
2	Plotting and visualizing data using Tabulation and Graphical Representations.			3 hours
3	Applying simple linear and multiple linear regression models to real dataset; computing and interpreting the coefficient of determination for scale data.			3 hours
4.	Testing of hypothesis for Large sample tests for real-time problems.			2 hours
5.	Testing of hypothesis for Small sample tests for One and Two Sample mean and paired comparison (Pre-test and Post-test)			2 hours
6.	Testing of hypothesis for Small Sample tests for F-test			2 hours
7	Testing of hypothesis for Small Sample tests for Chi-square test			2 hours
8	Applying Time series analysis-Trends. Growth ,Logistic, Exponential models			2 hours
9	Applying Time series model AR , ARMA and ARIMA and testing Forecasting accuracy tests.			3 hours
10	Performing ANOVA (one-way and two-way), CRD, RBD and LSD for real dataset.			3 hours
11	Performing 2^2 factorial experiments with real time Applications			2 hours
12	Performing 2^3 factorial experiments with real time Applications			3 hours
			Total Laboratory Hours	30 hours
Mode of Evaluation				
Weekly Assessments, Final Assessment Test				
Recommended by Board of Studies	25-02-2017			
Approved by Academic Council	No. 46	Date	24-08-2017	

ENG5001	Fundamentals of Communication Skills	L	T	P	J	C
		0	0	2	0	1
Pre-requisite	Not cleared EPT (English Proficiency Test)	**Syllabus version**				
		1.0				

Course Objectives:

1. To enable learners learn basic communication skills - Listening, Speaking, Reading and Writing
2. To help learners apply effective communication in social and academic context
3. To make students comprehend complex English language through listening and reading

Expected Course Outcome:

1. Enhance the listening and comprehension skills of the learners
2.Acquire speaking skills to express their thoughts freely and fluently
3.Learn strategies for effective reading
4.Write grammatically correct sentences in general and academic writing
5. Develop technical writing skills like writing instructions, transcoding etc.,

Module:1	Listening	**8 hours**

Understanding Conversation
Listening to Speeches
Listening for Specific Information

Module:2	Speaking	**4 hours**

Exchanging Information
Describing Activities, Events and Quantity

Module:3	Reading	**6 hours**

Identifying Information
Inferring Meaning
Interpreting text

Module:4	Writing: Sentence	**8hours**

Basic Sentence Structure
Connectives
Transformation of Sentences
Synthesis of Sentences

Module:5	Writing: Discourse	**4hours**

Instructions
Paragraph
Transcoding

	Total Lecture hours:	**30 hours**

Text Book(s)

1. Redston, Chris, Theresa Clementson, and Gillie Cunningham. *Face2face Upper Intermediate Student's Book.* 2013, Cambridge University Press.

Reference Books

1. Chris Juzwiak .*Stepping Stones: A guided approach to writing sentences and Paragraphs (Second Edition),* 2012, Library of Congress.
2. Clifford A Whitcomb & Leslie E Whitcomb, *Effective Interpersonal and Team Communication Skills for Engineers*, 2013, John Wiley & Sons, Inc., Hoboken: New Jersey.
3. ArunPatil, Henk Eijkman &Ena Bhattacharya, *New Media Communication Skills for Engineers and IT Professionals,*2012, IGI Global, Hershey PA.
4. Judi Brownell, *Listening: Attitudes, Principles and Skills*, 2016, 5th Edition, Routledge:USA
5. John Langan, Ten Steps to Improving College Reading Skills, 2014, 6th Edition, Townsend

6.	Press:USA Redston, Chris, Theresa Clementson, and Gillie Cunningham. *Face2face Upper Intermediate Teacher's Book*. 2013, Cambridge University Press.	
	Authors, book title, year of publication, edition number, press, place	
Mode of Evaluation: CAT / Assignment / Quiz / FAT / Project / Seminar		
List of Challenging Experiments (Indicative)		
1.	Familiarizing students to adjectives through brainstorming adjectives with all letters of the English alphabet and asking them to add an adjective that starts with the first letter of their name as a prefix.	2 hours
2.	Making students identify their peer who lack Pace, Clarity and Volume during presentation and respond using Symbols.	4 hours
3.	Using Picture as a tool to enhance learners speaking and writing skills	2 hours
4.	Using Music and Songs as tools to enhance pronunciation in the target language / Activities through VIT Community Radio	2 hours
5.	Making students upload their Self- introduction videos in Vimeo.com	4 hours
6.	Brainstorming idiomatic expressions and making them use those in to their writings and day to day conversation	4 hours
7.	Making students Narrate events by adding more descriptive adjectives and add flavor to their language / Activities through VIT Community Radio	4 hours
8	Identifying the root cause of stage fear in learners and providing remedies to make their presentation better	4 hours
9	Identifying common Spelling & Sentence errors in Letter Writing and other day to day conversations	2 hours
10.	Discussing FAQ's in interviews with answers so that the learner gets a better insight in to interviews / Activities through VIT Community Radio	2 hours
	Total Laboratory Hours	**30 hours**
Mode of evaluation: Online Quizzes, Presentation, Role play, Group Discussions, Assignments, Mini Project		

Recommended by Board of Studies	22-07-2017		
Approved by Academic Council	No. 46	Date	24-8-2017

ENG5002	Professional and Communication Skills	L	T	P	J	C
		0	0	2	0	1
Pre-requisite	ENG5001	**Syllabus version**				
		1.1				

Course Objectives:

1. To enable students to develop effective Language and Communication Skills
2. To enhance students' Personal and Professional skills
3. To equip the students to create an active digital footprint

Expected Course Outcome:

1. Improve inter-personal communication skills
2. Develop problem solving and negotiation skills
3. Learn the styles and mechanics of writing research reports
4. Cultivate better public speaking and presentation skills
5. Apply the acquired skills and excel in a professional environment

Module:1	**Personal Interaction**	**2hours**
Introducing Oneself- one's career goals Activity: SWOT Analysis		
Module:2	**Interpersonal Interaction**	**2 hours**
Interpersonal Communication with the team leader and colleagues at the workplace Activity: Role Plays/Mime/Skit		
Module:3	**Social Interaction**	**2 hours**
Use of Social Media, Social Networking, gender challenges Activity: Creating LinkedIn profile, blogs		
Module:4	**Résumé Writing**	**4 hours**
Identifying job requirement and key skills Activity: Prepare an Electronic Résumé		
Module:5	**Interview Skills**	**4 hours**
Placement/Job Interview, Group Discussions Activity: Mock Interview and mock group discussion		
Module:6	**Report Writing**	**4 hours**
Language and Mechanics of Writing Activity: Writing a Report		
Module:7	**Study Skills: Note making**	**2hours**
Summarizing the report Activity: Abstract, Executive Summary, Synopsis		
Module:8	**Interpreting skills**	**2 hours**
Interpret data in tables and graphs Activity: Transcoding		
Module:9	**Presentation Skills**	**4 hours**
Oral Presentation using Digital Tools Activity: Oral presentation on the given topic using appropriate non-verbal cues		
Module:10	**Problem Solving Skills**	**4 hours**
Problem Solving & Conflict Resolution Activity: Case Analysis of a Challenging Scenario		
	Total Lecture hours:	**30hours**

Text Book(s)

1	Bhatnagar Nitin and Mamta Bhatnagar, *Communicative English For Engineers And Professionals*, 2010, Dorling Kindersley (India) Pvt. Ltd.

Reference Books

1	Jon Kirkman and Christopher Turk, *Effective Writing: Improving Scientific, Technical and*

	Business Communication, 2015, Routledge			
2	Diana Bairaktarova and Michele Eodice, *Creative Ways of Knowing in Engineering*, 2017, Springer International Publishing			
3	Clifford A Whitcomb & Leslie E Whitcomb, *Effective Interpersonal and Team Communication Skills for Engineers*, 2013, John Wiley & Sons, Inc., Hoboken: New Jersey.			
4	ArunPatil, Henk Eijkman &Ena Bhattacharya, *New Media Communication Skills for Engineers and IT Professionals*,2012, IGI Global, Hershey PA.			
Mode of Evaluation: CAT / Assignment / Quiz / FAT / Project / Seminar				
List of Challenging Experiments (Indicative)				
1.	SWOT Analysis – Focus specially on describing two strengths and two weaknesses			2 hours
2.	Role Plays/Mime/Skit -- Workplace Situations			4 hours
3.	Use of Social Media – Create a LinkedIn Profile and also write a page or two on areas of interest			2 hours
4.	Prepare an Electronic Résumé and upload the same in vimeo			2 hours
5.	Group discussion on latest topics			4 hours
6	Report Writing – Real-time reports			2 hours
7	Writing an Abstract, Executive Summary on short scientific or research articles			4 hours
8	Transcoding – Interpret the given graph, chart or diagram			2 hours
9	Oral presentation on the given topic using appropriate non-verbal cues			4 hours
10	Problem Solving -- Case Analysis of a Challenging Scenario			4 hours
			Total Laboratory Hours	**30 hours**
Mode of evaluation: : Online Quizzes, Presentation, Role play, Group Discussions, Assignments, Mini Project				
Recommended by Board of Studies	22-07-2017			
Approved by Academic Council	No. 47	Date	05-10-2017	

FRE5001	FRANCAIS FONCTIONNEL	L	T	P	J	C
		2	0	0	0	2
Pre-requisite		**Syllabus version**				
Nil		1.0				

Course Objectives:

The course gives students the necessary background to:

1. Demonstrate competence in reading, writing, and speaking basic French, including knowledge of vocabulary (related to profession, emotions, food, workplace, sports/hobbies, classroom and family).
2. Achieve proficiency in French culture oriented view point.

Expected Course Outcome:

The students will be able to

1. Remember the daily life communicative situations via personal pronouns, emphatic pronouns, salutations, negations, interrogations etc.
2. Create communicative skill effectively in French language via regular / irregular verbs.
3. Demonstrate comprehension of the spoken / written language in translating simple sentences.
4. Understand and demonstrate the comprehension of some particular new range of unseen written materials.
5. Demonstrate a clear understanding of the French culture through the language studied.

Module:1	Saluer, Se présenter, Etablir des contacts	**3 hours**

Les Salutations, Les nombres (1-100), Les jours de la semaine, Les mois de l'année, Les Pronoms Sujets, Les Pronoms Toniques, La conjugaison des verbes réguliers, La conjugaison des verbes irréguliers- avoir / être / aller / venir / faire etc.

Module:2	**Présenter quelqu'un, Chercher un(e) correspondant(e), Demander des nouvelles d'une personne.**	**3 hours**

La conjugaison des verbes Pronominaux, La Négation, L'interrogation avec *'Est-ce que ou sans Est-ce que'*.

Module:3	**Situer un objet ou un lieu, Poser des questions**	**4 hours**

L'article (défini/ indéfini), Les prépositions (à/en/au/aux/sur/dans/avec etc.), L'article contracté, Les heures en français, La Nationalité du Pays, L'adjectif (La Couleur, l'adjectif possessif, l'adjectif démonstratif/ l'adjectif interrogatif (quel/quelles/quelle/quelles), L'accord des adjectifs avec le nom, L'interrogation avec Comment/ Combien / Où etc.,

Module:4	**Faire des achats, Comprendre un texte court, Demander et indiquer le chemin.**	**6 hours**

La traduction simple :(français-anglais / anglais –français)

Module:5	**Trouver les questions, Répondre aux questions générales en français.**	**5 hours**

L'article Partitif, Mettez les phrases aux pluriels, Faites une phrase avec les mots donnés, Exprimez les phrases données au Masculin ou Féminin, Associez les phrases.

Module:6	**Comment ecrire un passage**	**3 hours**
Décrivez : La Famille /La Maison, /L'université /Les Loisirs/ La Vie quotidienne etc.		
Module:7	**Comment ecrire un dialogue**	**4 hours**
Dialogue: a) Réserver un billet de train b) Entre deux amis qui se rencontrent au café c) Parmi les membres de la famille d) Entre le client et le médecin		
Module:8	**Invited Talk: Native speakers**	**2 hours**

	Total Lecture hours:	**30 hours**	

Text Book(s)	
1.	Echo-1, Méthode de français, J. Girardet, J. Pécheur, Publisher CLE International, Paris 2010.
2	Echo-1, Cahier d'exercices, J. Girardet, J. Pécheur, Publisher CLE International, Paris 2010.
Reference Books	
1.	CONNEXIONS 1, Méthode de français, Régine Mérieux, Yves Loiseau,Les Éditions Didier, 2004.
2	CONNEXIONS 1, Le cahier d'exercices, Régine Mérieux, Yves Loiseau, Les Éditions Didier, 2004.
3	ALTER EGO 1, Méthode de français, Annie Berthet, Catherine Hugo, Véronique M. Kizirian, Béatrix Sampsonis, Monique Waendendries , Hachette livre 2006.

