`

HINDUSTAN
INSTITUTE OF TECHNOLOGY & SCIENCE
(DEEMED TO BE UNIVERSITY)

DEPARTMENT OF AUTOMOBILE ENGINEERING

CURRICULUM AND SYLLABUS

Under CBCS

(Applicable for Students admitted from Academic Year 2015-16)

B. Tech.

AUTOMOBILE ENGINEERING

SCHOOL OF MECHANICAL SCIENCES

HINDUSTAN INSTITUTE OF TECHNOLOGY & SCIENCE

Motto, Vision, Mission and Value Statement

Motto

To Make Every Man a Success and No Man a Failure.

Vision

To be an International Institute of Excellence, providing a conducive environment for education with a strong emphasis on innovation, quality, research and strategic partnership blended with values and commitment to society.

Mission

- To create an ecosystem for learning and world class research.
- To nurture a sense of creativity and innovation.
- To instill highest ethical standards and values with a sense of professionalism.
- To take up activities for the development of Society.
- To develop national and international collaboration and strategic partnership with industry and institutes of excellence.
- To enable graduates to become future leaders and innovators.

Value Statement

Integrity, Innovation, Internationalization

DEPARTMENT OF AUTOMOBILE ENGINEERING

VISION AND MISSION

VISION

To enable the graduates to be successful in their career as an Automobile Engineer.

MISSION

M1: To inculcate knowledge in Automobile Engineering

M2: To impart skills and training on the advancements in Automobile Engineering such as Automotive Electronics, Autonomous Vehicles, etc.

M3: To instill the highest ethical standards to be a Professional Automobile Engineer for social development.

B. TECH. AUTOMOBILE ENGINEERING

PROGRAMME EDUCATIONAL OBJECTIVES (PEO)

PEO 1 : Provide in-depth knowledge in Automobile Engineering and awareness of latest development in allied fields of engineering to the students and make them industry ready engineers (T – shaped engineers).

PEO 2 : Provide a range of specialized modules integrated within the structured learning environment for encouraging the students for higher studies and do research in automobile and related fields.

PEO 3 : Develop a challenging environment that supports and encourages the students to become an entrepreneur.

PEO 4 : Develop a culture that promotes individual and team work for carrying out innovative projects, assignments and research work in engineering sciences.

PEO 5 : A competitive degree structure is provided, that responds to time, need and technology.

PROGRAMME OUTCOMES (PO's)

Engineering Graduates will be able to:

PO1 : **Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2 : **Problem Analysis**: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3 : **Design Development of Solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4 : **Conduct Investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5 : **Modern Tool Usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

PO6 : **The Engineer & Society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7 : **Environment & Sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8 : **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9 : **Individual & Team Work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10 : **Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11 : **Project Management & Finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12 : **Life-Long Learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAM SPECIFIC OUTCOMES: (PSO's)

PSO1 : Design, Analysis, Fabrication and Testing of vehicles, which enable the students to compete globally.

PSO2 : Carry out research in fuel economy, emission reductions, alternate fuels and solar vehicle for the benefit of the society and environment

Semester I

Sl. No.	Course Code	Course Classification	Course Title	L	T	P	C	TCH
Theory								
1	ELA101	CF	Technical English	3	0	0	3	3
2	MAA101	CF(BS)	Engineering Mathematics– I	3	1	0	4	4
3	PHA101/ CYA101	CF(BS)	Engineering Physics / Engineering Chemistry	3	0	0	3	3
4	MEA101	CF(ES)	Computer Aided Engineering Drawing	1	1	3	3	5
5	CSA101	CF(ES)	Computer Programming	3	0	0	3	3
Practical								
6	PHA131/ CYA131	CF(BS)	Physics Lab/Chemistry Lab*	0	0	3	1	3
7	CSA131	CF(ES)	Computer Programming Lab	0	0	3	1	3
8	ELA131	CF	Communication Skills Lab-I	0	0	3	1	3
9	GEA131	CF(ES)	Engineering Practices Lab-I	0	0	3	1	3
			Total				**20**	**30**

Semester II

Sl. No.	Course Code	Course Classification	Course Title	L	T	P	C	TCH
Theory								
1	MAA102	CF (BS)	Engineering Mathematics – II	2	1	1	4	4
2	PHA101/ CYA101	CF(BS)	Engineering Physics / Engineering Chemistry	3	0	0	3	3
3	MEA102	CF(ES)	Engineering Mechanics	3	1	0	4	4
4	EEB122	CC (PC)	Basic Electrical & Electronics Engineering	3	1	0	4	4
5	ATB101	CC(PC)	Production Technology	3	0	0	3	3
6	ELA102	CF	Personality Development & Soft Skills	3	0	0	3	3

Practical								
7	PHA131/ CYA131	CF(BS)	Physics Lab/Chemistry Lab*	0	0	3	1	3
8	GEA132	CF(ES)	Engineering Practices Lab-II#	0	0	3	1	3
9	EEB145	CC (PC)	Basic Electrical& Electronics Laboratory	0	0	3	1	3
			Total				**24**	**30**

Semester III

Sl. No.	Course Code	Course Classification	Course Title	L	T	P	C	TCH
Theory								
1	MAA201	CF (BS)	Engineering Mathematics–III	3	1	0	4	4
2	ATB201	CC (PC)	Applied Thermodynamics	3	1	0	4	4
3	ATB202	CC(PC)	Theory of Machines	3	1	0	4	4
4	ATB203	CC(PC)	Automotive Petrol Engines	3	0	0	3	3
5	ATB204	CC(PC)	Automotive Diesel Engines	3	0	0	3	3
6		EE	Engineering Elective-I	3	0	0	3	3
Practical								
7	ATB231	CC(PC)	Automotive Engines Components Laboratory	0	0	3	1	3
8	ATB232	CC(PC)	Engine Testing Laboratory	0	0	3	1	3
9	ATB233	CC(PC)	Manufacturing Technology Lab	0	0	3	1	3
10	SSA231	CF	Aptitude- I	1	0	1	1	2
Total							**25**	**32**

Semester IV

Sl. No.	Course Code	Course Classification	Course Title	L	T	P	C	TCH
Theory								
1	MAA211	CF (BS)	Numerical Methods	3	1	0	4	4
2	ATB205	CC(PC)	Solid Mechanics	3	1	0	4	4
3	ATB206	CC(PC)	Fluid Mechanics and Machinery	3	1	0	4	4
4	ATB207	CC(PC)	Automotive Chassis	3	0	0	3	3
5		EE	Engineering Elective-II	3	0	0	3	3
6		OE	Open Elective-I	3	0	0	3	3
Practical								
7	ATB234	CC(PC)	Automotive Chassis Components Laboratory	0	0	3	1	3
8	ATB235	CC(PC)	Solid Mechanics &	0	0	3	1	3

			Metallurgy Laboratory					
9	ATB236	CC(PC)	Fluid Mechanics and Machinery Laboratory	0	0	3	1	3
10	ATB237	CC(PC)	Design Project-I*	0	0	8	3	-
11	SSA232	CF	Aptitude- II	1	0	1	1	2
Total							**28**	**32**

Note: * The Design Project by students which does not require contact hours.

Semester V

Sl. No.	Course Code	Course Classification	Course Title	L	T	P	C	TCH
Theory								
1	ATB301	CC (PC)	Automotive Transmission	3	0	0	3	3
2	ATB302	CC (PC)	Automotive Electrical and Electronics	3	0	0	3	3
3	ATB303	CC (PC)	Automotive Engine Components Design	3	1	0	4	4
4		CC (PE)	Professional Elective-I	3	0	0	3	3
5		EE	Engineering Elective-III	3	0	0	3	3
6		OE	Open Elective-II	3	0	0	3	3
Practical								
7	MSB331	CC (PC)	Automotive Design and Styling Laboratory	0	0	3	1	3
8	ATB331	CC (PC)	Automotive Electrical and Electronics Laboratory	0	0	3	1	3
9	ATB332	CC (PC)	Automotive Fuels & Lubricants Laboratory	0	0	3	1	3
10	ATB333	CC(PC)	Design Project-II*	0	0	8	2	-
11	ATB337	CC (PC)	Two and Three-Wheeler Laboratory	0	0	3	1	3
12	ELA331	CF	Communication Skills & Personality Development	0	0	2	1	2
Total							**26**	**33**

Note: * The Design Project by students which does not require contact hours.

Semester VI

Sl. No.	Course Code	Course Classification	Course Title	L	T	P	C	TCH
Theory								
1	ATB304	CC (PC)	Automotive Chassis Design	3	1	0	4	4
2	ATB305	CC (PC)	Vehicle Dynamics	3	1	0	4	4
3	ATB306	CC (PC)	Control Systems	3	1	0	4	4
4		CC (PE)	Professional Elective-II	3	0	0	3	3
5		EE	Engineering Elective-IV	3	0	0	3	3
6		OE	Open Elective-III	3	0	0	3	3
Practical								

7	ATB334	CC (PC)	Computer Aided Engine and Chassis Design Laboratory	0	0	3	1	3
8	ATB335	CC (PC)	Vehicle Dynamics Laboratory	0	0	3	1	3
9	ATB336	CC (PC)	Control Systems Laboratory	0	0	3	1	3
10	SSA331	CF	Placement Preparatory Program -I	1	0	1	1	2
Total							**25**	**32**

Semester VII

Sl. No.	**Course Code**	**Course Classification**	**Course Title**	**L**	**T**	**P**	**C**	**TCH**
Theory								
1	ATB401	CC (PC)	Vehicle Diagnostics	3	0	0	3	3
2	ATB402	CC (PC)	Finite Element Methods in Automobiles	3	1	0	4	4
3	CYA102	CF(BS)	Environmental Science and Engineering	3	0	0	3	3
4		CC (PE)	Professional Elective-III	3	0	0	3	3
5		EE	Engineering Elective-V	3	0	0	3	3
6		OE	Open Elective-IV	3	0	0	3	3
Practical								
7	ATB431	CC (PC)	Vehicle Diagnostics Laboratory	0	0	3	1	3
8	ATB432	CC (PC)	Engine Tuning Laboratory	0	0	3	1	3
9	ATB433	CC (PC)	Vehicle Analysis Laboratory	0	0	3	1	3
10	ATB434	CC (PC)	Comprehension & Viva-Voce	-	-	-	1	-
11	SSA431	CF	Placement Preparatory Program -II	-	-	-	-	-
Total							**23**	**28**

Semester VIII

Sl. No.	**Course Code**	**Course Classification**	**Course Title**	**L**	**T**	**P**	**C**	**TCH**
Theory								
1		CC (PE)	Professional Elective-IV	3	0	0	3	3
2		CC (PE)	Professional Elective-V	3	0	0	3	3
3		CC (PE)	Professional Elective-VI	3	0	0	3	3
Practical								
4	ATB441	CC (PC)	Project & Viva-voce	0	0	24	6	24
Total							**15**	**33**

Professional Elective Courses- PE

Semester V

Sl. No	Course Code	Course Title	L	T	P	C	TCH
1	ATC351	Fuels & Lubricants	3	0	0	3	**3**
2	ATC352	Heat and Mass Transfer	3	0	0	3	**3**
3	ATC353	Automotive Sensors and Applications *	3	0	0	3	**3**
4	ATC354	Automotive Product Design and Development	3	0	0	3	**3**
5	ATC355	Off Road Vehicles	3	0	0	3	**3**

Semester VI

Sl. No	Course Code	Course Title	L	T	P	C	TCH
1	ATC356	Automotive Pollution and Control	3	0	0	3	**3**
2	ATC357	Automotive Materials and Metallurgy	3	0	0	3	**3**
3	ATC358	Alternate Fuels and Energy Systems	3	0	0	3	**3**
4	ATC359	Electronic Engine Management System *	3	0	0	3	**3**
5	ATC360	Electronics in Motorsport Engineering *	3	0	0	3	**3**
6	ATC361	Vehicle Body Engineering	3	0	0	3	**3**

Semester VII

Sl. No	Course Code	Course Title	L	T	P	C	TCH
1	ATC451	Automotive Aerodynamics	3	0	0	3	**3**
2	ATC452	Engine Exhaust System Development	3	0	0	3	**3**
3	ATC453	Electromagnetic Interference and Compatibility *	3	0	0	3	**3**
4	AT C454	Computational Fluid Dynamics	3	0	0	3	**3**

Semester VIII

Sl. No	Course Code	Course Title	L	T	P	C	TCH
1	ATC455	Manufacturing Process of Automotive Components	3	0	0	3	**3**
2	ATC456	Automotive Accident Investigation and Re-Construction Techniques	3	0	0	3	**3**
3	ATC457	Automotive Instrumentation and Embedded system *	3	0	0	3	**3**
4	ATC458	ECU Model Based System Design and Simulation for Automotives	3	0	0	3	**3**
5	ATC459	Two and Three Wheeler Technology	3	0	0	3	**3**
6	ATC460	Modern Vehicle Technology *	3	0	0	3	**3**
7	ATC461	Advanced Theory of IC Engines	3	0	0	3	**3**
8	ATC462	Hybrid and Electric Vehicles *	3	0	0	3	**3**
9	ATC463	Virtual Instrumentation in Automotives*	3	0	0	3	**3**

*****Students opting for *B.Tech Automobile Engineering in specialization with Autotronics* should earn a minimum of 15 credits in the prescribed courses.

Semester wise Credit

Course Category		I	II	III	IV	V	VI	VII	VIII	Any Sem	Total	Grand Total
CF	English	4	3	1	1	1	1	-	-		11	51
	BS	8	8	4	4	-	-	3	-		27	
	ES	8	5	-	-	-	-	-	-		13	
CC	PC (Theory)	-	7	14	11	10	12	7	-		61	108
	PC (Practical)	-	1	3	6	6	3	4	6#		29	
	PE	-	-	-	-	3	3	3	9		18	
EE		-	-	3	3	3	3	3	-		15	15
OE		-	-	-	3	3	3	3	-		12	12
Non CGPA Courses		-	-	-	-	-	-	-	-	4	4	4
Total		20	24	25	28	26	25	23	15	4	190	190

Project work

ELA101	TECHNICAL ENGLISH	L	T	P	C	TCH
		3	0	0	3	3

GOAL

The goal of the programme is to provide a theoretical input towards nurturing accomplished learners who can function effectively in the English language skills; to cultivate in them the ability to indulge in rational thinking, independent decision-making and lifelong learning; to help them become responsible members or leaders of the society in and around their workplace or living space; to communicate successfully at the individual or group level on engineering activities with the engineering community in particular, and on multi-disciplinary activities in general, with the world at large.

OBJECTIVES

The course should enable the students to:

1. Widen the capacity of the learners to listen to English language at the basic level and understand its meaning.
2. Enable learners to communicate in an intelligible English accent and pronunciation.
3. Assist the learners in reading and grasping a passage in English.
4. Learn the art of writing simple English with correct spelling, grammar and punctuation.
5. Cultivate the ability of the learners to think and indulge in divergent and lateral thoughts.

EXPECTED OUTCOMES

The students should be able to:

1. Have the self-confidence to improve upon their informative listening skills by an enhanced acquisition of the English language.
2. Speak English at the formal and informal levels and use it for daily conversation, presentation, group discussion and debate.
3. Read, comprehend and answer questions based on literary, scientific and technological texts.
4. Write instructions, recommendations, checklists, process-description, letter-writing and report writing.
5. Have the confidence to develop thinking skills and participate in brainstorming, mind-mapping, audio visual activities, creative thinking and also answer tests in the job-selection processes.

UNIT I **LISTENING SKILL** 9 hrs

Listening to the sounds, silent letters & stress in English words & sentences - Listening to conversation & telephonic conversation -- Listening for general meaning & specific information -- Listening for positive & negative comments - Listening to technical topics - Listening to prose & poetry reading - Listening exercises.

Embedded language learning: Sentence definition -- Spelling & punctuation -- Imperative form Sequencing of sentences -- Gerunds -- Infinitives -- 'Wh-'questions.

UNIT II **SPEAKING SKILL** 9 hrs

Self-introduction - Expressing personal opinion - Dialogue - Conversation - Simple oral interaction -Speaking on a topic -- Expressing views for & against -- Speaking on personal topics like hobbies, topics of interest, present & past experiences, future plans - Participating in group discussions, role plays, debates, presentations, power-point presentations & job-interviews.

Embedded language learning: Adverbs -Adjectives - Comparative and Numerical adjectives -- Nouns & compound nouns -- Prefixes and suffixes.

UNIT III **READING SKILL** 9 hrs

Reading anecdotes, short stories, poems, parts of a novel, notices, message, time tables, advertisements, leaflets, itinerary, content page - Reading pie chart & bar chart -- Skimming and scanning -- Reading for contextual meaning - Scanning for specific information -- Reading newspaper & magazine articles - Critical reading -- Reading-comprehension exercises.

Embedded language learning: Tenses - Active and passive voice -- Impersonal passive -- Words and their function -- Different grammatical forms of the same word.

UNIT IV **WRITING SKILL** 9 hrs

Writing emails, notes, messages, memos, notices, agendas, advertisements, leaflets, brochures, instructions, recommendations & checklists -- Writing paragraphs -- Comparisons & contrasts Process description of Flow charts - Interpretation of Bar charts & Pie charts - Writing the minutes of a meeting -- Report writing -- Industrial accident reports -- Letter-writing -- Letter to the editors - Letter inviting & accepting or declining the invitation - Placing orders - Complaints -- Letter requesting permission for industrial visits or implant training, enclosing an introduction to the educational institution -- Letters of application for a job, enclosing a CV or Resume - Covering letter.

Embedded language learning: Correction of errors - Subject-verb Concord -- Articles - Prepositions - Direct and indirect speech.

UNIT V **THINKING SKILL** 9 hrs

Eliciting & imparting the knowledge of English using thinking blocks - Developing thinking skills along with critical interpretation side by side with the acquisition of English -- Decoding diagrams & pictorial representations into English words, expressions, idioms and proverbs.

Embedded language learning: General vocabulary -- Using expressions of cause and effect -Comparison & contrast -- If-conditionals -- Expressions of purpose and means.

REFERENCES

1.Norman Whitby. Business Benchmark: Pre-Intermediate to Intermediate - BEC Preliminary. New Delhi: Cambridge University Press, 2008 (Latest South Asian edition).

2.Devaki Reddy &Shreesh Chaudhary. Technical English. New Delhi: Macmillan, 2009.

3.Rutherford, Andrea J. Basic Communication Skills for Technology. 2nd edition. New Delhi:Pearson Education, 2006.

MAA101	ENGINEERING MATHEMATICS- I	L	T	P	C	TCH
		3	1	0	4	4

GOAL	To create the awareness and comprehensive knowledge in engineering mathematics.
OBJECTIVES	The course should enable the students to : 1. Find the inverse of the matrix by using Cayley Hamilton Theorem and Diagonalisation of matrix using transformation. 2. Understand the Evolutes and Envelope of the curve. 3. Learn the solutions of second order linear differential equations of standard types and Legendre's linear differential equation. 4. Learn partial differentiations involving two and three variables and expansions of functions using Taylor series. 5. Learn the expansions of trigonometric, hyperbolic functions and their relations.
EXPECTED OUTCOMES	The students should be able to : 1. Identify Eigen value problems from practical areas and obtain its solutions and using transformation diagonalizing the matrix which would render Eigen values. 2. Find out effectively the geometrical aspects of curvature and appreciates mathematical skills in constructing Evolutes and envelopes in mechanics and engineering drawing. 3. Recognize and to model mathematically and solving, the differential equations arising in science and engineering. 4. Understand and model the practical problems and solve it using maxima and minima as elegant applications of partial differentiation. 5. Acquire skills in using trigonometric and hyperbolic and inverse hyperbolic functions.

UNIT I	**MATRICES**	
Review: Basic concepts of matrices-addition, subtraction, multiplication of matrices – ad-joint -inverse - solving cubic equations. Characteristic equation - Properties of Eigen values - Eigen values and Eigen vectors - Cayley Hamilton theorem (without proof) - Verification and inverse using Cayley Hamilton theorem. Diagonalisation of matrices - Orthogonal matrices - Quadratic form - Reduction of symmetric matrices to a Canonical form using orthogonal transformation - Nature of quadratic form		
UNIT II	**DIFFERENTIAL CALCULUS**	12 hrs.
Review: Basic concepts of differentiation - function of function, product and quotient rules. Methods of differentiation of functions - Cartesian form - Parametric form - Curvature - Radius of curvature - Centre of curvature - Circle of curvature. Evolutes of parabola, circle, ellipse, hyperbola and cycloid - Envelope.		
UNIT III	**ORDINARY DIFFERENTIAL EQUATIONS**	12 hrs.
Review: Definition, formation and solutions of differential equations. Second order differential equations with constant coefficients - Particular integrals-,eaxCosbx, eaxSinbx. Euler's homogeneous linear differential equations - Legendre's linear differential equation Variation of parameters.		
UNIT IV	**PARTIAL DIFFERENTIATION**	12 hrs.
Partial differentiation - differentiation involving two and three variables - Total differentiation -Simple problems. Jacobian - verification of properties of Jacobians - Simple problems. Taylor's series Maxima and minima of functions of two and three variables.		
UNIT V	**TRIGONOMETRY**	12 hrs.
Review: Basic results in trigonometry and complex numbers - De Moivre's theorem. Expansions of sin n ,cos n , tan n, where n is a positive integer. Expansions of in terms of sines and cosines of multiples of where m and n are positive integers. Hyperbolic and inverse hyperbolic functions - Logarithms of complex numbers - Separation of complex functions into real and imaginary parts - Simple problems. Note: Questions need not be asked from review part.		

TEXT BOOKS

Erwin Kreyzig, A Text book of Engineering Mathematics, John Wiley, 1999.

1. Grewal B.S, Higher Engineering Mathematics, Thirty Eighth Editions, Khanna Publisher, Delhi, 2004.
2. Chandrasekaran A, A Text book of Engineering Mathematics I, Dhanam Publications, Chennai, 2010.

REFERENCES

1. Venkataraman M.K, Engineering Mathematics, Volume I, The National Publishing Company, Chennai, 1985.
2. Kandaswamy P, Thilagavathy K and Gunavath K, Engineering Mathematics, Volume I & II, S.Chand and Company, New Delhi, 2005.
3. Bali N.P, NarayanaIyengar. N.Ch., Engineering Mathematics, Laxmi Publications
4. Pvt. Ltd, New Delhi, 2003.

PHA101	ENGINEERING PHYSICS	L	T	P	C	TCH
		3	0	0	3	3

GOAL

To impart fundamental knowledge in various fields of Physics and its applications.

OBJECTIVES

The course should enable the students to :

1. Develop strong fundamentals of properties and behavior of the materials
2. Enhance theoretical and modern technological aspects in acoustics and ultrasonic.
3. Enable the students to correlate the theoretical principles with application oriented study of optics.
4. Provide a strong foundation in the understanding of solids and materials testing.
5. Enrich the knowledge of students in modern engineering materials.

EXPECTED OUTCOMES

The students should be able to :

1. Understand the properties and behavior of materials.
2. Have a fundamental knowledge of acoustics which would facilitate in acoustical design of buildings and on ultrasonic and be able to employ it as an engineering tool.
3. Understand the concept, working and application of lasers and fiber optics.
4. Know the fundamentals of crystal physics and non-destructive testing methods.
5. Have an understanding of the production, characteristics and application of the new engineering materials. This would aid them in the material selection stage.

UNIT I PROPERTIES OF MATTER — 9 hrs.

Elasticity - types of moduli of elasticity - Stress-Strain diagram - Young's modulus of elasticity Rigidity modulus - Bulk modulus - Factors affecting elasticity - twisting couple on a wire - Torsional pendulum - determination of rigidity modulus of a wire - depression of a cantilever - Young's modulus by cantilever - uniform and non-uniform bending - viscosity - Ostwald's viscometer - comparison of viscosities.

UNIT II ACOUSTICS AND ULTRASONICS — 9 hrs.

Classification of sound - characteristics of musical sound - intensity - loudness - Weber Fechner law - Decibel - Reverberation - Reverberation time, derivation of Sabine's formula for reverberation time(Jaeger's method) - absorption coefficient and its determination - factors affecting acoustics of building (Optimum reverberation time, loudness, focusing, echo, echelon effect, resonance and noise) and their remedies. Ultrasonic - production – Magneto-striction and Piezoelectric methods - properties - applications of ultrasonic with particular reference to detection of flaws in metal (Non - Destructive testing NDT) - SONAR.

UNIT III LASER AND FIBRE OPTICS — 9 hrs.

Principle of lasers - Stimulated absorption - Spontaneous emission, stimulated emission - population inversion - pumping action - active medium - laser characteristics - Nd-Yag laser - CO2 laser Semiconductor laser - applications - optical fiber - principle and propagation of light in optical fibers Numerical aperture and acceptance angle - types of optical fibers - single and multimode, step index and graded index fibers - applications - fiber optic communication system.

UNIT IV CRYSTAL PHYSICS AND NON- DESTRUCTIVE TESTING — 9 hrs.

Crystal Physics: Lattice - Unit cell - Bravais lattice - Lattice planes - Miller indices - 'd' spacing in cubic lattice - Calculation of number of atoms per unit cell - Atomic radius - coordination number Packing factor for SC, BCC, FCC and HCP structures.

Non Destructive Testing: Liquid penetrate method - Ultrasonic flaw detection - ultrasonic flaw detector (block diagram) - X-ray Radiography - Merits and Demerits of each method.

UNIT V MODERN ENGINEERING MATERIALS AND SUPERCONDUCTING MATERIALS — 9 hrs.

Modern Engineering Materials: Metallic glasses: Preparation properties and applications. Shape memory alloys (SMA): Characteristics, applications, advantages and disadvantages of SMA. Nano Materials: Synthesis -Properties and applications. Superconducting Materials: Superconducting phenomena - Properties of superconductors - Meissner effect - Type I and Type II superconductors - High Tc superconductors (qualitative) - use of superconductors.

TEXT BOOKS

1. Gaur R.K. and Gupta S.L., "Engineering Physics ", 8th edition, Dhanpatrai publications (P) Ltd., New Delhi 2010.
2. P.Mani, "Engineering Physics", Vol-I, Dhanam Publications, Chennai 2011.
3. Rajendran V. an Marikani A., "Applied Physics for engineers" , 3rd edition, Tata McGraw -Hill publishing company Ltd., New Delhi,2003.

REFERENCES

1. Uma Mukherji, Engineering Physics ,Narosa publishing house, New Delhi, 2003.
2. Arumugam M., Engineering Physics ,Anuradha agencies, 2007.
3. Palanisamy P.K., Engineering Physics, SciTech Publications, Chennai 2007.
4. Arthur Beiser, Concepts of Modern Physics, Tata McGraw -Hill Publications, 2007.
5. P.Charles, Poople and Frank J. Owens, Introduction to Nanotechnology, Wiley

CYA101	ENGINEERING CHEMISTRY	L	T	P	C	TCH
		3	0	0	3	3

GOAL

To impart basic principles of chemistry for engineers

OBJECTIVES

The course should enable the students to :

1. Make the students conversant with the basics of
(a) Water Technology And (b) Polymer Science
2. Provide knowledge on the requirements and properties of a few important engineering materials.
3. Educate the students on the fundamentals of corrosion and its control.
4. Give a sound knowledge on the basics of a few significant terminologies and concepts in thermodynamics.
5. Create awareness among the present generation about the various conventional energy sources.

EXPECTED OUTCOMES

The students should be able to :

1. Gain basic knowledge in water analysis and suitable water treatment method.
2. Get an idea on the type of polymers to be used in engineering applications.
3. Get awareness about new materials.
4. Get knowledge on the effects of corrosion and protection methods will help the young minds to choose proper metal / alloys and also to create a design that has good corrosion control.
5. Get exposure on the important aspects of basic thermodynamics will be able to understand the advanced level thermodynamics in engineering applications.
6. Get a good background on the various aspects of energy sources will create awareness on the need to utilize the fuel sources effectively and also for exploring new alternate energy resources.

UNIT I — **WATER TECHNOLOGY AND POLYMER CHEMISTRY** — 9 hrs.

Hardness (Definition, Types, Units) - problems - Estimation of Hardness (EDTA Method) - Water softening - Carbonate conditioning and Calgon conditioning - Demineralization (Ion-Exchange Method) - Water Quality Parameters - Municipal Water Treatment- Desalination - Reverse Osmosis.

Classification of Polymers - PVC, Bakelite - preparation, properties and applications - Effect of Polymer Structure on Properties - Compounding of Plastics- Polymer Blends and Polymer Alloys Definition, Examples.

UNIT II — **ENGINEERING MATERIALS** — 9 hrs.

Properties of Alloys - Heat Treatment of Steel - Polymer Composites - types and applications. Lubricants - Classification, properties and applications - Mechanism of Lubrication - MoS2 And Graphite - Adhesives - classification and properties - Epoxy resin (Preparation, properties and applications) - Refractories - Classification, Properties and General Manufacture - Abrasives Classification , Properties and Uses – Carbon nano tubes - preparation, properties and applications.

UNIT III — **ELECTRO CHEMISTRY AND CORROSION** — 9 hrs.

Conductometric Titration – HClvsNaOH and mixture of acids vsNaOH - Electrochemical Series and its applications - Nernst Equation - problems - Polarization, Decomposition Potential, Over-voltage (definitions only) - Galvanic series - Corrosion (Definition, Examples, effects) - Mechanism of Dry Corrosion and Wet Corrosion - Differential aeration Corrosion , examples - Factors Influencing Corrosion - Metal and Environment - Corrosion Control - Design -Cathodic Protection methods - Protective Coatings - Galvanizing - Anodizing - Electroplating (Cu and Ni) and Electro-less plating (Cu and Ni) Constituents of Paints and varnish.

UNIT IV — **CHEMICAL THERMODYNAMICS** — 9 hrs.

Thermodynamic terminology- First Law of Thermodynamics-Internal energy- enthalpy - heat capacity work done in isothermal expansion of an ideal gas -problems - second law of thermodynamics entropy change - phase transformations and entropy change - problems - Work Function & Free Energy Function- Maxwell's Relations-Gibbs Helmholtz equation- van't Hoff Isotherm- van't Hoff Isochore - Problems.

UNIT V — **FUELS AND ENERGY SOURCES** — 9 hrs.

Fuels - classification - Calorific Value - Dulong's Formula - Problems - Determination of Calorific Value by Bomb Calorimeter - Coal - Proximate Analysis - problems - Octane Number - Cetane Number - Diesel Index (Definitions only) - Bio Gas - Producer Gas -Water Gas - Preparation, Properties and Uses - Batteries - Primary Cells - Leclanche Cell -Secondary Cell - Nickel Cadmium Battery Fuel Cells - Hydrogen -Oxygen Fuel Cell - Solar Battery - Lead Acid Storage Cell - Nuclear Energy Light water nuclear power plant.

TEXT BOOKS

1. S. S. Dara, Text Book of Engineering Chemistry, S. Chand & Company Ltd., New Delhi, 2003
2. Murthy, Agarwal& Naidu, Text Book of Engineering Chemistry, BSP, 2003.
3. S.Sumathi, Engineering Chemistry, Dhanam Publications, 2008.
4. S.Sumathi and P.S.Raghavan, Engineering Chemistry II, Dhanam Publications, 2008.

REFERENCES

1. B. K. Sharma, Engineering chemistry, Krishna Prakasam Media (P) Ltd., 2003

2. Vogel, A text book of Qualitative Inorganic Analysis, ELBS, London, 2004

3. A. Gowarikar, Text Book of Polymer Science, 2002

4. Kuriacose&Rajaram, Vols. 1 & 2, Chemistry in Engineering and Technology, 2004
5. Puri, Sharma and Pathania, Principles of Physical Chemistry, Vishal Publishing Co.Jalandar, 2004.

