



# INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal, Hyderabad -500 043

## AERONAUTICAL ENGINEERING

### COURSE DESCRIPTOR

<b>Course Title</b>	<b>INTRODUCTION TO AUTOMOBILE ENGINEERING</b>				
<b>Course Code</b>	AME552				
<b>Programme</b>	B.Tech				
<b>Semester</b>	VI	AE			
<b>Course Type</b>	Open Elective				
<b>Regulation</b>	IARE - R16				
<b>Course Structure</b>	<b>Theory</b>			<b>Practical</b>	
	<b>Lectures</b>	<b>Tutorials</b>	<b>Credits</b>	<b>Laboratory</b>	<b>Credits</b>
	3	-	3	-	-
<b>Chief Coordinator</b>	Mr. R Sabari Vihar, Assistant Professor				
<b>Course Faculty</b>	Mr. R Sabari Vihar, Assistant Professor				

#### I. COURSE OVERVIEW:

This course is intended to introduce structural and operational details of automobile and its systems. Major systems are fuel supply, cooling, ignition, electrical, transmission, suspension, braking and steering. Transport of personnel and goods play an important role in the economy of country and standard of living. Lakhs of vehicles running crores of kilometers. So the man power is required to manufacture and maintain all these vehicles. After completion of this course the students gains adequate knowledge either to work in manufacturing or maintenance sector of automobiles.

#### II. COURSE PRE-REQUISITES:

Level	Course Code	Semester	Prerequisites	Credits
UG	AAE002	III	Theory of Structures	4
UG	AME003	IV	Thermodynamics	4

### III. MARKSDISTRIBUTION:

Subject	SEE Examination	CIA Examination	Total Marks
Introduction to Automobile Engineering	70 Marks	30 Marks	100

### IV. DELIVERY / INSTRUCTIONAL METHODOLOGIES:

✗	Chalk & Talk	✓	Quiz	✓	Assignments	✗	MOOCs
✓	LCD / PPT	✓	Seminars	✓	Mini Project	✓	Videos
✓	Open Ended Experiments						

### V. EVALUATION METHODOLOGY:

The course will be evaluated for a total of 100 marks, with 30 marks for Continuous Internal Assessment (CIA) and 70 marks for Semester End Examination (SEE). Out of 30 marks allotted for CIA during the semester, marks are awarded by taking average of two CIA examinations or the marks scored in the make-up examination.

**Semester End Examination (SEE):** The SEE is conducted for 70 marks of 3 hours duration. The syllabus for the theory courses is divided into FIVE units and each unit carries equal weightage in terms of marks distribution. The question paper pattern is as follows. Two full questions with “either” or “choice” will be drawn from each unit. Each question carries 14 marks. There could be a maximum of two sub divisions in a question.

The emphasis on the questions is broadly based on the following criteria:

50 %	To test the objectiveness of the concept.
50 %	To test the analytical skill of the concept OR to test the application skill of the concept.

### Continuous Internal Assessment (CIA):

CIA is conducted for a total of 30 marks (Table 1), with 25 marks for Continuous Internal Examination (CIE), 05 marks for Quiz/ Alternative Assessment Tool (AAT).

Table 1: Assessment pattern for CIA

Component	Theory		Total Marks
	CIE Exam	Quiz / AAT	
CIA Marks	25	05	30

### Continuous Internal Examination (CIE):

Two CIE exams shall be conducted at the end of the 8th and 16th week of the semester respectively. The CIE exam is conducted for 25 marks of 2 hours duration consisting of two

parts. Part–A shall have five compulsory questions of one mark each. In part–B, four out of five questions have to be answered where, each question carries 5 marks. Marks are awarded by taking average of marks scored in two CIE exams.

**Quiz / Alternative Assessment Tool (AAT):**

Two Quiz exams shall be online examination consisting of 25 multiple choice questions and are to be answered by choosing the correct answer from a given set of choices (commonly four).

Marks shall be awarded considering the average of two quizzes for every course. The AAT may include seminars, assignments, term paper, open ended experiments, five minutes video and MOOCs.