Mode of Evaluation: CAT / Assignment / Quiz / FAT			
Recommended by Board of Studies			
Approved by Academic Council	No 41	Date	17-06-2016

GER5001	Deutsch für Anfänger	L	T	P	J	C
		2	0	0	0	2
Pre-requisite	**NIL**	**Syllabus version**				
		1.0				

Course Objectives:

The course gives students the necessary background to:

1. Enable students to read and communicate in German in their day to day life
2. Become industry-ready
3. Make them understand the usage of grammar in the German Language.

Expected Course Outcome:

The students will be able to

1. Create the basics of German language in their day to day life.
2. Understand the conjugation of different forms of regular/irregular verbs.
3. Understand the rule to identify the gender of the Nouns and apply articles appropriately.
4. Apply the German language skill in writing corresponding letters, E-Mails etc.
5. Create the talent of translating passages from English-German and vice versa and To frame simple dialogues based on given situations.

Module:1	**3 hours**

Einleitung, Begrüssungsformen, Landeskunde, Alphabet, Personalpronomen, Verb Konjugation, Zahlen (1-100), W-fragen, Aussagesätze, Nomen – Singular und Plural

Lernziel:

Elementares Verständnis von Deutsch, Genus- Artikelwörter

Module:2	**3 hours**

Konjugation der Verben (regelmässig /unregelmässig) die Monate, die Wochentage, Hobbys, Berufe, Jahreszeiten, Artikel, Zahlen (Hundert bis eine Million), Ja-/Nein- Frage, Imperativ mit Sie

Lernziel :

Sätze schreiben, über Hobbys erzählen, über Berufe sprechen usw.

Module:3	**4 hours**

Possessivpronomen, Negation, Kasus- AkkusatitvundDativ (bestimmter, unbestimmterArtikel), trennnbare verben, Modalverben, Adjektive, Uhrzeit, Präpositionen, Mahlzeiten, Lebensmittel, Getränke

Lernziel :

Sätze mit Modalverben, Verwendung von Artikel, über Länder und Sprachen sprechen, über eine Wohnung beschreiben.

Module:4	**6 hours**

Übersetzungen : (Deutsch – Englisch / Englisch – Deutsch)

Lernziel :

Grammatik – Wortschatz – Übung

Module:5	**5 hours**

Leseverständnis,Mindmap machen,Korrespondenz- Briefe, Postkarten, E-Mail

Lernziel :

Wortschatzbildung und aktiver Sprach gebrauch

Module:6	.	**3 hours**
Aufsätze : Meine Universität, Das Essen, mein Freund oder meine Freundin, meine Familie, ein Fest in Deutschland usw		
Module:7		**4 hours**
Dialoge: e) Gespräche mit Familienmitgliedern, Am Bahnhof, f) Gespräche beim Einkaufen ; in einem Supermarkt ; in einer Buchhandlung ; g) in einem Hotel - an der Rezeption ;ein Termin beim Arzt. Treffen im Cafe		
Module:8		**2 hours**
Guest Lectures/Native Speakers / Feinheiten der deutschen Sprache, Basisinformation über die deutschsprachigen Länder		

	Total Lecture hours:	**30 hours**	

	Text Book(s)
1.	**Studio d A1 Deutsch als Fremdsprache, Hermann Funk, Christina Kuhn, Silke Demme : 2012**
Reference Books	
1	Netzwerk Deutsch als Fremdsprache A1, Stefanie Dengler, Paul Rusch, Helen Schmtiz, Tanja Sieber, 2013
2	Lagune ,Hartmut Aufderstrasse, Jutta Müller, Thomas Storz, 2012.
3	Deutsche SprachlehrefürAUsländer, Heinz Griesbach, Dora Schulz, 2011
4	ThemenAktuell 1, HartmurtAufderstrasse, Heiko Bock, MechthildGerdes, Jutta Müller und Helmut Müller, 2010
	www.goethe.de wirtschaftsdeutsch.de hueber.de, klett-sprachen.de www.deutschtraning.org

Mode of Evaluation: CAT / Assignment / Quiz / FAT			
Recommended by Board of Studies			
Approved by Academic Council	No. 41	Date	17-06-2016

STS5001	Essentials of Business Etiquettes	L	T	P	J	C
		3	0	0	0	1
Pre-requisite		**Syllabus version**				
		2.0				

Course Objectives:

1. To develop the students' logical thinking skills
2. To learn the strategies of solving quantitative ability problems
3. To enrich the verbal ability of the students
4. To enhance critical thinking and innovative skills

Expected Course Outcome:

- Enabling students to use relevant aptitude and appropriate language to express themselves
- To communicate the message to the target audience clearly

Module:1	**Business Etiquette: Social and Cultural Etiquette and Writing Company Blogs and Internal Communications and Planning and Writing press release and meeting notes**	**9 hours**

Value, Manners, Customs, Language, Tradition, Building a blog, Developing brand message, FAQs', Assessing Competition, Open and objective Communication, Two way dialogue, Understanding the audience, Identifying, Gathering Information,. Analysis, Determining, Selecting plan, Progress check, Types of planning, Write a short, catchy headline, Get to the Point –summarize your subject in the first paragraph., Body – Make it relevant to your audience,

Module:2	**Study skills – Time management skills**	**3 hours**

Prioritization, Procrastination, Scheduling, Multitasking, Monitoring, Working under pressure and adhering to deadlines

Module:3	**Presentation skills – Preparing presentation and Organizing materials and Maintaining and preparing visual aids and Dealing with questions**	**7 hours**

10 Tips to prepare PowerPoint presentation, Outlining the content, Passing the Elevator Test, Blue sky thinking, Introduction , body and conclusion, Use of Font, Use of Color, Strategic presentation, Importance and types of visual aids, Animation to captivate your audience, Design of posters, Setting out the ground rules, Dealing with interruptions, Staying in control of the questions, Handling difficult questions

Module:4	**Quantitative Ability -L1 – Number properties and Averages and Progressions and Percentages and Ratios**	**11 hours**

Number of factors, Factorials, Remainder Theorem, Unit digit position, Tens digit position, Averages, Weighted Average, Arithmetic Progression, Geometric Progression, Harmonic Progression, Increase & Decrease or successive increase, Types of ratios and proportions

Module:5	**Reasoning Ability-L1 – Analytical Reasoning**	**8 hours**

Data Arrangement(Linear and circular & Cross Variable Relationship), Blood Relations, Ordering/ranking/grouping, Puzzle test, Selection Decision table		
Module:6	**Verbal Ability-L1 – Vocabulary Building**	**7 hours**
Synonyms & Antonyms, One word substitutes, Word Pairs, Spellings, Idioms, Sentence completion, Analogies		
	Total Lecture hours:	**45 hours**

Reference Books	
1.	Kerry Patterson, Joseph Grenny, Ron McMillan, Al Switzler(2001) Crucial Conversations: Tools for Talking When Stakes are High. Bangalore. McGraw-Hill Contemporary
2.	Dale Carnegie,(1936) How to Win Friends and Influence People. New York. Gallery Books
3.	Scott Peck. M(1978) Road Less Travelled. New York City. M. Scott Peck.
4.	FACE(2016) Aptipedia Aptitude Encyclopedia. Delhi. Wiley publications
5.	ETHNUS(2013) Aptimithra. Bangalore. McGraw-Hill Education Pvt. Ltd.

Websites:	
1.	www.chalkstreet.com
2.	www.skillsyouneed.com
3.	www.mindtools.com
4.	www.thebalance.com
5.	**www.eguru.ooo**

Mode of Evaluation: FAT, Assignments, Projects, Case studies, Role plays,
3 Assessments with Term End FAT (Computer Based Test)

Recommended by Board of Studies	09/06/2017		
Approved by Academic Council	No. 45th AC	Date	15/06/2017

STS5002	Preparing for Industry	L	T	P	J	C
		3	0	0	0	1
Pre-requisite		**Syllabus version**				
		2.0				

Course Objectives:

5. To develop the students' logical thinking skills
6. To learn the strategies of solving quantitative ability problems
7. To enrich the verbal ability of the students
8. To enhance critical thinking and innovative skills

Expected Course Outcome:

- Enabling students to simplify, evaluate, analyze and use functions and expressions to simulate real situations to be industry ready.

Module:1	**Interview skills – Types of interview and Techniques to face remote interviews and Mock Interview**	**3 hours**

Structured and unstructured interview orientation, Closed questions and hypothetical questions, Interviewers' perspective, Questions to ask/not ask during an interview, Video interview¸ Recorded feedback, Phone interview preparation, Tips to customize preparation for personal interview, Practice rounds

Module:2	**Resume skills – Resume Template and Use of power verbs and Types of resume and Customizing resume**	**2 hours**

Structure of a standard resume, Content, color, font, Introduction to Power verbs and Write up, Quiz on types of resume, Frequent mistakes in customizing resume, Layout - Understanding different company's requirement, Digitizing career portfolio

Module:3	**Emotional Intelligence - L1 – Transactional Analysis and Brain storming and Psychometric Analysis and Rebus Puzzles/Problem Solving**	**12 hours**

Introduction, Contracting, ego states, Life positions, Individual Brainstorming, Group Brainstorming, Stepladder Technique, Brain writing, Crawford's Slip writing approach, Reverse brainstorming, Star bursting, Charlette procedure, Round robin brainstorming, Skill Test, Personality Test, More than one answer, Unique ways

Module:4	**Quantitative Ability-L3 – Permutation-Combinations and Probability and Geometry and mensuration and Trigonometry and Logarithms and Functions and Quadratic Equations and Set Theory**	**14 hours**

Counting, Grouping, Linear Arrangement, Circular Arrangements, Conditional Probability, Independent and Dependent Events, Properties of Polygon, 2D & 3D Figures, Area & Volumes, Heights and distances, Simple trigonometric functions, Introduction to logarithms, Basic rules of logarithms, Introduction to functions, Basic rules of functions, Understanding Quadratic Equations, Rules & probabilities of Quadratic Equations, Basic concepts of Venn Diagram

Module:5	**Reasoning ability-L3 – Logical reasoning and Data Analysis and Interpretation**	**7 hours**
Syllogisms, Binary logic, Sequential output tracing, Crypto arithmetic, Data Sufficiency, Data interpretation-Advanced, Interpretation tables, pie charts & bar chats		
Module:6	**Verbal Ability-L3 – Comprehension and Logic**	**7 hours**
Reading comprehension, Para Jumbles, Critical Reasoning (a) Premise and Conclusion, (b) Assumption & Inference, (c) Strengthening & Weakening an Argument		
	Total Lecture hours:	**45 hours**

Reference Books	
1.	Michael Farra and JIST Editors(2011) Quick Resume & Cover Letter Book: Write and Use an Effective Resume in Just One Day. Saint Paul, Minnesota. Jist Works
2.	Daniel Flage Ph.D(2003) The Art of Questioning: An Introduction to Critical Thinking. London. Pearson
3.	David Allen(2002) Getting Things done : The Art of Stress -Free productivity. New York City. Penguin Books.
4.	FACE(2016) Aptipedia Aptitude Encyclopedia.Delhi. Wiley publications
5.	ETHNUS(2013) Aptimithra. Bangalore. McGraw-Hill Education Pvt. Ltd.
Websites:	
1.	www.chalkstreet.com
2.	www.skillsyouneed.com
3.	www.mindtools.com
4.	www.thebalance.com
5.	www.eguru.ooo

Mode of Evaluation: FAT, Assignments, Projects, Case studies, Role plays, 3 Assessments with Term End FAT (Computer Based Test)			
Recommended by Board of Studies	09/06/2017		
Approved by Academic Council	No. 45th AC	Date	15/06/2017

Programme Core

Course code	Sensors and Engine Management Systems	L	T	P	J	C
ECE5071		3	0	0	4	4
Pre-requisite	Nil	Syllabus version :1.1				

Course Objectives:

The course is aimed at
1. Giving details of the Engine sensor waveforms and methods to analyze the same.
2. Providing an overview of petrol and diesel engines using Engine Control Unit (ECU).
3. Giving insights into the operation of ECU with the suitable mapping of sensors.

Expected Course Outcome:

At the end of the course, the student will be able to
1. Comprehend the concepts of ECU design for automotive applications.
2. Analyze response of Transducers and sensors for automotive applications
3. Understand the various after treatment and alternative fuel-based systems.
4. Comprehend the operation of petrol engine management systems.
5. Understand the operation of automotive sensors and fuel injection systems.
6. Comprehend the Electronic control unit pertaining to chassis and body
7. Illustrate the various Automotive subsystems
8. Design and implement sensor and ECU related projects.