MEA101	COMPUTER AIDED ENGINEERING DRAWING	L	T	P	C	TCH
		1	1	3	3	5

GOAL

To develop graphical skills for communicating concepts, ideas and designs of engineering products and to give exposure to national standards relating to technical drawings using Computer Aided Design and Drafting practice

OBJECTIVES

The course should enable the students to :

1. Introduce drawing standards and use of drawing instruments.
2. Introduce first angle projection.
3. Practice of engineering hand sketching and introduce to computer aided drafting
4. Familiarize the students with different type of pictorial projections.
5. Introduction to Solid modeling
6. Introduce the process of design from sketching to parametric 3D CAD and 2D orthographic drawings to BIS

EXPECTED OUTCOMES

The students should be able to :

1. Develop Parametric design and the conventions of formal engineering drawing
2. Produce and interpret 2D & 3D drawings
3. Communicate a design idea/concept graphically
4. Examine a design critically and with understanding of CAD - The student learn to interpret drawings, and to produce designs using a combination of 2D and 3D software.
5. Get a Detailed study of an engineering artifact.

UNIT I **BASICS OF ENGINEERING GRAPHICS AND PLANE CURVES** 12 hrs.

Importance of graphics Use of drawing instruments - BIS conventions and specifications - drawing sheet sizes, layout and folding - lettering - Dimensioning-Geometrical constructions - Scales. Introduction to plane curves like ellipse, parabola, cycloids and involutes
Drafting methods - introduction to Computer Aided Drafting – Computer Hardware – Workstation – Printer and Plotter – Introduction to software for Computer Aided Design and Drafting – Exposure to Solid Modeling software – Geometrical Construction-Coordinate Systems/Basic Entities

UNIT II **VISUALIZATION, ORTHOGRAPHIC PROJECTIONS AND FREE HAND SKETCHING** 15 hrs.

Visualization concepts and Free Hand sketching: Visualization principles —Representation of Three Dimensional objects - Pictorial Projection methods - Layout of views- Free hand sketching of multiple views from pictorial views of objects.Drafting of simple Geometric Objects/Editing
General principles of presentation of technical drawings as per BIS - Introduction to Orthographic projections - Naming views as per BIS - First angle projection method. Conversion to orthographic views from given pictorial views of objects, including dimensioning – Drafting of Orthographic views from Pictorial views.

UNIT III **PROJECTIONS OF POINTS, LINES, SURFACES AND SOLIDS** 18 hrs.

Introduction to Projections of points – Projections of straight lines located in first quadrant using rotating line method only – Projections of plane surfaces when the surface of the lamina is inclined to one reference plane only – Projections of simple solids when the axis of the solid is inclined to one reference plane only – Sectioning of above solids in simple positions – Section Views. Practice includes drafting the projection of lines and solids using appropriate software. 2D drawing commands: Zoom, Picture editing commands, Dimensioning and 2D drafting.

UNIT IV **GEOMETRICAL MODELING AND ISOMETRIC VIEWS** 15 hrs

Solid Modeling – Types of modeling - Wire frame model, Surface Model and Solid Model – Introduction to graphic software for solid modeling. Principles of isometric projection and solid modeling.Isometric drawing – Iso-Planes and 3D Modeling commands. Projections of Principal Views from 3-D Models

UNIT V **COMPUTER AIDED DESIGN AND DRAFTING** 15 hrs.

Preparation of solids of machine components like slide block, solid bearing block, bushed bearing, gland, wall bracket, guide bracket, shaft bracket, jig plate, shaft support (open type), vertical shaft support etc using appropriate modeling software.
Introduction to computer aided drafting and dimensioning using appropriate software. Generate 2D drawing from the 3D models – generate and develop the lateral surfaces of the objects. Presentation Techniques of Engineering Drawings – Title Blocks – Printing/Plotting of drawing.

TEXT BOOKS

1. Jeyapoovan T, Engineering Drawing and Graphics Using AutoCAD, Vikas Publishing House Pvt. Ltd., New Delhi, 2010.
2. Warren J. Luzadder and Jon.M.Duff, Fundamentals of Engineering Drawing, Prentice Hall of India Pvt. Ltd., Eleventh Edition, 2003.

REFERENCE BOOKS:

1. Introduction to AutoCAD – 2D and 3D Design, A.Yarmwood, Newnes Elsevier, 2011
2. Engineering Drawing and Graphic Technology-International Edition, Thomas E. French, Charles J. Vierck, Robert J. Foster, McGraw-Hill, 1993
3. Engineering Drawing and Design-Sixth Edition, C. Jensen, J.D. Helsel, D.R. Short, McGraw-Hill, 2002
4. Technical Drawing-Fourteenth Edition, F. E. Giesecke, A. Mitchell, H. C. Spencer, I.L. Hill, J.T. Dygdon, J.E., Novak, Prentice-Hall, 2012,
5. Bhatt N.D and Panchal V.M, Engineering Drawing: Plane and Solid Geometry, Charotar Publishing House, 2007.

6.Mechanical Engineering Drawing-Self Taught, JashuaRose,http://www.gutenberg.org/files/23319/23319-h/23319 h.htm

Bureau of Indian Standards (BIS) for Engineering Drawing:

1. IS 10711 – 2001: Technical products Documentation – Size and lay out of drawing sheets.
2. IS 9609 (Parts 0 & 1) – 2001: Technical products Documentation — Lettering.
3. IS 10714 (Part 20) – 2001 & SP 46 – 2003: Lines for technical drawings.
4. IS 11669 – 1986 & SP 46 – 2003: Dimensioning of Technical Drawings.

CSA101	COMPUTER PROGRAMMING	L	T	P	C	TCH
		3	0	0	3	3
GOAL	To introduce computers and programming and to produce an awareness of the power of computational techniques that is currently used by engineers and scientists and to develop programming skills to a level such that problems of reasonable complexity can be tackled successfully.					
OBJECTIVES	The course should enable the students to : 1. Learn the major components of a Computer system. 2. Learn the problem solving techniques. 3. Develop skills in programming using C language.					
EXPECTED OUTCOMES	The students should be able to : 1. Understand the interaction between different components of Computer system and number system. 2. Devise computational strategies for developing applications. 3. Develop applications (Simple to Complex) using C programming language.					
UNIT I	**COMPUTER FUNDAMENTALS**					9 hrs.
Introduction - Evolution of Computers - Generations of Computer - Classification of Computers Application of Computers - Components of a Computer System - Hardware - Software - Starting a Computer (Booting) - Number Systems.						
UNIT II	**COMPUTER PROGRMMING AND LANGUAGES**					9 hrs.
Introduction - Problem-Solving Techniques: Algorithms, Flowchart, Pseudocode - Program Control Structures - Programming Paradigms - Programming languages - Generations of Programming Languages - Language Translators - Features of a Good Programming Languages.						
UNIT III	**PROGRAMMING WITH C**					9 hrs.
Introduction to C - The C Declaration - Operators and Expressions - Input and Output in C - Decision Statements - Loop Control Statements.						
UNIT IV	**FUNCTIONS, ARRAYS AND STRINGS**					9 hrs.
Functions - Storage Class - Arrays - Working with strings and standard functions.						
UNIT V	**POINTERS, STRUCTURES AND UNION**					9 hrs.
Pointers - Dynamic Memory allocation - Structure and Union - Files.						
TEXT BOOK 1. ITL Education Solution Limited, Ashok Kamthane, "Computer Programming", PearsonEducationInc 2007 (Unit: I to V).						
REFERNCES 1. Byron S. Gottfried, "Programming with C", Second Edition, Tata McGraw Hill 2006. 2. YashvantKanetkar, "Let us C", Eighth edition, BPP publication 2007. 3. Stephen G.Kochan, "Programming in C - A Complete introduction to the C programming language" , Pearson Education, 2008. 4. T.JeyaPoovan, "Computer Programming Theory and Practice", Vikas Pub, New Delhi						

CSA131	COMPUTER PROGRAMMING LABORATORY	L	T	P	C	TCH
		0	0	3	1	3

GOAL	To provide an awareness to develop the programming skills using computer languages.
OBJECTIVES	The course should enable the students to : 1. To gain knowledge about Microsoft office, Spread Sheet. 2. To learn a programming concept in C.
EXPECTED OUTCOMES	The students should be able to : 1. Use MS Word to create document, table, text formatting and Mail merge options. 2. Use Excel for small calculations using formula editor, creating different types of charts and including pictures etc, 3. Write and execute the C programs for small applications.

LIST OF EXPERIMENTS

a) Word Processing 1. Document creation, Text manipulation with Scientific notations. 2. Table creation, Table formatting and Conversion. 3. Mail merge and Letter preparation. 4. Drawing- flow Chart	12 hrs.
b) Spread Sheet 5. Chart - Line, XY, Bar and Pie. 6. Formula - formula editor. 7. Spread sheet - inclusion of object, Picture and graphics, protecting the document	9 hrs.
c) Programming in C 8. To write a C program to prepare the electricity bill. 9. Functions (a) Call by value (b) Call by reference. 10. To write a C program to print the Fibonacci series for the given number. 11. To write a C program to find the factorial of number using recursion. 12. To write a C program to implement the basic arithmetic operations using Switch Case statement. 13. To write a C program to check whether the given number is an Armstrong number. 14. To write a C program to check whether the given string is a Palindrome. 15. To write a C program to create students details using Structures. 16. To write a C program to demonstrate the Command Line Arguments. 17. To write a C program to implement the Random Access in Files. 18. To write C programs to solve some of the Engineering applications	24 hrs.

HARDWARE/SOFTWARE REQUIRED FOR BATCH OF 30 STUDENTS

HARDWARE

LAN system with 33 nodes (OR) Standalone PCs - 33 Nos

Printers - 3 Nos

SOFTWARE

OS - Windows / UNIX

Application package - MS office

Software - C language

GEA131	ENGINEERING PRACTICE LABORATORY - I (Common to all branches)	L	T	P	C	TCH
		0	0	3	1	3
GOAL	To provide the students with hands on experience on various basic engineering practices in Civil and Mechanical Engineering.					
OBJECTIVES	The course should enable the students to : 1. Relate theory and practice of basic Civil and Mechanical Engineering 2. Learn concepts of welding and machining practice 3. Learn concepts of plumbing and carpentry practice					
OUTCOMES	The students should be able to : 1. Identify and use of tools, Types of joints used in welding, carpentry and plumbing operations. 2. Have hands on experience on basic fabrication techniques such as carpentry and plumbing practices. 3. Have hands on experience on basic fabrication techniques of different types of welding and basic machining practices.					

LIST OF EXPERIMENTS	15 hrs
I. MECHANICAL ENGINEERING PRACTICE **1. Welding** Arc welding: Butt joints, Tee and lap joints. **2. Basic Machining** Facing, turning, threading and drilling practices using lathe and drilling operation with vertical drilling machine. **3. Machine assembly practice** Study of centrifugal pump **4. Study on,** a. Smithy operations - Productions of hexagonal headed bolt. b. Foundry operations - Mould preparation for gear and step cone pulley.	
II. CIVIL ENGINEERING 1. Basic pipe connection using valves, couplings, unions, reducers, elbows in household fitting. 2. Practice in mixed pipe connections: Metal, plastic and flexible pipes used in household appliances. 3. Wood work: Sawing, Planning and making common joints. 4. Study of joints in door panels, wooden furniture.	12 hrs

Reference:

Jeyapoovan T and Saravanapandian M., Engineering practices lab manual, 4th Edition, Vikas publishing House, New Delhi, 2010.

List equipment and components (For a Batch of 30 Students)

CIVIL

1. Assorted components for plumbing consisting of metallic pipes, plastic pipes, flexible pipes, couplings, unions, elbows, plugs and other fittings. 15 Sets.
2. Carpentry vice (fitted to work bench) 15 Nos.
3. Standard woodworking tools 15 Sets.
4. Models of industrial trusses, door joints, furniture joints 5 each
5. Power Tools:
   (a) Rotary Hammer 2 Nos
   (b) Demolition Hammer 2 Nos
   (c) Circular Saw 2 Nos
   (d) Planer 2 Nos
   (e) Hand Drilling Machine 2 Nos
   (f) Jigsaw 2 Nos

MECHANICAL

1. Arc welding transformer with cables and holders 5 Nos.
2. Welding booth with exhaust facility 5 Nos.
3. Welding accessories like welding shield, chipping hammer, wire brush, etc. 5 Sets.
4. Oxygen and acetylene gas cylinders, blow pipe and other welding outfit. 2 Nos.
5. Centre lathe 2 Nos.
6. Hearth furnace, anvil and smithy tools 2 Sets.
7. Moulding table, foundry tools 2 Sets.
8. Power Tool: Angle Grinder 2 Nos
9. Study-purpose items: centrifugal pump, air-conditioner One each.

ELA131	COMMUNICATION SKILLS LABORATORY -I	L	T	P	C	TCH
		0	0	3	1	3

GOAL

The goal of the programme is to provide **a practical input** towards nurturing accomplished learners who can function effectively in the English language skills

OBJECTIVES

The course should enable the students to :

1. To develop the learners comprehension of English Language.
2. To enhance the listening skills and understand the pronunciation of standard English.
3. To analyse the structure of sentences, find errors and insert the appropriate syntax.
4. To develop the listening , speaking, reading and writing skills
5. To think creatively and write in a coherent manner

OUTCOMES

The students should be able to :

1. Integrate and express the thoughts in English explicitly in real life situations.
2. Develop functional knowledge of spoken English so as to use it in the institution and job interviews
3. Enact in role-plays and participate in debates, group discussion and team activities
4. Deduce the meaning listening to speeches in English.
5. Arrange sentences in logical manner using appropriate syntax
6. Construct and write sentences in a creative manner..

UNIT I **LISTENING SKILL**

Listening to conversations and interviews of famous personalities in various fields -- Listening practice related to the TV-- Talk shows - News - Educative programmes -- Watching films for critical comments - Listening for specific information - Listening for summarizing information - Listening to monologues for taking notes - Listening to answer multiple-choice questions.

UNIT II **SPEAKING SKILL**

Self-introduction -- Group discussion - Persuading and negotiating strategies - Practice in dialogues - Presentations based on short stories / poems -- Speaking on personal thoughts and feelings -academic topics - News reading - Acting as a compere -- Speaking about case studies on problems and solutions - Extempore speeches.

UNIT III **READING SKILL**

Reading anecdotes to predict the content - Reading for interpretation -- Suggested reading -- Short stories and poems -- Critical reading - Reading for information transfer - Reading newspaper and magazine articles for critical commentary - Reading brochures, advertisements, pamphlets for improved presentation.

UNIT IV **WRITING SKILL**

At the beginning of the semester, the students will be informed of a mini dissertation of 1000 words they need to submit individually on any non-technical topic of their choice. The parts of the dissertation will be the assignments carried out during the semester and submitted towards the end of the semester on a date specified by the department. This can be judged as part of the internal assessment.

UNIT V **THINKING SKILL**

Practice in preparing thinking blocks to decode diagrammatical representations into English words, expressions, idioms and proverbs - Inculcating interest in English using thinking blocks. Making pictures and improvising diagrams to form English words, phrases and proverbs -- Picture reading

REFERENCES

1. Raman, Meenakshi, and Sangeetha Sharma. Technical Communication: English Skills for Engineers. 2nd edition. New Delhi: Oxford University Press, 2010.
2. Riordian, Daniel. Technical Communication. New Delhi. Cengage Learning, 2009

Websites for learning English

1. British: Learn English - British Council (Listen & Watch) - <http://learnenglish. british council.org/>
2. American: Randall's ESL Cyber Listening Lab - <http://www.esl-lab.com/>
3. Intercultural: English Listening Lesson Library Online http://www.elllo.org/

Language Lab sessions and online exams

Reference: Language Lab software

PHA131	PHYSICS LABORATORY (Common To All Branches)	L	T	P	C	TCH
		0	0	3	1	3
GOAL	To enhance the students' knowledge on practical training through experiments to understand and appreciate the concepts learnt in Physics					
OBJECTIVES	To expose the students for practical training through experiments to understand and appreciate the concepts learnt in physics					
EXPECTED OUTCOMES	Performing the experiments related to the subjects will help the students to apply the practical knowledge in industrial applications and for developing or modifying methods					

List of Experiments

1. Torsional Pendulum - Determination of rigidity modulus of the material of a wire.
2. Non Uniform Bending - Determination of Young's Modulus.
3. Viscosity -Determination of co-efficient of Viscosity of a liquid by Poiseuille's flow.
4. Lee's Disc - Determination of thermal conductivity of a bad conductor.
5. Air Wedge - Determination of thickness of a thin wire.
6. Spectrometer - Refractive index of a prism.
7. Semiconductor Laser – Determination of wavelength of Laser using Grating

LIST OF EQUIPMENTS REQUIRED FOR A BATCH OF 30 STUDENTS

1. Torsional Pendulum(500 gm, wt, 60 cm wire Al-Ni Alloy) 5 Nos.
2. Travelling Microscope(X10) 15 Nos.
3. Capillary tube(length 10cm, dia 0.05mm) 5 Nos.
4. Magnifying lens(X 10) 5 Nos.
5. Lee's disc apparatus(std form) 5 Nos.
6. Stop watch(+/- 1 s) 5 Nos.
7. Meter scale1m length 5 Nos.
8. Spectrometer(main scale 360 deg, ver 30") 5 Nos.
9. Grating(2500 LPI) 5 Nos.
10. Laser(632.8 nm) 5 Nos.
11. Semi-transparent glass plate - Al coating, 65 nm thickness, 50% visibility - 5 Nos.
12. Equilateral Prism (n = 1.54) - 5 nos.
13. Thermometer - +/- 1 deg - 8 nos.
14. Screw gauge - (+/- 0.001cm) - 12 nos
15. Vernier caliper - (+/- 0.01 cm) - 8 nos.
16. Steam Boiler - 1 L - 5 nos
17. Scale - 50 cms - 5 nos.
18. Cylindrical mass - 100 gms - 10 sets
19. Slotted wt - 300 gms - 5 sets
20. Heater -1.5 KW - 5 nos
21. Transformer sodium vapour lamp - 1 KW -10 nos.
22. Sodium vapour lamp - 700 W - 5 nos
23. Burette - 50 mL5 nos
24. Beaker - 250 mL - 5 nos
25. Spirit level - 10 nos

REFERENCES

1. P.Mani, Engineering Physics Practicals, Dhanam Publications, Chennai, 2005.

CYA131	CHEMISTRY LABORATORY (Common To All Branches)	L	T	P	C	TCH
		0	0	3	1	3
GOAL	To enhance the students' knowledge on practical training through experiments to understand and appreciate the concepts learnt in Chemistry.					
OBJECTIVES	To expose the students for practical training through experiments to understand and appreciate the concepts learnt in chemistry					
EXPECTED OUTCOMES	Performing the experiments related to the subjects will help the students to apply the practical knowledge in industrial applications and for developing or modifying methods					

List of Experiments

1. Estimation of Commercial soda by acid-base titration
2. Determination of Percentage of nickel in an alloy
3. Determination of Temporary, permanent and total hardness of water by EDTA method
4. Determination of Chloride content in a water sample
5. Potentiometric Estimation of iron
6. Conductometric Titration of a strong acid with a strong base
7. Conductometric Titration of mixture of acids.
8. Determination of Degree of polymerization of a polymer by Viscometry

List of Glassware and Equipment required for a batch of 30 students

1	Burette	(50 mL)	30 nos
2	Pipette	(20 mL)	30 nos.
3	Conical Flask	(250 mL)	30 nos
4	Distilled water bottle	(1 L)	30 nos
5	Standard flask	(100 mL)	30 nos
6	Funnel	(small)	30 nos
7	Glass rod	20 cm length	30 nos
8	Reagent Bottle	(250 mL)	30 nos.
9	Reagent Bottle	(60 mL)	30 nos
10	Beaker	(100 mL)	30 nos
11.	Oswald Viscometer	Glass	30 nos
12.	Measuring Cylinder	(25 mL)	30 nos
13.	Digital Conductivity Meter	PICO make	8 nos
14.	Conductivity cell	(K=1)	12 nos
15.	Digital Potentiometer	PICO make	8 nos
16.	Calomel Electrode	Glass	12 nos
17.	Platinum Electrode	Polypropylene	12 nos
18.	Burette Stands	Wooden	30 nos
19.	Pipette stands	Wooden	30 nos
20.	Retard stands	Metal	30 nos
21.	Porcelain Tiles	White	30 nos
22.	Clamps with Boss heads	Metal	30 nos

REFERENCES

1. J.Mendham, R.C. Denney, J.D. Barnes and N.J.K. Thomas, Vogel's Textbook of Quantative Chemical Analysis, 6th Edition, Pearson Education, 2004.

2. C. W. Garland, J. W. Nibler, D. P. Shoemaker, ;"Experiments in Physical Chemistry, 8th ed.," McGraw-Hill, New York, 2009.

3. S. Sumathi, Engineering Chemistry Practicals, Dhanam Publications, 2011.

MAA102	ENGINEERING MATHEMATICS-II	L	T	P	C	TCH
		2	1	1	4	4

GOAL	The course is aimed at developing the basic Mathematical skills of engineering students that are imperative for effective understanding of engineering subject using MATLAB.
OBJECTIVES	1. To understand effectively the evaluation of double and triple integrals and their applications 2. To know the basics of vector calculus comprising of gradient, divergence, curl, line surface and volume integrals along with the classical theorems involving them 3. To have a sound knowledge of Laplace transform and its properties. Solutions of Laplace transform using MATLAB. 4. To understand and expand periodic functions as Fourier series using MATLAB
EXPECTED OUTCOMES	• To understand effectively the evaluation of double and triple integrals and their applications • To know the basics of vector calculus comprising of gradient, divergence, curl, line surface and volume integrals along with the classical theorems involving them • To have a sound knowledge of Laplace transform and its properties. Solutions of Laplace transform using MATLAB. • To understand and expand periodic functions as Fourier series using MATLAB

UNIT I	**MULTIPLE INTEGRALS**	12(8+4)

Double integration – Cartesian and polar co-ordinates – Change of order of integration. Area as a double integral – Triple integration in Cartesian co ordinates – Volume as a triple integral - Change of variables between Cartesian and polar coordinates.

Lab: Area and Volume of double integration and triple integration.

UNIT II	**VECTOR CALCULUS**	12(8+4)

Gradient, Divergence and Curl – Unit normal vector, Directional derivative – angle between surfaces-Irrotational and solenoidal vector fields.

Green's theorem - Gauss divergence theorem and Stoke's theorem (without proof) – Verification and evaluation of the above the theorems - Simple applications to regions such as square, rectangle, triangle, cuboids and rectangular parallelopipeds.

Lab: Green's theorem - Gauss divergence theorem and Stoke's theorem

UNIT III	**LAPLACE TRANSFORM**	12(8+4)

Laplace transform – Conditions of existence – Transform of elementary functions – properties - Derivatives and integrals of transforms – Transforms of derivatives and integrals – Initial and final value theorems – Transform of periodic functions. Inverse Laplace transforms using partial fraction and convolution theorem. Solution of linear ODE of second order with constant coefficients.

Lab: Solutions of differential equations using Laplace transform

UNIT IV	**FOURIER SERIES**	12(8+4)

Dirichlet's Conditions – General Fourier Series – Odd and even functions – Half range sine and cosine series –Harmonic Analysis.

Lab: Solutions of Fourier series and Harmonic Analysis.

UNIT V	**COMPLEX VARIABLES**	12(8+4)

Functions of a complex variable – Analytic function - Cauchy - Riemann equations (Statement only) – Properties of analytic function (Statement only) – Construction of Analytic functions by Milne – Thomson method.

Lab: Cauchy - Riemann equations, Milne – Thomson method

Note: Questions need not be asked from review part.

TEXT BOOKS

1. Venkatraman M.K, Mathematics, Volume – II & Volume -III, National Publishing Company, Chennai, 1985.
2. A.P.Santhakumaran, P.Titus, Engineering Mathematics - II, NiMeric Publications, Nagercoil, 2012

REFERENCES

1. Kandasamy P, Engineering Mathematics Volume II, S. Chand & Co., New Delhi, 1987.
2. Grewal B.S, "Engineering Maths – II", Sultan Chand, New Delhi, 1993.
3. Bali N.P, Manish Goyal, Text book of Engineering Mathematics, 3rd Edition, Lakshmi Publications, 2003.
4. Chandrasekaran A, Engineering Mathematics, Volume – II, Dhanam Publication, 2008.

PHA101	ENGINEERING PHYSICS	L	T	P	C	TCH
		3	0	0	3	3

GOAL	To impart fundamental knowledge in various fields of Physics and its applications.
OBJECTIVES	The course should enable the students to : 1. Develop strong fundamentals of properties and behavior of the materials 2. Enhance theoretical and modern technological aspects in acoustics and ultrasonic. 3. Enable the students to correlate the theoretical principles with application oriented study of optics. 4. Provide a strong foundation in the understanding of solids and materials testing. 5. Enrich the knowledge of students in modern engineering materials.
EXPECTED OUTCOMES	The students should be able to : 1. Understand the properties and behavior of materials. 2. Have a fundamental knowledge of acoustics which would facilitate in acoustical design of buildings and on ultrasonic and be able to employ it as an engineering tool. 3. Understand the concept, working and application of lasers and fiber optics. 4. Know the fundamentals of crystal physics and non-destructive testing methods. 5. Have an understanding of the production, characteristics and application of the new engineering materials. This would aid them in the material selection stage.

UNIT I	**PROPERTIES OF MATTER**	9 hrs.

Elasticity - types of moduli of elasticity - Stress-Strain diagram - Young's modulus of elasticity Rigidity modulus - Bulk modulus - Factors affecting elasticity - twisting couple on a wire - Torsional pendulum - determination of rigidity modulus of a wire - depression of a cantilever - Young's modulus by cantilever - uniform and non-uniform bending - viscosity - Ostwald's viscometer - comparison of viscosities.

UNIT II	**ACOUSTICS AND ULTRASONICS**	9 hrs

Classification of sound - characteristics of musical sound - intensity - loudness - Weber Fechner law - Decibel - Reverberation - Reverberation time, derivation of Sabine's formula for reverberation time(Jaeger's method) - absorption coefficient and its determination - factors affecting acoustics of building (Optimum reverberation time, loudness, focusing, echo, echelon effect, resonance and noise) and their remedies. Ultrasonic - production – Magneto-striction and Piezoelectric methods - properties - applications of ultrasonic with particular reference to detection of flaws in metal (Non - Destructive testing NDT) - SONAR.

UNIT III	**LASER AND FIBRE OPTICS**	9 hrs

Principle of lasers - Stimulated absorption - Spontaneous emission, stimulated emission - population inversion - pumping action - active medium - laser characteristics - Nd-Yag laser - CO2 laser Semiconductor laser - applications - optical fiber - principle and propagation of light in optical fibers Numerical aperture and acceptance angle - types of optical fibers - single and multimode, step index and graded index fibers - applications - fiber optic communication system.

UNIT IV	**CRYSTAL PHYSICS AND NON- DESTRUCTIVE TESTING**	9 hrs

Crystal Physics: Lattice - Unit cell - Bravais lattice - Lattice planes - Miller indices - 'd' spacing in cubic lattice - Calculation of number of atoms per unit cell - Atomic radius - coordination number Packing factor for SC, BCC, FCC and HCP structures. Non Destructive Testing: Liquid penetrate method - Ultrasonic flaw detection - ultrasonic flaw detector (block diagram) - X-ray Radiography - Merits and Demerits of each method.

UNIT V	**MODERN ENGINEERING MATERIALS AND SUPERCONDUCTING MATERIALS**	9hrs

Modern Engineering Materials: Metallic glasses: Preparation properties and applications. Shape memory alloys (SMA): Characteristics, applications, advantages and disadvantages of SMA. Nano Materials: Synthesis -Properties and applications. Superconducting Materials: Superconducting phenomena - Properties of superconductors - Meissner effect - Type I and Type II superconductors - High Tc superconductors (qualitative) - use of superconductors.

TEXT BOOKS

1. Gaur R.K. and Gupta S.L., "Engineering Physics ", 8th edition, Dhanpatrai publications (P) Ltd., New Delhi 2010.
2. P.Mani, "Engineering Physics", Vol-I, Dhanam Publications, Chennai 2011.
3. Rajendran V. an Marikani A., "Applied Physics for engineers" , 3rd edition, Tata McGraw -Hill publishing company Ltd., New Delhi,2003.

REFERENCES

1. Uma Mukherji, Engineering Physics ,Narosa publishing house, New Delhi, 2003.
2. Arumugam M., Engineering Physics ,Anuradha agencies, 2007.
3. Palanisamy P.K., Engineering Physics, SciTech Publications, Chennai 2007.
4. Arthur Beiser, Concepts of Modern Physics, Tata McGraw -Hill Publications, 2007.
5. P.Charles, Poople and Frank J. Owens, Introduction to Nanotechnology, Wiley

CYA101	ENGINEERING CHEMISTRY	L	T	P	C	TCH
		3	0	0	3	3
GOAL	To impart basic principles of chemistry for engineers					
OBJECTIVES	The course should enable the students to : 1. Make the students conversant with the basics of (a) Water technology And (b) Polymer science 2. Provide knowledge on the requirements and properties of a few important engineering materials. 3. Educate the students on the fundamentals of corrosion and its control. 4. Give a sound knowledge on the basics of a few significant terminologies and concepts in thermodynamics. 5. Create awareness among the present generation about the various conventional energy sources.					
EXPECTED OUTCOMES	The students should be able to : 1. Gain basic knowledge in water analysis and suitable water treatment method. 2. Get an idea on the type of polymers to be used in engineering applications. 3. Get awareness about new materials. 4. Get knowledge on the effects of corrosion and protection methods will help the young minds to choose proper metal / alloys and also to create a design that has good corrosion control. 5. Get exposure on the important aspects of basic thermodynamics will be able to understand the advanced level thermodynamics in engineering applications. 6. Get a good background on the various aspects of energy sources will create awareness on the need to utilize the fuel sources effectively and also for exploring new alternate energy resources.					
UNIT I	**WATER TECHNOLOGY AND POLYMER CHEMISTRY**					9 hrs.
Hardness (Definition, Types, Units) - problems - Estimation of Hardness (EDTA Method) - Water softening - Carbonate conditioning and Calgon conditioning - Demineralization (Ion-Exchange Method) - Water Quality Parameters - Municipal Water Treatment- Desalination - Reverse Osmosis. Classification of Polymers - PVC, Bakelite - preparation, properties and applications - Effect of Polymer Structure on Properties - Compounding of Plastics- Polymer Blends and Polymer Alloys Definition, Examples						
UNIT II	**ENGINEERING MATERIALS**					9 hrs
Properties of Alloys - Heat Treatment of Steel - Polymer Composites - types and applications. Lubricants - Classification, properties and applications - Mechanism of Lubrication - MoS2 And Graphite - Adhesives - classification and properties - Epoxy resin (Preparation, properties and applications) - Refractories - Classification, Properties and General Manufacture - Abrasives Classification , Properties and Uses – Carbon nano tubes - preparation, properties and applications.						
UNIT III	**ELECTRO CHEMISTRY AND CORROSION**					9 hrs
Conductometric Titration – HClvsNaOH and mixture of acids vsNaOH - Electrochemical Series and its applications - Nernst Equation - problems - Polarization, Decomposition Potential, Over-voltage (definitions only) - Galvanic series - Corrosion (Definition, Examples, effects) - Mechanism of Dry Corrosion and Wet Corrosion - Differential aeration Corrosion , examples - Factors Influencing Corrosion - Metal and Environment - Corrosion Control - Design -Cathodic Protection methods - Protective Coatings - Galvanizing - Anodizing - Electroplating (Cu and Ni) and Electro-less plating (Cu and Ni) Constituents of Paints and varnish.						
UNIT IV	**CHEMICAL THERMODYNAMICS**					9 hrs
Thermodynamic terminology- First Law of Thermodynamics-Internal energy- enthalpy - heat capacity work done in isothermal expansion of an ideal gas -problems - second law of thermodynamics entropy change - phase transformations and entropy change - problems - Work Function & Free Energy Function- Maxwell's Relations-Gibbs Helmholtz equation- van't Hoff Isotherm- van't Hoff Isochore - Problems.						
UNIT V	**FUELS AND ENERGY SOURCES**					9hrs
Fuels - classification - Calorific Value - Dulong's Formula - Problems - Determination of Calorific Value by Bomb Calorimeter - Coal - Proximate Analysis - problems - Octane Number - Cetane Number - Diesel Index (Definitions only) - Bio Gas - Producer Gas -Water Gas - Preparation, Properties and Uses - Batteries - Primary Cells - Leclanche Cell -Secondary Cell - Nickel Cadmium Battery Fuel Cells - Hydrogen -Oxygen Fuel Cell - Solar Battery - Lead Acid Storage Cell - Nuclear Energy Light water nuclear power plant.						

