# ANNA UNIVERSITY, CHENNAI

**AFFILIATED INSTITUTIONS**

**REGULATIONS - 2013**

**M.E AUTOMOBILE ENGINEERING**

**I TO IV SEMESTERS CURRICULUM AND SYLLABUS**

## SEMESTER I

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**TOTAL CREDITS TO BE EARNED FOR THE AWARD OF DEGREE = 71**

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OBJECTIVE:
- Study of the Constructional details and Theory of important drive line, Structural, Steering, Braking and Suspension Systems of Automobiles. Problem–Solving in Steering Mechanism, Propeller Shaft, Braking and Suspension Systems are to be done.

UNIT I LAYOUT, FRAME, FRONT AXLE AND STEERING SYSTEM 13

UNIT II DRIVE LINE, FINAL DRIVE AND DIFFERENTIAL 12

UNIT III REAR AXLES, WHEELS, RIMS AND TYRES 11

UNIT IV SUSPENSION SYSTEM 12
Requirements of Suspension System, Types of Suspension – Constructional details and characteristics of Single Leaf, Multi–Leaf spring, Coil spring and Torsion bar, Rubber, Pneumatic and Hydro – elastic Suspension, Independent Suspension System, Shock Absorbers.

UNIT V BRAKE SYSTEM 12

TOTAL : 60 PERIODS

TEXT BOOKS

REFERENCES
AIM:
• To impart the knowledge on basic concepts on Automotive Engines and its various sub components along with its functions.

OBJECTIVE:
• The main objective of this course is to impart knowledge in automotive engine. The detailed concept, construction and principle of operation of engine and various engine components, combustion, cooling and lubrication systems will be taught to the students. At the end of the course the students will have command over automotive engines and the recent development in the area of engines.

UNIT I  ENGINE BASIC THEORY  
Engine types – otto, diesel, dual operating cycles - Engine design and operating parameters - Two and four stroke engines - Typical performance curves for automobile engines- two stroke engine - performance and pollution aspects.

UNIT II  FUEL SUPPLY AND IGNITION SYSTEMS  

UNIT III  COOLING AND LUBRICATING SYSTEMS  
Air cooling and water cooling – thermo syphon cooling, forced cooling systems. Fins and radiator - design aspects. Theory of lubrication — types of lubrication, splash lubrication system, petroil lubrication system, forced feed lubrication system.

UNIT IV  AIR MOTION, COMBUSTION AND COMBUSTION CHAMBERS  

UNIT V  NEW ENGINE TECHNOLOGY  

TOTAL: 45 PERIODS

TEXTBOOK

REFERENCES:
OBJECTIVES:
- The main objective of this course is to impart knowledge in automotive transmission. The detailed concept, construction and principle of operation of various types of mechanical transmission components, hydrodynamic devices, hydrostatic devices and automatic transmission system will be taught to the students. The design of clutch and gearbox will also be introduced to the students. At the end of the course the students will have command over automotive transmission concepts and application.

UNIT I  CLUTCH  9
Requirements of Transmission system. Clutches – Functions, Principle of operation and types – single plate, multi plate, diaphragm and overrunning clutches.

UNIT II  GEAR BOX  9
Purpose of gear box. Construction and working principle of sliding, constant and synchromesh gear boxes. Problems on performance of automobile such as Resistance to motion, Tractive effort, Engine speed & power and acceleration. Determination of gear box ratios for different vehicle applications.

UNIT III  HYDRODYNAMIC TRANSMISSION  9

UNIT IV  AUTOMATIC TRANSMISSION  9

UNIT V  HYDROSTATIC DRIVE AND ELECTRIC DRIVE  9

TEXTBOOK:

REFERENCES:
OBJECTIVE:

• To impart knowledge on numerical methods that will come in handy to solve numerically the problems that arise in engineering and technology. This will also serve as a precursor for future research.

OUTCOME:

• It helps the students to get familiarized with the numerical methods which are necessary to solve numerically the problems that arise in engineering.

UNIT I ALGEBRAIC EQUATIONS (9+3)


UNIT II ORDINARY DIFFERENTIAL EQUATIONS (9+3)

Runge Kutta Methods for system of IVPs, numerical stability, Adams-Bashforth multistep method, solution of stiff ODEs, shooting method, BVP: Finite difference method, orthogonal collocation method, orthogonal collocation with finite element method, Galerkin finite element method.