**VI. HOW PROGRAM OUTCOMES ARE ASSESSED:**

Program Outcomes (POs)		Strength	Proficiency assessed by
PO 1	<b>Engineering knowledge:</b> Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	3	Assignments & Projects
PO 3	<b>Design/ development of solutions:</b> Competence to design a system, component or process to meet societal needs within realistic constraints.	1	Assignments
PO 6	<b>The engineer and society:</b> To utilize the engineering practices, techniques, skills to meet needs of the health, safety, legal, cultural and societal issues.	2	Seminars

**3 = High; 2 = Medium; 1 = Low**

**VII. HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:**

Program Specific Outcomes (PSOs)		Strength	Proficiency assessed by
PSO 1	<b>Professional Skills:</b> To produce engineering professional capable of synthesizing and analyzing mechanical systems including allied engineering streams.	2	Seminars
PSO 3	<b>Successful career and Entrepreneurship:</b> To build the nation, by imparting technological inputs and managerial skills to become technocrats.	2	Projects
PSO 3	<b>Practical implementation and testing skills:</b> Providing different types of in house and training and industry practice to fabricate and test and develop the products with more innovative technologies	-	-
PSO 4	<b>Successful career and entrepreneurship:</b> To prepare the students with broad aerospace knowledge to design and develop systems and subsystems of aerospace and allied systems and become technocrats.	-	-

**3 = High; 2 = Medium; 1 = Low**

## VIII. COURSE OBJECTIVES :

The course should enable the students to:	
I	Understand the function of various parts of automobile, features of fuel supply systems for S.I and C.I engines
II	Distinguish the features of various types of cooling, ignition and electrical systems
III	Identify the merits and demerits of the various transmission and suspension systems
IV	Recognize the working of various braking and steering systems
V	Summarize the ways and means of reducing the emissions from automobiles.

## IX. COURSE OUTCOMES (Cos):

COs	Course Outcome	CLOs	Course Learning Outcome
CO 1	Understanding design and analysis of power transmitting elements, selection of suitable materials and manufacturing processes.	CLO 1	Understand the basic working of Auto mobile and different automobile components
		CLO 2	Analyse the working of the basic components in the IC engines
		CLO 3	Understand the importance of lubrication system in automobile
		CLO 4	Compare different fuel injection system and advantages of each individual and Concept electronic controlled fuel injection
CO 2	Analyzing the forces acting on various joints and their design.	CLO 5	Compare the different cooling processes in I.C engines, working of radiator and cooling accessories
		CLO 6	Analyze the different spark ignition system advantages of each individual system
		CLO 7	Understand the working of different automobile components like lighting system, horn, wiper, fuel gauge, temperature indicator
		CLO 8	Understand the different working principles of clutches, and fly wheel
CO 3	To develop an ability to identify, formulate, and solve various machine members problems	CLO 9	Analyse the transmission systems like gear boxes, propeller shafts, universal joints, differential gear boxes
		CLO 10	Explain the shock absorbers, suspension system and mechanisms to use for this
CO 4	Ability to design and analyze shafts with different geometrical features under various loading conditions which are helpful for steering's.	CLO 11	Compare the types of braking system, working principles
		CLO 12	Explain the steering system and components of steering system
		CLO 13	Explain the steering mechanisms, techniques to improve better steering
		CLO 14	Understand the importance of pollution controls, pollution control techniques
CO 5	Ability to understand different regulations and regulatory authorities for controlling pollution.	CLO 15	Understand the importance of alternative fuels to reduce the environment emotions
		CLO 16	Analyse the different alternative energy sources to reduce the environment emotions

## X. COURSE LEARNING OUTCOMES (CLOs):

CLO Code	CLO's	At the end of the course, the student will have the ability to:	PO's Mapped	Strength of Mapping
AME552.01	CLO 1	Understand the basic working of Auto mobile and different automobile components	PO 1	3