TEXT BOOKS

1. S. S. Dara, Text Book of Engineering Chemistry, S. Chand & Company Ltd., New Delhi, 2003
2. Murthy, Agarwal& Naidu, Text Book of Engineering Chemistry, BSP, 2003.
3. S.Sumathi, Engineering Chemistry, Dhanam Publications, 2008.
4. S.Sumathi and P.S.Raghavan, Engineering Chemistry II, Dhanam Publications, 2008.

REFERENCES

1. B. K. Sharma, Engineering chemistry, Krishna Prakasam Media (P) Ltd., 2003
2. A 1. Vogel, A text book of Qualitative Inorganic Analysis, ELBS, London, 2004.
3. A. Gowarikar, Text Book of Polymer Science, 2002
4. Kuriacose&Rajaram, Vols. 1 & 2, Chemistry in Engineering and Technology, 2004
5. Puri, Sharma and Pathania, Principles of Physical Chemistry, Vishal Publishing

MEA102	ENGINEERING MECHANICS	L	T	P	C	TCH
		3	1	0	4	4

GOAL

To provide an understanding of the effects of forces, torques and motion on a variety of structures and vehicles.

OBJECTIVES

The course should enable the students to :

1. Impart knowledge on the vector and scalar representation of forces and moments
2. Impart knowledge on static equilibrium of particles and rigid bodies both in two dimensions and also in three dimensions.
3. Understand the principle of work and energy.
4. Comprehend on the effect of friction on equilibrium, the laws of motion, the kinematics of motion and the interrelationship.
5. Write the dynamic equilibrium equation.

All these should be achieved both conceptually and through solved examples.

EXPECTED OUTCOMES

The students should be able to :

1. Apply the law of forces and Newton's 2nd law in determining motion and the dynamics of particles and vehicles
2. Implement vectors in mechanics problems and Know about Energy and momentum conservation
3. Know the dynamics of a rigid body and its rotation and Do the calculation and motion of the centre of mass of a system of particles.
4. Use vectors to solve mechanics problems and Develop particle and vehicle trajectory equations
5. Calculate the motion of rigid bodies and Solving problems on engineering mechanics that arise on other modules of the course.

UNIT I — **BASICS & STATICS OF PARTICLES** — 12 hrs.

Introduction - Units and Dimensions - Laws of Mechanics - Lame's theorem, Parallelogram and triangular Law of forces - Vectors - Vectorial representation of forces and moments - Vector operations : addition, subtraction, dot product, cross product - Coplanar Forces - Resolution and Composition of forces - Equilibrium of a particle - Forces in space - Equilibrium of a particle in space - Equivalent systems of forces - Principle of transmissibility - Single equivalent force.

UNIT II — **EQUILIBRIUM OF RIGID BODIES** — 12hrs

Free body diagram - Types of supports and their reactions - Requirements of stable equilibrium Static determinacy - Moments and Couples - Moment of a force about a point and about an axis Vectorial representation of moments and couples - Scalar components of a moment - Varignon's theorem - Equilibrium of Rigid bodies in two dimensions - Equilibrium of Rigid bodies in three dimensions - Examples.

UNIT III — **FRICTION** — 12hrs

Frictional force - Laws of Coulomb friction - Simple contact friction - Belt friction - Transmission of power through belts - Wedge Friction - Screw Jack - Rolling resistance.

UNIT IV — **PROPERTIES OF SURFACES AND SOLIDS** — 12hrs

Determination of Areas and Volumes - Determination of first moment of area Centroid of sections, Second and product moments of plane area - Rectangle, circle, triangle, T section, I section, Angle section, Hollow section- Parallel axis theorem and perpendicular axis theorem - Polar moment of inertia -Product moment of inertia.

UNIT V — **DYNAMICS OF PARTICLES** — 12 hrs

Displacements, Velocity and acceleration, their relationship - Relative motion - Curvilinear motion Newton's law - Work Energy Equation of particles - Impulse and Momentum - Impact of elastic bodies.

TEXT BOOKS

1. Beer, F.P and Johnson Jr. E.R, Vector Mechanics for Engineers, Vol. 1 Statics and vol. 2 Dynamics, McGraw-Hill International Edition, 1997.
2. Rajasekaran, S, Sankarasubramanian, G., Fundamentals of Engineering Mechanics, Vikas Publishing House Pvt., Ltd., 2003.
3. Bedford and N. Fowler, Engineering Mechanics-Dynamics, Adison-Wesley

REFERENCES

1. Hibbeller, R.C., Engineering Mechanics, Vol. 1 Statics, Vol. 2 Dynamics, Pearson Education Asia Pvt. Ltd., 2000.

2. Ashok Gupta, Interactive Engineering Mechanics - Statics - A Virtual Tutor (CDROM), Pearson Education Asia Pvt., Ltd., 2002.Hill, 2001.

3. Irving H. Shames, Engineering Mechanics - Statics and Dynamics, IV Edition - Pearson EducationAsia Pvt., Ltd., 2003.

ATB101	PRODUCTION TECHNOLOGY	L	T	P	C	TCH
		3	0	0	3	3
GOAL	To introduce basic manufacturing processes and to develop theoretical skill of students					
OBJECTIVES	The course should enable the students to : 1. Learn Metal joining processes 2. Learn Casting processes. 3. Learn Metal forming/high energy rate forming. 4. Learn the processing of plastics					
EXPECTED OUTCOMES	The students should be able to : 1. Understand the various manufacturing methods employed in the Industry. 2. Get knowledge in Basic welding & finishing operations 3. Get knowledge in Hot & cold working of metals including High Energy Rate forming 4. Get knowledge in Plastic manufacturing.					
UNIT I	**METAL CASTING PROCESSES**					10 hrs.
Sand casting - Sand moulds - Type of patterns - Pattern materials - Pattern allowances- Types of Moulding sand - Properties - Core making - Methods of Sand testing - Moulding machines - Types of moulding machines - Melting furnaces - Working principle of Special casting processes - Shell, investment casting - Ceramic mould - Lost Wax process - Pressure die casting - Centrifugal casting - CO_2 process - Sand Casting defects - Inspection methods.						
UNIT II	**FABRICATION PROCESS**					10 hrs
Fusion welding processes - Types of Gas welding - Equipment's used - Flame characteristics - Filler and Flux materials - Arc welding equipment's - Electrodes - Coating and specifications - Principles of Resistance welding - Spot/butt, seam welding - Percusion welding - Gas metal arc welding - Flux cored - Submerged arc welding - Electro slag welding - TIG welding - Principle and application of special welding processes - Plasma arc welding - Thermit welding - Electron beam welding - Friction welding - Diffusion welding - Flame cutting - Weld defects - Brazing and soldering process - Methods and process capabilities - Filler materials and fluxes - Types of Adhesive bonding.						
UNIT III	**BULK DEFORMATION PROCESSES**					10 hrs
Hot working and cold working of metals - Forging processes - Open and close die forging - Characteristics of the process - Types of Forging Machines - Typical forging operations - Rolling of metals - Flat strip rolling - Types of Rolling mills - Shape rolling operations - Tube piercing - Defects in rolled parts - Principles of Extrusion - Types of Extrusion - Hot and Cold extrusion -Principle of rod and wire drawing - Equipment's used.						
UNIT IV	**SHEET METAL FORMING PROCESSES**					8 hrs
Sheet metal characteristics - Typical shearing operations, bending and drawing operations - Stretch forming operations - Formability of sheet metal - Test methods - Working principle and application of special forming processes - Hydro forming - Rubber pad forming - Metal spinning - Explosive forming - Magnetic pulse forming - Peen forming - Super plastic forming - Process characteristics.						
UNIT V	**FORMING AND SHAPING OF PLASTICS**					7 hrs
Types of plastics - Characteristics of forming and shaping processes - Moulding of Thermoplastics Working principles and typical applications of - Injection moulding - Plunger and screw machines Blow moulding - Rotational moulding - Film blowing - Extrusion - Typical industrial applications Thermoforming - Processing of Thermosets - Working principles and typical applications Compression moulding - Transfer moulding - Bonding of Thermoplastics - Fusion and solvent methods - Induction and Ultrasonic methods.						

TEXT BOOKS

1. Hajra Choudhury, Elements of Workshop Technology, Vol. I and II, Media PromotorsPvt Ltd., Mumbai, 2007
2. Serope Kalpak jain, Steven R.Schmid, Manufacturing Engineering and Technology, Pearson Education, Inc. 4th Edition, 2009.

REFERENCES

1. Elements of Manufacturing Processes, B.S. MagendranParashar& R.K. Mittal, Prentice Hall of India, 2008.
2. Manufacturing Technology, P.N. Rao, Tata McGraw-Hill Publishing Limited, 2010.
3. A text book of production technology, P.C. Sharma, S. Chand and Company, 2010.
4. Manufacturing Process - Begman, John Wilely& Sons, VIII Edition, 1999.

EEB122	BASIC ELECTRICAL & ELECTRONICS ENGINEERING	L	T	P	C	TCH
		3	1	0	4	4

GOAL	To understand basic principles underlying the behaviour of electrical circuits, electric power apparatus and measurement techniques.
OBJECTIVES	The course should enable the students : 1. To explain the basic theorems used in Electrical circuits and the different components and function of electrical machines. 2. To explain the fundamentals of semiconductor and applications. 3. To explain the principles of digital electronics 4. To impart knowledge of communication.
EXPECTED OUTCOMES	The students should be able : 1. To familiarize on the basic theorems used in Electrical circuits and the different components and function of electrical machines. 2. To acquire knowledge on the fundamentals of semiconductor and applications. 3. To gain knowledge on the principles of digital electronics 4. To develop knowledge of communication.

UNIT I	**ELECTRICAL CIRCUITS & MEASURMENTS**	12 hrs.

Ohm's Law – Kirchoff's Laws – Steady State Solution of DC Circuits –Introduction to AC Circuits – Waveforms and RMS Value – Power and Powerfactor – Single Phase and Three Phase Balanced Circuits.
Operating Principles of Moving Coil and Moving Iron Instruments (Ammetersand Voltmeters), Dynamometer type Watt meters and Energy meters.

UNIT II	**ELECTRICAL MACHINES**	12 hrs

Construction, Principle of Operation, Basic Equations and Applications of DCGenerators, DC Motors, Single Phase Transformer, single phase induction
Motor.

UNIT III	**SEMICONDUCTOR DEVICES AND APPLICATIONS**	12 hrs

Characteristics of PN Junction Diode – Zener Effect – Zener Diode and itsCharacteristics – Half wave and Full wave Rectifiers – Voltage Regulation.Bipolar Junction Transistor – CB, CE, CC Configurations and Characteristics –Elementary Treatment of Small Signal Amplifier

UNIT IV	**DIGITAL ELECTRONICS**	12 hrs

Binary Number System – Logic Gates – Boolean Algebra – Half and Full Adders– Flip-Flops – Registers and Counters – A/D and D/A Conversion (singleconcepts)

UNIT V	**FUNDAMENTALS OF COMMUNICATION ENGINEERING**	12 hrs

Types of Signals: Analog and Digital Signals – Modulation and Demodulation:Principles of Amplitude and Frequency Modulations.Communication Systems: Radio, TV, Fax, Microwave, Satellite and OpticalFibre (Block Diagram Approach only).

TEXT BOOKS:

1. Mittle N., "Basic Electrical Engineering", Tata McGraw Hill Edition, NewDelhi, 1990.
2. Sedha R.S., "Applied Electronics", S. Chand & Co., 2006.

REFERENCES:

1. Muthusubramanian R, Salivahanan S and Muraleedharan K A, "BasicElectrical, Electronics and Computer Engineering", Tata McGraw Hill,Second Edition, 2006.
2. Nagsarkar T K and Sukhija M S, "Basics of Electrical Engineering",Oxford press 2005.
3. Mehta V K, "Principles of Electronics", S.Chand& Company Ltd, 1994.
4. MahmoodNahvi and Joseph A. Edminister, "Electric Circuits", Schaum'Outline Series, McGraw Hill, 2002.
5. Premkumar N, "Basic Electrical Engineering", Anuradha Publishers,2003

ELA102	PERSONALITY DEVELOPMENT & SOFT SKILS	L	T	P	C	TCH
		3	0	0	3	3

GOAL

- To enhance holistic development of students and improve their employability skills.
- To nurture the language skills and cultivate in them the ability to indulge in rational thinking, independent decision-making and lifelong learning
- To help them become responsible members or leaders of the society in and around their workplace or living space
- to communicate successfully at the individual or group level on engineering activities with the engineering community in particular, and on multi-disciplinary activities in general, with the world at large

OBJECTIVES

The course should enable the students to

1. Develop inter personal skills and be an effective goal oriented team player.
2. Develop professionals with idealistic, practical and moral values.
3. Develop communication and problem solving skills.
4. To face the challenges in the world and enable the students excel in the world of work and life.

EXPECTED OUTCOMES

The students should be able to:

1. Have the self-confidence to improve upon their informative listening skills by an enhanced acquisition of the English language.
2. Speak English at the formal and informal levels and use it for daily conversation, presentation, group discussion and debate.
3. Read, comprehend and answer questions based on literary, scientific and technological texts.
4. Have the confidence to develop thinking skills and participate in brainstorming, mind-mapping, audiovisual activities, creative thinking and also answer tests in the job-selection processes.
5. Make right decisions , communicate effectively, and develop self-management talents , to lead a healthy and productive life.
6. Imbibe the requisite employability skills , learned skills, intuitive skills and people skills

UNIT I — **SPEAKING SKILLS** — 9 hrs

Art of Speaking- Body Language and speaking- Non Verbal communication- -Vocal Communication Techniques- Intercultural communication- The difference in Approach in five countries- Vocabulary Enrichment- Pronunciation of words- Mark the stress on appropriate syllable-split the word into syllables-Speaking as an Art-Simple Oral Interaction-Body Language and Speaking- Five characteristics of an ideal GD- group discussions - role plays- short speeches-Extempore – JAM –Debate-Talk shows-Power point presentation and speaking

UNIT II — **LANGUAGE SKILLS** — 9 hrs

Functional Grammar: Synonyms and Antonyms – Active and Passive Voice- Direct and Indirect Speech-Conditional Clauses- collocations- rearrange the jumbled sentences and make meaningful sentences- Language functions: apologising, greeting, clarifying, inviting, advising, agreeing, disagreeing, refusing, thanking, interrupting, expressing obligation, expressing preferences,CV / application letters- Job interviews-FAQ's– e- mail etiquette

UNIT III — **PEOPLE SKILLS/SOFT SKILLS** — 9 hrs

SWOT analysis- JOHARI window- Goal setting- speaking on Goals - goals to be achieved- modes of behaviour to achieve the goals-decision making-time management -stress management-power of positive attitude- leadership skills

UNIT IV — **COMPREHENSION SKILLS** — 9 hrs

Art of Listening-listening to English news- listening to debates on current issues - Listening to dialogues for general meaning and specific information- listening to toast master speeches- -cloze exercises-open comprehension questions-Art of Listening- Reading passages –interpreting in own words- reading articles in magazines/journals/newspapers- writing articles for newspaper-reporting events-completing the middle/end of a story

UNIT V — **PERSONALITY DEVELOPMENT** — 9 hrs

Define Personality- Types of Personality-Personality test-Leadership Skills - Interpersonal Skills- Team Work - Mind Mapping- concept maps- Study skills and techniques -Edward De Bono's lateral thinking-exercises-questionnaires-project

TEXT BOOK:

English for Life and the workplace through LSRW&T skills by Dr. Dolly John, Pearson Publications

REFERENCES

1. Education and Personality Development, Dr. P.K. Manoharan, APH Publishing Corporation.
2. Effective technical Communication, M. Ashraf Rizvi, Tata McGraw Hill Companies

3. Professional Speaking Skills, ArunaKoneru, Oxford University Press

4. Essential Grammar in Use, Fourth Edition by Raymond Murphy, Cambridge University Press
5. Covey Sean, Seven Habit of Highly Effective Teens, New York, Fireside Publishers, 1998.
6. Carnegie Dale, How to win Friends and Influence People, New York: Simon & Schuster, 1998.

Web links for reference for Flipped classroom sessions

1. https://owl.english.purdue.edu/exercises/28/12/33
2. http://englishplaza.vn/flexpaper/pdf/english-collocations-in-use_1405952201.pdf
3. http://www.htsb.org/wp-content/uploads/2014/07/Academic-Language-Functions-toolkit.pdf
4. http://www.intelligencetest.com/puzzles/lateral.htm
5. http://www.teachingenglish.org.uk/sites/teacheng/files/mind_map.pdf
6. http://www.teachingenglish.org.uk/article/using-mind-maps-develop-writing.
7. http://www.teachingenglish.org.uk/article/jigsaw-readingArrange
8. http://www.teachthought.com/critical-thinking/10-team-building-games-that-promote-critical-thinking
9. http://www.myenglishpages.com/site_php_files/grammar-exercise-conditionals.php
10. http://flax.nzdl.org/greenstone3/flax?a=fp&sa=collActivity&c=copyrightlaw
11. http://www.humanmetrics.com/personality/type

GEA132	ENGINEERING PRACTICES LABORATORY - II (Common to all branches)	L 0	T 0	P 3	C 1	TCH 3
GOAL	To provide the students with hands on experience on various basic engineering practices in Civil and Mechanical Engineering.					
OBJECTIVES	The course should enable the students to : 1. Relate theory and practice of basic Civil and Mechanical Engineering 2. Learn concepts of welding and machining practice 3. Learn concepts of plumbing and carpentry practice					
EXPECTED OUTCOMES	The students should be able to : 1. Identify and use of tools, Types of joints used in welding, carpentry and plumbing operations. 2. Have hands on experience on basic fabrication techniques such as carpentry and plumbing practices. 3. Have hands on experience on basic fabrication techniques of different types of welding and basic machining practices.					

LIST OF EXPERIMENTS		45 hrs.
Electrical Engineering:		6
1.	Wiring for a tube light.	
2.	Wiring for a lamp and fan.	6
3.	Staircase wiring	3
4.	Study of (i) Iron box and (ii) Fan with Regulator Electronics Engineering	6
5.	Study of Electronic components and Equipments	3
6.	Characteristics of PN junction diode & measurement of Ripple factor of half wave and full wave rectifier.	9
7.	Applications of OP-AMP - Inverter, Adder and Subtractor.	9
8.	Study and verification of Logic Gates	3

Components Required:

Electrical Engineering

Choke	2 nos
Starter	2 nos
Tubelight stand	2 nos
36W tubelight	2 nos
Fan	2 nos
40W lamp	5 nos
Single way switch	10 nos
Two way switch	5 nos
Iron box	2 nos
Fan with regulator opened	1 no (demo purpose)

Electronics Engineering

IC Trainer Kit, Resistors, Capacitors, CRO, Function Generator, Bread Board, Regulated Power Supply, Zener Diode, PN Junction Diode, Potentiometer, Digital Multimeter, Ammeter, Voltmeter, Wattmeter, IC 7408,IC 7432,IC 7486, IC 7400, IC 7404, IC 7402

TEXT BOOK

1. T. Jeyapoovan, M.Saravanapandian and S. Pranitha, Engineering Practices Lab Manual, 3rd Edition 2006, Vikas Publishing house (P) Ltd., New Delhi.

EEB145	BASIC ELECTRICAL & ELECTRONICS LABORATORY	L	T	P	C	TCH
		0	0	3	1	3
GOAL	To Impart hands-on training to the students on various types of motors and controls					
OBJECTIVES	The course should enable the students to : 1. Impart knowledge on DC Motors and its load characteristics 2. Impart knowledge on Single phase transformers 3. Impart knowledge on AC Motors and its load characteristics 4. Impart knowledge on DC & AC Starters					
EXPECTED OUTCOMES	The students should be able to : 1. Gain knowledge on DC Motors and its load characteristics 2. Acquire knowledge on Single phase transformers 3. Develop knowledge on AC Motors and its load characteristics 4. Gain knowledge on DC & AC Starters .					

LIST OF EXPERIMENTS: 45 hrs.

1. OCC and Load characteristics of separately exited DC Motor
2. OCC and Load characteristics of self exited DC Motor.
3. Load test on DC series Motor
4. Load Test on DC Shunt motor
5. Load test on single phase Induction Motor
6. Verification of Ohms Law
7. Verification of Kirchoffs current Law
8. Verification of Kirchoffs voltage Law
9. Characteristics of PN junction diode
10. Verification of Boolean Theorem.

LIST OF EQUIPMENT

1. DC Generators
2. DC Series motor
3. DC Shunt motor
4. Single Phase Induction Motor
5. PN Junction Diode
6. IC 7408,IC 7404,IC7432
7. Ammeter, Voltmeter and Resistors

CYA131	CHEMISTRY LABORATORY (Common To All Branches)	L	T	P	C	TCH
		0	0	3	1	3
GOAL	The goal of the programme is to provide a practical input towards industrial applications and for developing or modifying methods					
OBJECTIVES	To expose the students for practical training through experiments to understand and appreciate the concepts learnt in chemistry					
EXPECTED OUTCOMES	Performing the experiments related to the subjects will help the students to apply the practical knowledge in industrial applications and for developing or modifying methods					

List of Experiments — 45hrs

1. Estimation of Commercial soda by acid-base titration
2. Determination of Percentage of nickel in an alloy
3. Determination of Temporary, permanent and total hardness of water by EDTA method
4. Determination of Chloride content in a water sample
5. Potentiometric Estimation of iron
6. Conductometric Titration of a strong acid with a strong base
7. Conductometric Titration of mixture of acids.
8. Determination of Degree of polymerization of a polymer by Viscometry

List of Glassware and Equipment required for a batch of 30 students

1	Burette	(50 mL)	30 nos
2	Pipette	(20 mL)	30 nos.
3	Conical Flask	(250 mL)	30 nos
4	Distilled water bottle	(1 L)	30 nos
5	Standard flask	(100 mL)	30 nos
6	Funnel	(small)	30 nos
7	Glass rod	20 cm length	30 nos
8	Reagent Bottle	(250 mL) 30 nos.	
9	Reagent Bottle	(60 mL)	30 nos
10	Beaker	(100 mL) 30 nos	
11.	Oswald Viscometer	Glass	30 nos
12.	Measuring Cylinder	(25 mL)	30 nos
13.	Digital Conductivity Meter	PICO make	8 nos
14.	Conductivity cell	(K=1)	12 nos
15.	Digital Potentiometer	PICO make	8 nos
16.	Calomel Electrode	Glass	12 nos
17.	Platinum Electrode	Polypropylene	12 nos
18.	Burette Stands	Wooden	30 nos
19.	Pipette stands	Wooden	30 nos
20.	Retard stands	Metal	30 nos
21.	Porcelain Tiles	White	30 nos
22.	Clamps with Boss heads	Metal	30 nos

REFERENCES

1. J.Mendham, R.C. Denney, J.D. Barnes and N.J.K. Thomas, Vogel's Textbook of Quantative Chemical Analysis, 6th Edition, Pearson Education, 2004.
2. C. W. Garland, J. W. Nibler, D. P. Shoemaker, ;"Experiments in Physical Chemistry, 8th ed.," McGraw-Hill, New York, 2009.
3. S. Sumathi, Engineering Chemistry Practicals, Dhanam Publications, 2011.

SEMESTER III

MAA201	ENGINEERING MATHEMATICS- III	L	T	P	C	TCH
		3	1	0	4	4

GOAL

To provide comprehensive knowledge in engineering mathematics

OBJECTIVES

The course should enable the student to :

1. Learn techniques of solving the standard types of first and second partial differential equations.
2. Learn solving one dimensional wave equation, One and two dimensional heat equation using Fourier series.
3. Understand the problems using Fourier transform and learns their properties.
4. Understand the problems using Z – transform and learns their properties

EXPECTED OUTCOMES

The students should be able to :

1. Formulate mathematically certain practical problems in terms of partial differential equations, solve them and physically interpret the results.
2. Formulate and identify certain boundary and initial value problems encountered in engineering practices, decide on applicability of the Fourier series method of solution, solve the vibration and heat flow problems and then interpret the results.
3. Apply Fourier transform pair, their properties, with the possible special cases with attention to their applications
4. Apply the basics of Z – transform in its applicability to discretely varying functions, gained the skill to formulate certain problems in terms of difference equations and solve them using the Z – transform technique bringing out the elegance of the procedure involved.

UNIT I **PARTIAL DIFFERENTIAL EQUATIONS** 12 hrs.

Formation of partial differential equation differential equations by elimination arbitrary constant arbitrary functions – Solution of standard types of first order partial differential equations – Lagrange's linear equation – Linear partial differential equations of second and higher order with constant coefficients

UNIT II **ONE DIMENSIONAL WAVE AND HEAT FLOW** 12 hrs

Classification of second order linear partial differential equations – Solutions of one dimensional wave equation – One dimensional heat equation.

UNIT III **TWO DIMENSIONAL HEAT FLOW** 12 hrs

Steady state solution of two dimensional heat equations (Insulated edges excluded) – Fourier series solutions in Cartesian coordinates and Polar coordinates (sector, semicircle, circle and annular regions)

UNIT IV **FOURIER TRANSFORM** 12 hrs

Fourier Integral Theorem (without proof) – Fourier transform pair – Sine and Cosine transforms – Properties – Transforms of Simple functions – Convolution theorem – Parseval's identity

UNIT V **Z –TRANSFORM AND DIFFERENCE EQUATIONS** 12 hrs

Z – Transform – Elementary Properties – Inverse Z – transform – Convolution theorem – Formation of Difference equations – Solution of difference equations using z – transform

TEXT BOOK

1. M.K. Venkatraman, Mathematics, Vol – II, National Publishing Company, Chennai.
2. A.P.Santhakumaran, P.Titus, J.Xavier Pragasam, Transforms and Partial Differential Equations, Nimeric Publications

REFERENCES

1. Kandasamy. Engineering Mathematics Volume II, S. Chand & Co., New Delhi.
2. B.S. Grewal , "Engineering Maths – II, Sultem Chand, New Delhi.
3. Bali N.P & Manish Goyal, Text book of Engg. Maths, 3rd Edition, Lakshmi Publications.

ATB201	APPLIED THERMODYNAMICS	L	T	P	C	TCH
		3	1	0	4	4

GOAL

To expose the students to understand the application of thermodynamics in engineering.

OBJECTIVES

The course should enable the student to :

1. Understand the principles of thermodynamics and the applications of first and second law of thermodynamics.
2. Grasp the concepts of heat engine and heat pump
3. Understand the concept of gas power cycle,
4. Understand the vapour power cycle and refrigeration cycles.
5. Understand the concept of Steam and Jet Propulsion.

EXPECTED OUTCOMES

The students should be able to :

1. Describe the principles of first and second law of thermodynamics.
2. Apply the concept of Heat Engine and heat pump in engineering.
3. Identify and describe the gas power cycles, vapour power cycles and refrigerator cycles.
4. Describe the performance of reciprocating air compressors.
5. Apply the concepts of Steam and Jet Propulsion in real time applications

UNIT I **FIRST LAW OF THERMODYNAMICS** 12 hrs.

System, thermodynamic equilibrium, state, property, process, cycle, Zeroth law of thermodynamics, energy, work, heat, first law of thermodynamics, PMM I, ideal gases, application of first law of thermodynamics to closed and open systems, pressure - volume diagrams, steady flow process, application of steady flow energy equation.

UNIT II **SECOND LAW OF THERMODYNAMICS** 12 hrs.

Limitations of first law, statements of second law of thermodynamics, PMM II, Clausius inequality, heat engine, heat pump, refrigerator, carnot cycle, carnot theorem, entropy, temperature - Entropy diagram, entropy changes for a closed system.

UNIT III **GAS POWER CYCLES, FLUID FLOW AND VAPOUR POWER CYCLE** 12 hrs.

Air standard Brayton cycle with inter-cooling, reheating and regeneration properties of steam, one dimensional steady flow of gases and steam through nozzles and diffusers, Rankine cycle.

UNIT IV **RECIPROCATING AIR COMPRESSORS, REFRIGERATION CYCLES** 12 hrs.

Single acting and double acting air compressors, work required effect of clearance volume, volumetric efficiency, isothermal efficiency, free air delivery, multistage compression, condition for minimum work. Fundamentals of refrigeration, C.O.P., reversed Carnot cycle, simple vapour compression refrigeration system, T-S, P-H diagrams, simple vapour absorption refrigeration system, desirable properties of an ideal refrigerant

UNIT V **STEAM AND JET PROPULSION** 12 hrs.

Properties of steam, Dryness fraction, Quality of steam by steam tables and Mollier chart –Rankine cycle, Work done, Steam rate – Steam Nozzles, Types of nozzles, Friction in nozzles -Simple jet propulsion system – Thrust rocket motor – Specific impulse.

TEXT BOOKS

1. R.K.Rajput - "A Textbook of Engineering thermodynamics"- Laxmi Publications (P) Ltd, New Delhi-2001.
2. Biray K. Dutta - "Heat Transfer Principles and Applications"- Printice hall of India, New Delhi-2003
3. R.Rudramoorthy - "Thermal Engineering" - Tata McGraw Publishing Co. Ltd, New Delhi 2003
4. P.K. Nag - "Engineering Thermodynamics" Tata McGraw Hill.-2005

REFERENCES

1. R.S.Khurmi, J.K.Gupta - "A textbook of Thermal Engineering"- S.Chand& company Ltd- 2003.
2. E.Ratha Krishnan "Fundamentals of Engineering thermodynamics", Eastern Economy Edition-Prentice Hall of India Private Limited, New Delhi-110 001, 2000.
3. Yunus A. Cengel, Michael A.Boles - "Thermodynamics An Engineering approach"- Third Edition-2002.
4. Y.V.C.Rao - Heat transfer - University press, Hyderabad - 2001.

ATB202	THEORY OF MACHINES	L	T	P	C	TCH
		3	1	0	4	4
GOAL	To expose the students to understand the different mechanisms in machines.					
OBJECTIVES	The course should enable the students to: 1. Understand the various Mechanisms in machines 2. Understand the concepts of frictions in machines 3. Know about the different types of gears and its drives 4. Know about the balancing mechanisms in machine 5. Understand the application of cams, governors and gyroscopic effects					
EXPECTED OUTCOMES	The students should be able to: 1. Acquire the knowledge of different mechanisms in machines. 2. Apply the concept of friction in drives. 3. Attain the application of gears in machines 4. Attain the knowledge of Balancing in machines 5. Acquire the knowledge of Cam principles and various control mechanics.					
UNIT I	**MECHANISMS**					12 hrs.
Machine Structure – Kinematic link, pair and chain – Grublers criteria – Constrained motion – Degrees of freedom - Slider crank and crank rocker mechanisms – Inversions – Applications – Kinematic analysis of simple mechanisms – Determination of velocity and acceleration						
UNIT II	**FRICTION**					12hrs
Friction in screw and nut – Pivot and collar – Thrust bearing – Plate and disc clutches – Belt (flat and V) and rope drives. Ratio of tensions – Effect of centrifugal and initial tension – Condition for maximum power transmission – Open and crossed belt drive.						
UNIT III	**GEARS**					12hrs
Gear profile and geometry – Nomenclature of spur and helical gears – Gear trains: Simple, compound gear trains and epi-cyclic gear trains - Determination of speed and torque.						
UNIT IV	**BALANCING**					12hrs
Static and dynamic balancing – Single and several masses in different planes –Balancing of reciprocating masses- primary balancing and concepts of secondary balancing – Single and multi-cylinder engines (Inline) – Balancing of radial V engine – direct and reverse crank method.						
UNIT V	**CAM AND CONTROL MECHANISMS**					12hrs
Cams – Types of cams – Design of profiles – Knife edged, flat faced and roller ended followers with and without offsets for various types of follower motions. **Governors:** Basics of governors and its types in Automobiles. **Gyroscopes:** Gyroscopic effects in Automobiles						

TEXT BOOKS

1. Rattan.S.S, ―Theory of Machines‖, Tata McGraw–Hill Publishing Co., New Delhi, 2004.
2. Ballaney.P.L, ―Theory of Machines‖, Khanna Publishers, New Delhi, 2002.
3. R.S. Khurmi and J.K. Gupta, ―Theory of Machines‖, S.Chand&co-2005.