UNIT III FINITE DIFFERENCE METHOD FOR TIME DEPENDENT PARTIAL DIFFERENTIAL EQUATION (9+3)


UNIT IV FINITE DIFFERENCE METHODS FOR ELLIPTIC EQUATIONS (9+3)

Laplace and Poisson’s equations in a rectangular region: Five point finite difference schemes, Leibmann’s iterative methods, Dirichlet and Neumann conditions – Laplace equation in polar coordinates: finite difference schemes – approximation of derivatives near a curved boundary while using a square mesh.

UNIT V FINITE ELEMENT METHOD (9+3)


BOOK FOR STUDY:

AM7111 ENGINE AND CHASSIS LABORATORY

OBJECTIVE:
- The main objective of this course is to impart knowledge in the assembling and dismantling and study of different types of an engine and its various systems like steering system, transmission system, electrical system, ignition system, injection system, Braking system. At the end of the course the student will be well versed in the assembling and dismantling of any vehicles.

LIST OF EXPERIMENTS
1. Performance and emission Test of SI Engine.
2. Performance and emission Test of CI Engine.
3. Heat balance test on IC engines
5. Determination of in-cylinder pressure vs crank angle.
7. Study of Wheel Alignment System
8. Assembling and dismantling of the following
   i. SI engine.
   ii. CI engine
   iii. V engine
   iv. Single plate, Diaphragm Clutch.
   v. Constant mesh, Sliding mesh gear box
   vi. Transfer case
   vii. Differential
   viii. Front axle, Rear axle
   ix. Brake system
   x. Steering system

TOTAL: 45 PERIODS

AM7201 AUTOMOTIVE ELECTRICAL AND ELECTRONICS

AIM:
- The student will have to know about all theoretical information and about electrical components used in a vehicle.

OBJECTIVE
To impart knowledge to the students in the principles of operation and constructional details of various Automotive Electrical and Electronic Systems like Batteries, Starting System, charging System, Ignition System, Lighting System and Dash – Board Instruments, Electronic ignition system, various sensors and the role of ECU.

UNIT I BATTERY AND STARTING SYSTEMS
UNIT II CHARGING AND LIGHTING SYSTEMS

UNIT III ELECTRONIC IGNITION AND INJECTION SYSTEMS

UNIT IV ELECTRICAL SYSTEMS
Warning and alarm instruments : Brake actuation warning system, traficators, flash system, oil pressure warning system, engine over heat warning system, air pressure warning system, speed warning system, door lock indicators, neutral gear indicator, horn design, permanent magnet horn, air & music horns. Wind shield wiper, window washer, instrument wiring system and electromagnetic interference suppression, wiring circuits for instruments, electronic instruments, dash board illumination.

UNIT V MICROPROCESSOR IN AUTOMOBILES
Microprocessor And Microcomputer controlled devices in automobiles such as instrument cluster, Voice warning system, Travel information system, Keyless entry system, Automatic Transmissions. Environmental requirements (vibration, Temperature and EMI).

TOTAL : 45 PERIODS

TEXTBOOK:

REFERENCES:

AM7202 AUTOMOTIVE POLLUTION AND CONTROL

OBJECTIVE:
- The main objective of this course is to impart knowledge in automotive pollution control. The detailed concept of formation and control techniques of pollutants like UBHC, CO, NOx, particulate matter and smoke for both SI and CI engine will be taught to the students. The instruments for measurement of pollutants and emission standards will also be introduced to the students. At the end of the course the students will have command over automotive pollution and control.

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

UNIT II EMISSION FROM SPARK IGNITION ENGINE AND ITS CONTROL 10
Emission formation in SI Engines- Carbon monoxide & Carbon di oxide - Unburned hydrocarbon, NOx, Smoke —Effects of design and operating variables on emission formation — controlling of pollutants - Catalytic converters, Charcoal Canister, CCS, Positive Crank case ventilation system, Secondary air injection, thermal reactor, Laser Assisted Combustion.

UNIT III EMISSION FROM COMPRESSION IGNITION ENGINE AND ITS CONTROL 10
Formation of White, Blue, and Black Smokes, NOx, soot, sulphur particulate and Intermediate Compounds – Physical and Chemical delay — Significance Effect of Operating variables on Emission formation — Fumigation, Split injection, Catalytic Coating, EGR, HCCI, Particulate Traps, SCR, Fuel additives — Cetane number Effect.