Module:1	Electronic Control Unit(ECU) design:	6 hours	

The concepts of ECU design for automotive applications, Need for ECUs, advances in ECUs for automotive, design complexities of ECUs, V-Model for Automotive ECU's Architecture, analog and digital interfaces

Module:2	Basics of Engine Control systems	6 hours	

IC engines operation – Petrol and Diesel; IC engine as a propulsion source for Automobiles; the need for engine controls and management; Control objectives linked to fuel efficiency, emission limits and vehicle performance; advantages of using Electronic engine controls

Module:3	Petrol Engine Management Systems	7 hours	

Evolution of Petrol engine controls, Electronic ignition, multi-point fuel injection, direct injection; Basics of ignition system and fuel injection system; Architecture of a EMS with multi point fuel injection

Module:4	Diesel Engine Management Systems:	6 hours	

Basics of Diesel engine Controls ; Evolution of diesel engine controls; in-line fuel pump; rotary fuel pump; EGR control; Electric motor driven fuel pump;electronic fuel injection control and timing.

Module:5	After treatment and alternate fuel	6 hours	

Automobile emission – source, control, tests, standards (Indian), Exhaust Gas Recirculation (EGR), Catalytic converter, Alternative fuels – hydrogen – CNG, LPG, Biodiesel

Module:6	Transducer Principles	6 hours	

Transducers classification and basic principles, General Input-output configuration, static characteristics and dynamic characteristics of instruments, Variable resistance transducers, Metal and semiconductor strain gages and their signal conditioning ,Inductive transducers, Electromagnetic sensors, Hall effect sensors, Capacitive transducers, Piezo electric transducers and their signal conditioning, Ultrasonic sensors

Module:7	Sensors for Transportation	6 hours	

Vehicle Body:- Torque sensors/ Force sensors, Sensors Flap air flow sensors, Temperature sensor, Ultrasonic sensors, Ranging radar (ACC) Power Train:- Fuel level sensors, Speed and RPM sensors, Lambda Oxygen sensor, Hotwire air mass meter Chassis:- Steering wheel angle sensor, Vibration and acceleration sensors, Pressure sensors, Speed and RPM sensors

Module:8	**Contemporary Topics**	**2 hours**	
	Total Lecture Hours:	**45 hours**	

Text Book(s)

1. Fundamentals of Internal Combustion Engines - H.N. Gupta - Second edition (2013) – PHI publisher
2. Internal Combustion Engines - 2012 -V Ganesan –Tata McGraw Hill
3. Automotive Sensors (Sensors Technology) –2009 by John Turner & Joe Watson (Author)

Reference Books

1. Automotive Sensors, BOSCH. 2002
2. Fundamentals of Automotive Electronics Book - Sixth Edition-2012 - Alma Hillier

Typical Projects

1. **Develop regenerative braking system** –To develop the hydraulic SIMULINK model which can describe the process of braking pressure increase and decrease precisely. Meanwhile the motor cooperates with the hydraulic braking system well throughout the whole braking procedure. The maximum jerk exerted on the vehicle to decrease during the exiting of regenerative braking.
2. **Coolant Monitoring System**–To develop cooling system monitor and, more particularly, to the use of differential pressure to determine whether a sufficient flow of coolant is passing through the cooling system of an internal combustion engine.
3. **Automatic Control of Power Windows on Carbon Monoxide Level in Vehicle** – To develop microcontroller based power window control used as a control system for moving a power window panel. The purpose of power window control system is to raise and lower door glass with the help of a switch and its operation is controlled based on gas sensors
4. **Lubrication oil monitoring using ultrasonic sensor** – To develop simple warning system to predict the contamination level of lubrication oil at low cost using sensors connected with engine management systems

Mode of Evaluation: CAT / Assignment / Quiz / FAT / Project / Seminar			
Recommended by Board of Studies	09-03-2016		
Approved by Academic Council	No. 40	Date	18-03-2016

Course code	Course Title	L	T	P	J	C
ECE5072	Micro controllers for Vehicular Systems	3	0	2	0	4

Pre-requisite	Nil	Syllabus version : 1.1

Course Objectives:

The course is aimed at:

1. Introducing the students to various automotive grade microcontroller for vehicles.
2. Teaching Embedded C programming with 8051 controller and ARM processor.
3. Explaining the architecture and features of ARM processor.

Expected Course Outcome:

At the end of the course, the students will able to

1. Understand the architecture of 8051 Microcontroller.
2. Write programs for solving problems using 8051 Microcontroller.
3. Comprehend ARM architecture & its features
4. Describe the architecture of Cortex-M.
5. Perform ARM processor based experiments using Embedded C programming tool.
6. Have an overview of the types of ARM cores in the market and to make a suitable choice for an application.
7. comprehend various Microcontroller for powertrain and body electronics

Module:1	**Introduction to 8 bit microcontrollers**	**5 hours**	
RISC / CISC and Harvard / Princeton, 8bit Architecture [8051,PIC18], External memory interface, Ports, Timers/counters, SerialCommunication, Interrupts			
Module:2	**8 bit microcontrollers programming for Body, Safety and Temperature**	**7 hours**	
Programming in Embedded C [8051, PIC18], Applications onBody, safety and Temperature			
Module:3	**ARM Architecture**	**7 hours**	
ARM Design Philosophy, Overview of ARM architecture, States[ARM, Thumb, Jazelle], Registers, modes, Conditional Execution,Pipelining, Vector Tables, Exception handling			
Module:4	**ARM Core**	**6 hours**	
Architecture of Cortex-M, Memory Addressing, IO ports,Timers/counter, Watch Dog Timer, PWM, ADC/DAC, UART,Interrupts, Displays, C programming.			
Module:5	**ARM core programming**	**6 hours**	
Embedded C programming for IO ports, Timers, PWM, ADC and External interfaces			
Module:6	**Automotive 32-bit MCU**	**6 hours**	
Choosing MCU's for Automotive Applications, Atmel – SMART ARM based MCU, ST- SPC5 32-bit Automotive MCU, NXPAutomotive MCU			
Module:7	**Automotive MCU by Applications**	**6 hours**	
Automotive microcontrollers for Powertrain Control, Hybrid and Electric Auxiliaries, Transmission and Body Electronics			
Module:8	**Contemporary Topics**	**2 hours**	
	Total Lecture Hours:	**45 hours**	

Text Book(s)

1.	The 8051 Microcontroller and Embedded Systems Using Assembly and C -3rd Edition - Muhammad Ali Mazidi -2014		
Reference Books			
1. 2. 3.	8051 Microcontrollers - David Calcutt, Fred Cowan, Hassan Parchizadeh – Newness – 2011 The Definitive Guide to the ARM Cortex M0 - Joseph Yiu –Newness -2011 Automotive Microcontrollers, Volume 2 by Ronald K. Jurgen – SAE publications		
Mode of Evaluation: CAT / Assignment / Quiz / FAT / Project / Seminar			
Mode of evaluation:			
Recommended by Board of Studies	09/03/2016		
Approved by Academic Council	No. 40	Date	18/03/2016

Course Code	Course Title	L	T	P	J	C
ECE5073	Vehicle Control Systems	3	0	0	0	3
Pre-requisite	NIL	Syllabus Version : 1.1				

Course objectives (CoB):

The course is aimed at:

[1] Getting the know how required for mathematical modelling, performance and stability analysis of feedback vehicle control system.

[2] Providing a comprehensive coverage of controller design, state space design methods and digital control system.

[3] Acquiring the skills for carrying out typical projects involving vehicle controls using MATLAB and Simulink

Course Outcomes (CO):

At the end of the course, the student will be able to

[1 Understand the modelling aspects involved in the design of the physical system for vehicle applications

[2] Identify the steady state and transient response of the different order of the system, analyse its performance and compute error coefficients.

[3] Evaluate the stability of the system in frequency domain

[4] Design a controller for automotive application using MATLAB/SIMULINK

[5] Comprehend the Classical controller design

[6] Identify the state space design methods like SISO, etc.

[7] Explain the stability test procedure and get introduced to digital controller design.

Module:1	System Modelling using Transfer function	4 hours	
Fundamentals of modelling -transfer function approach. Introduction to block diagrams & signal flow graphs. Introduction to Simulink			
Module:2	**Performance of Feedback Control System**	**4 hours**	
First order, Second order control system response for step, ramp and impulse inputs. Error Analysis - Type number -characteristic equation -Poles and Zeroes concept -Error Analysis and performance indices			
Module:3	**Stability analysis of feedback control system**	**4 hours**	
Frequency response plots -frequency domain specifications -stability analysis- Routh Hurwitz stability criteria –Root Locus – stability in the frequency domain –gain and phase margins – Nyquist stability criterion			
Module:4	**Controller Design**	**4 hours**	
Proportional, Integral, Derivative controllers, P, PI, and PID control actions and mathematical models. Using Simulink to build ‘P’, ‘PI’, ‘PID’ controller modules and carry out experiments. Importance and interpretations of results.			
Module:5	**Classical controller design**	**3 hours**	
Classical design in the frequency domain- lead, lag compensator design.			
Module:6	**Modern control theory**	**5 hours**	
State space design methods: SISO,MIMO systems, Various forms of representation of the system (Bush form, etc), controllability and observability, state observer			
Module:7	**Introduction to Digital Control System**	**4 hours**	
Discrete Time systems, Sampling and aliasing considerations, System time response, characteristics -Jury’s stability test -mapping s to z plane -Digital controller design: from analog to digital design.			
Module:8	**Contemporary Topics**	**2 hours**	
			Total Lecture: 30 hours

Mode: Flipped Class Room, [Lecture to be videotaped], lectures by industry / subject experts
Text Book(s) 1. Katsuhiko Ogata, “Modern Control Engineering”, Prentice Hall, (4th Edition), 2001 2. K. Ogata, “Discrete-Time Control Systems”, Prentice-Hall, Inc., 1994
Reference Books: 1. I.J. Nagrath and M. Gopal, "Control Systems Engineering", New Age International (P) Limited, 4th Edition, 2006 **2.**Norman S. Nise," Control Systems Engineering ", 6th Edition December 2010 3.Uwe Kiencke, Lars Nielsen, “Automotive Control Systems: For Engine, Driveline, and Vehicle”, Springer; 1 edition, March 30, 2000 .
Indicative Project Titles
1.Mathematical modeling of linear and nonlinear SISO process
2.Transfer function and state-space modeling of SISO process
3.Designing of P, PI, PID controllers using performance criteria
4.Processor in loop testing
5.Designing of lag-lead compensators
6.Designing of digital controller
7.Closed loop control of a DC motor
8.Cruise control system
9.Lambda control for engines
10.Simulink model development for automotive applications
Recommended by Board of Studies : 09/03/2016
Approved by Academic Council : No. 40 Date : 18/03/2016

Course Code	Course Title	L	T	P	J	C
ECE5074	Automotive networking and protocols	3	0	2	0	4
Pre-requisite	NIL	Syllabus Version:1.1				

Course objectives (CoB):

The course is aimed at:

[1] Providing an overview of automotive network systems

[2] Exposing students to the aspects of design, development, application and performance issues associated with automotive network systems.