<b>CLO Code</b>	<b>CLO's</b>	<b>At the end of the course, the student will have the ability to:</b>	<b>PO's Mapped</b>	<b>Strength of Mapping</b>
AME552.02	CLO 2	Analyse the working of the basic components in the IC engines	PO 1	3
AME552.03	CLO 3	Understand the importance of lubrication system in automobile	PO 1	3
AME552.04	CLO 4	Compare different fuel injection system and advantages of each individual and Concept electronic controlled fuel injection	PO 1	3
AME552.05	CLO 5	Compare the different cooling processes in I.C engines, working of radiator and cooling accessories	PO 1	3
AME552.06	CLO 6	Analyze the different spark ignition system advantages of each individual system	PO 1	3
AME552.07	CLO 7	Understand the working of different automobile components like lighting system, horn, wiper, fuel gauge, temperature indicator	PO 3	1
AME552.08	CLO 8	Understand the different working principles of clutches, and fly wheel	PO 3	1
AME552.09	CLO 9	Analyse the transmission systems like gear boxes, propeller shafts, universal joints, differential gear boxes	PO 3	1
AME552.10	CLO 10	Explain the shock absorbers, suspension system and mechanisms to use for this	PO 1	3
AME552.11	CLO 11	Compare the types of braking system, working principles	PO 3	1
AME552.12	CLO 12	Explain the steering system and components of steering system	PO 1	3
AME552.13	CLO 13	Explain the steering mechanisms, techniques to improve better steering	PO 1	3
AME552.14	CLO 14	Understand the importance of pollution controls, pollution control techniques	PO 6	2
AME552.15	CLO 15	Understand the importance of alternative fuels to reduce the environment emotions	PO 6	2
AME552.16	CLO 16	Analyse the different alternative energy sources to reduce the environment emotions	PO 6	2

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#### **XI. MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES**

<b>Course Outcomes (COs)</b>	<b>Program Outcomes (POs)</b>			<b>Program Specific Outcomes (PSOs)</b>	
	<b>PO 1</b>	<b>PO 3</b>	<b>PO 6</b>	<b>PSO 1</b>	<b>PSO 2</b>
CO 1	3			2	
CO 2		1		2	
CO 3	3	1			2
CO 4	3	1	2		2
CO 5			2		2

**XII. MAPPING COURSE LEARNING OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:**

Course Learning Outcomes (CLOs)	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CLO 1	3												2		
CLO 2	3												2		
CLO 3	3												2		
CLO 4	3												2		
CLO 5	3												2		
CLO 6	3												2		
CLO 7			1										2		
CLO 8			1										2		
CLO 9			1											2	
CLO 10	3													2	
CLO 11			1											2	
CLO 12	3													2	
CLO 13	3													2	
CLO 14						2								2	
CLO 15						2								2	
CLO 16						2								2	

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**XIII. ASSESSMENT METHODOLOGIES–DIRECT**

CIE Exams	PO 1 PO 3 PO 6	SEE Exams	PO 1 PO 3 PO 6	Assignments	PO 1 PO 3 PO 6	Seminars	PO 6
Laboratory Practices	-	Student Viva	PO 1	Mini Project	PO 1	Certification	-
Term Paper	-						

**XIV. ASSESSMENT METHODOLOGIES-INDIRECT**

✓	Early Semester Feedback	✓	End Semester OBE Feedback
✓	Assessment of Mini Projects by Experts		