REFERENCES

1. Rao,J.S and Dukkipati, R.V, ―Mechanism and Machine Theory‖, Second Edition, Wiley Eastern Ltd., 1992.
2. Malhotra, D.R and Gupta, H.C., ―The Theory of Machines‖, SatyaPrakasam, Tech. India Publications, 1989.
3. Gosh, A. and Mallick, A.K., ―Theory of Machines and Mechanisms‖, Affiliated East West Press, 1989.
4. Shigley, J.E. and Uicker, J.J., ―Theory of Machines and Mechanisms‖, McGraw-Hill, 1980.
5. Burton Paul, ―Kinematics and Dynamic of Planer Machinery‖, Prentice Hall, 1979.

ATB203	AUTOMOTIVE PETROL ENGINES	L	T	P	C	TCH
		3	0	0	3	3
GOAL	To expose the students to understand the concepts on Automotive Petrol Engines and its various subcomponents along with its functions.					
OBJECTIVES	The course should enable the students to: 1. Understand the Construction and working of engine 2. Understand the Fuel and ignition system in engines 3. Know about the different types of cooling and lubrication system in engine 4. Understand the Concept of combustion chamber and combustion phenomena in engine **5.** Know about the construction and operations of two stroke engines.					
EXPECTED OUTCOMES	The students should be able to: 1. Acquire the basic knowledge of SI engine construction and working principles 2. Attain the concept of various of fuel and ignition systems 3. Gain the knowledge of cooling and lubrication systems 4. Obtain the knowledge in design of combustion chambers 5. Get the basic knowledge of two stroke engine					
UNIT I	**ENGINE CONSTRUCTION AND OPERATION**					9 hrs.
4 stroke engine - Constructional details, working principle. Otto cycle, Actual indicator diagram, Fuel air cycle. Cylinder layout and configurations. Firing order and its significance. Engine balancing. Materials for engine components.						
UNIT II	**FUEL AND IGNITION SYSTEM**					9hrs
Carburetor – requirements, working principle, types, different circuits – Compensation – Maximum power devices – Petrol injection in SI engines, Magneto coil and battery coil spark ignition system. Advance mechanism. Electronic ignition System – CDI.						
UNIT III	**COOLING AND LUBRICATION SYSTEMS**					9hrs
Need for cooling. Types of cooling system – air cooling and Liquid cooled systems. Forced circulation system, pressure cooling system, Evaporative cooling system – Need for Lubrication system. Mist lubrication system, wet & dry sump lubrication, Properties of lubricants, properties of coolant – Recent Technologies.						
UNIT IV	**COMBUSTION AND COMBUSTION CHAMBERS**					9hrs
Combustion in SI engine – Stages of combustion – Flame propagation – Rate of pressure rise – Abnormal combustion – pre ignition and knock in SI engines – effect of engine variables on knock – Combustion chambers for SI engine – Different types – Factors controlling combustion chamber design.						
UNIT V	**TWO STROKE ENGINES**					9hrs
Two stroke engine – types, terminologies, definitions, construction and operation. Comparison of four stroke and two stroke engine operation. Theoretical scavenging processes. Merits and demerits, scavenging efficiency, Scavenging pumps, Rotary valve engine.						

TEXT BOOKS:

1. Mathur and Sharma. Internal Combustion Engines, DhanpatRai and sons publications, 2003
2. Ganesan.V., Internal Combustion Engines, Tata McGraw Hill Publishing Co.,
3. John B.Heywood Fundamentals of Internal combustion engines, McGraw Hill Publishers, 1998.

REFERENCES:

1. Heldt.P.M. High Speed Combustion Engines, Oxford IBH Publishing Co., Calcutta, 1975.
2. Obert E.F., Internal Combustion Engines Analysis and Practice, International Text Books: Co., Scranton, Pennsylvania, 1988.
3. William.H.Crouse, Automotive Engines, McGraw Hill Publishers, 1985.

ATB204	AUTOMOTIVE DIESEL ENGINES	L	T	P	C	TCH
		3	0	0	3	3
GOAL	To expose the students to understand the concepts on Automotive Diesel Engines and its various subcomponents along with its functions.					
OBJECTIVES	The course should enable the students to: 1. Understand the Construction and working of engine 2. Understand the Fuel injection systems in engines 3. Know about the different types of air motion in the engine 4. Understand the Concept of super charging and turbo charging **5.** Know about the various Engine testing procedures.					
EXPECTED OUTCOMES	The students should be able to: 1. Acquire the basic knowledge of CI engine construction and working principles 2. Attain the knowledge on fuel injection systems 3. Obtain the knowledge on air motion and combustion 4. Acquire the knowledge on super chargers and turbo chargers 5. Gain the Knowledge on engine testing procedures					
UNIT I	**BASICS OF DIESEL ENGINES**					9 hrs.
Diesel engine classification, construction and operation. Two stroke and four stroke diesel engines. Diesel cycle – Fuel - air and actual cycle analysis problems. Diesel fuel properties. Ignition quality of diesel. Cetane number and cetane Index.						
UNIT II	**DIESEL FUEL SYSTEMS**					9hrs
Requirements – solid injection. Function of components – conventional fuel injection system, common rail direct injection(CRDI) - Jerk and distributor type pumps. Pressure waves, Injection lag. Unit injector. Types of injection nozzle, Nozzle tests. Electronic fuel injection. Spray characteristics. Injection timing. Pump calibration. Split and Multiple injections. Mechanical and pneumatic governors.						
UNIT III	**AIR MOTION, COMBUSTION AND COMBUSTION CHAMBERS**					9hrs
Air intake systems – Importance of air motion – Swirl, Squish and Tumble. Swirl ratio. Fuel air Mixing. Stages of combustion. Delay period – factors affecting combustion. Knock in CI Engines. Direct and indirect injection combustion chambers. Air cell chamber.Combustion chamber design – M-Combustion chamber.Combustion chambers for HCCI engines.						
UNIT IV	**SUPER CHARGERS AND TURBO CHARGERS**					9hrs
Necessity and limitation of supercharging. Thermodynamic cycle with super charging. Types of supercharging and turbocharging – Relative merits. Intercooler.Matching of turbocharger. Modification of an engine for supercharging. Effect of supercharging on engine performance. Variable geometry and variable nozzle turbocharger. E-Turbocharger.						
UNIT V	**TESTING AND PERFORMANCE**					9hrs
Automotive and stationary diesel engine testing and related standards – Engine power and Efficiencies – performance characteristics. Variables affecting engine performance – Heat Balance – Methods to improve engine performance - Introduction to Stratified charge engine, LHR engines, HCCI Engine.						

TEXT BOOKS

1. Mathur and Sharma. Internal Combustion Engines, DhanpatRai and sons publications, 2003
2. Ganesan.V., Internal Combustion Engines, Tata McGraw Hill Publishing Co.,
3. John B.Heywood Fundamentals of Internal combustion engines, McGraw Hill Publishers, 1998..

REFERENCES:

1. Heldt.P.M. High Speed Combustion Engines, Oxford IBH Publishing Co., Calcutta, 1975.
2. Obert E.F., Internal Combustion Engines Analysis and Practice,
3. Maleev, V.M., Diesel Engine Operation and Maintenance, McGraw Hill, 1974.
4. Heinz Heitzler Advanced engine tech- McGraw Hill, 2004
5. William.H.Crouse, Automotive Engines, McGraw Hill Publishers, 1985

ATB231	AUTOMOTIVE ENGINE COMPONENTS LABORATORY	L	T	P	C	TCH
		0	0	3	1	3
GOAL	To Impart and familiarize in Various Engine components and their sub systems					
OBJECTIVES	The course should enable the students to experience the skill of Study, Dismantle and Assemble the various engines and its components					
EXPECTED OUTCOMES	The students should be able to 1. Dismantle, Study and Reassemble the engine components. 2. Identify various Engine components and its sub systems					

LIST OF EXPERIMENTS

1. Dismantling, Study and Assembling of Multi Cylinder SI Engine
2. Dismantling, Study and Assembling of Multi Cylinder C I Engine
3. Study of oil filter, fuel filter, fuel injection system, carburetor
4. Study of MPFI and CRDI Systems
5. Study of Ignition Systems – Battery coil, Magneto and Electronic
6. Study of engine cooling system components
7. Study of engine lubrication system components

List of Equipment

1. Multi Cylinder SI Engine
2. Multi Cylinder CI Engine
3. Oil filter, Fuel filter, Fuel Injection System(Inline and Rotary) , carburetor
4. MPFI and CRDI Systems
5. Ignition Systems – Battery coil, Magneto and Electronic
6. Engine cooling system components
7. Engine lubrication system components

ATB232	ENGINE TESTING LABORATORY	L	T	P	C	TCH
		0	0	3	1	3
GOAL	To Familiarize the students on Various engine testing procedures					
OBJECTIVES	The course should enable the students to experience various engine testing procedures					
EXPECTED OUTCOMES	The students should be able to carry out the experiments to determine the performance characteristics of various IC Engines					

List of Experiments — 45 hrs

1. Port timing and Valve timing Diagram
2. Study of Dynamometers
3. Performance test on single cylinder SI Engine
4. Performance test on Multi cylinder SI Engine
5. Performance test on single cylinder C I Engine
6. Performance test on Multi cylinder C I Engine
7. Heat Balance test on Multi Cylinder SI Engine
8. Heat Balance test on Multi Cylinder C I Engine
9. Morse test on Multi Cylinder SI Engine
10. Retardation test on single cylinder CI Engine.

List of Equipment

1. Two Stroke Engine and Four Stroke Engine Cut Model
2. Single cylinder SI engine Test Rig
3. Multi Cylinder SI engine Test Rig
4. Single cylinder C I engine Test Rig
5. Multi Cylinder C I engine Test Rig

ATB233	MANUFACTURING TECHNOLOGY LABORATORY	L	T	P	C	TCH
		0	0	3	1	3
GOAL	To expose the students to the most widely used manufacturing processes using various manufacturing machines.					
OBJECTIVES	The course should enable the students to gain knowledge in various manufacturing techniques using different manufacturing machines					
EXPECTED OUTCOMES	The students should acquire the knowledge on manufacturing techniques to produce components.					

List of Experiment — 45 hrs

1. Milling – Polygon structure, Gear, Keyway,Helical Groove
2. Grinding- Surface ,Cylindrical ,Lapping ,Honing etc.,
3. Machining- Shaping, Step turning, Taper Turning,Center less turning, Thread Cutting
4. Multi machining operation of the single component
5. Gear Cutting –Spur, Helical etc.,

List of Equipment

1. Centre Lathes -
2. Turret and Capstan Lathe
3. Horizontal Milling Machine
4. Vertical Milling Machine
5. Surface Grinding Machine
6. Gear Hobbing Machine
7. CNC Lathe (Trainer or Industrial Type)

SSA231	APTITUDE – I	L	T	P	C	TCH
		1	0	1	1	2
PURPOSE:	The purpose of this course is to build confidence and inculcate various soft skills and to help Students to identify and achieve their personal potential.					
INSTRUCTIONAL OBJECTIVES	1.To guide thought process 2.Appear for placement aptitude tests confidently 3.To develop Communication skill 4.To build confidence 5.Acquire aptitude skills for employment					

METHODOLOGY:

The entire program is designed in such a way that every student will participate in the class room activities. The activities are planned to bring out the skills and talents of the students which they will be employing during various occasions in their real life.

1. Group Activities + Individual activities
2. Collaborative learning
3. Interactive sessions
4. Ensure participation
5. Empirical learning

LOGICAL REASONING:

Number, Letter series, Analogies- Coding, Decoding – Blood relations, direct sense,
Operator based questions – Clock & Calendars
Distribution, Binary Logic and Puzzles – Arrangements, Selections.
Routes & Networks, Comparison – Cubes & Venn Diagrams.

VERBAL ABILITY:

Critical Reasoning – Antonym, Synonym
Odd man – fill in the blank
Sentence Construction / Completion – Idiomatic expression
Detection of errors.
Jumbled sentences, Vocabulary, Alphabetical sequence, cloze passage.

EVALUATION:

1. University Theory Question paper
2. Activities assessed by both group and individual participation
3. Continuous assessment based on daily participation

SCHEME OF INSTRUCTION:

Marks allocated for regular participation in all oral activities in class.

SCHEME OF EXAMINATION:

Complete internal evaluation on regular basis.

SEMESTER IV

MAA211	NUMERICAL METHODS	L	T	P	C	TCH
		3	1	0	4	4
GOAL	To create the awareness and comprehensive knowledge in numerical solutions.					
OBJECTIVES	The course should enable the students to: 1. Learn the techniques of solving the algebraic and transcendental equations. 2. Learn to interpolate using Newton's forward and backward difference formulae for equal and unequal intervals 3. Understand the use of numerical differentiation and understands to find the approximate area using numerical integration. 4. Understand solving numerically the initial value problems for ordinary differential equations using single step and multi-step method. 5. Learn the methods of solving second order partial differential equations numerically and use it to solve initial and boundary value problems for partial differential equations.					
EXPECTED OUTCOMES	The students should be able to: 1. Find out the roots of nonlinear (algebraic or transcendental) equations, solutions of large system of linear equations by direct and indirect methods. 2. Solve problems where huge amounts of experimental data are involved, the methods discussed on interpolation will be useful in constructing approximate polynomial to represent the data and to find the intermediate values. 3. Use the numerical differentiation and integration when the function in the analytical form is too complicated or the huge amounts of data are given such as series of measurements, observations or some other empirical information. 4. Solve engineering problems which are characterized in the form of nonlinear ordinary differential equations, since many physical laws are couched in terms of rate of change of oneindependent variable 5. Solve the initial and boundary value problems related heat flow, both one and two dimensional and vibration problems. Understands the numerical techniques of solving the partial differential equation in engineering applications.					
UNIT I	**SOLUTION OF ALGEBRAIC AND TRANSCENDENTAL EQUATIONS**					12 hrs.
Linear interpolation methods (method of false position) - Newton's method - Statement of Fixed Point Theorem - Fixed point iteration: x=g(x) method. Solution of linear algebraic system of equations Direct methods - Gauss-Jordon method and Crout's method - Iterative method: Gauss-Seidel method.						
UNIT II	**INTERPOLATION AND APPROXIMATION**					12hrs
Interpolation - equal intervals - Newton's forward and backward difference formulae - problems. Interpolation-unequal intervals - Newton's divided difference formula - Lagrange's and inverse interpolation-problems.						
UNIT III	**NUMERICAL DIFFERENTIATION AND INTEGRATION**					12hrs
Numerical differentiation - Newton's forward and backward difference - Divided differences and finite differences - Numerical integration by trapezoidal and Simpson's 1/3 and 3/8 rules. Two and Three point Gaussian quadrature formulae - Double integrals using trapezoidal and Simpson's rules.						
UNIT IV	**INITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS**					12hrs
Single step methods: Taylor series method - first order-second order and simultaneous - Euler and Modified Euler methods. Fourth order Runge - Kutta method for solving first and second order equations -Multi-step methods: Milne's and Adam's predictor and corrector methods.						
UNIT V	**INITIAL AND BOUNDARY VALUE PROBLEMS FOR PARTIAL DIFFERENTIAL EQUATIONS**					12hrs
Finite difference solution of second order ordinary differential equation - classification of partial differential equations - Finite difference solution of two dimensional heat flow equations Laplace and Poisson equations. One dimensional heat equation by explicit and implicit methods - One dimensional wave equation						

TEXT BOOKS

1. Kandasamy P, Thilagavathy K, Gunavathy K, "Numerical Methods", S.Chand Co. Ltd., New Delhi, 2003.
2. Chandrasekaran A. and Beena James, "Numerical Methods", Dhanam publications, Chennai, 2011.

REFERENCES

1. Burden R.L, and Faires T.D, "Numerical Analysis", Seventh Edition, Thomson Asia Pvt. Ltd., Singapore, 2002.
2. Gerald C.F, Wheatley P.O, "Applied Numerical Analysis", Sixth Edition, Pearson Education Asia, New Delhi, 2002.
3. Balagurusamy E, "Numerical Methods", Tata McGraw-Hill Pub.Co.Ltd, New Delhi, 1999.

ATB205	SOLID MECHANICS	L	T	P	C	TCH
		3	1	0	4	4
GOAL	This Expose the Students to understand the concept of Mechanics of Solid Materials.					
OBJECTIVES	The course should enable the students to: 1. Understand the basic concept of Solid Mechanics.. 2. Understand the various stress acting on the beams 3. Study about the deflection of beams 4. Study the Significance of loading on Shaft, springs, columns. 5. Know about the Biaxial Stresses					
EXPECTED OUTCOMES	The students should be able to: 1. Acquire the knowledge on basics of Solid Mechanics 2. Attain the Knowledge of stress acting on the beams 3. Gain the knowledge of deflection of beams 4. Obtain the acquaintance in loading on Shaft, springs, columns 5. Develop the basic understanding of Biaxial Stresses					
UNIT I	**INTRODUCTION TO SOLID MECHANICS**					12 hrs.
Definition of stress, strain and their relations – Relations between material constants – Axial loading - Statically determinate and indeterminate problems in tension & compression – Plane truss analysis – method of joints – method of sections – 3-D trusses – Thermal stresses –Impact loading**.**						
UNIT II	**STRESS IN BEAMS**					12hrs
Shear force & bending moment diagrams: Bending and shear stress variation in beams of Symmetric sections, a typical spar section: Beams of uniform strength - beams of two materials.						
UNIT III	**DEFLECTION OF BEAMS**					12hrs
Double integration method – Macaulay's method – moment area method – conjugate beam Method – principle of superposition – Maxwell's reciprocal theorem**.**						
UNIT IV	**TORSION – SPRINGS- COLUMNS**					12hrs
Torsion of solid and hollow circular shafts – shear stress variation – open and closed-coiled helical springs – stresses in helical springs – classification of columns – Euler buckling –columns with different end conditions**.**						
UNIT V	**BIAXIAL STRESSES**					12hrs
Stresses in thin-walled pressure vessels – combined loading of circular shaft with bending, torsion and axial loadings – Mohr's circle and its construction – determination of principal stresses.						

TEXT BOOKS

1. Popov E.P, "Engineering Mechanics of Solids", Prentice-Hall of India, New Delhi, 1997.
2. R S Khurmi Strength of Materials, KHANNA Publications New-Delhi. 2001

REFERENCES

1. Nash W.A, Theory and problems in Strength of Materials, Schaum Outline Series, McGraw-Hill Book Co, New York, 1995
2. Kazimi S.M.A, Solid Mechanics, Tata McGraw-Hill Publishing Co, New Delhi, 1981
3. Ryder G.H, Strength of Materials, Macmillan India Ltd., Third Edition, 2002
4. Ray Hulse, Keith Sherwin & Jack Cain, Solid Mechanics, Palgrave ANE Books, 2004.
5. Singh D.K, Mechanics of Solids" Pearson Education 2002.

ATB206	FLUID MECHANICS AND MACHINERY	L	T	P	C	TCH
		3	1	0	4	4
GOAL	To familiarize the Students to understand the. Concept of fluid mechanics and its applications on machineries.					
OBJECTIVES	The course should enable the students to: 1. Understand the properties of fluids. 2. Understand the concept of fluid kinematics and dynamics 3. Know the concept of incompressible flow 4. Understand the concept of Turbo machineries					
EXPECTED OUTCOMES	The students should be able to: 1. Acquire the knowledge on properties of fluids. 2. Obtain the concept of kinematics and dynamics of fluids 3. Obtain the concept of incompressible flow 4. Develop the Knowledge on Turbo machineries.					
UNIT I	**BASIC CONCEPTS AND PROPERTIES**					12 hrs.
Fluid - definition, distinction between solid and fluid - Units and dimensions - Properties of fluids - density, specific weight, specific volume, specific gravity, temperature, viscosity, compressibility, vapour pressure, capillary and surface tension - Fluid statics: concept of fluid static pressure, absolute and gauge pressures - pressure measurements by manometers and pressure gauges.						
UNIT II	**FLIUD KINEMATICS**					12hrs
Fluid Kinematics - Flow visualization - lines of flow - types of flow - velocity field and acceleration - continuity equation (one- and three-dimensional differential forms)- Equation of streamline - stream function - velocity potential function - circulation - flow net.						
UNIT III	**FLUID DYNAMICS**					12hrs
Fluid dynamics - equations of motion - Euler's equation along a streamline - Bernoulli's equation - applications - Venturimeter, Orifice meter, Pitot tube - dimensional analysis - Buckingham's theorem- applications - similarity laws and models.						
UNIT IV	**INCOMPRESSIBLE FLUID FLOW**					12hrs
Viscous flow - Navier - Stoke's equation (Statement only) - Shear stress, pressure gradient relationship - laminar flow between parallel plates - Laminar flow through circular tubes (Hagen poiseulle's)-Hydraulic and energy gradient - flow through pipes - Darcy - weisback's equation - pipe roughness - friction factor - Moody's diagram-minor losses - flow through pipes in series and in parallel - power transmission - Boundary layer flows, boundary layer thickness, boundary layer separation - drag and lift coefficients.						
UNIT V	**HYDRAULIC TURBINES AND PUMPS**					12hrs
Turbines: Definition and classifications - Pelton turbine - Francis turbine - propeller turbine - Kaplan turbine - working principles - velocity triangles - work done - specific speed efficiencies -performance curve for turbines. Pumps: definition and classifications - Centrifugal pump: classifications, working principles, velocity triangles, specific speed, efficiency and performance curves - Reciprocating pump: classification, working principles, indicator diagram, rotary pumps: working principles of gear and vane pumps.						

TEXT BOOKS

1. Bansal, R.K., "Fluid Mechanics and Hydraulics Machines", (5th edition), Laxmipublications (P) Ltd., New Delhi, 1995.
2. Vasandani, V.P., "Hydraulic Machines - Theory and Design", Khanna Publishers, 1992.
3. Ramamirtham, S., "Fluid Mechanics and Hydraulics and Fluid Machines", DhanpaRai and Sons, Delhi, 1998.

REFERENCES

1. White, F.M., "Fluid Mechanics", Tata McGraw-Hill, 5th Edition, New Delhi, 2003.
2. Som, S.K., and Biswas, G., "Introduction to fluid mechanics and fluid machines", Tata McGraw-Hill, 2nd edition, 2004.
3. Streeter, V.L., and Wylie, E.B., "Fluid Mechanics", McGraw-Hill, 1983.
4. Kumar, K.L., "Engineering Fluid Mechanics", Eurasia Publishing House (P) Ltd., New Delhi (7^{th} edition), 1995.

ATB207	AUTOMOTIVE CHASSIS	L	T	P	C	TCH
		3	0	0	3	3

GOAL

This subject deals with the functions and constructional details of all the chassis components.

OBJECTIVES

The course should enable the students to:

1. Understand various types of layout of Chassis.
2. Understand the construction, materials and various types of front axles and steering systems
3. Know about the various Drive Line Systems
4. Conceive the significance of various Suspension Systems
5. Know about the brake systems.

EXPECTED OUTCOMES

The students should be able to:

1. Acquire the knowledge of different types of chassis.
2. Attain the concept of various front axles and steering systems
3. Gain the knowledge of various Drive line systems
4. Obtain the knowledge in Suspension system
5. 5. Develop the basic knowledge of Braking systems

UNIT I **INTRODUCTION** 9 hrs.

Types of chassis layout with reference to power plant locations and drives, vehicle frames, various types of frames, monocoque structure, constructional details, materials, testing of vehicle frames, unitized frame body construction.

UNIT II **FRONT AXLE AND STEERING SYSTEM** 9hrs

Types of front axles, construction details, materials, front wheel geometry: castor, camber, king pin inclination, toe-in. conditions for true rolling motion of wheels during steering, steering geometry, Ackermann steering system, constructional details of steering linkages, different types of steering gear boxes, steering linkages and layouts, turning radius, wheel wobble, power assisted steering, steering of crawler tractors and Electronic Steering System.

UNIT III **DRIVE LINE** 9hrs

Effect of driving thrust and torque reactions, Hotchkiss drive, torque tube drive and radius rods, propeller shaft, universal joints, front wheel drive, different types of final drive, double reduction and twin speed final drives, differential principle, construction details of differential unit, non-slip differential, differential locks, differential housings, construction of rear axles, types of loads acting on rear axles, fully floating, three quarter floating and semi floating rear axles, rear axle housing, construction of different types of axle housings, multi axle vehicles, wheels and tyres.

UNIT IV **SUSPENSION SYSTEM** 9hrs

Need of suspension system, types of suspension, suspension springs, constructional details and characteristics of leaf, coil and torsion bar springs, independent suspension, rubber suspension, pneumatic suspension, shock absorbers, semi-active and active suspension system.

UNIT V **BRAKING SYSTEM** 9hrs

Classification of brakes, drum brakes and disc brakes, constructional details, theory of braking, concept of dual brake system, parking brake, material, hydraulic system, vacuum assisted system, air brake system, antilock braking, retarded engine brakes, eddy retarders and electronic braking system.

TEXT BOOKS

1. Heldt.P.M.- "Automotive Chassis"- Chilton Co., New York- 1990
2. Steed W - "Mechanics of Road Vehicles"- Illiffe Books Ltd., London- 1960
3. NK. Giri – Automobile Engineering - Khanna Publishers – 2005

REFERENCES

Newton, Steeds and Garrotte- “The Motor Vehicles"- Butterworths, London- 2000.

ATB234	AUTOMOTIVE CHASSIS COMPONENTS LABORATORY	L	T	P	C	TCH
		0	0	3	1	3
GOAL	To Impart and familiarize in Various Chassis components and their sub systems					
OBJECTIVES	The course should enable the students to experience the skill of Study, Dismantle and Assemble the various Chassis components and its sub systems					
EXPECTED OUTCOMES	The students should be able to Dismantle, Study and Reassemble the Chassis components and its sub systems.					

List of Experiment 45 hrs

1. Study and measurement of the chassis frames:

   Heavy duty vehicle frames

   Light duty vehicle frames

2. Dismantle, study and assemble of Front Axle, Rear Axle and Differential
3. Dismantle study and assemble of various Steering systems.
4. Dismantle, study and assemble of various Braking systems – including

   Anti–Lock braking systems

5. Dismantle, study and assembling of Dependent and Independent suspension systems
6. Dismantle, study and assembling of various clutch assemblies
7. Dismantle, study and assembling of various Gear Boxes and Transfer case
8. Dismantle, study and assembling of various joints and propeller shafts.

The List of Equipment ------ Each 1 No (For a Batch of 30 Students)

1. Heavy duty vehicle chassis frame (Leyland, Tata etc)
2. Light duty vehicle chassis frame (VW, Ford , Lexus , Hyundai etc.)
3. Front axle
4. Rear axle
5. Steering system
6. Steering gear box (Rack and pinion, re-circulating ball type)
7. Hydraulic brake system
8. Air brake system
9. ABS
10. Leaf spring, coil spring, torsion bar
11. Hydraulic shock absorber
12. Clutch – Single Plate, Multi plate, Centrifugal and Semi Centrifugal
13. Gear box (light duty, heavy duty)
14. Transfer case
15. UV joint , CV Joint ,Slip joint and propeller shaft

ATB235	SOLID MECHANICS & METALLURGY LABORATORY	L	T	P	C	TCH
		0	0	3	1	3
GOAL	To familiarize the students on various material properties and testing procedures					
OBJECTIVES	The course should enable the students to gain knowledge on different metals, components and their testing procedure.					
EXPECTED OUTCOMES	The students should acquire the knowledge on mechanical properties and testing procedure of engineering materials					

List of Experiment — 45 hrs

1. Tension test on a mild steel rod
2. Double shear test on Mild steel and Aluminium rods
3. Torsion test on mild steel rod
4. Impact test on metal specimen
5. Hardness test on metals - Brinell and Rockwell Hardness Number
6. Deflection test on beams
7. Compression test on helical springs
8. Strain Measurement using Rosette strain gauge
9. Effect of hardening- Improvement in hardness and impact resistance of steels
10. Tempering- Improvement Mechanical properties Comparison
    (i) Unhardened specimen
    (ii) Quenched Specimen and
    (iii) Quenched and tempered specimen.
11. Microscopic Examination of
    i. Hardened samples and
    ii. Hardened and tempered samples.

List of Equipment

1. Universal Tensile Testing machine with double shear attachment - 40 Ton Capacity
2. Torsion Testing Machine (60 NM Capacity)
3. Impact Testing Machine (300 J Capacity)
4. Brinell Hardness Testing Machine
5. Rockwell Hardness Testing Machine
6. Spring Testing Machine for tensile and compressive loads (2500 N)
7. Metallurgical Microscopes
8. Muffle Furnace (800^{o}C)

ATB236	FLUID MECHANICS AND MACHINERY LABORATORY	L	T	P	C	TCH
		0	0	3	1	3
GOAL	To familiarize the students on performance test and characteristics curves of various hydraulic machineries					
OBJECTIVES	The course should enable the students to gain knowledge on application of Bernoulli's theorem, flow through pipes and characteristics of pumps & turbines.					
EXPECTED OUTCOMES	The students should acquire the knowledge on flow through pipes and hydraulic machineries					

List of Experiment 45 hrs

1. Determination of the Coefficient of discharge of given Orifice meter
2. Determination of the Coefficient of discharge of given Venturi meter
3. Calculation of the rate of flow using Rotameter
4. Determination of friction factor of given set of pipes
5. Conducting experiments and drawing the characteristic curves of centrifugal pump /submergible Pump
6. Conducting experiments and drawing the characteristic curves of reciprocating pump.
7. Conducting experiments and drawing the characteristic curves of Gear pump.
8. Conducting experiments and drawing the characteristic curves of Pelton wheel.
9. Conducting experiments and drawing the characteristics curves of Francis turbine.
10. Conducting experiments and drawing the characteristic curves of Kaplan turbine.

List of Equipment

1. Orifice meter setup
2. Venturi meter setup
3. Rotameter setup
4. Pipe Flow analysis setup
5. Centrifugal pump/submergible pump setup
6. Reciprocating pump setup
7. Gear pump setup
8. Pelton wheel setup
9. Francis turbine setup
10. Kaplan turbine setup

ATB237	DESIGN PROJECT -I	L	T	P	C	TCH
		0	0	8	3	-
GOAL	To provide practical knowledge on the various automotive components design and manufacturing aspects.					
OBJECTIVES	The course should enable the students to expose the knowledge on automotive design and manufacturing aspects.					
EXPECTED OUTCOMES	The students should be able to Identify the various Automotive components, materials manufacturing processes.					