Course Outcomes (CO):

At the end of the course, the student will be able to

[1] Illustrate the basics of automotive networking and protocols

[2] Comprehend the general protocols and their usage in automotive sector

[3] Understand the LIN protocol and implement inconvenience feature applications

[4] Design and implement CAN protocol for chassis and power train applications

[5] Understand the concepts of time triggered protocols and it's usage in automotive field

[6] Design and implement in media-oriented system transport protocol applications

[7] Understand flex ray protocol and their usage in safety critical applications

[8] Design node to node communication using LIN, CAN protocol and also implement the ECU communication using CAN analyzer

Module:1	Introduction to automtotive networking	3 hours	

Overview of Data communication and networking –need for In-Vehicle networking –layers of OSI reference model –multiplexing and de-multiplexing concepts –vehicle buses

Module:2	General purpose protocols	3 hours	

Overview of general purpose networks and protocols –Ethernet, TCP, UDP, IP

Module:3	Protocol for low data rate applications	5 hours	

LIN standard overview –workflow concept-applications –LIN protocol specification –signals –Frame transfer –Frame types –Schedule tables –Task behaviour model –Network management –status management

Module:4	Protocol for medium data rate applications	5 hours	

Overview of CAN –fundamentals –Message transfer –frame types-Error handling –fault confinement-Bit time requirements

Module:5	Time triggered protocol	3 hours	

Introduction to CAN open –TTCAN –Device net –SAE J1939

Module:6	Protocol for infotainment	4 hours	

MOST –Overview of data channels –control channel-synchronous channel –asynchronous channel –Logical device model –functions-methods-properties-protocol basics- Network section-data transport –Blocks –frames –Preamble-boundary descriptor

Module:7	Protocols for safety critical applications	5 hours	

Flexray-Introduction –network topology –ECUs and bus interfaces –controller host interface and protocol operation controls –media access control and frame and symbol processing –coding/decoding unit

Module:8	Contemporary Topics	2 hours	

Total Lecture: 30 hours

Mode: Flipped Class Room, [Lecture to be videotaped], lectures by industry / subject experts

Text Book(s)

1. J.Gabrielleen,"Automotive in-vehicle networks",John Wiley & Sons, Limited, 2008

Reference Books:

1. Robert Bosch,"Bosch automotive networking",Bentley publishers,2007
2. Society of automotive engineers,"In-vehicle networks" ,2002

3. Ronald K Jurgen, “Automotive Electronics Handbook”, McGraw-Hill Inc. 1999.
4. Indra Widjaja, Alberto Leon-Garcia, “Communication Networks: Fundamental Concepts and Key Architectures”, McGraw-Hill College; 1st edition, 2000.
5. Konrad Etschberger,” Controller Area Network”, IXXAT Automation, August 22, 2001.
6. Olaf Pfeiffer, Andrew Ayre, Christian Keydel, “Embedded Networking with CAN and CANopen”, Annabooks/Rtc Books, 2003

Lab experiments using microcontroller

LIN node to node communication using HCS512 microcontroller

- Data will be sent and received from master and slave node using LIN protocol

CAN node to node communication using HCS512 microcontroller

- Data will be sent and recived from master and slave node using CAN protocol

Flexray communication using EVB9S12XF512E board

- Multiple Data bytes sent using flexray protocol

TCP/IP communication using LabView

- Sending data to particular port address using TCP/IP protocol

TCP/UDP communication using LabView

- Sending data to particular port address using TCP/UDP protocol

Recommended by Board of Studies : 09/03/2016

Approved by Academic Council : No.40 Date : 18/03/2016

Course Code	Course title	L	T	P	J	C
ECE5075	ELECTRIC AND ELECTRONIC POWER SYSTEMS FOR VEHICLES	3	0	0	4	4

Pre-requisite	Nil	Syllabus version :1

Course Objectives:

The course to aimed at

1. Developing the skills to understand the circuit and electrical wiring diagram and interpret the same.
2. Providing students with a good understanding of automotive electrical systems with particular emphasize on batteries, charging, ignition, starters and lighting systems.
3. Imparting students the knowledge about the new developments and advancements of automotive electrical technologies.

Expected Course Outcome:

At the end of the course, the students will able to

1. Interpret the electrical wiring, circuit diagram for automotive applications
2. Understand the role of batteries in vehicles
3. Develop a charging system for vehicles
4. Understand the starter and ignition systems in vehicles
5. Demonstrate knowledge on lighting systems for vehicles.
6. Comprehend the passive restraint systems and electrical accessories in vehicles
7. Design and implement various electrical outlet systems for vehicles

Module:1	Electrical Systems and Circuits	6 hours	
System approach –electrical wiring, terminals and switching –multiplexed wiring systems – CAN – circuit diagrams and symbols, Requirements for two wheeler, three wheeler vehicles, Requirements for heavy vehicles- trucks and trailers			
Module:2	**Batteries**	**6hours**	
Vehicle Batteries –Lead-Acid batteries –maintenance and charging –diagnosing Lead acid battery faults –advanced battery technology			
Module:3	**Charging systems**	**6 hours**	
Requirements of charging systems —generation of electrical energy in motor vehicle –physical principles – alternators –characteristic curves –charging circuits –diagnosing charging system faults			
Module:4	**Starting system**	**6 hours**	
Requirements –starter motors and circuits –types of starter motors –diagnosing starting system faults			
Module:5	**Ignition system**	**6 hours**	
Fundamentals –electronic ignition –programmed ignition –distributor less ignition –direct ignition spark plug ignition –diagnosing faults			
Module:6	**Lighting system**	**6 hours**	
Insulated and earth return systems, positive and negative earth systems, Concealed headlights Lighting circuit types, glare and preventive methods			
Module:7	**Gauges, Accessories and Passive restraint systems**	**6 hours**	
Electrical fuel pump, speedometer, oil and temperature gauges, Horns, Wipers, washers, Blower motors, Defoggers, Power windows, seats, door locks, Air bag systems, Seat belt pretensioners			
Module:8	Contemporary Topics	**3 hours**	
	Total Lecture hours:	**45 hours**	

Reference Books

1.	Judge, A.W., “Modern Electrical Equipment of Automobiles”, Chapman & Hall London, 1992
2.	Young, A.P., &Griffiths.L., “Automobile Electrical Equipment”, English Languages Book Society & New Press, 1990
3.	Automotive Electricals Electronics System and Components, Robert Bosch Gmbh, 4th Edition, 2004
4.	Automotive Hand Book, Robert Bosch, Bently Publishers, 1997
5.	Jurgen, R., Automotive Electronics Hand Book
6.	Automotive Electricals / Electronics System and Components, Tom Denton, 3rd Edition, 2004

Mode of Evaluation:Continuous Assessment Test, Quiz, Digital Assignment, Challenging Experiments, Final Assessment Test

Typical Projects	
1.	Design a battery management system
2.	Testing of starting motors and Alternators.
3.	Electronic motor control system for door and car roof sun visor.
4.	Battery circuit topology for lighting and accessories.
5.	Battery powered Electric Vehicle Technology
6.	Automatic lighting System
7.	Automatic wiper system
8.	Automatic lighting System
9.	Optimizing the Performance of Electric Cooling Fans
10.	Upgrading the Alternator

Recommended by Board of Studies	09/03/2016		
Approved by Academic Council	No. 40	Date	18/03/2016

Programme Elective

Course code	Course Title	L	T	P	J	C
ECE6071	Data acquisition and signal conditioning	3	0	2	0	4
Pre-requisite	Basics of Electronics and Electrical circuits	Syllabus version:1.1				

Course Objectives: The course is aimed at:

1. Imparting an in-depth knowledge in sensor signal conditioning, signal conversion, data acquisition, signal processing, transmission and analysis.
2. Providing a comprehensive coverage of data acquisition methods for sensor systems and hardware interface cards available commercially.
3. Enabling the students to do acquire the necessary skills to undertake project work using Multisim and LabView

Expected Course Outcome:

At the end of the course, the student will be able to

1. Understand the basics of amplifier for designing circuits
2. Design the circuits using amplifiers for automotive applications
3. Estimate drift in resistors over a period of time and also to learn non-linear signal processing techniques
4. Design different converter like ADC, DAC and voltage to frequency converter
5. Gain knowledge about interference, grounding and its effects the circuitry
6. Understand the data operation of loggers, data acquisition boards and software for acquiring the samples
7. Describe different standards like RS232, GPIB which will be used for interfacing with the DAQ boards

Module:1	**Introduction to linear integrated circuits**	**3 hours**	
Introduction to amplifier–amplifier parameters –operational amplifiers - Differential amplifiers-instrumentation amplifiers			
Module:2	**Amplifiers**	**5 hours**	
carrier amplifiers –Lock-in-Amplifiers –chopper and low drift amplifiers –electrometer and transimpedance amplifiers –charge amplifier –isolation amplifier			
Module:3	**Non-linear signal processing techniques**	**3 hours**	
Limiting, clipping, logarithmic amplification, multiplication and division –analog linearization –special purpose signal conditioners –Noise in amplifiers –noise and drift in resistors			
Module:4	**Signal Conversion**	**5 hours**	
Voltage to frequency converter –capacitance to period converter –frequency to code conversion - sampling concepts –pre filtering –Sample and Hold amplifier –Analog-to-Digital converters - multiplexers and De-multiplexers –Digital-to Analog converters			
Module:5	**Data transmission**	**4 hours**	
Data transmission systems –pulse code format –modulation techniques –telemetry –noise and interference –types and reduction –signal circuit grounding –shield grounding –capacitive, magnetic and optical isolation.			
Module:6	**Data Acquisition System**	**3 hours**	**CO: 6**
DAS boards –interfacing issues with DAS boards, software drivers–data logger –Data acquisition method with time-division channeling and main errors of multi channel data-acquisition systems, data transmission and error protection			
Module:7	**Interfacing**	**5 hours**	**CO: 7**
Bus standard for communication between instruments - GPIB (IEEE-488bus) - RS-232C- USB -4-to-20mA current loop -serial communication systems			
Module:8	**Contemporary Topics**	**2 hours**	
	Total Lecture Hours:	**30 hours**	

Text Book(s)			
1.	**Pallas Areny. R , Webster. J. G, "Sensors and Signal conditioning", 2nd ed. John Wiley and Sons, 2001**		
Reference Books			
1.	**Jacob Fraden, " Handbook of Modern Sensors: physics, Designs and Applications", 3rd ed., Springer, 2003.**		
2.	**Taylor, H. Rosemary , "Data Acquisition for Sensor Systems", Kluwer Academic Publishers Group, 1997.**		
Mode of Evaluation: CAT / Assignment / Quiz / FAT /			
Mode of evaluation:			
Recommended by Board of Studies	09/03/2016		
Approved by Academic Council	No. 40	Date	18/03/2016

Course code	Course Title	L	T	P	J	C
ECE 6072	Automotive power electronics and motor drives	3	0	2	0	4
Pre-requisite	Basics of Electrical circuits	Syllabus version: 1.1				

Course Objectives:

The course is aimed at:

1. Imparting an in-depth knowledge about power electronics devices using MATLAB
2. Acquiring the design capability of converters and inverters for the electric and hybrid vehicles
3. Gaining knowledge on the different motors and their application in electric vehicles

Expected Course Outcome:

At the end of the course, the student will be able to

1. Understand the operation of power semiconductor devices
2. Understand the operation of AC-DC converters at different loads
3. Understand the operation of three phase inverters
4. Design different converters: buck, boost and buck-boost converters
5. Understand the concepts of ultracapacitor and its usage in automotive field
6. Describe the different speed control methods of induction motors
7. Give details about the operation and characteristics of different motors
8. Design and implement power electronics circuits for automotive applications

Module:1	**Introduction**	**4 hours**	
Introduction to power electronics- Structure , operation and characteristics of automotive semiconductor devices -SCR,Power Transistor, Power MOSFET and IGBT- turn on and off circuits – series and parallel operation of SCR –protection Circuits –design of snubber circuits			
Module:2	**Converters**	**4 hours**	
Half wave controlled converter with R,RL-RLE load,fully controlled converters with R-RL-RLE load-Three phase half wave controlled converter with R-RL load- Three phase fully controlled converter with R-RL load			
Module:3	**Inverters**	**4 hours**	
Voltage source inverter with 120 degree and 180 degree conduction mode-current source inverters – PWM techniques			
Module:4	**Choppers**	**3 hours**	
Step up and step down choppers –Different types of coppers – use of choppers			
Module:5	**Ultracapacitors**	**4 hours**	
Theory of electronic double layer capacitance-model and cell balancing-sizing criteria-converter interface-ultracapacitors in combination with batteries			
Module:6	**Automotive motor Control**	**4 hours**	
Methods of controlling speed – Induction and DC Motor controls			
Module:7	**Automotive drive system**	**5 hours**	
BLDC - Motor construction, characteristics and operation -Open loop and close loop control through speed and current sensors-Switched Reluctance Motor -Motor construction, operation and its application.			
Module:8	**Contemporary Topics**	**2 hours**	
	Total Lecture Hours:	**30 hours**	

Text Book(s)

1. **P.S. Bimbhra, "Power Electronics:", Khanna Publishers, 14th edition,2014**

Reference Books

1. **Ali Emadi, "Handbook of Automotive power electronics and motor Drives" CRC Press ,2005.**
2. **Bimal K Bose, "Power Electronics and Motor Drive: Advances and Trends",**

	Elsevier,Inc., 2006.		
Mode of Evaluation: CAT / Assignment / Quiz / FAT /			
Mode of evaluation:			
Recommended by Board of Studies	09/03/2016		
Approved by Academic Council	No. 40	Date	18/03/2016

Course code	Course Title	L	T	P	J	C
ECE6073	AUTOSAR AND ISO STANDARDS FOR AUTOMOTIVE SYSTEMS	2	0	0	0	2
Pre-requisite	Nil	Syllabus version : 1				

Course Objectives: The course is aimed at:

1. Enabling the students to understand Autosar standards
2. Introducing to the students the basic knowledge of Communication Stack in Autosar
3. Preparing the students to understand the implementation and integration in Autosar

Expected Course Outcome:

At the end of the course, the student will be able to

1.Apply the knowledge of various autosar standards
2.Analyze autosar codes
3.Apply the AutoSAR – Implementation Integration
4.Analyze the AutoSAR – System Services
5. Implement CAN programming concepts through Autosar
6. Analyze the ISO/TS 16949 standards
7. Know the implementation aspects of ISO/TS 16949 standards

Module:1	**AutoSAR Standards**	3 hours	
General requirement on basic software modules – Functional, Fault operation and error detection.			
Module:2	**AutoSAR Standards – Communication Stack**	5 hours	
Network Management, TTCAN Interface standards, TTCAN Drivers			
Module:3	**AutoSAR – Implementation Integration**	3 hours	
Platform Types, Memory Mapping			
Module:4	**AutoSAR – System Services**	3 hours	
Watchdog Manager, Synchronized Time Base Manager			
Module:5	**ISO/TS 16949**	5 hours	
ISO/TS 16949 - ISO/TS 16949:2009 specifies the quality system requirements for the design and development, production, installation and servicing of automotive related products.			
Module:6	**Introduction to ISO26262 Standard: Basic Concepts**	3 hours	
Structure of ISO26262 standard and its parts-Vocabulary-Management of functional Safety-Concept Phase			
Module:7	**Introduction to ISO26262 Standard: Implementation Aspects**	**6 hours**	
Product Development System level-Product Development Hardware level-Product Development Software level-Production and Operation-Supporting Processes-ASIL Oriented and Safety Oriented Analysis-Guidelines on ISO26262 (Informative)-Case Studies to illustrate concepts, Hazard analysis and Risk assessment-Safety Goals, Preliminary Architecture-Functional Safety Concept			
Module:8	**Contemporary Topics**	**2 hours**	
	Total Lecture Hours:	**30 hours**	

Reference Books

1. Automotive Quality systems – David Hoyle, Butterworth Heinemann limited, 2000
2. www. autosar.org

Mode of Evaluation: CAT / Assignment / Quiz / FAT / Project / Seminar

Mode of evaluation:

Recommended by Board of Studies	09/03/2016		
Approved by Academic Council	No. 40	Date	18/03/2016

Course Code	Course title	L	T	P	J	C
ECE6074	ALTERNATIVE DRIVES, TRACTION AND CONTROLS	3	0	0	4	4
Pre-requisite	Electric and Electronic Power systems for vehicles	Syllabus version: 1				

Course Objectives:

The course is aimed at:

1. Acquainting students with the basics of propulsion using IC engines and electric motors
2. Knowing about different energy storage and conversion schemes for Hybrid vehicles
3. Giving details about the different architectures for Hybrid electric vehicles

Expected Course Outcome:

At the end of the course, the students will able to

1. Understand automotive electrical systems
2. Suggest an alternate vehicle technology
3. Understand the difference in electric motors and IC engines for propulsion in automobiles
4. Describe the charging systems for different storages devices
5. Understand the types of motors used and control mechanism involved for these types of motors in vehicles
6. Explain the various architectures for Hybrid electric vehicles
7. Understand the need of fuel cells and use them for hybrid vehicles

Module:1	Introduction to Automotive Electrical Systems	6 hours	

Electrical Systems and Circuits - Starting systems - Ignition Systems - Lighting & accessories - Electromagnetic Interference and Compatibility

Module:2	Introduction to Hybrid vehicle Technology	6 hours	

Background on need for alternate vehicle technologies for propulsion - Emissions from IC engine based transportation and regulating standards - Projections on availability of non-renewable energy sources - Alternate technologies for vehicles for reducing urban pollution and for extending availability of resources - Importance of Hybrid Electric Vehicles technology

Module:3	Basics of vehicle propulsion	7 hours	

Components comprising traction torque - Vehicle performance Parameters – Speed and Acceleration - Fuel economy in IC engine vehicles - Torque – Speed characteristics of IC engines - Comparison of Electric motors and IC engines as vehicle propulsion power sources - Basics of Electric vehicles - Types of Motors and the speed – Torque characteristics

Module:4	Energy Storage / Energy Conversion	6 hours	

Different types of Batteries for Electric vehicles - Lead acid batteries, Nickel Metal Hydride Batteries, Lithium ion batteries - Comparison of different types of batteries - Battery Management systems / Energy Management Systems - Wireless Charging Systems - Fast Charging Systems - Super Capacitors - Fuel Cells - Solar Energy Converters.

Module:5	Motors and controllers	6 hours	

DC motors - Principle and control - Induction motor drives - Methods of speed control of Induction motor - Constant V / f control - Vector control method - Inverter for Vector control - Basic principles of BLDC motors - Performance analysis and control of BLDC Motors - Sensor less technique for driving BLDC motors - Regenerative braking with electric drive - Four quadrant operation - Optimizing energy recovery**.**

Module:6	Architectures for Hybrid Electric vehicles	6 hours	

Series, parallel and series – parallel hybrids - Different architectures for Hybrid Electric vehicles - Series Hybrid Electric vehicle basics - Sizing of major components - Peak power sourcing - Parallel Hybrid electric vehicle basics - Engine on / off control strategy - Peak power sourcing -

Drive train rating - Parallel Mild hybrid Electric drive system - Series-parallel mild hybrid electric vehicle system.			
Module:7	**Industry examples of Hybrid Electric vehicle**	**6 hours**	
Fuel cell: Basic principles of fuel cells			
Module:8	Contemporary Topics	**2 hours**	
	Total Lecture hours:	**45 hours**	

Text Book(s)

1.	Modern Electric, Hybrid Electric and Fuel cell vehicles - by MehrdadEhsani, Yimin Gao, Sebatien Gay and Ali Emadi; Published by CRC press.

Reference Books

1.	Iqbal Husain, Electric & Hybrid Vehicles, CRC Press
2.	Ronald K Jurgen, Automotive Electronics Handbook, McGraw-Hill Inc. 1999

Mode of Evaluation:Continuous Assessment Test, Quiz, Digital Assignment, Final Assessment Test.

Typical Projects

- Convert two wheeler into hybrid vehicle
- Convert three wheeler in hybrid vehicle
- SOH monitoring
- Disconnecting battery from vehicle during idle
- SOC monitoring
- Comparative Torque analysis for various motors
- Starter system electrical wiring
- Ignition system electrical wiring
- Mild hybrid systems

Mode of Evaluation:Review I, II and III

Recommended by Board of Studies	09/03/2016		
Approved by Academic Council	No. 40	Date	18/03/2016

Course Code	Course Title	L	T	P	J	C
ECE6075	Soft Computing Techniques for Automotive Applications	3	0	0	4	4

Pre-requisite	NIL	Syllabus version:1

Course objectives (CoB): The course is aimed at:

[1] Explaining various architectures of Neural Networks and algorithms used in Fuzzy Logic.

[2] Imparting knowledge about concepts of neurons, crisp set, fuzzy sets, rough sets and fuzzy inference systems.

[3] Providing mathematical foundations of membership functions, fuzzy arithmetic and fuzzy rule base and inference.

Course Outcomes (CO):

At the end of the course, the student will be able to

[1] Identify the essentials components of Soft Computing in automotive applications.

[2] Explain working mechanism of Feed forward neural networks.

[3] Describe the importance of Radial basis neural network and its applications to solve real life problems.

[4] Gain knowledge about working mechanism of convolution neural networks.

[5] Explore recent trends in Convolution Neural Network for Automotive applications.

[6] Understand the fundamentals of fuzzy sets and operations associated.

[7] Understand the ability to apply Fuzzy rules for decision making in real-time scenarios, at a basic level.

[8] design and implement various neural, fuzzy and genetic algorithms for automotive related applications.

Module:1	Introduction	6 hours	

Artificial neural networks – biological neural networks – Applications of neural networks – signal processing – control – Pattern recognition – medicine – speech production – speech recognition – business – Architecture – setting of weights – activation functions – McCulloch Pitt Neuron-application to simulation of fundamental logic gates

Module:2	Simple neural networks for Pattern classification	6 hours	

Biases and thresholds – Linear separability – HebbNet – Algorithm – Application – Perceptron – Application – Learning rule convergence theorem – Adaline – Architecture – application – Madaline-automatic identification of number plates, milestones

Module:3	Pattern Association	7 hours	

Hebb and Delta rule for pattern Association – Heteroassociative memory neural network – Associative Net – Storage capacity – Iterative Autoassociative Net – Discrete Hopfield Net – Bidirectional Associative memory – algorithm – application-classification of vehicles

Module:4	Neural network based on Competition	6 hours	

Fixed weight competitive nets – Maxnet – Mexican Hat – Hamming Net – Kohonen Self Organizing Maps – Learning Vector Organization – Full Counterpropagation – Forward only counter propagation-application-sign board recognition-lane departure warning

Module:5	Adaptive Resonance theory and backpropagation neural net	6 hours	

ART1 – ART2 – Standard back propagation – Alternative weight update procedures – alternative activation functions-application-pedestrian detection

Module:6	Fuzzy logic – Introduction	6 hours	

Classical sets – operations on classical sets – properties of classical sets - Fuzzy set operations –

Properties of fuzzy sets – Classical relations – Operations and properties of Crisp relations – Fuzzy relations – operations and properties – Tolerance and equivalence relations –applications-identification of automatic right gear engagement			
Module:7	**Properties of Membership functions, Fuzzification and Defuzzification**	**6 hours**	
Features of membership functions – various forms – fuzzification – defuzzification to crisp sets – lambda cuts for fuzzy relations – defuzzification to scalars – Membership value assignments – Intution – Inference – Rank ordering – Neural networks – Genetic algorithms – Inductive reasoning-application-automatic electronic fuel injection system design			
Module:8	Contemporary Topics	**2 hours**	
			Total Lecture: 45 hours
# Mode: Flipped Class Room, [Lecture to be videotaped], lectures by industry / subject experts			
Text Book(s) **1.** Fundamentals of Neural Networks – Architectures, Algorithms and Applications, LaureneFausett, Pearson Education, New Delhi, 2012			
Reference Books: 1. Fuzzy Logic with Engineering Applications, Timothy J. Ross, Third Edition, Wiley India Edition, New Delhi, 2010 2.Fuzzy Image Processing and Applications with MATLAB, TamalikaChaira, Ajoy Kumar Ray, CRC Press, New York, 2010.			
Mode of Evaluation: Continues Assessment Test, Quiz, Digital Assignment, Challenging Experiments, Final Assessment Test			
Indicative Project Titles			
1. Neural network implementation in FPGA			
2. Fuzzy based real time intelligent traffic assistant system			
3. Fuzzy logic implementation for parking systems			
4. Implementation of neuro fuzzy ,fuzzy neuro algorithms for automotive applications			
5. Identification of optimal air-fuel mixture ratio			
Recommended by Board of Studies	09/03/2016		
Approved by Academic Council	No. 40	Date	18/03/2016

Course Code	Course Title	L	T	P	J	C
ECE6076	AUTOMOTIVE EMI AND EMC STANDARDS	3	0	0	0	3
Pre-requisite	Nil	Syllabus version:1				

Course Objectives:

The course is aimed at:

1. Teaching the students about the concepts of noise, filter and shield related to EMI and EMC
2. Acquainting the students with skills used to build systems compliant with EMC standards
3. Providing the students with the knowledge of testing the products for emissions and ESD

Expected Course Outcome:

At the end of the course, the student will be able to

1. Comprehend the concepts of power, signal and ground
2. Develop and understand ` the concepts of antennas and transmission lines in EMC
3. Understand the concepts of electric, magnetic and electromagnetic fields
4. Reproduce the testing methods adopted for conducted and radiated emissions
5. Understand the effects of cable and harnessing in EMI and EMC
6. Explain about the vehicle generated noise
7. Understand the issues of EMC in vehicles and various test methods for ESD

Module:1	**Introduction to EMC**	**7 hours**	

EMC an introduction, System level issues- component and system, significance of EMC, Power and signal return- current path, safety grounding, single point ground

Module:2	**Basic concepts used in EMC**	**7 hours**	

Antennas, Omni Directional Antennas, Transmission lines, shields, Fourier series, Capacitor, inductor and actual properties, filtering overview, enclosure shielding, shield discontinuities

Module:3	**Electromagnetic Fields**	**7 hours**	

Introduction, Characteristics of EM environment, comparison of circuit theory and EM field theory, Maxwells equation, Regions around the source, Polarization

Module:4	**EMC testing**	**6 hours**	

EMC disciplines, Radiated Emission Diagnostics, Switching transients, test methods

Module:5	**Effects of cable and harnessing**	**6 hours**	

Conducted emission and immunity, Automotive EMC approaches, Filter placement, coupling between wires, Grounding and PCB layout, Ferrites, High frequency emissions

Module:6	**Automobile Electrical and Electronics Systems**	**5 hours**	

Vehicle generated radiated emissions, Broadband noise, Narrowband noise, Signal characteristics, Vehicle radiated emission tests

Module:7	**EMC issues**	**5 hours**	

Vehicle ABS, Flight controls, Blimp problems, Fuel systems, Aircraft, Runway wheel chairs, Ignitions sytems, Inexpensive Shielding methods, EMC design for immunity, Automotive industry practices

Module:8	**Contemporary topics**	**2 hours**	
	Total Lecture hours:	**45 hours**	

Text Book(s)

1.	Automotive Electromagnetic compatibility – Terence Rybak, Mark steffka – Kluver Academic Publishers

Reference Books

1.	Balcells- J.; González- D.; Gago- J. Curso "EMC design in industrial systems". 2003
2.	Weston- D.A. Electromagnetic compatibility: principles and applications. 2nd ed.- rev. and

	exp. NeYork [etc.]:Marcel Dekker- 2001. ISBN 0824788893
Mode of Evaluation: Continuous Assessment Test, Quiz, Digital Assignment, Final Assessment Test.	