## XV. SYLLABUS

<b>Unit-I</b>	<b>INTRODUCTION</b>
Introduction to automobile engineering, chassis and automobile components, automobile engines, otto cycle, diesel cycle, dual cycle, engine lubrication, lubricating oil, lubrication oil filter, engine servicing; Fuel supply system; Fuel tank, strainer, feed pump, fuel filter, injection pump, injector, filters, electronic controlled fuel injection, common rail direct injection systems.	
<b>Unit-II</b>	<b>COOLING SYSTEM</b>
Cooling requirements, air cooling, liquid cooling, water forced circulation system, radiators, cooling fan, water pump, thermostat, pressure sealed cooling, antifreeze solutions, intelligent cooling; Ignition system: Function of an ignition system, battery ignition system, storage battery, condenser and spark plug, magneto coil ignition system, electronic ignition system, electronic ignition, spark advance mechanisms; Electrical system: Charging circuit, generator, current-voltage regulator, starting system, bendix drive mechanism solenoid switch, lighting systems, automatic high beam control, horn, wiper, fuel gauge, oil pressure gauge, engine temperature indicator..	
<b>Unit-III</b>	<b>TRANSMISSION AND SUSPENSIONS SYSTEMS</b>
Transmission system: Clutches, principle, types, single plate clutch, multi plate clutch, magnetic and centrifugal clutches, fluid fly wheel.  Gear boxes, types, constant mesh, synchro mesh gear boxes, epicyclic gear box, auto transmission, continuous variable transmission, propeller shaft, Hotch-Kiss drive, Torque tube drive, universal joint, differential, rear axles types, wheels and tyres; Suspension system: Objects of suspension systems, rigid axle suspension system, torsion bar, shock absorber, independent suspension system.	
<b>Unit-IV</b>	<b>BRAKING AND STEERING SYSTEMS</b>
Braking system: Mechanical brake system, Hydraulic brakes system, Master cylinder, wheel cylinder, Requirements of brake fluid, pneumatic and vacuum brake, ABS; Steering system: Steering geometry, camber, castor, king pin, rake, combined angle toe-in, toe-out, types of steering mechanism, Ackerman steering mechanism, Davis steering mechanism, steering gears types, steering linkages.	
<b>Unit-V</b>	<b>EMISSIONS FROM AUTOMOBILES</b>
Emissions from automobiles, pollution standards national and international, pollution control techniques, petrol injection, common rail diesel injection, variable valve timing; Energy alternatives, solar, photovoltaic, hydrogen, biomass, alcohols, LPG, CNG, liquid fuels and gaseous fuels, hydrogen as a fuel for internal combustion engines, their merits and demerits.	
<b>Text Books:</b>	
<ol style="list-style-type: none"> <li>1. Willam H crouse, Donald L. Anglin, —Automobile Engineering], McGraw Hill, 10th Edition, 2006.</li> <li>2. Manzoor, Nawazish Mehdi, Yosuf Ali, —A Text Book Automobile Engineering], Frontline Publications, 1 st Edition, 2011.</li> </ol>	
<b>Reference Books:</b>	
<ol style="list-style-type: none"> <li>1. R. K. Rajput, —A Text Book of Automobile Engineering, Laxmi Publications, 1st Edition, 2015</li> <li>2. Joseph Heinter, —Automotive Mechanics, CBS, 2nd Edition, 2006.</li> <li>3. K. Netwon, W. Steeds, T. K.Garrett, —Automotive Engineering], Butterworth-Heinamann, 13th Edition, 2016.</li> <li>4. S. Srinivasan, —Automotive Engines, Tata McGraw-Hill, 2nd Edition, 2003.</li> <li>5. Khalil. U. Siddiqui, —A Text Book of Automobile Engineering, New Age International, 1st Edition, 2012.</li> </ol>	

## XVI. COURSE PLAN:

The course plan is meant as a guideline. Probably there may be changes.