Students should design and develop model of Automobile systems and validate the results. The assessment will be done on a continuous basis as follows:

Review / Exam	Weightage
First Review	10%
Second Review	20%
Third Review	20%
Final Viva- Voce	50%
TOTAL	**100%**

SSA232	APTITUDE – II	L	T	P	C	TCH
		1	0	1	1	2
PURPOSE:	The purpose of this course is to build confidence and inculcate various soft skills and to help Students to identify and achieve their personal potential					
INSTRUCTIONAL OBJECTIVES	1. To guide thought process 2. Appear for placement aptitude tests confidently 3. To develop Communication skill 4. To build confidence 5. Acquire aptitude skills for employment					

METHODOLOGY:

The entire program is designed in such a way that every student will participate in the class room activities. The activities are planned to bring out the skills and talents of the students which they will be employing during various occasions in their real life.

1. Group Activities + Individual activities
2. Collaborative learning
3. Interactive sessions
4. Ensure participation
5. Empirical learning

QUANTITATIVE APTITUDE:

Sample Equation, Ratio, Proportion, Variation
Percentage, Profit & Loss, Partnership
Averages, Mixtures, Allegations: Simple & Compound Interest
Time Work, Time Distance
Geometry & Mensuration
Permutation, Combination & Probability
Data Interpretation & Data Sufficiency

Analytical reasoning:
Non- Verbal Reasoning
Word problem

EVALUATION:

1. Activities assessed by both group and individual participation
2. Continuous assessment based on daily participation

SCHEME OF INSTRUCTION:

Marks allocated for regular participation in all oral activities in class.

SCHEME OF EXAMINATION:

Complete internal evaluation on regular basis.

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SEMESTER V

ATB301	AUTOMOTIVE TRANSMISSION	L	T	P	C	TCH
		3	0	0	3	3
GOAL	To expose the students about various automotive transmission used in vehicles.					
OBJECTIVES	The subject should enable the student to 1. Understand the working principle of various types of Clutch and Gear Box. 2. Understand the construction and working principle of Fluid Coupling & Torque Convertor. 3. Know about the various planetary gear systems and overdrives. 4. Know about the concepts of hydrostatic drive and electric drives. **5.** Understand the construction and working of the modern automatic transmissions.					
EXPECTED OUTCOMES	The students should be able to 1. Familiarize the various types of Clutch and Gear Box. 2. Acquire the knowledge on Fluid Coupling & Torque Convertor. 3. Develop the knowledge on various planetary gear systems and overdrives. 4. Gain knowledge on hydrostatic drive and electric drives. 5. Gain the information about modern automatic transmissions.					
UNIT I	**CLUTCH and GEAR BOX**					9 hrs.
Clutch: Principle, construction and working principle of single plate, multi plate, centrifugal, semi centrifugal clutches, Applications and Limitations, Clutch Materials. Gear Box: Principle, construction and working principle of sliding mesh ,constant mesh, synchromesh gear boxes, Applications and Limitations ,Gear , performance characteristics Lubrication.						
UNIT II	**HYDRODYNAMIC DRIVE**					9hrs
Fluid coupling: advantages and limitations, construction details, torque capacity, slip in fluid coupling, performance characteristics. Means used to reduce drag torque in fluid coupling. Principal of torque conversion, single, multi stage and poly-phase torque converters, performance characteristics, constructional and operational details of typical hydraulic transmission drives.						
UNIT III	**AUTOMOTIVE TRANSMISSION**					9hrs
All spur and internal gear type planetary gearboxes, Ford T-model, Cotal and Wilson Gear box, determination of gear ratios, automatic overdrives.						
UNIT IV	**HYDROSTATIC DRIVE AND ELECTRIC DRIVE**					9hrs
Hydrostatic drives: advantages and disadvantages, principles of hydrostatic drive systems, construction and working of typical hydrostatic drives, Janney Hydrostatic drive. Electrical drives: advantages and limitations, principles of Ward Leonard system of control Modern electric drive for buses and performance characteristics.						
UNIT V	**AUTOMATIC TRANSMISSION APPLICATIONS**					9hrs
Automatic transmission: relative merits and demerits when compared to conventional transmission, automatic control of gears, study of typical automatic transmissions, Ford and Chevrolet drive, automatic control of gear box, Electronically Controlled Transmission and CVT. Case study for the Transmission of Nissan, Mercedes Benz, Toyota.						
TEXT BOOKS 1. N.K.Giri Automobile Engineering ,Khanna Publishers 2005 2. Heldt P.M - Torque converters- Chilton Book Co.-1992 3. Newton and Steeds - Motor Vehicle- Illiffee Publisher- 2000						
REFERENCES 1. Design Practices, passenger Car Automotive Transmissions- SAE Hand book- 1994.						

ATB302	AUTOMOTIVE ELECTRICAL AND ELECTRONICS	L	T	P	C	TCH
		3	0	0	3	3

GOAL

To impart knowledge in Automotive Electrical and Electronics

OBJECTIVES

The course should enable the student to

1. Understand construction and working of batteries and accessories
2. Understand the construction and working of starting system.
3. Know about the working of charging system
4. Know about the concepts of automotive electronics
5. Understand the working of sensors and activators

EXPECTED OUTCOMES

The students should be able to

1. Familiarize with lead acid battery and accessories.
2. Acquire the knowledge of starting system.
3. Develop the knowledge on charging system.
4. Gain knowledge on automotive electronics.
5. Gain the information about sensors and activators.

UNIT I **BATTERIES AND ACCESSORIES** 9 hrs.

Principle and construction of lead acid battery, characteristics of battery, rating capacity and efficiency of batteries, various tests on batteries, maintenance and charging. Lighting system: insulated and earth return system, details of head light and side light, LED lighting system, headlight dazzling and preventive methods - Horn, wiper system and trafficator.

UNIT II **STARTING SYSTEM** 9hrs

Condition at starting, behavior of starter during starting, series motor and its characteristics, principle and construction of starter motor, working of different starter drive units, care and maintenances of starter motor, starter switches.

UNIT III **CHARGING SYSTEM** 9hrs

Generation of direct current, shunt generator characteristics, armature reaction, third brush regulation, cutout, Voltage and current regulators, compensated voltage regulator, alternators principle and constructional aspects and bridge rectifiers, new developments.

UNIT IV **FUNDAMENTALS OF AUTOMOTIVE ELECTRONICS** 9hrs

Current trends in automotive electronic engine management system, electromagnetic interference suppression, electromagnetic compatibility, electronic dashboard instruments, onboard diagnostic system, security and warning system.

UNIT V **SENSORS AND ACTUATORS** 9hrs

Types of sensors: sensor for speed, throttle position, exhaust oxygen level, manifold pressure, crankshaft position, coolant temperature, exhaust temperature, air mass flow for engine application. Solenoids, stepper motors, relay.

TEXT BOOKS

1. Young A.P. & Griffiths. L. "Automotive Electrical Equipment", ELBS & New Press- 1999.
2. RB Gupta, Automotive Electrical and Electronics
3. Crouse, W.H "Automobile Electrical Equipment", McGraw-Hill Book Co., Inc., New York, 3rd edition, 1986.

REFERENCES

1. Bechhold "Understanding Automotive Electronics", SAE, 1998.
2. Judge A.W "Modern Electrical Equipment of Automobiles", Chapman & Hall, London, 1992.
3. Kholi.P.L "Automotive Electrical Equipment", Tata McGraw-Hill Co., Ltd., New Delhi, 1975.
4. Robert Bosch "Automotive Hand Book", SAE (5th Edition), 2000.
5. Ganesan.V. "Internal Combustion Engines", Tata McGraw-Hill Publishing Co., New.Delhi
6. William B.Riddens "Understanding Automotive Electronics", 5th edition - Butter worth Heinemann Woburn, 1998.

ATB303	AUTOMOTIVE ENGINE COMPONENTS DESIGN	L	T	P	C	TCH
		3	1	0	4	4

GOAL	To expose the students to develop the knowledge on automotive engine components design.
OBJECTIVES	The subject should enable the student to: 1. Know about various types of materials and their properties. 2. Know about the geometrical dimensioning. **3.** Understand the design procedure of various engine components.
EXPECTED OUTCOMES	The subject should enable the student to: 1. Familiarize on various types of materials and their properties. 2. Acquire knowledge on geometrical dimensioning. 3. Develop the knowledge on design procedure of various engine components.

UNIT I	**INTRODUCTION**	12 hrs.

Engineering materials and their physical properties applied to design, selection of materials, factor of safety, endurance limit, notch sensitivity, principles of design optimization, future trends, computer aided drafting.

UNIT II	**LIMITS, FITS, TOLERANCES, SURFACE FINISH, SHAFTS AND SPRINGS**	12hrs

Definitions, types of tolerances and fits, design considerations for interference fits, surface finish, surface roughness, design of power transmission shafts, design of helical springs.

UNIT III	**DESIGN OF CYLINDER AND PISTON**	12hrs

Choice of material for cylinder and piston, piston friction, piston slap, design of cylinder, piston, piston pin, piston rings, piston failures, lubrication of piston assembly.

UNIT IV	**DESIGN OF CONNECTING ROD, CRANKSHAFT**	12hrs

Material for connecting rod, determining minimum length of connecting rod, small end and big end design, shank design, design of big end cap bolts, connecting rod failures, balancing of I.C. Engines, significance of firing order, material for crankshaft, design of crankshaft under bending and twisting, balancing weight calculations.

UNIT V	**DESIGN OF VALVES AND FLYWHEEL**	12hrs

Design aspects of intake and exhaust manifolds, inlet and Exhaust valves, valve springs, tappets, valve train. Materials and design of flywheel.

TEXT BOOKS

1. R.K. Jain, "Machine Design", Khanna Publishers, New Delhi, 1997.
2. "Design Data Book", PSG College of Technology, Coimbatore, 2000.
3. P.M.Heldt "High Speed Combustion Engines", Oxford-IBH Publishing Co., Calcutta, 1965.

REFERENCES

1. A.Kolchin and V.Demidov, "Design of Automotive Engines", MIR Publishers, Moscow, 1984.
2. Sundararaja Murthy T.V "Machine Design", Khanna Publishers, New Delhi, 1991.
3. R.S.Khurmi, Machine design.

MSB331	AUTOMOTIVE DESIGN AND STYLING LABORATORY	L	T	P	C	TCH
		0	0	3	1	3
GOAL	To expose the students on automotive design, sketching and styling of the interior and exterior of the vehicle.					
OBJECTIVES	The subject should enable the student to: 1. Know about various automotive design and styling techniques.					
EXPECTED OUTCOMES	The subject should enable the student to: 1. Acquire the Knowledge on various automotive design and styling techniques like ethnography, ergonomics, conceptual ideas etc.,					

List of Experiment — 45 hrs.

1.Introduction to Automotive design

History of Automotive design, Car design brands and brand values and

Brand history and Styling DNA

2.Ethnography and User experience study

User research and Lifestyle and Market study and segmentation

3.Ergonomics and Packaging study

Technical packaging, Current trends in Innovation & Comfort and Safety

4.Conceptualizing ideas

Fundamentals of sketching, Creativity and Ideation and Physical modelling Workshops

5.Digital tools in Automotive design

Adobe Illustrator and Photoshop, Polygon Modelling - 3ds max and Maya

NURBS modelling - Autodesk Alias Automotive

6.Design Portfolio

Portfolio layouts, Presentation and Communication skills

LIST OF EQUIPMENT:

1. Computer Nodes
2. Software Like 3ds Max, Maya, Autodesk Alias, Adobe Illustrator And Photoshop Etc.,

ATB331	AUTOMOTIVE ELECTRICAL AND ELECTRONICS LABORATORY	L	T	P	C	TCH
		0	0	3	1	3
GOAL	To expertise the students on different automotive electrical and electronic systems.					
OBJECTIVES	The course should enable the students to : 1. Understand the various testing procedures of Battery, Alternator and Starter motor. 2. Know about Diagnosis of ignition system and automotive electrical wiring. 3. Analyze the Off Board Diagnostics Systems (OBDS) procedure. 4. Know about the rectifier, IC timer and microprocessor 8085. **5.** Know about ALP program, Interfacing and data acquisition using 8085 MEL Kit					
EXPECTED OUTCOMES	The students should be able to : 1. Familiarize with various testing procedures of Battery, Alternator and Starter motor. 2. Acquire the Diagnosis of ignition system and automotive electrical wiring. 3. Develop the Skills on Off Board Diagnostics Systems (OBDS) procedure. 4. Gain the knowledge about the rectifier, IC timer and microprocessor 8085. 5. Acquire the skill on ALP program, Interfacing and data acquisition using 8085 MEL Kit					

List of Experiment — 45 hrs.

Electrical

1. Battery testing
2. Alternator testing.
3. Starter motor testing.
4. Diagnosis of ignition system.
5. Diagnosis of automotive electrical wiring.
6. Fault finding of relay & fuses in car using Off Board Diagnostics Systems (OBDS).
7. Relay & fuser Fault diagnostic of a car using OBDS

Electronics

1. Characteristics of rectifier
2. Study of IC timer
3. Study of Microprocessor 8085
4. Simple ALP program using 8085 MEL Kit
5. Data acquisition from sensors using 8085 MEL Kit
6. Interfacing of stepper motor with 8085 MEL Kit
7. Fault finding location of sensor in car using OBDS

List of Equipment

i. Battery, hydrometer, voltage tester
ii. Starter motor, regulator, cutout relay
iii. Distributor, ignition coil, spark plug
iv. Auto electrical wiring system
v. Rectifiers, filters
vi. Amplifier
vii. IC timer
viii. Data logger
ix. 8085 MEL kit.
x. OBDS kit.

ATB332	AUTOMOTIVE FUELS AND LUBRICANTS LABORATORY	L	T	P	C	TCH
		0	0	3	1	3
GOAL	To Expose the students on various testing methods of fuels and lubricants					
OBJECTIVES	The course should enable the students to Know the different properties of fuels and lubricants.					
EXPECTED OUTCOMES	The students should be familiar with testing procedures on fuels and lubricants using various equipment.					

List of Experiments — 45 hrs.

1. Temperature dependence of viscosity of lubrication oil by Redwood viscometer.
2. Viscosity index of lubricating oil by Say bolt viscometer
3. Flash and fire points of fuels/lubricants.
4. ASTM distillation test of gasoline
5. Drop point of grease
6. Mechanical penetration in grease.
7. Aniline distillation test of gasoline
8. Reid vapor pressure test.
9. Copper strip corrosion
10. Cloud and pour point of fuel
11. Carbon residue of fuel
12. Study and determination of Calorific Value & properties of Fuels.

List of Equipment

1. Redwood Viscometer
2. Say bolt Viscometer
3. Flash and Fire point apparatus
4. ASTM distillation test apparatus
5. Mechanical penetration apparatus for grease
6. Aniline distillation test apparatus
7. Reid vapor pressure test apparatus
8. Drop point of grease apparatus
9. Bomb Calorimeter
10. Copper strip corrosion apparatus.
11. Cloud and pour point tester.
12. Carbon residual apparatus.

ATB337	TWO AND THREE WHEELER LABORATORY	L	T	P	C	TCH
		0	0	3	1	3
GOAL	The students will be able to understand the constructional details operating characteristics , vehicle design aspects, maintenance and rectifying of faults of Two wheelers and Three Wheelers					
OBJECTIVES	1. Road performance test of a two wheeler using chassis dynamometer. 2. Performance test of a shock absorber. 3. Performance test on coil spring. 4. Understand the slackness of chain. 5. Brake and Clutch adjustment as per specification for 2& 3 Wheelers 6. Dismantling and assembling of 2& 3 wheeler gear box and finding gear ratio. 7. Dismantling and assembling of three wheeler steering system. 8. Study of three wheeler chassis frame and power transmission system.					
EXPECTED OUTCOMES	1. Analyse the various testing procedure of Two Wheelers using Chassis Dynamometer and measuring the output from dynamometer. 2. Find the performance of Shock Absorber by using Shock Absorber Test Rig. 3. Find the performance of Coil Spring by using Coil Spring Test Rig 4. Find the slackness of chain and rectifying it by using Tension test elongation apparatus 5. Rectify the fault of Brake and Clutch by using suitable puller and Feeler gauge 6. Know the procedure of using suitable tools to dismantle & assemble of gearbox of 2&3 wheelers and drawing of power flow diagram from Input shaft to output shaft. 7. Know the procedure of using suitable tools to dismantle & assemble three wheeler steering system and rectifying it. 8. Know about various chassis construction details of Three wheelers and various types power transmission systems from gear box to drive wheels.					

List of Experiments — 45 hrs.

1. Road performance test of a two wheeler using chassis dynamometer.
2. Performance test of a shock absorber.
3. Performance test on coil spring
4. Two wheeler chain tension test.
5. Brake and Clutch adjustment as per specification.
6. Dismantling and assembling of two wheeler gear box and finding gear ratio.
7. Dismantling and assembling of three wheeler gear box and finding gear ratios.
8. Three wheeler brake and clutch play adjustment
9. Dismantling and assembling of three wheeler steering system.
10. Study of three wheeler chassis frame and power transmission system.

List of Equipment

a. Two wheeler chassis dynamometer - 1 No.

b. Shock absorber test rig - 1 No.

c. Two-wheeler gearbox - 2 Nos.

d. Two-wheeler clutch - 2 Nos.

e. Three-wheeler brake assembly - 2 Nos.

f. Three-wheeler steering assembly - 2 Nos.

g. Three-wheeler gear box - 2 Nos.

ATB333	DESIGN PROJECT -II	L	T	P	C	TCH
		0	0	8	2	-
GOAL	To expose the students with hands on experience in an Automotive Engineering Industry.					
OBJECTIVES	The course should enable the students to 1. Get an exposure of an organization. 2. Relate the theoretical concepts and organization functions. 3. Learn the real life applications of engineering and management.					
EXPECTED OUTCOMES	The students should able to 1. Gain the knowledge on various organizational functions. 2. Acquire the theoretical concepts and organization functions. 3. Attain the real life applications of engineering and management.					

Students should undergo Industrial training in reputed Industries for a period of 2 weeks (minimum) during the vacation period at the end of 4th semester. Examination will be conducted along with the 5th semester as practical subjects. Students should prepare a Report and do presentation along with viva voce for the examination.

Reference			
Date of BOS Approval :	7.11.2015	**Date of Academic Council Approval**	20.11.2015

ELA331- Communication Skills & Personality Development (Lab)

(Common to all Undergraduate Third-year Branches)

SEMESTER V / VI – 2015-2016

L	T	P	C
0	0	2	1

UNIT – I **9**

Listening and typing – Listening and sequencing of sentences – Filling in the blanks – Listening and answering the questions - Filling in the blanks - Cloze Exercises – Vocabulary building – Reading and answering questions.

UNIT – II **9**

Phonetics: Intonation – Ear Training – Correct Pronunciation – Sound recognition exercises -Common Errors in English - Conversations: Face to Face Conversation - Telephone conversation–Role play activities (Students take on roles and engage in conversation)

UNIT – III **9**

Resume / Report presentation / Letter writing - Structuring the resume / report – Letter writing / E-mail communication Samples, Presentation Skills - Elements of an effective presentation – Structure of a presentation – Presentation tools – Voice Modulation – Audience analysis – Body Language – Video Samples

UNIT – IV **9**

Soft Skills - Time Management – Articulativeness – Psychometrics – Innovation and Creativity – Stress Management & Poise – Video Samples, Group Discussion - Why is GD part of selection process? – Structure of a GD – Moderator – led and other GDs – Strategies in GD – Team work – Body Language – Mock GD – Video Samples

UNIT – V **9**

Interview Skills - Kinds of Interviews – Required key Skills – Corporate culture – Mock Interviews – Video Samples

References:

Books:

1. Meenakshi Raman and Sangeetha Sharma: Technical Communication – Principles and Practice, Oxford University Press, New Delhi (2004)
2. Barker. A –Improve your communication Skills – Kogan Page India Pvt. Ltd., New Delhi (2006)
3. John Seely, The Oxford Guide to writing and speaking. Oxford University Press, New Delhi (2004).
4. M. Ashraf Rizan: Effective technical communication, Tat Mcgraw Hill company Ltd (2005)

CD's

1. Communication skills Software by Globarena
2. Train2success series: 1. Telephone Skills, 2. Interview Skills, 3. Negotiation Skills by Zenith Global Consultants Ltd, Mumbai
3. 21 Steps to Personality Development by SP software (P) Ltd, Hyderabad.

Mode of Examination: **Online examination, Group Discussion and Presentation**

SEMESTER VI

ATB304	AUTOMOTIVE CHASSIS DESIGN	L	T	P	C	TCH
		3	1	0	4	4

GOAL

To expose the students to develop the knowledge on Automotive Chassis components design.

OBJECTIVES

The course should enable the student to

1. Learn design calculation of various types of clutches.
2. Understand the performance of vehicles and design of gear box.
3. Study various loads, moments and stresses on frame members and suspensions.
4. Learn the details about front axle and steering systems.
5. Understand the design of final drive and rear axle.

EXPECTED OUTCOMES

The subject should enable the student to:

1. Acquire the knowledge on design of various types of clutches.
2. Familiarize on the performance of vehicles and design of gear box.
3. Attain knowledge on various loads, moments and stresses on frame members and suspensions..
4. Obtain the design details of front axle and steering systems.
5. Gain the knowledge of final drive and rear axle design.

UNIT I — **CLUTCH DESIGN** — 12 hrs.

Design of single plate clutch, multi plate clutch, design of centrifugal clutch, cone clutch, energy dissipated, torque capacity of clutch, design of clutch components, design details of roller and sprag type of clutches.

UNIT II — **GEAR BOX DESIGN** — 12hrs

Performance of vehicle, total resistance to motion, traction and tractive effort, acceleration, calculation of gear ratio, design of three speed gear box, design of four speed gear boxes.

UNIT III — **VEHICLE FRAME AND SUSPENSION DESIGN** — 12hrs

Study of loads, moments and stresses on frame members, computer aided design of frame for passenger and commercial vehicles, computer aided design of leaf springs, coil springs and torsion bar springs.

UNIT IV — **FRONT AXLE AND STEERING SYSTEMS DESIGN** — 12hrs

Analysis of loads, moments and stresses at different sections of front axle, determination of loads at kingpin bearings, wheel spindle bearings, choice of bearings, determination of optimum dimensions and proportions for steering linkages ensuring minimum error in steering.

UNIT V — **FINAL DRIVE AND REAR AXLE DESIGN** — 12hrs

Design of propeller shaft, design details of final drive gearing, design details of full floating, semi-floating and three quarter floating rear shafts and rear axle housings.

TEXT BOOKS

1. Giri.N.K- "Automobile Mechanics"- Khanna Publisher, New Delhi- 2002
2. Heldt.P.M - "Automotive Chassis"- Chilton Co., New York- 1992
3. PSG DESIGN DATA BOOK – PSG College Of Technology 2009.

REFERENCES

1. Steeds. W -"Mechanics of Road Vehicles"- Illiffe Books Ltd., London- 1990
2. Giles.K.G - Steering, Suspension and tyres"- Illiffe Books Ltd., London - 1988
3. Newton Steeds & Garret- "Motor Vehicle"- Illiffe Books Ltd., London - 2000
4. Heldt.P.M- "Torque converter" - Chilton Book Co., New York - 1982
5. Dean Averns - "Automobile Chassis Design"- Illiffe Books Ltd - 1992

ATB305	VEHICLE DYNAMICS	L	T	P	C	TCH
		3	1	0	4	4
GOAL	To expose the students in the field of Vehicle Dynamics.					
OBJECTIVES	The course should enable the student to 1. Learn basic concepts of vibration. 2. Know about the tyres and its characteristics 3. Understand the behavior of vehicle Vertical and Longitudinal dynamics. 4. Know various lateral handling characteristics of the vehicles.					
EXPECTED OUTCOMES	The course should enable the student to 1. Familiarize basic concepts of vibration. 2. Attain the knowledge on tyres and its characteristics 3. Acquire the knowledge towards the behavior of vehicle Vertical and Longitudinal dynamics. 4. Gain knowledge in various lateral handling characteristics of the vehicles					
UNIT I	**BASIC CONCEPTS OF VIBRATION**					12 hrs.
Definitions, Modelling and Simulation, Global and Vehicle Coordinate System, Free, Forced, Undamped and Damped Vibration, Response Analysis of Single DOF, Two DOF, Multi DOF, Magnification factor, Transmissibility, Vibration absorber.						
UNIT II	**TYRES**					12hrs
Tyre forces and moments, Tyre structure, Longitudinal and Lateral force at various slip angles, rolling resistance, Tractive and cornering property of tyre. Performance of tyre on wet surface. Ride property of tyres. Magic formulae tyre model, Estimation of tire road friction. Test on Various road surfaces. Tyre vibration.						
UNIT III	**VERTICAL DYNAMICS**					12 hrs
Human response to vibration, Sources of Vibration. Design and analysis of Passive, Semi-active and Active suspension using Quarter car, half car and full car model. Influence of suspension system and tire stiffness. Control law for LQR, H-Infinite, Skyhook damping. Air suspension system and their properties.						
UNIT IV	**LONGITUDINAL DYNAMICS**					12hrs
Tyre forces, Load distribution for three wheeler and four wheeler. Calculation of Maximum acceleration, Reaction forces for Different drives. Braking and Driving torque. Prediction of Vehicle performance.ABS, stability control, Traction control.						
UNIT V	**LATERAL DYNAMICS**					12hrs
Steady state handling characteristics.Steady state response to steering input.Testing of handling characteristics. Transient response characteristics, Direction control of vehicles. Roll centre, Roll axis, Vehicle under side forces. Stability of vehicle on banked road, during turn.						

TEXT BOOK

1. Singiresu S. Rao, Mechanical Vibrations (5th Edition), Prentice Hall, 2010
2. J. Y. Wong, Theory of Ground Vehicles, 3rd Edition, Wiley-Interscience, 2001
3. Rajesh Rajamani, Vehicle Dynamics and Control, 1st edition, Springer, 2005
4. Thomas D. Gillespie, Fundamentals of Vehicle Dynamics, Society of Automotive Engineers Inc, 1992

REFERENCES

1. Dean Karnopp, Vehicle Stability, 1st edition, Marcel Dekker, 2004
2. G. NakhaieJazar, Vehicle Dynamics: Theory and Application, 1st edition, Springer, 2008
3. Michael Blundell & Damian Harty, The Multibody Systems Approach to Vehicle Dynamics, Elsevier Limited, 2004
4. Hans B Pacejka, Tire and Vehicle Dynamics, 2nd edition, SAE International, 2005
5. John C. Dixon, Tires, Suspension, and Handling, 2nd Edition, Society of Automotive Engineers Inc, 1996

ATB 306	CONTROL SYSTEMS	L	T	P	C	TCH
		3	1	0	4	4

GOAL

To expose the students on basic concepts of control system theory and design.

OBJECTIVES

The course should enable the student to

1. Understand the methods of representation of control systems and their transfer function
2. Provide adequate knowledge in the time response of systems and steady state error analysis.
3. Give basic knowledge on frequency responses of systems
4. Understand the concept of stability of control system and methods of stability analysis.
5. Study the state space analysis

EXPECTED OUTCOMES

The students should be able to

1. Familiarize with various methods of representation of control systems and their transfer function.
2. Apply time response analysis and determine steady state error.
3. Analyze the stability of the system using frequency response plots
4. Obtain the stability of the system by applying various stability criterion.
5. Familiarize with Design of state space equation in various forms.

UNIT I — **SYSTEMS AND THEIR REPRESENTATION** — 12 hrs.

Basic elements in control systems – Open and closed loop systems – Electrical analogy of mechanical and thermal systems – Transfer function – Synchros – AC and DC servomotors – Block diagram reduction techniques – Signal flow graphs.

UNIT II — **TIME RESPONSE** — 12hrs

Time response – Time domain specifications – Types of test input – I and II order system response – Error coefficients – Generalized error series – Steady state error – P, PI, PID modes of feedback control.

UNIT III — **FREQUENCY RESPONSE** — 12hrs

Frequency response – Bode plot – Polar plot. Determination of closed loop response from open loop response – Correlation between frequency domain and time domain specifications.

UNIT IV — **STABILITY OF CONTROL SYSTEM** — 12hrs

Characteristics equation – Location of roots in S plane for stability – Routh Hurwitz criterion – Root locus construction – Effect of pole, zero addition – Gain margin and phase margin – Nyquist stability criterions.

UNIT V — **STATE SPACE ANALYSIS** — 12hrs

Introduction to State Space Analysis – Phase variable and Canonical Forms – State Transition Matrix – Solutions to state space equation – Discretization of state space equation, controllability and observability of systems.

TEXT BOOKS

1. K. Ogata, ―Modern Control Engineering‖, 5th edition, Pearson Education, New Delhi, 2009 / PHI
2. I.J. Nagrath& M. Gopal, ―Control Systems Engineering‖, New Age International Publishers,2003.
3. AshishTewari, ―Modern Control Design with Matlab-Simulink, John Wiley, New Delhi 2002

REFERENCES

1. B.C. Kuo, ―Automatic Control Systems‖, Prentice Hall of India Ltd., New Delhi, 1995.
2. M. Gopal, ―Control Systems, Principles & Design‖, Tata McGraw Hill, New Delhi, 2002.
3. M.N. Bandyopadhyay, ―Control Engineering Theory and Practice‖, Prentice Hall of India, 2003.
4. M. Gopal, ―Modern Control System Theory‖, New Age International Publishers, 2002.

ATB334	COMPUTER AIDED ENGINE AND CHASSIS DESIGN LABORATORY	L	T	P	C	TCH
		0	0	3	1	3
GOAL	To expose the students towards enhancing knowledge on Computer aided Engine and Chassis design.					
OBJECTIVES	The course should enable the students to : 1. Know about the Designing and drafting of engine components such as piston, connecting rod, crankshaft, valves, camshaft and flywheel etc. 2. Understand the designing and drafting of clutch, gear box, bearings etc.					
EXPECTED OUTCOMES	The students should be able to : 1. Develop the skill on Designing and drafting of engine components such as piston, connecting rod, crankshaft, valves, camshaft and flywheel etc. 2. Develop the skill on designing and drafting of clutch, gear box, bearings etc					

List of Experiments — 45 hrs.

1. Design and drawing of piston, piston pin and piston rings and drawing of these Components.
2. Design of connecting rod small end and big end, shank design, design of big end cap, bolts and drawing of the connecting rod assembly
3. Design of crankshaft.
4. Design and drawing of flywheel. Design and drawing of the inlet and Exhaust valves.
5. Design of cam and camshaft, cam profile generation, drawing of cam and camshaft.
6. Complete design of clutch components
7. Assembly drawing of clutch using drafting software
8. Gear train calculations
9. Selection of bearings
10. Assembly drawing of gear box using drafting software.

List of Equipment

1. Computer Nodes
2. Software like PRO-E, CATIA, etc**..**

ATB335	VEHICLE DYNAMICS LABORATORY	L	T	P	C	TCH
		0	0	3	1	3
GOAL	To expose the students on the basics of vibration characteristics of the mechanical and Automotive components.					
OBJECTIVES	The course should enable the student to : 1. Understand the concept of Vibration, Gyroscopic effect and analysis of Automotive components. 2. Know about the software like MATLAB-SIMULINK,					
EXPECTED OUTCOMES	The students should be able to : 1. Attain the knowledge on Vibration, Gyroscopic effect and analysis of Automotive components. 2. Familiarize with software like MATLAB-SIMULINK					

List of Experiments — 45 hrs.

1. Testing of Natural frequency
2. Whirling of shafts
3. Modal analysis of Automotive components
4. Introduction to MATLAB-Simulink and solving MCK problems
5. Gyroscopic Effect
6. Tyre Testing
7. Modal analysis of Car

List of Equipment

1. Data Acquisition system – with various sensors, Microphone
2. Vibration Shaker
3. Impulse Force Hammer
4. Analysis Software like Dew soft, Minitab, LabVIEW, Matlab etc.
5. Whirling of shaft apparatus
6. Gyroscopic couple equipment
7. Tyre test rig
8. Quarter Car Model, Half car model and full car model Dynamometer.
9. Vehicle frames like two wheeler, three wheeler and four wheeler.