Recommended by Board of Studies	09/03/2016		
Approved by Academic Council	No. 40	Date	18/03/2016

Course code	Course Title	L	T	P	J	C
ECE6077	Vehicular Information and Communication Systems	3	0	0	4	4
Pre-requisite		Syllabus version: 1.1				

Course Objectives: The course is aimed at:

1. Teaching the students concepts of data processing, instrumentation and ECU recording equipment.
2. Providing students, a good understanding about automotive sound system and navigation for vehicular systems
3. Providing details about the positioning and guidance systems.

Expected Course Outcome:

At the end of the course, the student will be able to

1. Understand the data processing in motor vehicles.
2. Comprehend the networking in automotive.
3. Gain knowledge about the information & communication
4. Understand the ECU recording equipment and Parking systems
5. Explore the sound system for automotive
6. Understand the Positioning and Map Matching for vehicles
7. Understand the Route Planning and Route Guidance techniques for automotives
8. Design and implement vehicular information and communication system.

Module:1	**Data processing in motor vehicles**	**3hours**	
Requirements, Electronic control unit(ECU), Architecture,CARTRONIC.			
Module:2	**Automotive networking**	**3 hours**	
Cross-systemfunctions, Requirements for bus systems,Classification of bus systems, Applications in the vehicle, Coupling of networks,Example.			
Module:3	**Instrumentation**	**3 hours**	
Information and communication areas,Driver information systems, Instrument clusters, Display types			
Module:4	**ECU recording equipment and Parking systems**	**3 hours**	
Legal requirements, Design variations, parking aid with ultrasonic sensors, Further development			
Module:5	**Automotive sound systems**	**5 hours**	
Radio tuners, Conventional tuners, Digital receivers, Reception quality, Reception improvement, Auxiliary equipment, Vehicle antennas.			
Module:6	**Positioning and Map Matching**	**5 hours**	
Dead Reckoning,Global Positioning System , Sensor fusion. Conventional map matching , Fuzzy logic Based Map matching, Map aided Sensor calibration.			
Module:7	**Route Planning and Route Guidance**	**5 hours**	
Shortest Path , Heuristic Search, Bidirectional Search , Hierarchical search **,**Guidance while En Route , Guidance while off Route , Guidance with dynamic information			
Module:8	**Contemporary Topics**	**3 hours**	
	Total Lecture Hours:	**45 hours**	

Text Book(s)

1.	Bosch, “Automotive Handbook”, 8 th Edition, SAE publication, 2011

Reference Books

1.	Intelligent Vehicle Technologies Theory and Appications– L Vlacic, M Parent, F Harashima - Butterworth Heinemann.
2.	Vehicle location and Navigation Sys tems – Yilin Zhao – Artech House Inc.
3.	Sussman, Joseph. Perspectives on Intelligent Transportation Systems (ITS). New York, 14. NY: Springer, 2010
4.	Mashrur A. Chowdhury, and Adel Sadek, Fundamentals of Intelligent Transportation

	Systems Planning, Artech House, Inc., 2003			
Mode of Evaluation: CAT / Assignment / Quiz / FAT / Project / Seminar				
Mode of evaluation:				
Recommended by Board of Studies	09/03/2016			
Approved by Academic Council	No. 40	Date	18/03/2016	

Course code	Course Title	L	T	P	J	C
ECE6078	PARALLEL PROGRAMMING USING MULTICORES AND GRAPHICAL PROGRAMMING UNITS	3	0	0	4	4
Pre-requisite	Nil	Syllabus version :1				

Course Objectives: The course is aimed at:

1. Imparting the knowledge about implementation of multi-threading on single core versus multi-core platforms
2. Providing the basic concept of threads error diffusion and parallel error diffusion.
3. Elaborating the details of Deadlock and Semaphores and implementation of dependent threading features.

Expected Course Outcome:

At the end of the course, the student will be able to

1. Understand the basic concepts of multi-core architecture
2. Demonstrate knowledge of the core architectural aspects of Parallel Computing (CAT1, FAT)
3. Develop efficient parallel algorithms and apply a suite of techniques that can be applied across a wide range of applications.(CAT, FAT)
4. Apply the concept of threading for large scale systems (CAT2, FAT)
5. Apply methods to support and manage virtualization.(CAT2,FAT)
6. Develop and implement the various Parallel Programming Concepts in Linux Platform.(FAT)
7. Analyze the gblockIdx and threadIdx(FAT)
8. Use Parallel programming techniques using multicores and graphical programming units

Module:1	Introduction to Multi-core Architecture	6 hours	

Defining threads – threads inside the OS – threads inside the hardware – Application programming models and threading – virtual environment – Run time virtualization – System virtualization

Module:2	Overview of Threading	6 hours	

Defining threads – threads inside the OS – threads inside the hardware – Application programming models and threading – virtual environment – Run time virtualization – System virtualization

Module:3	Fundamental concepts of parallel programming	7 hours	

Task decomposition – data decomposition – data flow decomposition – Error diffusion – parallel error diffusion

Module:4	Parallel programming constructs	6 hours	

Synchronization – Critical sections – Deadlock – Semaphores – Locks – Condition variables – Messages – Fence – Barrier – Implementation dependent threading features

Module:5	OpenMP : Portable solution for threading	6 hours	

Loop carried dependence – Data-race conditions – Managing shared and private Data – Loop Scheduling and Partitioning – Effective use of reductions – work-sharing sections – Using barrier and Nowait – Interleaving single thread and multi-thread execution – Data copy-in and copy-out – Protecting updates of shared variables – OpenMP Library functions – OpenMP environmental variables – multithreading debugging techniques

Module:6	CUDA Programming	6 hours	

GPUs as Parallel computers – architecture of a modern GPU – Data Parallelism – CUDA program structure – Matrix – Matrix multiplication example – Device memories and data transfer – Kernel functions and threading – predefined variables – Runtime API

Module:7	CUDA threads and Memories	6 hours	

CUDA thread organization – Using block and thread – synchronization and Transparent Scalability – Thread Assignment – Thread scheduling – CUDA device memory types – strategy

for reducing global memory traffic			
Module:8	**Contemporary Topics**	**2 hours**	
	Total Lecture Hours:		**45 hours**
Text Book(s)			
1.	Multi-Core Programming, Increasing Performance through Software Multi-threading, Shameem Akhter and Jason Roberts, Intel Press, BPB Publications, New Delhi, 2010		
Reference Books			
1.	Programming Massively Parallel Processors, A hands-on approach, David B. Kirk and Wen-mei W. Hwu, Elesevier, New Delhi, 2010		
Mode of Evaluation: CAT / Assignment / Quiz / FAT / Project / Seminar			
Mode of evaluation:			
Recommended by Board of Studies	09/03/2016		
Approved by Academic Council	No. 40	Date	18/03/2016

Typical Projects (Indicative) CO_08

1. Real time classification of vehicles and traffic assessment using multicore programming.
2. Connecting multiple cameras to a vehicle and providing real time driver assistance using multicore framework
3. Driver assistance system using GPU processing that can filter the bad weather environment and provide alerts
4. Real time number plate recognition at toll gates using GPU programming and automatically collecting toll fee
5. Identification of overspeeding vehicles using road side video cameras and detection of law violators using GPU programming / Multi-core systems

Mode of Evaluation:Review I, II and III

Course Code	Course title	L	T	P	J	C
ECE6069	DIGITAL SIGNAL PROCESSING AND ITS APPLICATIONS	3	0	2	0	4

Pre-requisite	Advanced Mathematics	Syllabus Version : 1

Course Objectives:

The course is aimed at:

1. Introducing the concepts of sampling, digital filter, adaptive digital system
2. Providing the concepts of information theory and source coding different applications
3. Teaching methods and algorithms which would enable communication to happen as close to the maximum information transfer rate as possible

Expected Course Outcome:

At the end of the course, the student will be able to

1. Gain insight into digital models and algorithms to process the signals, after due conversion of signals from analog to digital
2. Determine the techniques to perform analog to digital and digital to analog conversion process
3. Design adaptive filters based on the signal processing and communication concepts
4. Analyse the signal spectrum from the received signal and modulation scheme suitable for information transmission
5. Determine the statistical properties of the signal
6. Find different ways of minimizing the number of bits, needed to represent a given amount of information
7. Find methods to minimize the probability of communication errors, without affecting the rate of communication process

Module:1	Introduction	5 hours	

The history of digital signal processing : Measurements and analysis , Telecommunications, Audio and television, Household appliances and toys, Automotive, Digital signal processing basics: Continuous and discrete signals, Sampling and reconstruction , Quantization , Processing models for discrete-time series, Common filters may be added digital filters: Filter architectures, Filter synthesis , Digital control systems :Proportional-integral-derivate controllers , Advanced controllers

Module:2	Analog Digital interface	6 hours	

System considerations : Encoding and modulation, Number representation and companding systems, Digital-to-analog conversion: Multiplying digital-to-analog converters , Integrating digital-to-analog converters, Bitstream digital-to-analog converters , Sample-and-hold and reconstruction filters , Analog-to-digital conversion : Anti-aliasing filters and sample-and-hold , Flash analog-to-digital converters , Successive approximation analog-to-digital converters , Counting analog-to-digital converters , Integrating analog-to-digital converters , Dither , Sigma–delta analog-to-digital converters

Module:3	Adaptive digital systems	4 hours	

Introduction: System structure The processor and the performance function: The adaptive linear combiner, The performance function , Adaptation algorithms : The method of steepest descent , Newton's method, The least mean square algorithm , Applications: Adaptive interference channel, Equalizers, Adaptive beam forming

Module:4	Spectral analysis and modulation	7 hours	

Discrete Fourier transform and fast Fourier transform: Spectral analysis , Discrete Fourier transform and fast Fourier, transform approaches , "Z" transforms Using the auto-correlation function, Periodogram averaging, Parametric spectrum analysis, Modulation : Amplitude shift keying (ASK), Frequency shift keying (FSK), Phase shift keying (PSK), Complex modulation , The Hilbert transformer

Module:5	**Introduction to Kalman filters**	**4 hours**	
An intuitive approach : Recursive least square estimation , The pseudo-inverse , The Kalman filter : The signal model , The filter, Kalman filter properties , Applications.			
Module:6	**Data compression**	**7 hours**	
An information theory primer: Information and entropy ,Source coding : Huffman algorithm, Delta modulation, adaptive delta modulation and continuously variable slope delta modulation, DPCM adaptive DPCM techniques, Speech coding, adaptive predictive coding and sub-band coding, Vocoders and linear predictive coding , JPEG, MPEG, MP3, The Lempel–Ziv algorithm, Recognition techniques: Speech recognition, Image recognition			
Module:7	**Error-correcting codes**	**9 hours**	
Channel coding: The channel model , The channel capacity , Error-correcting codes : Hamming distance and error correction , Linear block codes , Cyclic codes, Convolution codes, Viterbi decoding , Interleaving , Concatenated codes and turbo codes			
Module:8	**Contemporary Topics**	**3 hours**	
	Total Lecture hours:	**45 hours**	
Text Book(s)			
1.	Digital signal processing and applications, Dag Stranneby and William Walker, Second Edition, Elsevier, New York,2009		
Reference Books			
1.	Advanced digital signal processing noise reduction, Saeed V.Vasaghi, Fourth edition, Wiley, New Delhi, 2009		
2.	Digital Signal Processing: Fundamentals and Applications, by Li Tan, First edition 2007		
Mode of Evaluation:Continuous Assessment Test, Quiz, Digital Assignment, Final Assessment Test.			

