INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)
Dundigal, Hyderabad - 500 043

MECHANICAL ENGINEERING

COURSE DESCRIPTION FORM

Course Title	**AUTOMOBILE ENGINEERING**			
Course Code	**A62405**			
Regulation	**R15-JNTUH**			
Course Structure	Lectures	Tutorials	Practicals	Credits
	4	-	-	4
Course Coordinator	Mr. G. Sarat Raju, Associate Professor, Department of Mechanical Engineering.			
Team of Instructors	Mr. A. Anudeep Kumar, Assistant Professor. Mr. G. Sarat Raju, Associate 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. 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. PREREQUISITE(S):

Level	Credits	Periods / Week	Prerequisites
UG	4	4	Thermodynamics, Thermal Engineering, Kinematics of Machinery, dynamics of a machinery, Basic Electrical Engineering, Machine Design.

III. MARKS DISTRIBUTION:

Sessional Marks (25)	University End Exam Marks	Total Marks
Continuous Assessment Tests (Midterm examinations): There shall be 2 midterm examinations. Each midterm examination consists of one objective paper, one subjective paper and two assignments. The objective paper is for 10 marks and subjective paper is for 10 marks, with duration of 1 hour 20 minutes (20 minutes for objective and 60 minutes for subjective paper). Objective paper is set for 20 bits of – multiple choice questions, fill-in the blanks, 10 marks. Subjective paper contains of 4 full questions (one from each unit) of which, the student has to answer 2 questions, each question carrying 5 marks. First midterm examination shall be conducted for 2.5 units of syllabus and second midterm examination shall be conducted for another 2.5 units. 5 marks are allocated for Assignment. The total marks secured by the student in each midterm examination are evaluated for 25 marks.	75	100

IV. EVALUATION SCHEME:

S. No.	Component	Duration	Marks
1	I Mid Examination	80 Minutes	20
2	I Assignment		5
		TOTAL	**25**
3	II Mid Examination	80 Minutes	20
4	II Assignment		5
		TOTAL	**25**
5	EXTERNAL Examination	3 hours	75
		GRAND TOTAL	**100**

V. COURSE OBJECTIVES:

The objectives of the course are to enable the student;

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.

VI. COURSE OUTCOMES:

On successful completion of the course, the student will be able to

1. **Identify** the different parts of the automobile.
2. **Explain** the working of various parts like engine, transmission, clutch, brakes.
3. **Describe** the steering systems.
4. **Understand** the environmental implications of automobile emissions.
5. **Develop** a strong base for understanding future developments in the automobile industry.
6. **Ability** to apply various methods to reduce emissions from automobiles.
7. **Explain** the ignition systems for automobiles.
8. **Understand** the design transmission and suspension systems.
9. **Explain** the fuel supply systems for automobiles.
10. **Describe** the suspension systems operate.

VII. HOW COURSE OUTCOMES ARE ASSESSED:

Program Outcomes		Level	Proficiency assessed by
PO1	**Engineering knowledge**: Capability to apply the knowledge of Mathematics, Science and Engineering in the field of Mechanical Engineering.	H	Assignments Midterm and University examinations
PO2	**Problem analysis**: An ability to analyze complex engineering problems to arrive at relevant conclusions using knowledge of Mathematics, Science and Engineering.	H	Assignments Midterm and University examinations
PO3	**Design/development of solutions**: Competence to design a system, compone nt or process to meet societal needs within realistic constraints.	S	Assignments Midterm and University examinations
PO4	**Conduct investigations of complex problems**: To design and conduct research oriented experiments as well as to analyze and implement data using research methodologies.	S	Projects

PO5	**Modern tool usage**: An ability to formulate, solve complex engineering problems using modern engineering and Information Technology tools.	S	Mini Projects
PO6	**The engineer and society**: To utilize the Engineering practices, Techniques, skills to meet needs of the health, safety, legal, cultural and societal issues.	H	Assignment
PO7	**Environment and sustainability**: To understand impact of Engineering solutions in the societal context and demonstrate the knowledge for sustainable development.	N	--
PO8	**Ethics**: An understanding and Implementation of professional and Ethical responsibilities.	H	Guest Lecture
PO9	**Individual and teamwork**: To function as an effective individual and as a member or leader in Multi-disciplinary environment and adopt in diverse teams.	N	--
PO10	**Communication**: An ability to assimilate, comprehends, communicate, give and receive instructions to present effectively with engineering community and society.	S	Mini Project
PO11	**Project management and finance**: An ability to provide leadership in mana ging complex engineering projects at Multidisciplinary environment and to become a professional engineer.	N	--
PO12	**Life-long learning**: Recognition of the need and an ability to engage in life-long learning to keep abreast with technological changes.	S	Guest Lecture

VIII. HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

Program Specific Outcomes		Level	Proficiency assessed by
PSO1	**Professional Skills:** To produce engineering professional capable of synt hesizing and analyzing mechanical systems including allied engineering streams.	H	Practicals, Midterm and University examinations,
PSO2	**Design/Analysis:** An ability to adopt and integrate current technologies in the design and manufacturing domain to enhance the employability.	H	Projects
PSO3	**Successful Career and Entrepreneurship:** To build the nation, by imparting technological inputs and managerial skills to become Technocrat.	S	Guest Lectures

IX. SYLLABUS:

UNIT-I
INTRODUCTION:

Layout of automobile-introduction chassis and body components. Types of Automobile engines. – Power unit – introduction to engine lubrication –engine servicing.