Lecture No	Topics to be covered	Course Learning Outcomes (CLOs)	Reference
1-2	Introduction: Resistance to vehicle motion Layout of automobile Chassis and body components	CLO 1	T1.4
3	Types of automobile engines	CLO 2	T1.1
4	Engine lubrication, Engine Servicing	CLO 3	T2.1
5	Fuel System in S.I Engines mechanical and electrical, Fuel filters	CLO 4	T2.4
6	Carburetor, Air filters	CLO 2	T2.8
7	Petrol injection, MPFI and GDI Systems	CLO 2	T2.8
8	C.I Engines: Diesel injection systems	CLO 2	T2.9
9	Types of injection systems, DI systems IDI systems, Fuel pump, Nozzle, spray formation	CLO 4	T2.9
10-11	Injection timing, testing of fuel pumps, CRDI and TDI systems	CLO 4	T2.9
12-13	Cooling system: Cooling requirements, Air cooling, Liquid cooling, Thermo, Water and Forced circulation system	CLO 5	T2.5
14	Radiators, cooling fan, water pump	CLO 5	T2.5
15	Thermostat, evaporative cooling-pressure sealed cooling-antifreeze solutions	CLO 5	T2.5
15	Ignition System: Function of an ignition system, battery ignition system	CLO 6	T2.12
17	Storage batteries, auto transformer, contact breaker points.	CLO 6	T2.14
18	Condenser and spark plug-Magneto coil ignition system.	CLO 6	T2.12
19	Electronic ignition system using contact breaker	CLO 6	T2.13
20	Electronic ignition using contact triggers	CLO 6	T2.13
21	Spark advance and retard mechanism.	CLO 6	T2.13
22	Electrical System: Charging circuit, Generator	CLO 7	T2.15
23	Current voltage regulator	CLO 7	T2.15
24	Starting system, bendix drive mechanism	CLO 7	T2.16
25	Solenoid switch, lighting systems, Horn, wiper, fuel gauge	CLO 7	T2.16
26	Oil pressure guage, engine temperature indicator	CLO 7	T2.6
27	Transmission system:Clutches, principle, types, cone clutch	CLO 8	T1.3
28	Single plate clutch, Multi plate clutch, Magnetic and centrifugal clutches	CLO 8	T1.3
29	Fluid fly wheel-gear boxes, types	CLO 8	T1.3
30	Sliding mesh, constant mesh, synchromesh gear boxes	CLO 9	T1.4
31-32	Epicyclic gear box, over drive torque converter	CLO 9	T1.5
33	Propeller shaft-Hotch kiss drive, Torque tube drive	CLO 9	T1.6
34-35	Universal joint, differential, rear axles	CLO 9	T1.6
36	Wheels and tyres	CLO 10	T1.9



Lecture No	Topics to be covered	Course Learning Outcomes (CLOs)	Reference
37-38	Suspension System: Objects of suspension systems-rigid axle suspension system and torsion bar	CLO 10	T1.7
39-40	Shock absorber, independent suspension system	CLO 10	T1.7
41	Braking system: Mechanical brake system	CLO 11	T1.10
42-43	Hydraulic brake system, Master cylinder, Wheel cylinder	CLO 11	T1.10
44	Requirement of brake fluid, Pneumatic brakes	CLO 11	T1.10
45	Vacuum brakes	CLO 11	T1.11
46	Steering system: Steering geometry	CLO 12	T1.8
47-48	Camber, castor, king pin rake, Combined angle toein, Center point steering	CLO 12	T1.8
49-50	Ackerman steering mechanism, Davis steering mechanism, steering gears and steering linkages.	CLO 13	T1.8
51-52	Emission from automobiles: pollution standards National and international-pollution control techniques	CLO 14	T2.17
53	Multipoint fuel injection for SI Engines, Common rail diesel injection	CLO 14	T2.17
54-55	Energy alternatives-Solar, Photo-voltaic, hydrogen	CLO 16	T2.7
56-57	Biomass, alcohols, LPG, CNG	CLO 15	T2.17
58-60	Standard vehicle maintenance practice	CLO 15	T2.4

#### **XVII. GAPS IN THE SYLLABUS - TO MEET INDUSTRY / PROFESSION REQUIREMENTS:**

S No	Description	Proposed actions	Relevance with POs	Relevance with PSOs
1	To improve standards and analyse the concepts	Seminars / Guest Lectures / NPTEL	PO 1	PSO 1
2	Concepts related to thermodynamic laws, working principles of IC Engines	Seminars / /NPTEL	PO 1, PO 3	PSO 1
3	Encourage students to solve real time problems like pollution controls	Guest Lectures	PO 8	PSO 1

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**HOD, AE**