Course code	Course Title	L	T	P	J	C
ECE6079	Open source hardware and software system design	3	0	0	4	4
Pre-requisite	Nil	Syllabus version:1				

Course Objectives:

The course is aimed at:
1. Introducing to the students the foundation of open source programming.
2. Understand client-server architectural model for web applications.
3. Teaching the students the basis of Automation using Raspberry Pi.

Expected Course Outcome:

At the end of the course, the student will be able to
1. Understand the importance of Open Source programming
2. Identify and apply appropriate server side programming for web based applications
3. Understand various database operations
4. Comprehend the operation of different type of Socket programming
5. Understand the details of Raspberry Pi fundamentals and exploring GPIO Interface
6. Develop and implement the various Raspberry Pi project
7. Explore GPIO Interface
8. Design and analyse system using open source resources

Module:1	Introduction	5 hours	

Variable types – basic operators – decision making – loops – strings- Lists – Tuples – Dictionary – Date and Time – Functions – Modules – Files – Exceptions – Classes and Objects

Module:2	GUI and Web programming	6 hours	

Tkinter Programming – Tkinter Widgets - CGI – Web server support – Environmental variables – GET and POST methods – Passing information using POST method

Module:3	Data base access	6 hours	

Task decomposition – data decomposition – data flow decomposition – Error diffusion – parallel error diffusion

Module:4	Network Programming	7 hours	

Sockets – Server socket – Client Socket – General Socket methods – Sending an HTTP e-mail – Sending an attachment as an email

Module:5	Raspberry Pi fundamentals	6 hours	

Architecture – setting up the Raspberry Pi – Interacting with Raspberry command line – Setting up I2C, serial port – Connect Pi to network

Module:6	Raspberry Basic Projects	7 hours	

Controlling the brightness of LED – Buzzing sound – Switch high power DC source using transistor and relays – controlling high voltage AC device – Using PWM pulses for control – Pi to run different types of motors – servo motor – DC motor – Stepper motor - Displaying HD images – Playing music

Module:7	Advanced Raspberry projects	5 hours	

Exploring GPIO Interface – Controlling GPIO output – Detecting GPIO input – Work with switches – keypads – Interfacing various sensors – measuring light – detecting methane – measuring acceleration – measuring temperature – measuring distance – logging into a USB flash drive

Module:8	Contemporary Topics	2 hours	
	Total Lecture Hours:	45 hours	

Text Book(s)

1. Python programming for Raspberry Pi in 24 hours, Richard Blum and Christine Bresnahan, Sams Teach Yourself, Indiana, 2014

Reference Books

1.	Raspberry Pi Cookbook, Simon Monk, O'Reilly, California, 2014		
Mode of Evaluation: CAT / Assignment / Quiz / FAT / Project / Seminar			
Mode of evaluation:			
Recommended by Board of Studies	09/03/2016		
Approved by Academic Council	No. 40	Date	18/03/2016

Course code	Course Title	L	T	P	J	C
ECE6080	MACHINE VISION SYSTEM FOR AUTOMOTIVES	3	0	2	0	4
Pre-requisite	Nil	Syllabus version:1.1				

Course Objectives:

The course is aimed at:

1. Providing the basic concepts of Digital Image Processing & their algorithm implementation
2. Introducing the concepts of shape descriptors and their applications in automotive systems.
3. Elaborating on automation and automotive components testing.

Expected Course Outcome:

At the end of the course, the student will be able to

1. Understand the principle, advantages, limitation and possible application of image processing in Automotive
2. Identify and apply the appropriate image processing techniques to image segmentation, shape analysis and decision making
3. Understand the various operational behavior of Components in Automation
4. Comprehend the operation of different type of Cylinder blocks, detecting missing balls and behaviours
5. Comprehend the concepts of shape description
6. Develop and implement vision / manipulator interface
7. Detail out automotive component testing techniques
8. Implement machine vision system for automotives

Module:1	Introduction to Computer Vision	8 hours	

Artificial intelligence – image processing – industrial machine vision – image understanding – System Architecture – Illumination – Sensors - Elementary optics - Camera sensor – Camera interfaces and video standards- Sampling and quantization – inter pixel distances – adjacency conventions – Image acquisition hardware – speed considerations.

Module:2	Fundamentals of digital image processing	7 hours	

Point operation – Contrast stretching – thresholding – noise suppression – background subtraction – Neibourhood operations – Convolution – Thinning – Erosion – dilation – Geometrical operation – Warping – grey level interpolation – registration – morphology – structuring elements – opening and closing – grey scale morphology

Module:3	Segmentation Problem	7 hours	

Region and boundary based approach – Global, local and dynamic thresholding – Gradient and difference based edge detectors – template matching – region growing - quadtree – boundary detection – graph theoretic techniques – contour following – dynamic programming

Module:4	Image Analysis	5 hours	

Inspection, location and identification – local template matching – simple feature extraction – classification using Bayes' rule – Hough transform – Generalized Hough transform – Histogram analysis

Module:5	Shape description	5 hours	

Taxonomy of shape descriptors – external descriptors – features of the boundary – internal descriptors – features of the region – boundary chain code

Module:6	Automation considerations	5 hours	

Design of conveyor belts – Choice of various light sources – Design of separators – Grippers – Control of motors – vision / manipulator interface

Module:7	Automotive component testing applications	5 hours	

Differentiating types of cylinder blocks – detecting holes in a camshaft – detecting missing balls in bearings – checking faulty components in a car stereo – differentiating gear types – detecting a lack of sealing compound – detecting improper assembly of a fuse box – Checking an LCD panel

Module:8	**Contemporary Topics**	**2 hours**	
	Total Lecture Hours:	**45 hours**	

Text Book(s)	
1.	Computer and machine vision : Theory, Algorithm and Practicalities, E.R. Davies, Fourth Edition (Kindle Edition), 2012
Reference Books Intelligent Vision systems for Industry, Bruce G. Batchelor and Paul F. Whelan, Springer, London, 2012.	
1.	Raspberry Pi Cookbook, Simon Monk, O'Reilly, California, 2014
Mode of Evaluation: CAT / Assignment / Quiz / FAT / Project / Seminar	
Mode of evaluation:	

Recommended by Board of Studies	09/03/2016		
Approved by Academic Council	No. 40	Date	18/03/2016

Course Code	Course Title	L	T	P	J	C
ECE6081	Automotive Fault Diagnostics	3	2	0	0	4
Pre-requisite		Syllabus Version :1.1				

Course objectives (CoB):

The course is aimed at:

[1] Familiarising students with the basic concepts of automotive fault diagnostics

[2] Teaching students about the fault sensors output waveforms

[3] Elaborating the operation of Automotive Oscilloscopes, OBD II and Fault code readers

Course Outcomes (CO):

At the end of the course the student will be able to

[1] Understand the basic concepts of fault diagnosis in automotive field.

[2] Comprehend MIL for various automotive faults.

[3] Have a brief idea of various sensors and assess ECU failures with the help of oscilloscope

[4] Comprehend the operation of fault-finding systems (OBD)

[5] Identify and rectify the faults of automotive sensors and fuel injection systems.

[6] Analyze the various failure modes in Electronic control unit of chassis and body units

[7] Understand the concepts of Electrical systems fault diagnostics

Module:1	Introduction	6 hours	

Diagnostic Techniques - diagnostic process - diagnostics on paper - mechanical diagnostic techniques - electrical diagnostic techniques - fault codes - on and off-board diagnostics - Data sources

Module:2	Tools and Equipment	6 hours	

Basic equipment - Oscilloscopes - Scanners - Fault code readers - Engine Analysers

Module:3	Oscilloscope diagnostics	4 hours	

Sensors - Actuators - Ignition System - Other components

Module:4	On-board diagnostics	6 hours	

A first perspective - Petrol / Gasoline on-board diagnostics monitors - a second perspective

Module:5	Engine Systems	7 hours	

Diagnostics of Engine operation - Fuel system - Ignition - Emission - Fuel Injection - Diesel injection - Engine management - Fault finding information - air supply and exhaust systems - cooling - lubrication - batteries - starting system - charging system

Module:6	Chassis System	7 hours	

Diagnostics of brakes - anti-lock brakes diagnostics - traction control diagnostics - steering and types diagnostics - suspension diagnostics

Module:7	Electrical System	7 hours	

Electronic components and circuits diagnosis - multiplexing - lighting - diagnosing auxiliary system faults - in car entertainment security and communication - body electrical system faults - diagnosing instruments system faults - HVAC diagnostics - Cruise control diagnostics - Air bags and belt tensions diagnostics

Module:8	Contemporary Topics	2 hours	

Total Lecture: 45 hours

Text Book(s)

1. Automotive Technician Training, Tom Denton, Taylor and Francis, New York, 2015

Reference Books:

1. Automobile Electrical and Electronic Systems : Automotive Technology - Vehicle Maintenance and Repair, Tom Denton, Fourth Edition, Elsevier, New York, 2013
2. Advanced Automotive Fault Diagnosis: Automotive Technology - Vehicle Maintenance

and Repair, Tom Denton, Third Edition, Elsevier, New York, 2012.
Recommended by Board of Studies : 09/03/2016
Approved by Academic Council : No. 40 Date : 18/03/2016

Course code	Course Title	L	T	P	J	C
ECE6082	EMISSION CONTROL AND DIAGNOSTICS	3	0	0	4	4
Pre-requisite		Syllabus version:2				

Course Objectives:

The course is aimed at:

1. Preparing the students to analyze automotive pollution control techniques
2. Introducing the concepts of formation and control techniques of pollutants like sulphur, CO, NOx and particulate matter
3. Preparing the students to analyze smoke for both SI and CI engines

Expected Course Outcome:

At the end of the course, the student will be able to

1. Get details of the **emission from automobiles**
2. Analyze **emission from Spark Ignition Engine**
3. Analyze **emission from Compression Ignition Engine**
4. Explain about the **exhaust emissions**
5. Comprehend the **Emission Control Legislation - I**
6. Comprehend the **Eission Control Legislation - II**
7. Understand about the **Exhaust gas measuring techniques**
8. Design and implement emission control and diagnostics

Module:1	Emission From Automobiles	6 hours	

8 Sources of Air Pollution. Various emissions from Automobiles — Formation — Effects of pollutants on environment and human beings. Emission control techniques – Modification of fuel, after treatment 11 devices. Emission standards. Automotive waste management, old vehicle disposal, recycling, tyre recycling

Module:2	Emission From Spark Ignition Engine And Its Control	7hours	

Emission formation in SI Engines- Carbon monoxide & Carbon di oxide - Unburned hydrocarbon, NOx, Smoke —Effects of design and operating variables on emission formation – controlling of pollutants - Catalytic converters, Charcoal Canister, CCS, Positive Crank case ventilation system, Secondary air injection, thermal reactor, Laser Assisted Combustion

Module:3	Emission From Compression Ignition Engine And Its Control	6 hours	

-Formation of White, Blue, and Black Smokes, NOx, soot, sulphur particulate and Intermediate Compounds – Physical and Chemical delay — Significance Effect of Operating variables on Emission formation — Fumigation, Split injection, Catalytic Coating, EGR, HCCI, Particulate Traps, SCR, Fuel additives — Cetane number Effect.

Module:4	Exhaust emissions	6 hours	

Combustion products, Properties of exhaust gas components

Module:5	Emission control legislation - I	6 hours	

Overview, CARB legislation, EPA legislation, EU legislation, Japanese legislation

Module:6	Emission control legislation - II	6 hours	

US test cycles for passenger cars and light duty trucks, European test cycles for passenger cars and light duty trucks, Japanese test cycles for passenger cars and light duty trucks, test cycles for heavy commercial vehicles

Module:7	Exhaust gas measuring techniques – I	6 hours	

Exhaust gas test on chassis dynamometers, Exhaust gas measuring devices, Diesel smoke emission test, Evoporative emission test

Module:8	Contemporary Topics	2 hours	

	Total Lecture Hours:	**45 hours**	

Text Book(s)

1	G.P.Springer ad D.J.Patterson, Engine Emissions, Pollutant formation, Plenum Press, New York, 1986.
2	D.J.Patterson and N.A.Henin, 'Emission from Combustion Engine and their control', Anna Arbor Science Publication,1985.
3.	Autmotive Handbook – 9th Edition – 2014, BOSCH Charles K. Alexander, Matthew N. O. Sadiku, "Fundamentals of Electric Circuits," 2013, 5th Edition, Tata McGraw Hill Education Private Limited, New Delhi, India.