UNIT IV NOISE POLLUTION FROM AUTOMOBILES 8

UNIT V TEST PROCEDURES AND EMISSION MEASUREMENTS 9
Constant Volume Sampling I and 3 (CVSI &CVS3) Systems- Sampling Procedures — Chassis dyno - Seven mode and thirteen mode cycles for Emission Sampling — Sampling problems — Emission analysers —NDIR, FID, Chemiluminescent, Smoke meters, Dilution Tunnel, SHED Test, Sound level meters.

TOTAL: 45 PERIODS

TEXTBOOKS:

REFERENCES

AM7203 VEHICLE BODY ENGINEERING L T P C
3 0 0 3

OBJECTIVES:
• The main objective of this course is to impart knowledge in the construction of vehicle, aerodynamic, concept, paneling of passenger car body trim. At the end of the course the student will be well versed in the design and construction of external body of the vehicles.
UNIT I CAR BODY

UNIT II BUS BODY
Types of bus body: based on capacity, distance traveled and based on construction.– Layout for various types of Bus body, Types of metal sections used – Regulations – Constructional details: Conventional and integral. Driver seat design - Safety aspect of bus body.

UNIT III COMMERCIAL VEHICLE BODY
Types of commercial vehicle bodies – LCV, MCV, HCV. Construction details of - Flat platform body, Trailer, Tipper and Tanker body – Dimensions of driver’s seat in relation to controls – Drivers cab design.

UNIT IV VEHICLE AERODYNAMICS
Vehicle drag and types. 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 tunnels – Principle of operation, Types. Wind tunnel testing such as: Flow visualization techniques, Airflow management test – measurement of various forces and moments by using wind tunnel. Drag reducing devices.

UNIT V BODY MATERIALS, TRIM, MECHANISMS AND BODY REPAIR

TOTAL : 45 PERIODS

TEXTBOOK:

REFERENCES:

AM7204 VEHICLE DYNAMICS

UNIT I BASIS OF VIBRATION

UNIT II TYRES
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

UNIT III VERTICAL DYNAMICS

UNIT IV LONGITUDINAL DYNAMICS AND CONTROL

UNIT V LATERAL DYNAMICS

TOTAL: 45 PERIODS

TEXT BOOKS:

REFERENCES:
1. Dean Karnopp, Vehicle Stability, 1st edition, Marcel Dekker, 2004

AM7211 AUTOMOTIVE ELECTRICAL AND ELECTRONICS LABORATORY

LIST OF EXPERIMENTS:
1. Testing of
   a. battery
   b. starting systems
   c. charging systems
   d. ignition systems
   e. body controller systems
2. Study of automotive lighting system and adjustment of head lights beam
3. Study of Logic gates, Adders, Fliplops
4. Study of SCR and IC Timers
5. Interfacing amplifier, filter, Multiplexer and De-multiplexer
6. Interfacing seven segment displays
7. Basic microprocessor and microcontroller programming like arithmetic and Logic operation, code conversion, waveform generation, look up table
8. Interfacing ADC and DAC for Data Acquisition and Control Application
9. Interfacing Sensors for Measurements of position, displacement, velocity, force, temperature, proximity/range etc
11. Study of Virtual Instrumentation
12. Study of Development of Embedded Systems
13. Mini Project

TOTAL: 45 PERIODS
TEXT BOOKS:
2. Automobile Electronics by Eric Chowanietz SAE

REFERENCES:

AM7311 COMPUTER AIDED VEHICLE DESIGN LABORATORY

Design, model and (Structural / Thermal) analysis of the following components
1. Engine Cylinder
2. Piston Assembly.
3. Connecting rod.
4. Valves.
5. Crank shaft.
6. Cam shaft.
8. Suspension Spring.
10. Rear axle.
11. Gear box.

TOTAL: 45 PERIODS

REFERENCES:
9. ACAD, CATIA and ANSYS software guide / manual

AM7001 ADVANCED THERMODYNAMICS FOR AUTOMOBILE ENGINEERS

UNIT I BASIC CONCEPTS
Systems, property, state, path and process- quasi static process, work, modes of work. Review of laws of thermodynamics – first and second law of thermodynamics – Application of the energy equation to the engine combustion process. Application to closed and open systems of automobile. internal energy, specific heat capacities, enthalpy, and steady flow process.
UNIT II  ENTROPY

UNIT III  COMBUSTION THERMODYNAMICS

UNIT IV  FLAMES AND CHEMICAL KINETICS
Flames – premixed, diffusion, Laminar and turbulent – Explosion limits, Flammability limits, Ignition, Engine combustion systems. Chemical Kinetics – Reaction rates - Rate constant, Pollutants formed through chemical kinetics

UNIT V  CHEMICAL EQUILIBRIUM AND DISSOCIATION

TOTAL: 45 PERIODS

REFERENCES :

AM7002  ALTERNATIVE FUELS AND PROPULSION SYSTEMS  L T P C
3 0 0 3

OBJECTIVES
• At the end of the course, the student will be able to acquire knowledge of alternate fuels and the changes in the engine design for handling them and understand various propulsion systems for use in the automobiles.