Fuel System: S.I. Engine: Fuel supply systems, Mechanical and electrical fuel pump-filters-carburetor-types-air filters-petrol injection. Introduction to MPFI and GDI systems.

C.I. Engines: Requirements of diesel injection systems, types of injection systems, DI systems IDI systems, fuel pump, nozzle, spray formation, injection timing, testing of fuel pumps. Introduction CRDI and TDI systems.

UNIT-II
COOLING SYSTEM:

Cooling Requirements, Air Cooling, Liquid Cooling, Thermo, water and Forced Circulation System – Radiators – Types – Cooling Fan - water pump, thermostat, evaporating cooling – pressure sealed cooling – antifreeze solutions.

Ignition System: Function of an ignition system, battery ignition system, constructional features of storage, battery, auto transformer, contact breaker points, condenser and spark plug – Magneto coil ignition system, electronic ignition system using contact breaker, electronic ignition using contact triggers – spark advance and retard mechanism.

Electrical System : Charging circuit, generator, current – voltage regulator – starting system, bendix drive mechanism solenoid switch, lighting systems, Horn, wiper, fuel gauge – oil pressure gauge, engine temperature indicator etc.

UNIT-III
TRANSMISSION SYSTEM:

Clutches, principle, types, cone clutch, single plate clutch, multi plate clutch, magnetic and centrifugal clutches, fluid fly wheel – gear boxes, types, sliding mesh, construct mesh, synchromesh gear boxes, epicyclic gear box, over drive torque converter. 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.

UNIT-IV
BRAKING SYSTEM:

Mechanical brake system, Hydraulic brake system, Master cylinder, wheel cylinder tandem master cylinder Requirement of brake fluid, Pneumatic and vacuum brakes.

Steering System: Steering geometry – camber, castor, king pin rake, combined angle toein, center point steering. Types of steering mechanism – Ackerman steering mechanism, Davis steering mechanism, steering gears – types, steering linkages.

UNIT-V
EMISSION FROM AUTOMOBILES:

Emission from Automobiles – Pollution standards National and international – Pollution Control – Techniques – Multipoint fuel injection for SI Engines. Common rail diesel injection Energy alternatives – Solar, Photo-voltaic, hydrogen, Biomass, alcohols, LPG, CNG, liquid Fuels and gaseous fuels, electrical-their merits and demerits.

TEXT BOOKS:

1. Automobile Engineering/William H Crouse/McGraw Hill-2012.
2. A Text Book Automobile Engineering-Manzoor, Nawazish Mehdi & Yosuf Ali, Frontline Publications.

REFERENCES:

1. A Text book of automobile Engineering by R K Rajput, Laxmi publications.
2. Automotive Mechanics by Heitner.
3. Automotive Engineering by Newton steeds & Garrett.
4. Automotive Engines by Srinivasan.
5. A Text Book of Automobile Engineering by khalil U Siddiqui New age international.

X. COURSE PLAN:

The course plan is meant as a guideline. There may probably be changes.

Lecture No.	Course Learning Outcomes	Topics to be covered	Reference
1	Identify the forces on vehicle	UNIT-I Introduction Resistance to vehicle motion	T1:1.1, T1:1.2
2	Identify the major components	Layout of automobile Chassis and body components	T1:1.4
3	Identify types	Types of automobile engines	T1:1.5
4	Compare various lubrication systems	Engine lubrication	T1:2.2
5	Understand servicing procedures	Engine Servicing	T1:2.4,2.9
6	Examine various systems	Fuel System in S.I Engines mechanical and electrical, Fuel filters	T1:3.1,T1:4.5
7	Understand working of Carburetor.	Carburetor	T1:10.2,T1:11.2
8	Classify Air filters	Air filters	T1:11.5,T1:12.1
9	Recognize merits and demerits of various systems.	Petrol injection, MPFI and GDI Systems	T1:16
10	Understand working of C.I Engines	C.I Engines: Diesel injection systems	T1: 17,
11	Compare different injection systems.	Types of injection systems	T1:19
12	Recognize advantages of various Ignition systems.	DI systems IDI systems	T2:2.2
13	Understand working of Fuel pump.	Fuel pump	T1:22.2
14	Examine operation principles of Nozzle	Nozzle, spray formation	T1:22.2, T1:22.5.
15	**Describe** Injection timing.	Injection timing, testing of fuel pumps	T1:23.2, T1:23.3
16	Remembering	UNIT-II Cooling system: Cooling requirements, Air cooling, Liquid cooling, Thermo, Water and Forced circulation system	T1:7, T1:8
17	Remembering	Radiators, cooling fan, water pump	T1:2.2
18	Explain merits of various systems	Thermostat, evaporative cooling-pressure sealed cooling-antifreeze solutions	T2:2.4, R2.2:3
19	Describe ignition systems.	Ignition System: Function of an ignition system, battery ignition system	T2:2.5, R2:2.3
20	Understand the working principles of batteries	Storage batteries, auto transformer, contact breaker points.	T2:2.5, R2:2.3
21	Explain spark plug.	Condenser and spark plug-Magneto coil ignition system.	T2:2.5, R2:2.3
22	Explain ignition system.	Electronic ignition system using contact breaker	T2:2.5, R2:2.3
23	Understand operational details of Electronic ignition	Electronic ignition using contact triggers	T2:2.6, R2:2.5