ATB336	CONTROL SYSTEMS LABORATORY	L	T	P	C	TCH
		0	0	3	1	3
GOAL	To provide a platform for understanding the basic concepts of control theory and its application					
OBJECTIVES	The course will enable the students to 1. Determine the transfer function parameters of AC servomotor 2. Simulate type-0 and type-1 system. 3. Simulate linear systems and nonlinear systems using digital simulation 4. Design of P, PI and PID controllers **5.** Learn Stability analysis of linear systems.					
EXPECTED OUTCOMES	The student should be able to 1. Familiarize the transfer function parameters for any type of system 2. Acquire and Simulate(Digital and Analog)time response characteristics oftype-0 and type-1 system 3. Develop skill on linear and nonlinear Systems design 4. Familiarize with stability Analysis of the linear system.					

List of Experiments — 45 hrs.

1. Determination of transfer function parameters of AC servomotor
2. Analog simulation of type-0 and type-1 system.
3. Digital simulation of linear systems and non-linear systems
4. Design and implementation of compensators.
5. Design of P, PI and PID controllers.
6. Stability analysis of linear systems.

List of Equipment

1. AC Servomotor
2. DC Motor
3. Rheostat
4. Ammeter
5. Voltmeter
6. Single Phase Auto Transformer
7. RPS
8. Resistor
9. Inductor
10. Capacitor
11. IC 741
12. Multimeter
13. PC with MatLab

<table>
<tr><td>SSA331</td><td>Placement Preparatory Program-I</td><td>L</td><td>T</td><td>P</td><td>C</td><td>TCH</td></tr>
<tr><td></td><td></td><td>1</td><td>0</td><td>1</td><td>1</td><td>2</td></tr>
<tr><td>PURPOSE</td><td colspan="6">The purpose of this course is to build confidence and inculcate various soft skills and to help Students to identify and achieve their personal potential.</td></tr>
<tr><td>INSTRUCTIONAL OBJECTIVES</td><td colspan="6">At the end of the course the students will be able to
1. Acquire the important soft skills for employment
2. Take part is group discussions and job interviews confidently
3. Gain self confidence to face the placement process.</td></tr>
<tr><td>METHODOLOGY</td><td colspan="6">The entire program is designed in such a way that every student will participate in the class room activities. The activities are planned to bring out the skills and talents of the students which they will be employing during various occasions in their real life.
1. Group activities + individual activities.
2. Collaborative learning.
3. Interactive sessions.
4. Ensure Participation.
5. Empirical Learning.
• Resume writing
• SWOT Analysis
• Interview techniques
• Presentation Skills
• Body Language for Interview
• Rules of Group Discussion
• FAQ’s</td></tr>
<tr><td colspan="7">EVALUATION
1. Activities assessed by both group and individual participation
2. Continuous assessment based on daily participation
SCHEME OF INSTRUCTION
Marks allocated for regular participation in all oral activities in class.
SCHEME OF EXAMINATION
Complete internal evaluation on a regular Basis.</td></tr>
</table>

SEMESTER VII

ATB401	VEHICLE DIAGNOSTICS	L	T	P	C	TCH
		3	0	0	3	3

GOAL

To enhance the student's knowledge on life cycle improvement of the Automotive vehicles

OBJECTIVES

The course will enable the students to

1. Know about the vehicle maintenance procedures
2. Understand the maintenance procedures for various engine component and chassis component systems
3. Understand the maintenance procedures for various Electrical component and accessories.

EXPECTED OUTCOMES

The student should be able to

1. Familiarize on vehicle maintenance procedures
2. Gain knowledge in maintenance procedures for various engine component and chassis component systems
3. Acquire the knowledge in maintenance procedures for various Electrical component and accessories.

UNIT I — **MAINTENANCE OF RECORDS AND SCHEDULES** — 9 hrs.

Importance of maintenance, preventive (scheduled) and breakdown (unscheduled) maintenance, requirements of maintenance, preparation of check lists. Inspection schedule, Maintenance of records, log sheets and other forms, safety precautions in maintenance.

UNIT II — **ENGINE MAINTENANCE - REPAIR AND OVERHAULING** — 9hrs

Dismantling of engine components and cleaning, cleaning methods, visual and dimensional inspections, minor and major reconditioning of various components, reconditioning methods, engine assembly, special tools used for maintenance overhauling, engine tune up.

UNIT III — **CHASSIS MAINTENANCE - REPAIR AND OVERHAULING** — 9hrs

Mechanical and automobile clutch and gear box, servicing and maintenance, maintenance servicing of propeller shaft and differential system. Maintenance servicing of suspension systems. Brake systems, types and servicing techniques. Steering systems, overhauling and maintenance. Wheel alignment, computerized alignment and wheel balancing.

UNIT IV — **ELECTRICAL SYSTEM MAINTENANCE - SERVICING AND REPAIRS** — 9hrs

Testing methods for checking electrical components, checking battery, starter motor, charging systems, DC generator and alternator, ignitions system, lighting systems. Fault diagnosis and maintenance of modern electronic controls, checking and servicing of dash board instruments.

UNIT V — **MAINTENANCE OF FUEL SYSTEM, COOLING SYSTEMS, LUBRICATION SYSTEMAND VECHICLE BODY** — 9hrs

Servicing and maintenance of fuel system of different types of vehicles, calibration and tuning of engine for optimum fuel supply. Cooling systems, water pump, radiator, thermostat, anti-corrosionand antifreeze additives. Lubrication maintenance, lubricating oil changing, greasing of parts.Vehicle body maintenance, Minor and major repairs. Door locks and window glass actuating system maintenance.

TEXT BOOK

1. John Duke "Fleet Management", McGraw-Hill Co. 1984.

REFERENCE

1. James D Halderman - Advanced Engine Performance Diagnosis - PHI - 1998.
2. Service Manuals from Different Vehicle Manufacturers.

ATB402	FINITE ELEMENT METHODS IN AUTOMOBILES	L	T	P	C	TCH
		3	1	0	4	4

GOAL	To enhance the student's knowledge on applications of finite element methods in Automobiles
OBJECTIVES	The course will enable the students to **1.** Know the basic concept of finite element methods 2. Understand the procedure of static and dynamic analysis 3. Learn the Heat transfer and fluid flow problem in 1D and 2D approach 4. Know the application of finite element method in Automobiles
EXPECTED OUTCOMES	The student should be able to **1.** Familiarise the basic concept of finite element methods 2. Acquire the knowledge on static and dynamic analysis procedure. 3. Develop the skill on approaching the Heat transfer and fluid flow problems. 4. Gain knowledge on application of finite element method in Automobiles

UNIT I	**INTRODUCTION**	9 hrs.

Engineering design analysis-meaning and purpose. Basic concepts of FEM. Advantages and limitations of FEM. Test for convergence. Element choice. Commercial finite element packages-organization-advantages and limitations.Raleigh Ritz's, Galerkin and finite difference methods- Governing equation and convergence criteria of finite element method.

UNIT II	**STATIC ANALYSIS**	9hrs

Formulation of element stiffness matrices-1D bar and beam elements. Plane stress, Plane strain and axisymmetric problems, constant and linear strain triangular elements, stiffness matrix, axisymmetric load vector, quadrilateral elements, Isoperimetric elements. Treatment of boundary condition. Numerical Integration.

UNIT III	**DYNAMIC ANALYSIS**	9hrs

Equations of motion for dynamic problems. Consistent and lumped mass matrices. Formulation of element mass matrices. Free vibration problem formulation. Torsion problems.

UNIT IV	**HEAT TRANSFER AND FLUID FLOW ANALYSIS**	9hrs

Basic equations of heat transfer and fluid flow problems. Finite element formulation. One dimensional heat transfer and fluid flow problems. Derivation of element matrices for two dimensional problems.

UNIT V	**AUTOMOTIVE APPLICATIONS**	9hrs

Force distribution on different parts of automotive structure, design of the parts, static, dynamic and thermal analysis of the parts using finite element method. Material redistribution to minimize stresses and deflection. Optimization of location of ribs to maximize rigidity.

TEXT BOOKS

1. Tirupathi.R. Chandrapatha and Ashok D. Belegundu – Introduction to Finite Elements in Engineering – Printice Hall India, Third Edition, 2003.
2. Rao. S.S., Finite Element Methods in Engineering, Butterworth and Heinemann, 2001

REFERENCES

1. Reddy J.N. – An Introduction to Finite Element Method – McGraw Hill – 2000.
2. Krishnamurthy, C.S., Finite Element Analysis, Tata McGraw Hill, 2000.
3. Bathe, K.J. and Wilson, E.L., Numerical Methods in Finite Elements Analysis, Prentice Hall of India, 1985.
4. Robert D Cook, David S Malkus, Michael E Plesha, 'Concepts and Applications of Finite Element Analysis', 4th edition, John Wiley and Sons, Inc., 2003.
5. Larry J Segerlind, 'Applied Finite Element Analysis', Second Edition, John Wiley and Sons, Inc. 1984.

CYA102	ENVIRONMENTAL SCIENCE AND ENGINEERING	L	T	P	C	TCH
		3	0	0	3	3

GOAL

To impart basic knowledge on the significance of environmental science for engineers.

OBJECTIVES

The objective of the course is

- To make the students aware of the existing natural resources such as forest water resources etc. and to educate them to understand the need for preserving the resources.
- To educate the students about the functions of various ecosystems and biodiversity.
- To provide knowledge on the various aspects of different types of pollution such as air pollution, water pollution, soil pollution etc.
- To give a basic knowledge on the social issues such as global warming, acid rain, ozone layer depletion, nuclear hazards etc. and to educate them about the various Environmental Protection Acts. and ill effects of fireworks.
- To create an awareness among the present generation about the various aspects of human population and their effect on environment.

EXPECTED OUTCOMES

Upon successful completion of the course, the outcomes are as follows:

- The students would have understood the effects of over exploitation of water resources, forest resources etc. and their impact on day to day life on earth.
- Knowledge on the functions of several of ecosystems will help the students to design the processes that are eco-friendly.
- Knowledge on the different types of pollution will help the young minds to device effective control measures to reduce rate of pollution.
- Exposure on the issues such as global warming, acid rain, ozone layer depletion, nuclear hazards and ill effects of fire-works will make the students understand the significances of sustainable development and the need to enforce Environmental Acts.
- Educating on the various aspects of population explosion will create an awareness on population control for effective utilization of the resources and the need to explore new alternate energy resources for a healthy environment.

UNIT I — **INTRODUCTION TO ENVIRONMENTAL STUDIES AND NATURAL RESOURCES** — 10 hrs.

Definition, scope and importance – Need for public awareness – Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forests and tribal people – Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies – Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources. Case studies – Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification – Role of an individual in conservation of natural resources – Equitable use of resources for sustainable lifestyles.

Field study of local area to document environmental assets – river / forest / grassland / hill / mountain.

UNIT II — **ECOSYSTEMS AND BIODIVERSITY** — 12 hrs

Concept of an ecosystem – Structure and function of an ecosystem – Producers, consumers and decomposers – Energy flow in the ecosystem – Ecological succession – Food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the (a) Forest ecosystem (b) Grassland ecosystem (c) Desert ecosystem (d) Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) – Introduction to Biodiversity – Definition: genetic, species and ecosystem diversity – Biogeographical classification of India – Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values – Biodiversity at global, National and local levels – India as a mega-diversity nation – Hot-spots of biodiversity – Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – Endangered and endemic species of India – Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

Field study of common plants, insects, birds

Field study of simple ecosystems – pond, river, hill slopes, etc.

UNIT III — **ENVIRONMENTAL POLLUTION** — 10 hrs

Definition – Causes, effects and control measures of: (a) Air pollution (b) Water pollution (c) Soil pollution (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards – Soil waste Management: Causes, effects and control measures of urban and industrial wastes – Role of an individual in prevention of pollution – Pollution case studies – Disaster management: floods, earthquake, cyclone and landslides.

Ill effects of fireworks and upkeep of clean environment: Chemical contents of fireworks- and health hazards-Soil pollution, water pollution, air pollution and noise pollution.

Field Study of local polluted site – Urban / Rural / Industrial / Agricultural.

UNIT IV — **SOCIAL ISSUES AND THE ENVIRONMENT** — 7hrs

From Unsustainable to Sustainable development – Urban problems related to energy – Water conservation, rain water harvesting, watershed management – Resettlement and rehabilitation of people; its problems and concerns, case studies – Environmental ethics: Issues and possible solutions – Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust, case studies. – Wasteland reclamation – Consumerism and waste products – Environment Production Act – Air (Prevention and Control of Pollution) Act – Water (Prevention and control of Pollution) Act – Wildlife Protection Act – Forest Conservation Act – Issues involved in enforcement of environmental legislation – Public awareness

UNIT V — HUMAN POPULATION AND THE ENVIRONMENT — 6hrs

Population growth, variation among nations – Population explosion – Family Welfare Programme – Environment and human health – Human Rights – Value Education – HIV / AIDS – Women and Child Welfare – Role of Information Technology in Environment and human health – Case studies.

TEXT BOOKS

1. Gilbert M.Masters, Introduction to Environmental Engineering and Science, Pearson Education Pvt., Ltd., Second Edition, ISBN 81-297-0277-0, 2004.
2. Miller T.G. Jr., Environmental Science, International Students Edition, Thomson Learning Inc. 2004.
3. Townsend C., Harper J and Michael Begon, Essentials of Ecology, Blackwell Science, 1999.
4. Trivedi R.K. and P.K. Goel, Introduction to Air Pollution, Techno-Science Publications, 1998.

REFERENCES:

1. BharuchaErach, The Biodiversity of India, Mapin Publishing Pvt. Ltd., Ahmedabad India, 2004.
2. Trivedi R.K., Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards, Vol. I and II, Enviro Media.
3. Cunningham, W.P.Cooper, T.H.Gorhani, Environmental Encyclopaedia, Jaico Publ., House, Mumbai, 2001.
4. Wager K.D., Environmental Management, W.B. Saunders Co., Philadelphia, USA, 1998.

ATB431	VEHICLE DIAGNOSTICS LABORATORY	L	T	P	C	TCH
		0	0	3	1	3
GOAL	To provide practical knowledge on Vehicle Diagnostics and Maintenance.					
OBJECTIVES	The course will enable the students to 1. Know about workshop layout, vehicle maintenance procedures and fault finding techniques. 2. Understand the maintenance and reconditioning procedure for automotive engines, chassis and auxiliary systems.					
EXPECTED OUTCOMES	The student should be able to 1. Familiarize on workshop layout, vehicle maintenance procedures and fault finding techniques. 2. Acquire the knowledge on maintenance and reconditioning procedure for automotive engines, chassis and auxiliary systems					

List of Experiments 45 hrs.

1. Study the layout of automobile repair shop, tools and instruments.
2. Fault diagnosis of ignition, starting and charging system.
3. Fault diagnosis of petrol and diesel fuel system and filters & air cleaners.
4. Adjustment of pedal play in clutch, brake, hand brake and steering wheel.
5. Removal of tyre & tube.
6. Cylinder reboring.
7. Valve grinding and valve lapping.
8. Calibration of fuel injection pump
9. Wheel balancing and alignment
10. Brake bleeding and adjustment

List of Equipment

1. Engine Analyzer
2. Cylinder compression pressure gauge
3. Vacuum gauge
4. Tachometer
5. Wheel balancer and
6. Wheel aligner
7. Tyre remover
8. Bearing puller
9. Cylinder reboring machine
10. Valve grinding machine
11. Valve lapping machine
12. Fuel injection calibration test bench with nozzle tester

ATB432	ENGINE TUNING LABORATORY	L	T	P	C	TCH
		0	0	3	1	3

GOAL	To provide practical knowledge on Engine tuning procedure.
OBJECTIVES	The course will enable the students to. 1. Know about basics of engine ECU, coding and engine tuning. 2. Understand the effect of various engine performance parameters injection timing, valve timing, spark timing, crankshaft angle etc., 3. Know about ECU mapping of fuel injector, air flow, exhaust flow and cooling temperature etc., 4. Learn about the CFD analysis on tuning of intake and exhaust manifold.
EXPECTED OUTCOMES	The student should be able to 1. Familiarize on the basics of engine ECU, coding and engine tuning. 2. Acquire the knowledge on the effect of various engine performance parameters injection timing, valve timing, spark timing, crankshaft angle etc., 3. Gain knowledge on ECU mapping of fuel injector, air flow, exhaust flow and cooling temperature. etc., 4. Familiarize on CFD analysis on tuning of intake and exhaust manifold.

List of Experiments 45 hrs.

1. Introduction to engine ECU and coding.
2. Introduction to engine tuning.
3. Variation in injection timing, valve timing, spark timing, crankshaft angle etc.,
4. ECU mapping of fuel injector, air flow, exhaust flow and cooling temp.etc.,
5. Tuning of intake and exhaust manifold using CFD.

List of Equipment:

1. Engine ECU kit.
2. CFD software (STAR CCM / STAR CD etc.,)
3. Engine with dynamometer setup.
4. Smoke meter
5. Gas analyzer

ATB433	VEHICLE ANALYSIS LABORATORY	L	T	P	C	TCH
		0	0	3	1	3
GOAL	To provide a platform for understanding the basic concepts of Vehicle and subcomponents analysis using software.					
OBJECTIVES	The course will enable the students to. 1. Determine the structural and thermal analysis of the vehicle and the vehicle sub systems using FEA					
EXPECTED OUTCOMES	The student should be able to 1. Familiarize various techniques on structural and thermal analysis of the vehicle and the vehicle sub systems using FEA					

List of Experiments — 45 hrs.

1. Structural Analysis of Vehicle and its sub system
2. Thermal Analysis of Vehicle sub system

List of Equipment

1. Computer nodes with high configuration
2. Analysis software like ANSYS, ADAMS, NASTRAN ,ABACUS , CARSIM Etc
3. Modelling Software like SOLID WORKS, CATIA Etc

ATB434	COMPREHENSION & VIVA-VOCE	L	T	P	C	TCH
		0	0	0	1	0
GOAL	To Investigate the awareness of the students based on understanding and analysing the basic engineering knowledge learnt by them.					
OBJECTIVES	The course will enable the students to. 1. Provide opportunity for the students to recall the concepts of Automobile Engineering acquired. 2. Enhance the knowledge and understanding of the subjects thoroughly.					
EXPECTED OUTCOMES	The student should be able to 1. Recollect the concepts of Automobile Engineering. 2. Acquire the knowledge and understand the subjects.					
Students will be reviewed on various concepts and systems of Automobile Engineering of the previous semesters through seminars, group discussions, Quiz and comprehensive examination. At the end of the semester Students will have to appear for the viva voce examination.						

SEMESTER VIII

ATB441	PROJECT AND VIVA-VOCE	L	T	P	C	TCH
		0	0	24	6	24
GOAL	To expose the students to develop an engineering system / concept / model by incorporating the knowledge gained during their course of study					
OBJECTIVES	The project will enable the students to. 1. Provide a hands-on experience to develop model / concept / system by applying the theoretical and practical knowledge gained through the course of study					
EXPECTED OUTCOMES	The student should be able to 1. Demonstrate a model / concept / system by applying the theoretical and practical knowledge gained through the course of study.					

The objective of the project work is to enable the students in convenient groups of not more than 4 members on a project involving theoretical and experimental studies related to the automobile engineering. Every project work shall have a supervisor who is the member of the faculty of the institution. Six periods per week shall be allotted in the time table and this time shall be utilized by the students to receive the directions from the supervisor on library reading, laboratory work, computer analysis or field work as assigned by the supervisor and also to present in periodical seminars on the progress made in the project.

Each student will be assigned any one of the following types of project/thesis work:

(a) Industrial case study
(b) Preparation of a feasibility report
(c) Thesis by experimental research, and
(d) Design and development of equipment.

Each report must contain student's own analysis or design presented in the approved format.

Sessional marks will include

(a) Evaluation of the student's progress,
(b) Degree of involvement and participation,
(c) Merit of the project.

A student will have to defend his project/thesis and credit will be given on the merit of viva-voce examination.

Review / Exam	Weightage
First Review	10%
Second Review	20%
Third Review	20%
Final Viva Voce	50%
Total	**100%**

PROFESSIONAL ELECTIVE COURSES (PE)
SEMESTER-V

ATC351	FUELS AND LUBRICANTS	L	T	P	C	TCH
		3	0	0	3	3
GOAL	To enhance the students' knowledge on properties of fuels and lubricants used in I.C Engines.					
OBJECTIVES	The course should enable the student to: 1. Understand the various production processes of fuels and lubricants 2. Understand the requirement and classification of lubricants 3. Know about the properties and various testing methods 4. Know about the combustion and fuel characteristics.					
EXPECTED OUTCOMES	The students should be able to: 1. Familiarize on various production processes of fuels and lubricants 2. Gain the knowledge on requirement and classification of lubricants 3. Familiarize on the properties and various testing methods of fuels and lubricants 4. Attain knowledge on combustion and fuel characteristics.					

UNIT I	**MANUFACTURE OF FUELS AND LUBRICANTS**	9
Fuels, Structure of petroleum, refining process, fuels, thermal cracking, catalytic cracking, polymerization, alkylation, isomerization, blending, products of refining process. Manufacture of lubricating oil base stocks, manufacture of finished automotive lubricants.		

UNIT II	**THEORY OF LUBRICATION**	9
Engine friction: introduction, total engine friction, effect of engine variables on friction, Hydrostatic lubrication, hydrodynamic lubrication, elasto hydrodynamic lubrication, boundary lubrication, bearing lubrication, functions of the lubrication system, introduction to design of a lubricating system.		

UNIT III	**LUBRICANTS**	9
Specific requirements for automotive lubricants, oxidation deterioration and degradation of lubricants, additives and additive mechanism, synthetic lubricants, classification of lubricating oils, properties of lubricating oils, tests on lubricants. Grease, classification, properties, test used in grease.		

UNIT IV	**PROPERTIES AND TESTING OF FUELS**	9
Specifications of fuels, Additive - mechanism, requirements of an additive, petrol fuel additives and diesel fuel additives, Thermo-chemistry of fuels, properties and testing of fuels, relative density, calorific value, distillation, vapor pressure, flash point, spontaneous ignition temperature, viscosity, pour point, flammability, ignitability, diesel index, API gravity, aniline point etc.		

UNIT V	**COMBUSTION & FUEL RATING**	9
Stoichiometry - calculation of theoretically correct air required for combustion of liquid and gaseous fuels, volumetric and gravimetric analysis of the dry products of combustion, heat loss due to incomplete combustion, exhaust gas analysis by Orsat apparatus. Heating value of fuels, higher and lower heating values, Volatility characteristics of SI & CI Engine fuels, knock rating and additives, Octane &Cetane rating, HUCR, and CCR.		

TEXT BOOKS

1. Ganesan.V., ―Internal Combustion Engineering‖, Tata McGraw-Hill Publishing Co., New Delhi, 2003.
2. M.L. Mathur, R.P.Sharma ―A course in internal combustion engines‖, Dhanpatrai publication, 2003.
3. Obert.E.F ―Internal Combustion Engineering and Air Pollution‖, International book Co., 1988.

REFERENCES

1. Brame, J.S.S. and King, J.G. – Fuels – Solids, Liquids, Gaseous.
2. Francis, W – Fuels and Fuel Technology, Vol. I & II
3.Hobson, G.D. &Pohl.W- Modern Petroleum Technology
4.A.R.Lansdown – Lubrication – A practical guide to lubricant selection – Pergamon press – 1982.
5. Raymond.C.Gunther – Lubrication – Chilton Book Co., - 1971.

ATC352	HEAT AND MASS TRANSFER	L	T	P	C	TCH
		3	0	0	3	3

GOAL	To enhance the students knowledge on understanding the physical behavior of various modes of Heat Transfer.
OBJECTIVES	The course should enable the student to 1. Know about concept and application of conduction. 2. Understand the concept and application of convection 3. Learn the concept and application of radiation 4. Understand the principle of heat transfer and heat exchangers. Understand the principle of mass transfer
EXPECTED OUTCOMES	The students should be able to 1. Familiarize on the concept and application of conduction. 2. Acquire the knowledge on concept and application of convection 3. Gain knowledge on the concept and application of radiation 4. Attain knowledge on the principle of heat transfer and heat exchangers. Familiarize with the principle of mass transfer

UNIT I	**CONDUCTION**	9

Basic Concepts - Mechanism of Heat Transfer - Conduction, Convection and Radiation General Differential equation of Conduction - Fourier Law of Conduction Cartesian and Cylindrical Coordinates - One Dimensional Steady State Heat Conduc Conduction through Plane Wall, Cylinders and Spherical systems - Composite Systems - Conduction with Internal Heat Gener - Extended Surfaces - Unsteady Heat Conduction - Lumped Analysis - Use of Heislers Chart.

UNIT II	**CONVECTION**	9

Basic Concepts - Convective Heat Transfer Coefficients - Boundary Layer Concept - Types of Convection - Forced Convection - Dimensional Analysis - External Flow - Flow over Plates, Cylinders and Spheres - Internal Flow - Laminar and Turbulent Flow - Combined Laminar and Turbulent – Flow over Bank of tubes - Free Convection - Dimensional Analysis - Flow over Vertical Plate, Horizontal Plate, Inclined Plate, Cylinders and Spheres

UNIT III	**HEAT TRANSFER AND HEAT EXCHANGERS**	9

Nusselts theory of condensation-pool boiling, flow boiling, correlations in boiling and condensation. Types of Heat Exchangers - LMTD Method of heat Exchanger Analysis - Effectiveness - NTU method of Heat Exchanger Analysis - Overall Heat Transfer Coefficient - Fouling Factors.

UNIT IV	**RADIATION**	9

Basic Concepts, Laws of Radiation - Stefan Boltzman Law, Kirchoff Law -Black Body Radiation - Grey body radiation Shape Factor Algebra - Electrical Analogy - Radiation Shields -Introduction to Gas Radiation.

UNIT V	**MASS TRANSFER**	9

Basic Concepts - Diffusion Mass Transfer - Fick's Law of Diffusion - Steady state Molecular Diffusion - Convective Mass Transfer - Momentum, Heat and Mass Transfer Analogy - Convective Mass Transfer Correlations

TEXT BOOKS

1.Sachdeva R C, "Fundamentals of Engineering Heat and Mass Transfer" New Age International, 1995.
2.Yadav R "Heat and Mass Transfer" Central Publishing House, 1995.

REFERENCES

1.Ozisik M.N, "Heat Transfer", McGraw-Hill Book Co., 1994.

2.Nag P.K, "Heat Transfer", Tata McGraw-Hill, New Delhi, 2002.

3.Holman J.P "Heat and Mass Transfer" Tata McGraw-Hill, 2000.

4.Kothandaraman C.P "Fundamentals of Heat and Mass Transfer" New Age International, New Delhi, 1998.

5.Frank P. Incropera and David P. DeWitt, "Fundamentals of Heat and Mass Transfer", John Wiley and Sons, 1998.

ATC353	AUTOMOTIVE SENSORS AND APPLICATIONS*	L	T	P	C	TCH
		3	0	0	3	3
GOAL	To enable the students gaining knowledge on Automotive sensors, characterization, sensor selection, interfacing, sensing, data logging and data processing for specified applications.					
OBJECTIVES	The course should enable the students to: 1. Know the automotive instruments and sensor 2. Understand the measurement of engine parameter by using sensor. 3. Learn the working of actuators. 4. Know the working of sensors. 5. Understand the application of intelligent sensors.					
EXPECTED OUTCOMES	The students should be able to: 1. Familiarize on automotive instruments and sensor 2. Gain knowledge on the measurement of engine parameter by using sensor. 3. Acquire the concept on working of actuators. 4. Attain the knowledge on working of sensors. 5. Familiarize on application of intelligent sensors.					
UNIT I	**INTRODUCTION**					9
Introduction to automotive sensors and instrumentation, Market perspective for sensors and instrumentation techniques.Sensor electronics and techniques. Overview of sensor measurements. Sensor linearization and characterization. Sensor classification. Signals and systems Sensor product selection guide.						
UNIT II	**SENSORS FOR ENGINES**					9
Sensors and interfacing- Pressure, position, flow, temperature, humidity, speed, acceleration, oxygen, torque, light, distance and level.						
UNIT III	**ACTUATORS**					9
Principles of actuation and control. DC motors, stepper motors. Relays and solenoids.Hydraulic and pneumatic actuators.						
UNIT IV	**SENSORS FOR CHASSIS**					9
Sensors and interfacing techniques for Engine control, adaptive cruise control, braking control, traction control, steering and stability.						
UNIT V	**INTELLIGENT SENSORS**					9
Sensors for intelligent transport systems.Lighting, wipers, climate control and electronic displays.Sensors for occupant safety .The digital vehicle intelligent vehicle systems						

TEXT BOOKS

1. E Q Doebelin, Measurement Systems, Application and Design, 4th edition, McGraw-Hill, 2002
2. William B. Ribbens, Understanding Automotive Electronics, 5th edition, Newnes, 2006
3. Ronald k. Jurgen, Automotive Electronics Handbook, 2nd edition, McGraw-Hill, 2007.

ATC354	AUTOMOTIVE PRODUCT DESIGN AND DEVEOPMENT	L	T	P	C	TCH
		3	0	0	3	3
GOAL	To expose the students on basic concepts of engineering design, product development and styling of Automotive.					
OBJECTIVES	The course should enable the students to: 1. Know about the basics of engineering design process 2. Understand the concepts of benchmarking for quality improvement 3. Learn about the systematic methods of creative designing 4. Know about the various steps involved in product design and development					
EXPECTED OUTCOMES	The students should be able to: 1. Familiarize on the basics of engineering design process 2. Acquire the concepts of benchmarking for quality improvement 3. Gain knowledge on the systematic methods of creative designing 4. Acquire about the various steps involved in product design and development.					
UNIT I	**ENGINEERING DESIGN PROCESS**					9
Need for developing products – the importance of engineering design – types of design –the design process – relevance of product lifecycle issues in design –designing to codes and standards- societal considerations in engineering design –generic product development process –various phases of product development-planning for products –establishing markets- market segments- relevance of market research. Introduction to Automotive design , History of Automotive design, Car design brands & brand values and Brand history and Styling DNA and Case studies						
UNIT II	**BENCH MARKING**					9
Identifying customer needs –voice of customer –customer populations- hierarchy of human needs need gathering methods – affinity diagrams – needs importance- establishing engineering characteristics-competitive benchmarking- quality function deployment- house of quality- product design specification-case studies						
UNIT III	**CREATIVE DESIGN**					9
Creative thinking –creativity and problem solving- creative thinking methods- generating design concepts-systematic methods for designing –functional decomposition – physical decomposition –functional representation –morphological methods						
UNIT IV	**PRODUCT DESIGN**					9
Decision making –decision theory –utility theory –decision trees –concept evaluation methods –Pugh concept selection method- weighted decision matrix –analytic hierarchy process –introduction to embodiment design –product architecture – types of modular architecture –steps in developing product architecture						
UNIT V	**PRODUCT DEVELOPMENT**					9
Industrial design –Advance product Quality plan(APQP)- human factors design –user friendly design – design for serviceability – design for environment – prototyping and testing – Production part approval process(PPAP) –Feedback assessment and Corrective action- cost evaluation						

TEXT BOOKS

1. George E.Dieter, Linda C.Schmidt, "Engineering Design", McGraw-Hill International Edition, 4th Edition, 2009, ISBN 978-007-127189-9

2. Anita Goyal, Karl T Ulrich, Steven D Eppinger, "Product Design and Development ", 4th Edition, 2009, Tata McGraw-Hill Education, ISBN-10-007-14679-9

3. Kevin Otto, Kristin Wood, "Product Design", Indian Reprint 2004, Pearson Education,ISBN 9788177588217

4. YousefHaik, T. M. M. Shahin, "Engineering Design Process", 2nd Edition Reprint, Cengage Learning, 2010, ISBN 0495668141

5. Clive L.Dym, Patrick Little, "Engineering Design: A Project-based Introduction", 3rd Edition, John Wiley & Sons, 2009, ISBN 978-0-470-22596-7

ATC355	OFF ROAD VEHICLES	L	T	P	C	TCH
		3	0	0	3	3

GOAL	To expose the students to gain knowledge on various Off Road vehicles and their applications.
OBJECTIVES	The course should enable the students to : 1. Understand the construction and working of various Earth moving equipment 2. Know the construction and working of various constructional equipment 3. Understand the construction and working of Farm equipment 4. Know the working of Industrial equipment 5. Learn the working of Military equipment
EXPECTED OUTCOMES	The students should be able to : 1. Familiarize with the construction and working of various Earth moving equipment 2. Acquire the knowledge on construction and working of various constructional equipment 3. Gain knowledge on the construction and working of Farm equipment 4. Familiarize with the working of Industrial equipment 5. Develop the knowledge on working of Military equipment.