UNIT I  ALCOHOLS AS FUELS

UNIT II  VEGETABLE OILS AS FUELS
Vegetable oils and their important properties. Methods of using vegetable oils – Blending, preheating, Transesterification and emulsification – Performance, combustion and emission Characteristics in diesel engines. Issues & limitation in Vegetable Oils
UNIT III HYDROGEN AS ENGINE FUEL

UNIT IV BIOGAS, NATURAL GAS AND LPG AS FUELS
Biogas, Natural gas and LPG – Properties and production methods. CO₂ and H₂S scrubbing in Biogas, Modifications required for use in Engines- Performance, combustion and emission Characteristics in engines. Issues & limitation in Gaseous fuels.

UNIT V HYBRID AND ELECTRIC VEHICLES

REFERENCES
4. Transactions of SAE on Biofuels (Alcohols, vegetable oils, CNG, LPG, Hydrogen, Biogas etc.).

AM7003 HYDRAULIC AND PNEUMATIC SYSTEMS

OBJECTIVE:
- The objective of this course is to introduce the essential principles of hydraulic and pneumatic system and related automobile applications.

UNIT I INTRODUCTION

UNIT II PNEUMATIC SYSTEMS

UNIT III HYDRAULIC SYSTEMS
UNIT IV     SERVO AND PLC SYSTEMS
Electro pneumatics, ladder diagram. Servo and Proportional valves - types, operation, application. Hydro-Mechanical servo systems. PLC-construction, types, operation, programming.

UNIT V     AUTOMOTIVE APPLICATIONS
Hydraulic tipping mechanism, power steering, forklift hydraulic gear, hydro-pneumatic suspension, air brake. Maintenance and trouble shooting. Design and analysis of a hydraulic / Pneumatic system. Case Study

TOTAL : 45 PERIODS

TEXT BOOKS:
2. Werner Deppert and Kurt Stoll, “Pneumatic Controls : An introduction to principles”, Vogel-Druck Wurzburg, Germany, 1975

REFERENCES:

AM7004     IC ENGINE PROCESS MODELING     L T P C
3 0 0 3

OBJECTIVE:
• The main objective of this course is to impart knowledge in computer simulation of IC engine process. The detailed concept of air standard, fuel air cycle, progressive and actual cycle simulation of SI engine will be taught to the students. The simulation of two stroke SI engine will also be introduced to the students. At the end of the course the students will have command over simulation of IC engine process.

UNIT I     INTRODUCTION

UNIT II     COMBUSTION AND STOICHIOMETERY
Reactive processes, Heat of reaction, measurement of URP, measurement of HRP. Introduction - combustion equation for hydrocarbon fuels. Calculation of minimum air, excess air and stoichiometric air required for combustion. Conversion of volumetric analysis to mass analysis. Introduction, complete combustion in C-H-N-O systems, constant volume adiabatic combustion, constant pressure adiabatic combustion, calculation of adiabatic flame temperature, isentropic changes of state.

UNIT III     COMPUTER SIMULATION OF SI ENGINE WITH FUEL AIR CYCLE
SI Engine simulation with air as working medium, deviation between actual and ideal cycle. Fuel air cycle analysis - Temperature drop due to fuel vaporization, full throttle operation, work output and
efficiency calculation, part-throttle operation, engine performance at part throttle, super charged operation. SI Engines simulation with progressive combustion. Wiebe’s law combustion analysis.

UNIT IV COMPUTER SIMULATION OF SI ENGINE WITH GAS EXCHANGE PROCESS
Introduction, gas exchange process, Heat transfer process, friction calculations, compression of simulated values, validation of the computer code, engine performance simulation, pressure crank angle diagram, brake power, brake thermal efficiency, effect of speed on performance.

UNIT V COMPUTER SIMULATION OF CI ENGINE

TOTAL: 45 PERIODS

TEXTBOOK:

REFERENCES

AM7005 PRODUCTION OF AUTOMOBILE COMPONENTS

OBJECTIVE:
- The objective of this course is to make the students to know and understand the production methods of various engine components like piston, connecting rod, crankshaft etc and various chassis components like friction lining materials, propeller shaft, steering column, gears etc.