Reference Books

1.	V.Ganesan, 'Internal combustion Engines', Tata McGraw Hill Book Co, Eighth Reprint, 2005.
2.	Crouse and Anglin, 'Automotive Emission Control', McGraw Hill company., Newyork 1993.

1. ***Typical Project*** ***Effects of Fuel Modification and Emission Control Devices –****Tocharacterize the physical and chemical composition and the mutagenicity of emissions from a heavy-duty diesel engine equipped with a ceramic particle trap. This engine need to operate with low-sulfur fuel at a constant speed under two different load conditions and compare the results to those obtained in an differentsulfur level*
1. ***Sulphur analyzer –****Develop a system tocollect and analyze the data on the effects of sulfur on various exhaust emission systems*
2. ***Endurance tests –****To conduct various tests on the emission control technologies to measure and compare the effects of as many as 250 hours of aging on engines using diesel fuel containing varying levels of sulfur.*
3. **IOT based vehicle emission monitoring system –** To monitor the vehicle emission using the exhaust sensors and upload the emission data to cloud and diagnostic center will receive the data if emission is above the norms

2.

Mode of Evaluation: CAT / Assignment / Quiz / FAT / Project / Seminar

Mode of evaluation:

Recommended by Board of Studies	09/03/2016		
Approved by Academic Council	No. 40	Date	18/03/2016

Course code	Course Title	L	T	P	J	C
ECE6083	Vehicle safety systems	2	0	0	0	2
Pre-requisite	Basics of vehicle systems and its working	Syllabus version :2				

Course Objectives:

The course is aimed at:

1.Have a better understanding of good design practices which will enable product improvement that manifests significantly less risk to humans, machines and the environment

2. Gain the ability to design and demonstrate the vehicle safety critical systems to reduce the system errors and faults

3.Introducing the students to do design safety systems using MATLAB simulation

Expected Course Outcome:

At the end of the course, the student will be able to

1. Understand the basic concept of vehicle safety
2. Understand the operation of braking system design and its operation
3. Understand the braking system for passenger vehicles
4. Know the working principle of ABS and traction control systems
5. Understand the concepts of braking systems for commercial vehicles
6. Understand the vehicle stabilization for commercial vehicles
7. Understand about the airbag system for passenger safety

Module:1	**Basic concepts of vehicle safety**	**4 hours**	
Underlying principles-cause and effect –safety factors-design for uncertainty-identifying component safety factor-Digital models and man testing -compliance			
Module:2	**Braking systems**	**4 hours**	
Definitions-principles-design and components of braking system-brake-circuit configurations-braking system design			
Module:3	**Braking system for passenger cars and light utility vehicles**	**4 hours**	
Brake booster-brake master cylinder-braking force limiters-disk brakes-drum brakes			
Module:4	**Vehicle stabilization systems for passenger cars**	**4 hours**	
Anti Lock braking system(ABS)-traction control system(TCS)-Electronic stability program(ESP)-Electrohydraulic brakes			
Module:5	**Braking system for commercial vehicles**	**4 hours**	
System and configuration-air supply and processing-Transmission device-wheel brakes-parking brake system-retarder braking system			
Module:6	**Vehicle stabilization system for commercial vehicles**	**4 hours**	
Electronic stability program(ESP) for commercial vehicles-Electronically controlled braking(ELB)-function-system design-components-electro pneumatic braking			
Module:7	**Occupant injury prevention and distracted driver**	**4 hours**	
Introduction-proper use of head restraints-Airbags-distractors and risk reduction-information processing			
Module:8	**Contemporary Topics**	**2 hours**	
	Total Lecture Hours:	**30 hours**	

Text Book(s)

1. **George A. Peters, Barbara J. Peters,"Automotive vehicle safety",Taylor and Francis,3rd**

	edition,2003			
Reference Books				
1.	**1) Robert Bosch,"Automotive handbook",9th edition,2014**			
2.	**Bimal K Bose, "Power Electronics and Motor Drive: Advances and Trends", Elsevier,Inc., 2006.**			
Mode of Evaluation: CAT / Assignment / Quiz / FAT /				
Mode of evaluation:				
Recommended by Board of Studies		09/03/2016		
Approved by Academic Council		No. 40	Date	18/03/2016

Course code	Course Title	L	T	P	J	C
ECE6084	VEHICLE BODIES	2	0	0	0	2
Pre-requisite		Syllabus version :1				

Course Objectives: The course is aimed at:

1. Giving insight into the vehicle construction
2. Design and construction of vehicular bodies for passenger car and commercial vehicles
3. Providing an overview of lighting in vehicles

Expected Course Outcome:

At the end of the course the student will be able to

1. Understand **Road-vehicle systematics**
2. Understand **Vehicle bodies for passenger cars**
3. Comprehend and analyze **commercial vehicles** bodies
4. Classify **External lighting technologies**
5. Classify Internal lighting technologies
6. Brief about **Automotive windshield and window glass**
7. Design the **Windshield and rear-window cleaning systems**

Module:1	**Road-vehicle systematics**	**2 hours**	
Classification according to ECE, Classification according to USA			
Module:2	**Vehicle bodies- passenger cars**	**3 hours**	
Main dimensions, Body design, Aerodynamics, Aeroacoustics, body structure, Body materials, Body surface,Body finishing components,Safety			
Module:3	**Vehicle bodies-commercial vehicles**	**3 hours**	
Commercial vehicles, Light utility vans, Medium and heavy-duty trucks and tractor vehicles, Buses, Passive safety in commercial vehicles			
Module:4	**Lighting technology-I**	**5 hours**	
Functions,Regulations and equipment,Definitions and terms, Main headlamps,European system, Main headlamps, European regulations, Head lamps,USA, Headlamps,US regulations,Headlamp levelling, Europe, Headlamp cleaning systems, Fog lamps, Auxiliary driving lamps			
Module:5	**Lighting technology-II**	**5 hours**	
Lights and lamps, Hazard-warning and turn-signal flashers, Side-marker, clearance, and tail lamps, Parking lamps, License-plate lamps, Stop lamps, Rear fog warning lamps, Reversing lamps,Daytime running lamps, Reversing lamps, Daytime running lamps, other lighting devices, Motor-vehicle bulbs.			
Module:6	**Automotive windshield and window glass**	**4 hours**	
The material properties of glass, Automotive glazing, Functional design glazing			
Module:7	**Windshield and rear-window cleaning systems**	**4 hours**	
Windshield wiper systems, Rear-window wiper systems,Headlamp cleaning systems, Wiper motors, Washing systems			
Module:8	**Contemporary Topics**	**2 hours**	
	Total Lecture Hours:	**28 hours**	

Text Book(s)

1. Powloski.. J., "Vehicle Body Engineering", Business books limited, London,1970

Reference Books

1. Bosch, "Automotive Handbook", 8th Edition, SAE publication, 2011

Mode of Evaluation: CAT / Assignment / Quiz / FAT / Project / Seminar

Mode of evaluation:

Recommended by Board of Studies	09/03/2016
Approved by Academic Council	No.40 Date : 18/03/2016

Course code	Course Title	L	T	P	J	C
ECE6085	ENGINE PERIPHERALS	2	0	0	4	3
Pre-requisite		Syllabus version : 1				

Course Objectives: The course is aimed at:

1. Preparing the students to understand engine peripherals connections and operation theory
2. Introducing the basics of engine cooling and lubrication
3. Preparing to study and analyze emission reduction techniques

Expected Course Outcome:

At the end of the course, the student will be able to

1. Get an **Overview of Engine**
2. Comprehend the techniques for **Engine Cooling**
3. Understand about **Engine lubrication**
4. Demonstrate knowledge on **Air filtration**
5. Compherend the concepts of **engine peripherals**
6. Understand **Turbochargers and superchargers for IC engines**
7. Understand **Emission reduction systems and exhaust gas systems**
8. Design and implement **the engine peripherals**

Module:1	**Overview of Engine**	**3 hours**	
Engine operation, Engine components, Engine types			
Module:2	**Engine Cooling**	**4 hours**	
Water cooling, Air cooling, Intercooling, Oil and fuel cooling, cooling module technology, Intelligent thermal management, Exhaust gas cooling			
Module:3	**Engine lubrication**	**3 hours**	
Overview, Force feed lubrication system, lubrication components			
Module:4	**Air filtration**	**2 hours**	
Air pollution, Air filters			
Module:5	**Other engine peripherals**	**5 hours**	
HVAC, alternator, vacuum pump, steering pump, air intake system, exhaust system			
Module:6	**Turbochargers and superchargers for IC engines**	**5 hours**	
Superchargers (mechanical driven), Pressure wave, Exhaust gas and multistage superchargers, Acceleration aids			
Module:7	**Emission reduction systems and exhaust gas systems**	**6 hours**	
Exhaust gas recirculation systems, secondary air injection, Evaporative emission control system, crankcase ventilation, Manifold, Catalytic converters, particulate converters, muffers connecting elements			
Module:8	**Contemporary Topics**	**2 hours**	
	Total Lecture Hours:	**30 hours**	

Text Book(s)

1. Automotive Handbook – BOSCH – 9th Edition -2014

Reference Books

1. T. Kenneth Garrett, Kenneth Newton and William Steeds, “The Motor Vehicle” 13th Edition, Butterworth-Heinemann Limited, London, 2005
2. Heinz Heisler, “Advanced Vehicle Technology”, second edition, Butterworth – Heinemann, New York, 2002

Mode of Evaluation: CAT / Assignment / Quiz / FAT / Project / Seminar

Mode of evaluation:			
Recommended by Board of Studies	09/03/2016		
Approved by Academic Council	No. 40	Date	18/03/2016

Course Code	Course Title		L	T	P	J	C
ECE6086	Vehicle Security and Comfort Systems		3	0	0	4	4
Pre-requisite	NIL	Syllabus : 1.1					

Course objectives (CoB):

The course is aimed at:

1.Teaching the students about locking systems and theft-deterrent systems

2.Providing the technical knowhow of acoustic signaling devices and occupant-protection systems

3. Discussing about the Power-window drives, comfort and safety functions in the passenger compartment and driver assistance systems

Course Outcomes (CO):

At the end of the course, the student will be able to

[1] Understand about locking systems

[2] Understand the concept of theft-deterrent systems

[3] Understand about the acoustic signaling devices

[4] Demonstrate the knowledge about occupant-protection systems

[5] Brief about power-window drives

[6] Identify the technique for comfort and safety functions in the passenger compartment

[7] Understand about driver-assistance systems

[8] Design and implement vehicle security and comfort systems

Module:1	**Locking systems**	**4 hours**	
Function, structure, operating principle, Open by wire, Electrical locking system, Central locking system, Electronic vehicle immobilizer, functional description Comfort Entry/Go system			
Module:2	**Theft-deterrent systems**	**4 hours**	
Regulations,Permissibleslarm signals. System design, alarm detectors, Alarm system control unit, Alarm siren, Tilt sensor, Interior monitoring			
Module:3	**Acoustic signaling devices**	**4 hours**	
Acoustic signaling devices applications, Horn, Fanfare horns			
Module:4	**Occupant-protection systems**	**4 hours**	
Seat belts and seat-belt pretensioners, Front airbag, Side airbag, Components, Rollover protection systems			
Module:5	**Power-window drives**	**3 hours**	
Power-window motors, Power-window control, Power sunroof drives			
Module:6	**Comfort and safety functions in the passenger compartment**	**5 hours**	
Electrical seat adjustment, Electrical steering-column adjustment, Multi purpose actuator			
Module:7	**Driver-assistance systems**	**4 hours**	
Critical driving situations, Causes of accidents and possible action,Applications,Convenience and safety functions,Senors for allround electronic visibility, Sensor-data fusion.			
Module:8	**Contemporary Topics**	**2 hours**	
			Total Lecture: 30 hours

Mode: Flipped Class Room, [Lecture to be videotaped], lectures by industry / subject experts

Text Book

1. Bosch, “Automotive Handbook”, 8 th Edition, SAE publication, 2011

Reference Book

1. Bosch, "Safety, Comfort & Convenience Systems" 1st 1st Edition - 2006

Indicative Project Titles

1.Electronic vehicle immobilizer

2.Theft-deterrent system
3.Acoustic signaling devices
4.Occupant-protection systems
5.Driver assistance systems
6.Adaptive cruise control
7.Night vision
Recommended by Board of Studies : 09/03/2016
Approved by Academic Council : No. 40 Date : 18/03/2016