UNIT I	**EARTH MOVING EQUIPMENT**	9

Construction layout, capacity and applications of earthmovers like dumpers, front-end loaders, bulldozers, backhoe loaders, scrappers, Bucket conveyors etc. Selection criteria of prime mover for dumpers and front end loaders based on vehicle performance characteristics.

UNIT II	**CONSTRUCTIONAL EQUIPMENT**	9

Layout of Constructional equipment, excavators, Jip Cranes, hoist, motor graders, Mixing machine, concrete ready mixers, drillers, ramming machines for construction of bridges and working principles.

UNIT III	**FARM EQUIPMENT**	9

Classification of tractors – Main components of tractor. Working attachment of tractors – Auxiliary equipment – Trailers and body tipping mechanism - plowing - paddy plantation machine harvesting machines.

UNIT IV	**INDUSTRIAL EQUIPMENT**	9

Constructional features, capacity and stability of jib cranes. Vibratory compactors, forklifts. Towing vehicles. Case studies.

UNIT V	**MILITARY VEHICLES**	9

Ride and stability characteristics, power take off, special implementations. Special features and constructional details of tankers, gun carriers and transport vehicles, bridge builders

TEXT BOOKS

1. Abrosimov. K. Bran berg.A. andKatayer.K., " Road making Machinery ", MIR Publishers, Moscow, 1971.
2. SAE Handbook Volume III
3. Wong.J.T., " Theory of Ground vehicles ", John Wiley & Sons, New York, 1987.
4. Rodichev and G.Rodicheva, Tractor and Automobiles, MIR Publishers, 1987.
5. Construction planning, Equipment and Methods - Robert L. Peurifoy, William B. Ledbrtter, Clifford J. Schexnayder - McGrawHill, Fifth Edition.

REFERENCES

1. B. Geleman and M. Moskovin, Farm tractors, MIR publishers, Moscow.
2. Off the road wheeled and combined traction devices - Ashgate Publishing Co. Ltd. 1998.
3. Bart H Vanderveen, Tanks and Transport vehicles, Frederic Warne and Co ltd., London.
4. Astokhov, Truck Cranes, MIR Publishers, Moscow.
5. Kolchin,A., and V.Demidov, Design of Automotive Engines for Tractor, MIR Publishers, 1972.
6. OEM Vehicle manuals

VI SEMESTER

ATC356	AUTOMOTIVE POLLUTION AND CONTROL	L	T	P	C	TCH
		3	0	0	3	3
GOAL	To expose the students on various automobile emissions and methods to control the automobile pollutants.					
OBJECTIVES	The course should enable the students to : 1. Understand the effect of various types of emissions. 2. Know about the formation of various types of pollutants from SI and CI engines. 3. Understand the significance of emission control techniques. 4. Understand the construction and working of emission measuring instruments. 5. Learn the various emission standards and test procedures.					
EXPECTED OUTCOMES	The students should be able to : 1. Familiarize the effect of various automotive emissions. 2. Gain Knowledge about the formation of various types of pollutants from SI and CI engines. 3. Acquire the significance of emission control techniques. 4. Familiarize the construction and working of emission measuring instruments. 5. Gain information on various emission standards and test procedures.					
UNIT I	**INTRODUCTION**					9
Vehicle population assessment in metropolitan cities and contribution to pollution, effects on human health and environment, global warming, types of emission, transient operational effects on pollution.						
UNIT II	**POLLUTANT FORMATION IN SI ENGINES**					9
Pollutant formation in SI Engines, mechanism of HC and CO formation in four stroke and two stroke SI engines, NO_x formation in SI engines, effects of design and operating variables on emission formation, control of evaporative emission. Two stroke engine pollution.						
UNIT III	**POLLUTANT FORMATION IN CI ENGINES**					9
Pollutant formation in CI engines, smoke and particulate emissions in CI engines, effects of design and operating variables on CI engine emissions.No_x formation and control.Noise pollution from automobiles, measurement and standards.						
UNIT IV	**CONTROL OF SI AND CI ENGINES EMISSIONS**					9
Design of engine, optimum selection of operating variables for control of emissions, EGR, Thermal reactors, secondary air injection, DPF, Lean NOX, SCR, catalytic converters, catalysts, fuel modifications, fuel cells, Two stroke engine pollution control.						
UNIT V	**MEASUREMENT TECHNIQUES EMISSION STANDARDS AND TEST PROCEDURE**					9
NDIR, FID, Chemiluminescentanalyzers, Gas Chromatograph, smoke meters, emission standards, driving cycles - USA, Japan, Euro and India. Test procedures - ECE, FTP Tests. SHED Test - chassis dynamometers, dilution tunnels.						
TEXT BOOKS 1. Paul Degobert - Automobiles and Pollution - SAE International ISBN-1-56091-563-3, 1991. 2. Ganesan, V- "Internal Combustion Engines"- Tata McGraw-Hill Co.- 2003.						
REFERENCES 1. SAE Transactions- "Vehicle Emission"- 1982 (3 volumes). 2. Obert.E.F.- "Internal Combustion Engines"- 1988 3. Marco Nute- " Emissions from two stroke engines, SAE Publication - 1998.						

ATC357	AUTOMOTIVE MATERIALS AND METALLURGY	L	T	P	C	TCH
		3	0	0	3	3

GOAL

To enhance the students on the selection of various automotive materials, testing and their applications.

OBJECTIVES

The course should enable the students to,

1. Understand the constitutions of alloys and their phase diagrams.
2. Know about the various heat treatment process
3. Know about the selection criteria of materials.
4. Know about the nonmetallic materials
5. Know about the mechanical properties and testing of materials.

EXPECTED OUTCOMES

The students should be able to

1. Familiarize on the constitutions of alloys and their phase diagrams.
2. Acquire about the various heat treatment process
3. Gain knowledge on the selection criteria of materials.
4. Attain knowledge about the nonmetallic materials
5. Develop knowledge on the mechanical properties and testing of materials.

UNIT I **CONSTITUTION OF ALLOYS AND PHASE DIAGRAMS** 9

Constitution of alloys - Solid solutions, substitutional and interstitial - phase diagrams, Isomorphous, eutectic, peritectic, eutectoid and peritectroid reactions, Iron - Iron carbide equilibrium diagram. Classification of steel and cast Iron micro-structure, properties and application.

UNIT II **HEAT TREATMENT** 9

Definition - Full annealing, stress relief, recrystallisation and spheroidizing - Normalising, hardening and Tempering of steel. Isothermal transformation diagrams - Cooling curves superimposed on I.T. diagram CCR - Hardenability, Jominy end quench test - Austempering, martempering - Case hardening, carburising, nitriding, cyaniding, carbonitriding - Flame and Induction hardening

UNIT III **SELECTION OF MATERIALS** 9

Criteria of selecting materials for automotive components viz cylinder block, Cylinder head, piston, piston ring.Gudgeon pin, connecting rod, crank shaft, crank case, cam, cam shaft, engine valve, gear wheel , clutch plate, axle, bearings, chassis, spring, body panel, radiator, brake lining.

UNIT IV **NON-METALLIC MATERIALS** 9

Polymers - types of polymer, commodity and engineering polymers - Properties and applications of PE, PP, PS, PVC, PMMA, PET, PC, PA, ABS, PI, PAI, PPO, PPS, PEEK, PTFE Polymers - Urea and Phenol formaldeliydes - Engineering Ceramics - Properties and applications of Al2O3, SiC, SiC, Si3, N4, PSZ and Sialon - Fiber and particulate reinforced composites.

UNIT V **MECHANICAL PROPERTIES AND TESTING** 9

Mechanism of plastic deformation, slip and twinning - Types of fracture - Testing of materials under tension, compression and shear loads - Hardness tests (Brinell, Vickers and Rockwell) Impact test Izod and charpy, fatigue and creeptest.

TEXT BOOKS

1. Kenneth G.Budinski and Michael K.Budinski "Engineering Materials" Prentice-Hall of India Private Limited, 4th Indian Reprint 2002.

REFERENCES

1. William D Callister "Material Science and Engineering", John Wiley and Sons 1997.
2. Raghavan.V.Materials Science and Engineering, Prentice Hall of India Pvt. Ltd., 1999.
3. Sydney H.Avner "Introduction to Physical Metallurgy" McGraw-Hill Book Company.

ATC358	ALTERNATE FUELS AND ENERGY SYSTEMS	L	T	P	C	TCH
		3	0	0	3	3

GOAL	To expose the students with knowledge on alternate fuels and the changes in the engine design and to understand various energy systems for use in the automobiles.
OBJECTIVES	The course should enable the student to: 1.Know about the various alternate fuels. 2.Understandthe properties, performance and emission characteristics of Alcohols. 3.Know about Natural gas, LPG, hydrogen and biogas. 4.Understand the various vegetable oils used for engines. 5.Know about Electric vehicle
EXPECTED OUTCOMES	The student should be able to: 1 Familiarize on various alternate fuels. 2. Gain knowledge on the details of methanol and ethanol usage, storage, chemical structure. 3.Acquire knowledge of natural gas, LPG, hydrogen and biogas. 4. Attain the performance characteristics of various vegetable oils. 5. Familiarize with electric and hybrid vehicles.

UNIT I	**INTRODUCTION**	9

Need for alternate fuel, Availability and properties of alternate fuels, general use of alcohols, LPG, Hydrogen, Ammonia, CNG and LNG, Vegetable oils and biogas, Merits and demerits of various alternate fuels, Introduction to alternate energy sources. Like EV, Hybrid, Fuel cell and solar cars.

UNIT II	**ALCOHOLS**	9

Properties as engine fuel, Alcohols and gasoline blends, Performance in SI engine, Methanol and gasoline blends, Combustion characteristics in CI engines, Emission characteristics, DME, DEE properties performance analysis, Performance in SI & CI Engines.

UNIT III	**NATURAL GAS, LPG, HYDROGEN AND BIOGAS**	9

Availability of CNG, properties, Modification required using in engines, Performance and emission characteristics of CNG using LPG in SI & CI engines, Performance and emission of LPG. Hydrogen; Storage and handling, Performance and safety aspects.

UNIT IV	**VEGETABLE OILS**	9

Various vegetable oils for engines, Esterification, Performance in engines, Performance and emission characteristics, Bio diesel and its characteristics

UNIT V	**ELECTRIC, HYBRID, FUEL CELL AND SOLAR CARS**	9

Layout of an electric vehicle, Advantage and limitations, Specifications, System components, Electronic control system, High energy and power density batteries, Hybrid vehicle, Fuel cell vehicles, Solar powered vehicles.

TEXT BOOKS

1. Richard.L.Bechfold - Alternative Fuels Guide Book - SAE International Warrendale - 1997.

REFERENCES

1. MaheswarDayal - "Energy today & tomorrow" - I & B Horishr India - 1982.
2. Nagpal - "Power Plant Engineering" - Khanna Publishers - 1991.
3. "Alcohols as motor fuels progress in technology" - Series No.19 - SAE Publication USE - 1980.
4. SAE paper nos. 840367, 841333, 841334, 841156, Transactions, SAE, USA.

ATC359	ELECTRONIC ENGINE MANAGEMENT SYSTEM*	L	T	P	C	TCH
		3	0	0	3	3
GOAL	To enable the students to interface sensors in modern automotive electronic systems.					
OBJECTIVES	The course should enable the student to: 1. Understand the automotive instruments and sensors. 2. Know about the measurement of engine parameter by using sensor. 3. Know the working Electronic Ignition System. 4.Understand the Principles of Digital Control systems and its applications 5.Understand the concept of Engine mapping					
EXPECTED OUTCOMES	The students should be able to: 1. Familiarize with automotive instruments and sensors. 2. Gain knowledge about the measurement of engine parameter by using sensor. 3. Attain knowledge on the working Electronic Ignition System. 4. Attain the Principles of Digital Control systems and its applications 5. Familiarize with the concept of Engine mapping					
UNIT I	**SENSORS**					9
Types - Air flow, Pressure, Temperature, Speed Oxygen, Detonation, Position Principle of operation, Arrangement and material.						
UNIT II	**GASOLINE INJECTION SYSTEM**					9
Open loop and closed loop systems, Mono point, Multi point and Direct injection systems - Principles and Features, Bosch injection systems.						
UNIT III	**DIESEL INJECTION SYSTEM**					9
Inline injection pump, Rotary pump and injector - Construction and principle of operation, Common rail and unit injector system - Construction and principle of operation.						
UNIT IV	**IGNITION SYSTEMS**					9
Ignition fundamentals, Types of solid state ignition systems, High energy ignition distributors, Electronic spark timing and control.						
UNIT V	**ENGINE MAPPING**					9
Combined ignition and fuel management systems. Digital control techniques - Dwell angle calculation, Ignition timing calculation and Injection duration calculation. Hybrid vehicles and fuel cells.						

TEXT BOOKS

1. Bosch Technical Instruction Booklets.
2. Tom Denton, Automotive Electrical and Electronic Systems, Edward Amold,1995.

REFERENCES

1. Robert N.Brady, Automotive Computers and Digital Instrumentation, Prentice Hall, 1988.
2. Duffy Smith, Auto Fuel Systems, The god Heart Willcox Company Inc., Publishers, 1987.
3. Heinz Heisler, Advanced Engine Technology. SAE Publications, 1995.

ATC360	ELECTRONICS IN MOTOR SPORT ENGINEERING*	L	T	P	C	TCH
		3	0	0	3	3

GOAL	To expose the students on Electronics used in motorsport engineering.
OBJECTIVES	The course should enable the students to 1. Understand basic electrical and electronics circuit used in motorsport vehicle. 2. Provide adequate knowledge in sensors, actuators and its display techniques. 3. Know the microcomputer unit control technology. 4. Understand operation of microprocessor hardware and suppression methods. 5. Know about systematic fault diagnosis and repairs on vehicle electronic systems.
EXPECTED OUTCOMES	The student should be able to Familiarize basic electrical and electronics circuit used in motorsport vehicle. 1. Familiarize sensors, actuators and its display techniques. 2. Gain knowledge on micro computer unit control technology. 3. Acquire knowledge on operation of microprocessor hardware and suppression methods. 4. Familiarize vehicle electronic systems systematic fault diagnosis procedure and its rectification techniques.

UNIT I	**ANALYSIS AND TEST VEHICLE ELECTRICAL AND ELECTRONIC CIRCUITS**	9

Electrical calculations: voltage; emf; current; power; resistance; capacitance; inductance; series and parallel circuits

Semiconductor devices: electrical properties and characteristics of semiconductor material; P-N junction diode; Zener diode; N-P-N junction transistor; P-N-P junction transistor and thyristor; analyse the operation of a semiconductor based circuit, eg electronic ignition amplifier .Circuit diagrams: electrical and electronic component and circuit symbols; circuit diagram layouts

UNIT II	**OPERATION OF VEHICLE SENSORS, ACTUATORS AND DISPLAY**	9

Sensors: principles of operation and electrical characteristics of sensors used in vehicles eg sensors used in anti-lock braking systems (ABS), electronic fuel injection (EFI), engine management systems, airbags, security, driver information and vehicle condition monitoring systems); relevant test procedures for sensors.

Actuators: principles of operation and electrical characteristics of vehicle actuators egrelays, solenoids, electro-hydraulic/pneumatic valves, rotary actuators, stepper motors; relevant tests procedures for actuators

Information display devices: types of devices eg analogue gauges, light emitting diodes, liquid crystal displays, vacuum fluorescent displays, cathode ray tubes; relevant test procedures for displays

UNIT III	**MCU CONTROL TECHNOLOGY**	9

Micro-computer hardware system components, addressing modes, storage, control and operation principle of bus architecture, interrupt system, interface principle, and assembly language programming methods . Require students to master computer information processing, control and storage methods, understanding of computer systems and components are working process.

UNIT IV	**OPERATION OF MICROPROCESSOR HARDWARE AND SUPPRESSION METHODS**	9

Microprocessor hardware: implementation, operation and relevant developments of microprocessor systems in vehicles eg computer area network (CAN) bus links; packaging; microcontrollers; integrated circuits; reliability; electromagnetic compatibility Suppression methods: resistive suppression of oscillations; screening; use of inductors; capacitors and filter networks in interference suppression

UNIT V	**SYSTEMATIC FAULT DIAGNOSIS AND REPAIRS ON VEHICLE ELECTRONIC SYSTEMS**	9

Systematic testing: testing of input/output sensors, cables, supplies, earths, output actuators, display devices and microprocessor systems, correct use of multimeters and oscilloscope for measuring circuit and component values

Self-diagnosis: signal plausibility checks; open and short circuit checks; processor operation and memory test routines; error/trouble codes; standardization of connectors and codes; continuity checks; sensor output; resistance checks.Fault repairs: correct procedures for removal/refitting eg following manufacturer‘s recommendations; repair and replacement of system components

TEXT BOOKS :

1. Hillier's Fundamentals of Automotive Electronics, Book 2 Sixth Edition
2. Standard Handbook of Electronic Engineering, Fifth Edition, Donald Christiansen, Charles K. Alexander, Ronald K. Jurgen
3. Bosch―Automotive Hand Book‖, SAE (6th Edition), 2012.

REFERENCES

1. Bechhold ―Understanding Automotive Electronics, SAE, 1998.
2. Judge A.W ―Modern Electrical Equipment of Automobiles, Chapman & Hall, London, 1992.
3. Kholi.P.L ―Automotive Electrical Equipment, Tata McGraw-Hill Co., Ltd., New Delhi, 1975.
4. Ganesan.V. ―Internal Combustion Engines, Tata McGraw-Hill Publishing Co., New Delhi

ATC361	VEHICLE BODY ENGINEERING*	L	T	P	C	TCH
		3	0	0	3	3

GOAL

To provide the students sound knowledge of the design of the vehicles body for the maximum comfort

OBJECTIVES

The course should enable the student to:

1. Study different types of car and its constructions.
2. Understand the aerodynamics involved in vehicles.
3. Gain knowledge regarding various types of bus and its construction details.
4. Learn the details available in various commercial vehicles.
5. Study the properties of body materials and its corresponding mechanism.

EXPECTED OUTCOMES

Upon completion, the student should be able to:

1. Be acquainted with knowledge of different types of cars.
2. Analyse the aerodynamics involved in vehicles.
3. Be familiar with various types of bus and construction details.
4. Be familiar with various types of commercial vehicles..
5. Analyse the properties of body materials and its mechanisms.

UNIT I **CAR BODY DETAILS** 9

Types: saloon, convertibles, limousine, estate car, racing and sports car. Visibility: regulations, driver's visibility, tests for visibility, methods of improving visibility and space in cars.

Safety: safety design, safety equipments for cars. Car body construction; design criteria, prototype making, initial tests, crash tests on full scale model, Dummies and Instrumentation

UNIT II **VEHICLE AERODYNAMICS** 9

Objectives. Vehicle drag and types; various types of forces and moments, effects of forces and moments, side wind effects on forces and moments, Various body optimization techniques for minimum drag, wind tunnel testing: flow visualization techniques, scale model testing, component balance to measure forces and moments.

UNIT III **BUS BODY DETAILS** 9

Types: mini bus, single Decker, double-decker, two level and articulated bus. Bus body layout; floor height, engine location, entrance and exit location, seating dimensions. Constructional details: frame construction, double skin construction, types of metal sections used, Regulations, Conventional and integral type construction.

UNIT IV **COMMERCIAL VEHICLE DETAILS** 9

Types of body; flat platform, drop side, fixed side, tipper body, tanker body, Light commercial vehicle body types. Dimensions of driver's seat relation to controls. Drivers cab design.

UNIT V **BODY MATERIALS, TRIM AND MECHANISMS** 9

Steel sheet, timber, plastic, GRP, properties of materials; Corrosion, anticorrosion methods. Selection of paint and painting process. Body trim items. Body mechanisms

TEXT BOOK

1. J.Powloski - "Vehicle Body Engineering" - Business Books Ltd, London -1989

REFERENCES

1. Giles.J.C. - "Body construction and design" - Liiffe Books Butterworth & Co. - 1971.
2. John Fenton - "Vehicle Body layout and analysis" - Mechanical Engg. Publication Ltd., London - 1982.
3. Braithwaite.J.B. - "Vehicle Body building and drawing" - Heinemann Educational Books Ltd., London - 1977.

VII SEMESTER

ATC451	AUTOMOTIVE AERODYNAMICS	L	T	P	C	TCH
		3	0	0	3	3

GOAL

To enhance students' knowledge on basic principles of aerodynamics for the design of vehicle body.

OBJECTIVES

The course should enable the student to:

1. Understand the fundamentals of fluid mechanics related to vehicles.
2. Know about the aerodynamics drag of cars.
3. Learn about the shape optimization of cars.
4. Enhance the knowledge of vehicle handling.
5. Understand the principle of wind tunnel technology and measurement techniques.

EXPECTED OUTCOMES

Upon completion, the student should be able to:

1. Familiarize on basics of fluid mechanics related to vehicles.
2. Acquire the knowledge on aerodynamics drag of cars.
3. Gain knowledge on shape optimization of cars.
4. Develop the knowledge of vehicle handling.
5. Obtain the principle of wind tunnel technology and measurement techniques.

UNIT I **INTRODUCTION** 9

Scope, historical developments, fundamental of fluid mechanics, flow phenomenon related to vehicles, external and Internal flow problem, resistance to vehicle motion, performance, fuel consumption and performance potential of vehicle aerodynamics, engine cooling requirement, air flow to passenger compartment, duct for air conditioning, cooling of transverse engine and rear engine.

UNIT II **AERODYNAMIC DRAG OF CARS** 9

Cars as a bluff body, flow field around car, drag force, types of drag force, analysis of aerodynamic drag, drag coefficient of cars, strategies for aerodynamic development, low drag profiles.

UNIT III **SHAPE OPTIMIZATION OF CARS** 9

Front end modification, front and rear wind shield angle, boat tailing, hatch back, fast back and square back, dust flow patterns at the rear, effects of gap configuration, effect of fasteners.

UNIT IV **VEHICLE HANDLING** 9

The origin of forces and moments on a vehicle, lateral stability problems, methods to calculate forces and moments - vehicle dynamics under side winds, the effects of forces and moments, characteristics of forces and moments, dirt accumulation on the vehicle, wind noise, drag reduction in commercial vehicles.

UNIT V **WIND TUNNELS FOR AUTOMOTIVE AERODYNAMICS** 9

Introduction, principle of wind tunnel technology, limitation of simulation, stress with scale models, full scale wind tunnels, measurement techniques, equipment and transducers, road testing methods, numerical methods.

TEXT BOOK

1. Hucho.W.H. - "Aerodynamic of Road Vehicles" - Butterworths Co., Ltd., - 1997.

REFERENCES

1. A. Pope - "Wind Tunnel Testing"- John Wiley & Sons - 2nd Edition, New York - 1974.
2. Automotive Aerodynamic: Update SP-706 - SAE - 1987
3. Vehicle Aerodynamics - SP-1145 - SAE - 1996.

ATC452	ENGINE EXHAUST SYSTEM DEVELOPMENT	L	T	P	C	TCH
		3	0	0	3	3

GOAL	To enhance the students' knowledge on exhaust system for I.C.Engines
OBJECTIVES	The course should enable the students to 1. Understand the emission source and control parameters of IC engines. 2. Know about designing advanced exhaust after treatment devices and optimization of each component. The testing techniques involved in Emission test cycle. 3. Understand the Emission regulation trend. The exhaust noise control devices and sources. 4. Learn noise control methods and test procedures.Performance of gas flow analysis in exhaust stem using CFD software. 5. Understand technical know-how to perform FEA analysis and different testing standards for exhaust system validation.
EXPECTED OUTCOMES	The students should be able to: 1. Gain knowledge in the global environmental air pollution control bureaus. 2. Familiarize with emission control systems and noise control devices. 3. Design and validate full exhaust system for on-road, off-road and non-road applications. 4. Gain knowledge on the advanced technology development on exhaust system for SI and CI engines. 5. Familiarize with automobile design and computational simulation environments.

UNIT I	**INTRODUCTION**	9

Introduction of exhaust system – Engine Exhaust Technology Evolution – India automotive emission regulation – Noise limits for vehicles at manufacturing stage – Basics of Exhaust System from Engine head face to tail pipe – Components of exhaust system – Exhaust catalytic converter – Silencer (Muffler) – System integration.

UNIT II	**HOT END**	9

Understanding of Gasoline and diesel engine out pollutants – Emission Norms – Air to Air – Converter Hot end components – TWC – Manifold – Cone Profiles – Substrate – Types of Substrate – Wash coat – Mat – Types of Mats – Shell – Canning – Types of Canning – Controlled canning – GBD (Gab Bulk Density) – Temperature Sensor – Oxygen Sensor – Thermal Management – Insulators – Heat Shields – (Gasoline / Diesel) – Advancement in substrates – Technology for gasoline engine – Three way converter (TWC) – Gasoline particulate filter (GPF) – Lean NOx Trap (LNT) – Technology for diesel engine – Exhaust gas recirculation (EGR) – Diesel oxidation catalyst (DOC) – Partial flow filter (PFF) – Diesel particulate filter (DPF) – Selective catalytic reduction (SCR) – Selective catalytic reduction filter (SCRF) – Global regulations and testing protocols – System integration.

UNIT III	**COLD END**	9

Basics of Acoustics – Fundamentals of sound – Terminologies – Noise cancellation – Destructive & Constructive interferences – Engine exhaust noise introduction – Gasoline & Diesel engine operation & exhaust noise characteristics – Vehicle Pass by Noise – Exhaust noise measurement standards – Types of exhaust noises – Pulsation noises – Flow noises – Booming noises – Shell radiation noises – Passive noise reduction techniques – Types of mufflers – Reflective – Absorptive Hybrid mufflers – Muffler design constrains – Muffler internal design – Tri flow muffler – Straight though muffler – Helmholtz resonator – Internal resonators – Baffle plates – Perforations – shells – End Plates – Pipe diameters – Absorptive materials – Development methodologies – Muffler performance parameters – Sound transmission loss – Insertion loss – Noise reduction – Tail pipe noise level – back pressure – Vehicle interior noise levels – Advanced muffler technologies – Cat con integrated muffler – variable flow muffler – Twin mufflers – Active noise cancellation – Sporty sound mufflers – Sound engineering, Off Road – On Road – Non Road muffler applications Examples – Manufacturing Types & Process – Roll & Spot welding – Lock seaming – Double seaming – Web forming – Clinching – Cold metal transfer – Hydro forming – Piercing – Stamping – Muffler examples.

UNIT IV	**COMPUTATIONAL ANALYSIS (CFD, FEA)**	9

CFD for vehicle exhaust system – Governing equation of fluid flow and heat transfer – Flow Uniformity – Pressure loss through exhaust system – Flow Eccentricity – HEGO Index – Conjugate Heat Transfer Analysis – Introduction to finite element analysis.Present, Past, Future FEA – Introduction to Pre-processing ID, 2D, 3D Elements – Meshing, Processing Techniques – Statics of strength of materials – Types of Analysis – Modal Analysis – Linear Static Analysis – Introduction to Non-linear Analysis – Dynamic Analysis – Thermal Analysis – RLDA & Fatigue Analysis – Post processing techniques of different Analysis – Process Flows and Targets – Case Study 1-2-3.

UNIT V	**TESTING AND VALIDATION**	9

Vehicle noise measurement – Operational vibration analysis – Experimental modal analysis – Air leak test Thermal Shock Tests – Thermal fatigue test – Back pressure measurement test – Hot end system: Hot Vibration Test – Cold vibration test – Flow noise measurement – Shell deformation test – Cold end: Biaxial fatigue test – Uni-axial fatigue test – Salt spray test – Condensate Water Noise Test – Transmission loss measurement – Shell stiffness measurement – Glass wool endurance test – Resonance frequency measurement – Shell radiation noise measurement – Tail pipe noise measurement – Water drainage ability test.

TEXT BOOK

1. The Scientific Design of Exhaust and Intake Systems (Engineering and Performance), Philip II Smith & John Morrison – 3rd Edition, Bentley (Robert) Inc., US.
2. Noise and Bivration Control Engineering (Principles and applications) Istvan L. Ver and Leo L.
3. Beranek, - 2nd Edition 2006, John Wiley & Sons Inc.
4. Acoustics of Ducts and Mufflers with Applications to Exhaust and Ventilation System Design, M.L. Munjal – 2ndEdition, Wil Inter Science.

ATC453	ELECTROMAGNETIC INTERFERENCES AND COMPATIBILITY*	L	T	P	C	TCH
		3	0	0	3	3
GOAL	To expose the students on concepts and standards of electromagnetic interference and to design the systems with electromagnetic compatibility for applications.					
OBJECTIVES	The course should enable the students to: 1. Study the EMI /EMC Environment. 2. Study the EMI coupling principles and its types. 3. Study the EMI / EMC standards and measurements for the test procedures. 4. Study various EMI control techniques. 5. Design PCBs with EMC compliance.					
EXPECTED OUTCOMES	At the end of the course the student should be able to: 1. Familiarize on the fundamentals and the parameters of EMI/EMC environment. 2. Gain the knowledge on EMI coupling principles and its types. 3. Attain the knowledge on various standards and testing procedures for EMI/EMC. 4. Develop the knowledge on the different techniques for controlling EMI. 5. Attain the knowledge to design PCBs with EMC compliance.					
UNIT I	**EMI ENVIRONMENT**					9
EMI/EMC concepts and definitions, Sources of EMI, conducted and radiated EMI, Transient EMI, Time domain Vs Frequency doma EMI, Units of measurement parameters, Emission and immunity concepts, ESD.						
UNIT II	**EMI COUPLING PRINCIPLES**					9
Conducted, Radiated and Transient Coupling, Common Impedance Ground Coupling, Radiated Common Mode and Ground Lo Coupling, Radiated Differential Mode Coupling, Near Field Cable to Cable Coupling, Power Mains and Power Supply coupling						
UNIT III	**EMI/EMC STANDARDS AND MEASUREMENTS**					9
Civilian standards - FCC,CISPR, IEC, EN, Military standards - MIL STD 461D/462, EMI Test Instruments /Systems, EMI Shield Chamber, Open Area Test Site, TEM Cell, Sensors/Injectors/ Couplers, Test beds for ESD and EFT, Military Test Method a Procedures (462).						
UNIT IV	**EMI CONTROL TECHNIQUES**					9
Shielding, Filtering, Grounding, Bonding, Isolation Transformer, Transient Suppressors, Cable Routing, Signal Control, Compone Selection and Mounting.						
UNIT V	**EMC DESIGN OF PCBs**					9
PCB Traces Cross Talk, Impedance Control, Power Distribution Decoupling, Zoning, Mother board Designs and Propagation Delay Performance Models.						

TEXT BOOKS

1.HenryW.Ott, “Noise Reduction Techniques in Electronic Systems”, John Wiley and Sons, NewYork.

2. C.R.Paul, “Introduction to Electromagnetic Compatibility” , John Wiley and Sons, Inc, 1992

3.V.P.Kodali, “Engineering EMC Principles, Measurements and Technologies”, IEEE Press, 1996.