24	Describe Spark advance.	Spark advance and retard mechanism.	T2:2.6, R2:2.5
25	Explain Generator.	Electrical System: Charging circuit, Generator	T2:2.7, R2:2.7
26	Describe Current voltage regulator	Current voltage regulator	T2:2.8, R2:2.9
27	Explain working of bendix drive mechanism	Starting system, bendix drive mechanism	T2:2.8, R2:2.9
28	Explain Solenoid switch.	Solenoid switch, lighting systems, Horn, wiper, fuel gauge	T2:2.8, R2:2.9
29	Describe Oil pressure guage	Oil pressure guage, engine temperature indicator	T2:2.9, R2:2.10
30	Explain Transmission system.	UNIT-III Transmission system: Clutches, principle, types, cone clutch	T1:3.1, R3:3.1
31	Classify Clutch.	Single plate clutch, Multi plate clutch, Magnetic and centrifugal clutches	T1:3.2, R3.3.2
32	Classify Gearbox.	Fluid fly wheel-gear boxes, types	T1:3.3, R3:3.3
33	Explain Sliding mesh.	Sliding mesh, constant mesh, synchromesh gear boxes.	T1:3.4, R3:3.4
34	Describe Epicyclic gear box.	Epicyclic gear box, over drive torque converter	T1:3.5, R3:3.5
35	Explain Torque tube drive.	Propeller shaft-Hotch kiss drive, Torque tube drive	T1:3.6, R3:3.6
36	Classify axles.	Universal joint, differential, rear axles	T1:3.7, R3:3.7
37	Select suitable wheels and tyres	Wheels and tyres	T1:3.8, R3:3.8
38	Describe Suspension System.	Suspension System: Objects of suspension systems-rigid axle suspension system and torsion bar	T1:3.9, R3:3.9
39	Compare Various Suspension systems.	Shock absorber, independent suspension system	T1:3.10, R3:3.10
40	Explain Braking system.	UNIT-IV Braking system: Mechanical brake system	T2:4.1, R4:4.1
41	Classify Braking system	Hydraulic brake system, Master cylinder, Wheel cylinder	T2:4.2, R4:4.2
42	Explain Pneumatic brakes	Requirement of brake fluid, Pneumatic brakes	T2:4.3, R4:4.3
43	Explain Vacuum brakes.	Vacuum brakes	T2:4.4, R4:4.4
44	Describe Steering system	Steering system: Steering geometry	
45	Explain requirements of Steering system	Camber, castor, king pin rake, Combined angle toein, Center point steering	T2:4.5, R4:4.5
46	Classify Steering system	Ackerman steering mechanism, Davis steering mechanism, steering gears and steering linkages.	T2:4.6, R4:4.6
47	Describe Emission from automobiles.	UNIT-V: Emission from automobiles-pollution standards National and international pollution control techniques	T1:5.1, R1:5.1
48	Explain Multipoint fuel injection.	Multipoint fuel injection for SI Engines, Common rail diesel injection	T1:5.2, R1:5.2
49	Classify Fuels.	Energy alternatives-Solar, Photo-voltaic, hydrogen	T1:5.3, R1:5.3

50	Describe alternative fuels.	Biomass, alcohols, LPG, CNG	T1:5.4, R1:5.4
51	Describe vehicle maintenance.	Standard vehicle maintenance practice	T1:5.5, R1:5.5

XI. MAPPING COURSE OBJECTIVES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Objectives	Program Outcomes												Program Specific Outcomes		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
I	H		S		S			H		S		S	H	S	
II		H		H		S			S		H				H
III	H		S				S			H		S		H	
IV		H		S		H		S				S	H	S	
V			S		H			S					H		S

S =Supportive **H=Highly Related**

XII. MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES:

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
1	H		S		S	H		S		S			H	S	
2		H	S			S		H				S	S		H
3		S		S		H		S		S			H		
4	S		S		S			S		S		S	S	H	
5		S		H		S			S						
6	H			S								S		S	H
7	S			H						S			S	H	
8	S		H		S		S	H							
9		S		H	S					H		S	S	H	
10	H			S		S			H				S		S

S =Supportive **H=Highly Related**

Prepared By:

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