4. Bernhard Keiser, “Principles of Electromagnetic Compatibility”, Artech house, 3rd Ed, 1986.

ATC454	COMPUTATIONAL FLUID DYNAMICS	L	T	P	C	TCH
		3	0	0	3	3

GOAL	To expose the students' knowledge on numerical methods to solve complex problems in fluid flow and heat transfer.
OBJECTIVES	The course should enable the students to 1. Know the numerical modelling, governing equations of fluid flow and heat transfer 2. Understand the various discretization methods and solving methodologies. 3. Learn to solve complex problems in the field of different modes of heat transfer. 4. Understand the process of converting the PDE to difference equations using various discretization techniques.
EXPECTED OUTCOMES	The student should be able to 1. Familiarize on the numerical modelling, governing equations of fluid flow and heat transfer 2. Gain knowledge on the various discretization methods and solving methodologies. 3. Acquire the knowledge to solve complex problems in the field of different modes of heat transfer. 4. Attain the knowledge on the process of converting the PDE to difference equations using various discretization techniques.

UNIT I	**GOVERNING EQUATIONS AND BOUNDARY CONDITIONS**	9

Basics of computational fluid dynamics - Governing equations of fluid dynamics - Continuity, Momentum and Energy equations - boundary conditions - Time-averaged equations for Turbulent flow Turbulence -Kinetic -Energy Equations - mathematical behavior on CFD: Elliptic, Parabolic and Hyperbolic equations.

UNIT II	**DISCRETISATION AND SOLUTION METHODOLOGIES**	9

Methods of Deriving the Discretization Equations - Taylor Series formulation - Finite difference method - Control volume For Solution methodologies: Direct and iterative methods, Thomas algorithm, Relaxation method, Alternating Direction Implicit method

UNIT III	**HEAT CONDUCTION**	9

Finite difference and finite volume formulation of steady/transient one-dimensional conduction equation, Source term line Incorporating boundary conditions, Finite volume formulations for two and three dimensional conduction problems

UNIT IV	**CONVECTION AND DIFFUSION**	9

Finite volume formulation of steady one-dimensional convection and Diffusion problems, Central, upwind, hybrid and power-law Discretization equations for two dimensional convection and diffusion.

UNIT V	**CALCULATION OF FLOW FIELD**	9

Representation of the pressure - Gradient term and continuity equation - Staggered grid - Momentum equations - Pressure and velocity corrections - Pressure - Correction equation, SIMPLE algorithm and its variants. Turbulence models: mixing length model, Two equation (k-€) models.

TEXT BOOKS

1. Versteeg, H.K, and Malalasekera, W., An Introduction to Computational Fluid Dynamics: The Finite Volume Method, Long
2. Ghoshdastidar, P.S., Computer Simulation of flow and heat transfer, Tata McGraw Hill Publishing Company Ltd., 1998.

REFERENCES

1. Patankar, S.V., Numerical Heat Transfer and Fluid Flow, McGraw-Hill, 1980. Ane - Books Indian Edition.2009.
2. Muralidhar, K and Sundarajan .T., Computational Fluid Flow and Heat Transfer, Narosa Publishing House, New Delhi,2nd E
3. Bose, T.K., Numerical Fluid Dynamics, Narosa publishing House, 1997.
4. Muralidhar, K and Biswas Advanced Engineering Fluid Mechanics, Narosa Publishing House, New Delhi, 2nd Edition , 20
5. Anderson, J.D., Computational fluid dynamics - the basics with applications, 1995.

SEMESTER –VIII

ATC455	MANUFACTURING PROCESS OF AUTOMOTIVE COMPONENTS	L	T	P	C	TCH
		3	0	0	3	3
GOAL	To enhance the students' knowledge on various manufacturing processes involved in production of automotive components					
OBJECTIVES	The course should enable the student to: 1. Understand the powder metallurgy technology. 2. Know about the forming process involved in various automotive components. 3. Understand the casting & machining process of various automotive components. 4. Learn the various types of gear manufacturing process. 5. Understand recent trends in automotive components manufacturing.					
EXPECTED OUTCOMES	The students should be able to : 1. Familiarize on powder metallurgy technology. 2. Acquire the knowledge on forming process involved in various automotive components. 3. Obtain knowledge on casting & machining process of various automotive components 4. Gain knowledge on various gears manufacturing process. 5. Expertise in recent trends of Automotive manufacturing.					
UNIT I	**POWDER METALLURGY**					9
Process flow chart - Production of metal powders and their raw materials - Manufacture of friction lining materials for clutches and brakes - Testing and inspection of PM parts.						
UNIT II	**FORMING PROCESS**					9
Forging - process flow chart, forging of valves, connecting rod, crank shaft, cam shaft, propeller shaft, transmission gear blanks, foot brake linkage, steering knuckles. Extrusions: Basic Process steps, extrusion of transmission shaft, steering worm blanks, brake anchor pins, rear axle drive shaft, axle housing spindles, piston pin and valve tappets. Hydro forming: Process, hydro forming of manifold and comparison with conventional methods - Hydro forming of tail Lamp housing. Stretch forming - Process, stretch forming of auto body panels - Super plastic alloys for auto body panels.						
UNIT III	**CASTING AND MACHINING**					9
Sand casting of cylinder block and liners - Centrifugal casting of flywheel, piston rings, bearing bushes and liners, permanent mould casting of piston, pressure die casting of carburetor and other small auto parts. Machining of connecting rods - crank shafts - cam shafts - pistons - piston pins - piston rings - valves - front and rear axle housings - flywheel - Honing of cylinder bores - copy turning and profile grinding machines.						
UNIT IV	**GEAR MANUFACTURING**					9
Gear milling, Hobbing and shaping - Gear finishing and inspection.						
UNIT V	**RECENT TRENDS IN MANUFACTURING OF AUTO COMPONENTS**					9
Powder injection molding - Shot peen hardening of gears - Production of aluminum MMC liners for engine blocks - Plasma spray coated engine blocks and valves - Recent developments in auto body panel forming - Squeeze casting of pistons - aluminum composite brake rotors.						

TEXT BOOKS

1. Heldt.P.M., High Speed Combustion Engines, Oxford publishing co., New York, 1990.

REFERENCES

1. Haslehurst.S.E., Manufacturing Technology, ELBS, London, 1990.
2. Rusinoff., Forging and forming of metals, D.B, Taraporevla Son & co Pvt ltd, Mumbai, 1995.
3. Sabroff.A.M. & Others, Forging Materials & Processes, Reinhold Book Corporation, NewYork, 1988.
4. Upton, Pressure Die Casting, Pergamon Press, 1985.
5. High Velocity Forming of metals, ASTME, Prentice Hall of India (P) Ltd., New Delhi, 1990.

ATC456	AUTOMOTIVE ACCIDENT INVESTIGATION AND RE-CONSTRUCTION TECHNIQUES	L	T	P	C	TCH
		3	0	0	3	3
GOAL	To expose the students on the principles and techniques used for accident investigation, reconstruction and cost estimation					
OBJECTIVES	The course should enable the student to: 1. Understand the effect of the forces acting on a vehicle in motion and during a collision. 2. Investigate brake and tyre characteristics and their Influence on a vehicle. 3. Know about the Accident reconstruction techniques 4. Know about damage assessment and cost estimation					
EXPECTED OUTCOMES	The students should be able to : 1 Familiarize on the effect of the forces acting on a vehicle in motion and during a collision 2 Acquire the knowledge on brake and tyre characteristics and their Influence on a vehicle. 3 Develop knowledge on the Accident reconstruction techniques 4 Gain knowledge on damage assessment and cost estimation					

UNIT I	**FORCES, EFFECT OF FRICTION & VEHICLE COLLISION**	9

Understand the forces acting on a vehicle when in motion and during a collision Forces and motion: applications of mass, weight, force, Newton‘s Laws of motion and equations of motion on a moving vehicle; determination and effect of tractive effort and tractive resistance.

Effect of friction: definition of friction and the co-efficient of friction; factors affected e.g. skidding, sliding, rolling; calculations e.g. to determine stopping distances, cornering speeds, effects of gradient, rolling and air friction; deceleration and braking theory; brake efficiency; Vehicle collision: Collision with moving and stationary bodies; principle of conservation of momentum; principle of conservation of energy; calculation of impact speeds; interpretation of projective behavior e.g. objects projected from a vehicle on impact; load transfer.

UNIT II	**BRAKES AND ITS BEHAVIOUR**	9

Understand the influence of vehicle brake characteristics on the behavior of a vehicle Types of brake circuits: single line braking circuit; front and rear split circuit; diagonally split circuit; H-split; L-split; full dual circuit; air/hydraulic circuits; air brake circuits; Types of pressure valves: pressure limiting valves; load sensing valve; inertia sensing valve. Characteristics of brake fluid: types of fluid; constituents; contamination boiling point; vapor lock point Brake defects: braking faults eg effect of air in brake fluid, temporary loss of breaking, air contamination, heat soak, uneven braking, brake fade, drum expansion. Legal requirements: legal requirements with respect to hydraulic and air braking systems eg the design and use of braking systems are governed by two sets of regulations, the Construction and Use regulations OF ARAI and International standards.

UNIT III	**TYRE BEHAVIOUR AND CHARACTERISTICS**	9

Understand the influence of vehicle tyre characteristics on the behavior of a vehicle Tyre markings: car and truck markings; nominal rim diameter; nominal section width; overall diameter; section height; load index; speed index; nominal aspect ratio; load capacity Vehicle handling and tyre behavior: slip angle; self-aligning torque; cornering force; centrifugal force; cornering power; instantaneous center; neutral steer; under steer; over steer; effects of fault suspension dampers on vehicle handling Factors affecting adhesion: co-efficient of friction; effect on adhesion as retardation is increased on various types of surface and weather conditions; skidding; aquaplaning Tyre defects: under inflation; over inflation; lumps; bulges; casing break-up; cuts; exposed cords; inspection of tyre valve; reasons for tyre blow-out; effects of impact or concussion damage.

UNIT IV	**ACCIDENT RECONSTRUCTION TECHNIQUES**	9

Tyre marks and vehicle damage: skid marks; scuff marks; deceleration scuff and tyre prints; debris; secondary impact; vehicle position before and after impact

Accident scene construction plans: the immediate scene, intermediate scene, extended scene; sketch plans and scale plans; triangulation, base line and offsets; use of computer software e.g. CAD

UNIT V	**DAMAGE ASSESSMENT AND COST EVALUATION**	9

Damage assessment: vehicle details; vehicle condition; body repair; mechanical components; geometry; production of damage assessment report; post-repair inspection. Repair costing Thatcham repair times; manufacturers repair times computer estimating paint and materials; cash in lieu of repairs Repair methods and materials: suitability of repair methods; vehicle construction; materials used in vehicle construction; method and types of joining; plastic repairs

References

1. Vehicular Accident Investigation and Reconstruction, Donald J Van Kirk CRC Press, 01-Jan-2002 - Law - 512 pages
2. ACCIDENT INVESTIGTION IN THE PRIVATE SECTOR - Volume One, Two and Three By Jack Murray, M.B.A., C.L.I., C.F.E.
3. Vehicle Accident Analysis and Reconstruction Methods, Second Edition, Raymond M. Brach, Matthew Brach - Published by SAE International with a Product Code of R-397, ISBN of 978-0-7680-3437-0, and 442 pages in a hardbound binding.
4. Road Vehicle Dynamics, Rao S, Dukkipatti.

ATC457	AUTOMOTIVE INSTRUMENTATION AND EMBEDDED SYSTEM*	L	T	P	C	TCH
		3	0	0	3	3
GOAL	To make the students to understand the instruments involved in measurement of various automotive parameters and a basic knowledge on embedded systems					
OBJECTIVES	The course should enable the student to: 1. Understand measurement characteristics. 2. Understand the working of automotive instruments. 3. Know about the measurement analysis. 4. Understand the working of embedded systems. 5. Understand the working of real time operating system(RTOS)					
EXPECTED OUTCOMES	The students should be able to: 1. Familiarize on measurement characteristics. 2. Acquire the knowledge on working of automotive instruments. 3. Gain knowledge on measurement analysis. 4. Develop the knowledge on embedded systems. 5. Attain the knowledge on real time operating system(RTOS)					
UNIT I	**MEASUREMENT CHARACTERSTICS**					9
Instrument Classification, Characteristics of Instruments - Static and dynamic, experimental error analysis, Systematic and random errors, Statistical analysis, Uncertainty, Experimental planning and selection of measuring instruments, Reliability of instruments.						
UNIT II	**AUTOMOTIVE INSTRUMENTATION**					9
Modern automotive instrumentation - computerized instrumentation system, multiplexing, sampling and advantages - Measurements - fuel quality, coolant temperature, oil pressure vehicles speed, Display devices - LED, LCD, VFD, CRT and types, CAN network, the glass cockpit and information system. Onboard diagnostics - fault code displays. Off board diagnostics - engine data display, expert system occupant protection system - Airbag deployment system security and warning systems.						
UNIT III	**MEASUREMENT ANALYSIS**					9
Chemical, thermal, magnetic and optical gas analyzers, measurement of smoke, dust and moisture, gas chromatography, spectrometry, measurement of pH, Review of basic measurement techniques.						
UNIT IV	**INTRODUCTION TO EMBEDDED SYSTEM**					9
Introduction to functional building blocks of embedded systems - Register, memory devices, ports, timer, interrupt controllers using circuit block diagram representation for each categories -Devices & buses for devices network - serial communication using I2C, CAN, USB buses - parallel communication using ISA, PCI - device drivers in a system - Serial port & parallel port.						
UNIT V	**REAL TIME OPERATING SYSTEM (RTOS)**					9
Introduction to basic concepts of RTOS, Basics of real time & embedded system operating systems, RTOS - Interrupt handling, task scheduling; embedded system design issues in system development process - Action plan, use of target system, emulator, use of software tools.						

TEXT BOOKS

1. WilliamB.Riddens - Understanding Automotive Electronics, 5th edition- Butter worth Heinemann, Woburn- 1998
2. Rajkamal, 'Embedded System - Architecture, Programming, Design', Tata McGraw Hill,2003.
3. Daniel W. Lewis 'Fundamentals of Embedded Software', Prentice Hall of India, 2004.
4. Holman, J.P., Experimental methods for engineers, McGraw-Hill, 1988
5. Raman, C.S., Sharma, G.R., Mani, V.S.V., Instrumentation Devices and Systems, TataMcGraw Hill, New Delhi, 1983.

ATC458	ECU- MODEL BASED SYSTEM DESIGN AND SIMULATION FOR AUTOMOTIVES*	L	T	P	C	TCH
		3	0	0	3	3

GOAL	To expose the students on basic principles of ECU design and simulation.
OBJECTIVES	The course should enable the student to: 1. Understand the fundamentals of ECU design concept 2. Know about the mathematical modeling and validation. 3. Learn about model based system design. 4. Equip model building with Simulink design. 5. Understand hardware in loop simulation
EXPECTED OUTCOMES	Upon completion, the student should be able to: 1. Familiarize the fundamentals of ECU design concept 2. Develop the knowledge on mathematical modeling and validation. 3. Design the model based system. 4. Gain knowledge on model building with Simulink design. 5. Attain the concept on loop simulation hardware.

UNIT I	**ECU DESIGN CONCEPT**	9

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 of an advanced microcontroller used in the design of automobile ECUs -analog and digital interfaces-Controllers for ECUs: Understanding different ECUs in an automobile-challenges and design requirements of ECU design- selection of sensors and interfaces for ECU design.

UNIT II	**MATHEMATICAL MODELING AND VALIDATION**	9

Top level blocks diagram development for ECUs- design of software modules and hardware modules for ECU design-mathematical modeling of automotive applications-Designing-modelling and porting of software models on ECUs-development of test setup for ECU testing-System level testing: Experimental setup for ECU validation-system level optimization for cost- reliability check and endurance check of ECUs- signal integrity check and EMI/EMC analysis-integration of ECUs into automotive

UNIT III	**MODEL BASED SYSTEM DESIGN**	9

Introduction to Model based system design -hardware in-the-loop simulation- continuous and discrete simulation basics-modeling basics. Connection between Hardware and Simulation-Coupling concepts-simulator coupling and co-simulation, synchronization of co-simulations, basic coupling principles- Event Discrete Simulation-Real time workshop-Introduction to basic simulink blocks, xPC target, Real Time Workshop-State flow and Real Time Embedded coder.

UNIT IV	**MODEL BUILDING WITH SIMULINK**	9

Model Building with Simulink: Controller programming using model based system design for an automotive application using simulink-Plant Modelling- Plant modelling using simulink for the automotive application-PID controller design, analog output, targeting a processor for plant- Hardware implementation-Design of ECU for automotive applications, interfacing of sensors and actuators-System modelling and validation using test setup- Interfacing of software models with hardware design.

UNIT V	**HARDWARE IN LOOP SIMULATION**	9

System programming and development of experimental setup for hardware in loop simulation. Hardware in-the-Loop-Testing of plant separately, testing of controller separately and testing of plant and controller in the loop-System Verification and Validation-Comparing the HIL test results with real world result Hardware in-the-Loop testing- Experimental setup for HIL-HIL testing using dSPACE micro autobox, introduction to carmaker, building scenarios and vehicle analysis using carmaker-interfacing dSPACE with carmaker and case studies on micro autobox

TEXT BOOKS

1. Frank Vahid and Tony Givargis, (2002)Embedded System Design: A Unified Hardware/Software Introduction, John Wiley & Sons Ronald K. Jurgen ,(1999), Automotive Electronics Handbook, McGraw-Hill
2. Hall, Douglas V, (1999)Microprocessors and Interfacing: Programming and Hardware, 2nd edition, Tata McGraw Hill
3. David E. Simon, (1999), An Embedded Software Primer, Pearson Education
4. Ferguson, Colin R. (2000) Kirkpatrick, Allan T., Internal Combustion Engine - Applied Thermoscience, John Wiley

REFERENCES

1. Pulkrabek. (2003) Willard W., Engineering Fundamentals of the Internal Combustion Engine, Pearson, New Delhi
2. Robert Bosch GmbH (editor). (2008) Automotive Handbook, 7th edition, WileyErjavec, Jack. (2006) Automotive Technology: A Systems Approach, Thomson.James E. Duffy. (2004) Modern Automotive Technology, GoodheartWillcox
3. GisbertLechner. (1999) Automotive Transmission, Fundamentals, Selection, Design and Application, Springer, New York

ATC459	TWO AND THREE WHEELER TECHNOLOGY	L	T	P	C	TCH
		3	0	0	3	3
GOAL	To expose the students to understand the construction and working of two and three wheelers.					
OBJECTIVES	The course should enable the students to : 1. Learn the basics and working of two stroke and Four stroke SI engine. 2. Understand the construction of chassis and working of sub-systems. 3. Know the construction and working of Brake system, wheels and tyres. 4. Learn the different types of two wheelers and their maintenance. 5. Learn the different types of three wheelers and their maintenance.					
OUTCOMES	The course should enable the students to : 1. Familiarize the basics on two stroke and four stroke SI engine. 2. Acquire the knowledge on chassis and of sub-systems. 3. Gain the Knowledge on Brake system, wheels and tyres. 4. Attain the knowledge on different types of two wheelers and their maintenance. 5. Acquire the knowledge on different types of three wheelers and their maintenance.					
UNIT I	**POWER UNIT**					9
Two stroke SI engine, four stroke SI engine; merits and demerits. Symmetrical and unsymmetrical port timing diagrams. Types of scavenging processes; merits and demerits, scavenging pumps. Rotary valve engine. Fuel system. Lubrication system. Magneto coil and battery coil spark ignition system, electronic ignition system. Starting system; Kick starter system.						
UNIT II	**CHASSIS AND SUB-SYSTEMS**					9
Mainframe and its types. Chassis and shaft drive, Single, multiple plates and centrifugal clutches. Gear box and gear controls. Front and rear suspension systems. Shock absorbers. Panel meters and controls on handle bar.						
UNIT III	**BRAKES, WHEELS AND TYRES**					9
Drum brakes, Disc brakes, Front and rear brake links, Layouts. Spoked wheel, Cast wheel, Disc wheel, Disc types, Tyres and tubes.						
UNIT IV	**TWO WHEELERS**					9
Case study of major Indian models of motorcycles, scooters and mopeds.TVS mopeds and motorcycles, Hero Honda motorcycles, Bajaj scooters and motorcycles, Yamaha, Enfield motorcycles. Servicing and maintenance.						
UNIT V	**THREE WHEELERS**					9
Case study of Indian models. Auto rickshaws, Pickup van, Delivery van and trailer. Maintenance: daily, Weekly, Monthly, Fault tracing.						

TEXT BOOK

1.Irving.P.E. - Motor Cycle Engineering - Temple Press Book, London - 1992.

REFERENCES

1.The Cycle Motor Manual - Temple Press Limited, London - 1990

2.Encyclopedia of Motorcycling - 20 volume Marshall, Cavensih, UK - 1989

3.BrayantR.V,Vespa - Maintenance and Repair Series - S.Chand& Co., New Delhi -1986.

4.Raymond Broad Lambretta - A Practical Guide to maintenance and repair - S.Chand& Co., New Delhi - 1987.

ATC460	MODERN VEHICLE TECHNOLOGY*	L	T	P	C	TCH
		3	0	0	3	3
GOAL	To expose the students to understand the recent trends in engines, pollution control in automobiles, Vehicle operation and control and Vehicle automated tracks.					
OBJECTIVES	The course should enable the student to: 1. Understand the recent trends in engines 2. Understand the systems of Suspension, brakes and safety 3. Learn the significance of emission control methods. 4. Know the vehicle operation and control 5. Understand the vehicle automated tracks.					
EXPECTED OUTCOMES	The course should enable the student to: 1. Familiarize with the recent trends in engines 2. Acquire the knowledge on the systems of Suspension, brakes and safety 3. Gain knowledge on significance of emission control methods. 4. Acquire the knowledge on vehicle operation and control 5. Gain information on the automated vehicle tracks.					
UNIT I	**TRENDS IN POWER PLANTS**					9
Hybrid vehicles - stratified charged / lean burn engines - Hydrogen engines – battery vehicles - Electric propulsion with cables - magnetic track vehicles.						
UNIT II	**SUSPENSION BRAKES AND SAFETY**					9
Air suspension - Closed loop suspension - antiskid braking system, Retarders, Regenerative braking safety cage - air bags - crash resistance - passenger comfort.						
UNIT III	**NOISE & POLLUTION**					9
Reduction of noise - Internal & external pollution control through alternate fuels / powerplants - Catalytic converters and filters for particulate emission.						
UNIT IV	**VEHICLE OPERATION AND CONTROL**					9
Computer control for pollution and noise control and for fuel economy - Transducers and actuators - Information technology for receiving proper information and operation of the vehicle like optimum speed and direction.						
UNIT V	**VEHICLE AUTOMATED TRACKS**					9
Preparation and maintenance of proper road network - National highway network with automated roads and vehicles - Satellite control of vehicle operation for safe and fast travel.						
TEXT BOOK 1. Heinz Heisler, "Advanced Vehicle Technology" - Arnold Publication.						
REFERENCES 1. Beranek.L.L., Noise reduction, McGraw Hill Book Co., Inc., Newyork, 1993. **2.** Bosch Hand Book, 3rd Edition, SAE, 1993.						

ATC461	ADVANCED THEORY OF IC ENGINES	L	T	P	C	TCH
		3	0	0	3	3

GOAL

To expose the students to understand of the significance of various process in IC Engines.

OBJECTIVES

The course should enable the student to:

1. Understand the various cycles such as Otto, Diesel, Stirling and Brayton cycles.
2. Know the combustion process in SI and CI engines.
3. Learn the basic concepts of engine simulation.
4. Know the recent advancement in I.C. engines.
5. Understand the various electronics system/components used in engines.

EXPECTED OUTCOMES

The course should enable the student to:

1. Familiarize on the various cycles such as Otto, Diesel, Stirling and Brayton cycles.
2. Attain the knowledge on combustion process in SI and CI engines.
3. Develop the skill on the basic concepts of engine simulation.
4. Gain information on the recent advancement in I.C. engines.
5. Acquire the knowledge on various electronics system/components used in engines.

UNIT I	CYCLE ANALYSIS	9

Otto, Diesel, dual, Stirling and Brayton cycles, Comparison of air standard, Fuel air and actual cycles, Simple problems on the above topics.

UNIT II	COMBUSTION	9

Combustion reactions and stoichiometry, Heat of reaction, adiabatic flame temperature in constant pressure and constant volume systems, Fuels for internal combustion engines and their properties, Premixed and diffusion combustion as applicable to SI and CI engines, Concepts of burning rate and flame velocity, Fuel spray characteristics and combustion in diesel engines.

UNIT III	COMBUSTION MODELLING	9

Basic concepts of engine simulation, Governing equations, Simulation of various engine processes for SI and CI engines. Adiabatic flame temperature, Heat release calculations. Thermodynamic and Fluid mechanic based models.

UNIT IV	ADVANCES IN IC ENGINES	9

LHR engines, Surface ignition concept and multi fuel engines, Stratified charge and lean burn engines, Performance and emission characteristics, Merits and demerits.

UNIT V	ELECTRONIC ENGINE MANAGEMENT	9

Computer control of SI & CI engines for better performance and low emissions, Closed loop control of engine parameters of fuel injection and ignition

TEXT BOOKS

1.Ganesan .V - "IC Engines" - Tata McGraw-Hill, 2003.

2.John B. Haywood, "Internal Combustion Engine Fundamentals", McGraw-Hill Automotive Technology series.

REFERENCES

1. Ganesan .V - 'Computer Simulation of Spark Ignition Processes' - Universities Process Ltd, Hyderabad - 1993.
2. Ganesan.V. - Computer Simulation of compression ignition engines - Orcent Longman - 2000.
3. Richard Stone - "Introduction to IC Engines" - 2nd edition - Macmilan - 1992.

ATC462	HYBRID AND ELECTRIC VEHICLES	L	T	P	C	TCH
		3	0	0	3	3

GOAL

To expose the students on the recent technology in hybrid and electric vehicles.

OBJECTIVES

The course should enable the student to:

1. Understand the significance of hybrid vehicles.
2. Know the various types of battery and fuel cell.
3. Learn the different types of motors and controllers.
4. Know the significance of electric vehicle design consideration.
5. Understand the different types of Hybrid vehicles.

EXPECTED OUTCOMES

The course should enable the student to:

1. Attain the knowledge on hybrid vehicles.
2. Gain Knowledge on the various types of battery and fuel cell.
3. Acquire the knowledge on different types of motors and controllers.
4. Gain knowledge on significance of electric vehicle design.
5. Familiarize with different types of Hybrid vehicles.

UNIT I **REQUIREMENT FOR HYBRID VEHICLES** 9

Need of electric vehicles hybrid vehicles – comparative study of diesel, petrol, pure electric and hybrid vehicles. Limitations of electric vehicles. Specification of some electric and hybrid vehicles

UNIT II **BATTERIES AND FUEL CELLS** 9

Battery Parameters-Power requirement of electric vehicles- Different types of batteries - Lead acid-Nickel based-Sodium based-Lithium based- Metal Air based. Battery charging- Charger design- Quick charging devices- Battery Modeling.
Fuel Cell- Fuel cell characteristics- Fuel cell types-Hydrogen fuel cell- Connecting cell in series-water management in the PEM fuel cell- Thermal Management of the PEM fuel cell

UNIT III **MOTORS AND CONTROLLERS** 9

A characteristic of permanent magnet and separately exited DC motors. AC single phase and 3-phase motor – inverters – DC and AC motor speed controllers.

UNIT IV **ELECTRIC VEHICLE DESIGN CONSIDERATIONS** 9

Aerodynamic-Rolling resistance- Transmission efficiency- Vehicle mass- Electric vehicle chassis and Body design considerations- Heating and cooling systems- Controllers- Power steering- Tyre choice- Wing Mirror, Aerials and Luggage racks

UNIT V **HYBRID VEHICLES** 9

Types of Hybrid- Series, parallel, split – parallel, series - parallel - Advantages and Disadvantages. Power split device – Energy Management System - Design consideration -Economy of hybrid vehicles

TEXT BOOKS

1. James Larminie and John Lowry, "Electric Vehicle Technology Explained " John Wiley & Sons,2003
2. Iqbal Husain, " Electric and Hybrid Vehicles-Design Fundamentals", CRC Press,2003
3. MehrdadEhsani, " Modern Electric, Hybrid Electric and Fuel Cell Vehicles", CRC Press,2005

REFERENCES

1. Ron HodKinson, " light Weight Electric/ Hybrid Vehicle Design", Butterworth Heinemann Publication,2005
2. Lino Guzzella, " Vehicle Propulsion System" Springer Publications,2005.

ATC463	VIRTUAL INSTRUMENTATION IN AUTOMOTIVES*	L	T	P	C	TCH
		3	0	0	3	3

GOAL

To expose the students on the basics of virtual instrumentation used in automobiles.

OBJECTIVES

The course should enable the student to:

1. Understand the significance of virtual instrumentation.
2. Know about the converters and data acquisition.
3. Understand the various communication network modules.
4. Learn the real time control techniques in virtual instrumentation.
5. Learn the application of virtual instrumentation in automobiles.

EXPECTED OUTCOMES

The course should enable the student to:

1. Familiarize with the significance of virtual instrumentation.
2. Acquire the knowledge on converters and data acquisition.
3. Develop knowledge on various communication network modules.
4. Attain the knowledge on real time control techniques in virtual instrumentation.
5. Gain information on the application of virtual instrumentation in automobiles.

UNIT I **INTRODUCTION TO VIRTUAL INSTRUMENTATION** 9

Virtual Instrumentation-Definition and flexibility-Block diagram and Architecture of Virtual Instrumentation- Virtual instruments versus Traditional Instruments- Review of software in virtual Instrumentation and its programming techniques-sub, Loops and charts, Arrays, Clusters and Graphs, Case and Sequence Structures, Formula nodes, string and File Input / Output.

UNIT II **VIRTUAL INSTRUMENTATION DATA ACQUISTITION** 9

A/D and D/A Converters, plug-in Analog input / Output cards- Digital Input and Output cards, Organization of the DAQ system- Opto Isolation- Performing analog input and analog output- Scanning multiple analog channels- issues involved in selection of data acquisition cards- Data acquisition modules with serial communication- Design of digital voltmeter with transducer input-Timers and Counters.

UNIT III **COMMUNICATION NETWORK MODULE** 9

Introduction to PC buses-Local buses:-ISA,PCI,RS232,RS422 and RS 485- Interface buses:-USB,PCMCIA,VXI,SCXI and PXI – Instrumentation Buses:- Modbus and GPIB- Networked buses-ISO/OSI reference model, Ethernet and TCP/IP Protocols.

UNIT IV **REAL TIME CONTROL IN VIRTUAL INSTRUMENTATION** 9

Design of ON/OFF controller and proportional controller for a mathematically described processes using VI software-Modeling and basic control of level and Reactor Processes- Case Studies on development of HMI, SCADA in VI.

UNIT V **AUTOMOTIVE APPICATIONS** 9

PC based digital storage oscilloscope- Sensor technology and signal processing- virtual laboratory- spectrum analyzer- wave form generator- Data visualization and multiple locations:-Distributed monitoring and control-Vision and motion control. Case study related to automotive Applications.

TEXT BOOKS

1. Nadovich, C., “Synthetic Instruments Concepts and Applications”. Elsevier,2005
2. Bitter, R., Mohiuddin, T. and Nawricki, M., “Labview Advanced programming Techniques”, CRC Press, 2nd Edition, 2007.
3. Gupta, S. and Gupta J. P., “PC Interfacing for Data Acquisition and Process Control”, 2nd Edition, Instrument Society of America, 1994.

REFERENCES

1. Jamal, R. and Picklik, H., “Labview-Applications and Solutions “, National Instrument Release
2. Johnson, G.,” Labview Graphical programming McGraw-Hill, Newyork,1997.
3. Wells, L.K and Travis, J., “ Labview for Everyone”, Prentice Hall, New Jersey, 1997
4. Buchanan, W., ”Computer Busses ”, CRC Press, 2000