UNIT I CASTING
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. Melting practice of alloys

UNIT II MACHINING
Special consideration of machining of various components such as flywheel, piston rings, bearing bushes, and liners. Machining of connecting rods - crank shaft - cam shaft - piston - piston pin - valve - front and rear axle housing - fly wheel - Honing of cylinder bores - Copy turning and profile grinding machines.

UNIT III FORMING PROCESS
Forging materials - process flow chart, forging of valves, connecting rod, crank shaft, cam shaft, propeller shaft, transmission gear blanks, steering column. Extrusions: Basic process steps, extrusion of transmission shaft, housing spindle, steering worm blanks, piston pin and valve tappets. Hydro forming - Process, hydro forming of manifold and comparison with conventional methods- Hydro

UNIT IV  POWDER METALLURGY AND PROCESSING OF PLASTICS  8

UNIT V  RECENT TRENDS IN MANUFACTURING OF AUTO COMPONENTS  9

TOTAL : 45 PERIODS

TEXT BOOK

REFERENCES
5. High Velocity "Forming of Metals ", ASTME, prentice Hall of India (P) Ltd., New Delhi, 1990
6. HMT handbook

AM7006  THEORY OF FUELS AND LUBRICANTS  L T P C
3  0  0  3

OBJECTIVES
• To understand the properties of fuels and lubricants for the design and operation of the I.C engines.

UNIT I  MANUFACTURE OF FUELS AND LUBRICANTS  9
Structure of petroleum, refining process, fuels, thermal cracking, catalytic cracking, polymerization, alkylation, isomerisation, 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, hydrodynamic lubrication, elasto hydrodynamic lubrication, boundary lubrication, bearing lubrication, functions of the lubrication system, introduction to design of a lubricating system.

UNIT III  PROPERTIES AND TESTING OF LUBRICANTS  9
Specific requirements for automotive lubricants, oxidation deterioration and degradation of lubricants, 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
Thermo-chemistry of fuels, properties and testing of fuels, relative density, calorific value, flash point, fire point, distillation, vapour pressure, spontaneous ignition temperature, viscosity, pour point,
flammmability, ignitability, diesel index, API gravity, aniline point, carbon residue, copper strip corrosion etc.

UNIT V ADDITIVES FOR LUBRICANTS AND FUELS 9
Additive - mechanism, requirements of additive, petrol fuel additives, diesel fuel additives – Additives and additive mechanism, for lubricants. Introduction to Nano fluids

TOTAL : 45 PERIODS

TEXT BOOKS:

REFERENCES

AM7007 AUTOMOTIVE AIR CONDITIONING SYSTEMS L T P C
3 0 0 3

OBJECTIVE
At the end of the course, the students will be able to understand the components of the automotive air-conditioning and their functions and the latest developments in this field.

UNIT I FUNDAMENTALS 9
Terminology, design factors and concepts related to air conditioning system - Construction and Working principles of Thermostatic Expansion valve and Orifice tube based system- Heating system types -detailed study of HVAC components like compressor, evaporator, condenser, TXV, orifice tube , Receiver-drier, heater core etc. Location of air conditioning components in a vehicle.

UNIT II REFRIGERANTS & AIR MANAGEMENT SYSTEMS 9
Refrigerants:
Temperature and pressure relation, Properties of R-12 and R134a- refrigerant oil. Simple problems - Containers - Handling refrigerants - Tapping into the refrigerant container - Ozone Layer Depletion.

Air management system:
Air routing for manual, semi and automatic system- cases and ducts- Air distribution, control head and doors- Defrost system

UNIT III AUTOMATIC CLIMATE CONTROL SYSTEM 9
Block diagram - types of Sensors and Actuators, - Control Logic Electrical wiring diagram of manual and automatic system - multiplexing between BCM and PCM- control of compressor clutch, blower motor etc.- diagnostics tools and features.
UNIT IV  DESIGN OF AIR-CONDITIONING COMPONENTS  9
Modeling of Fixed and variable Displacement type compressor, evaporator modeling - heat transfer correlations for the fluids inside the evaporator, analysis of evaporator frosting- condenser modeling - improvement of refrigerant flow control method.

UNIT V  AIR CONDITIONING DIAGNOSIS AND SERVICES  9
AC system diagnosis based on temperature and pressure measurements, sight glass, sound etc. - refrigerant leak detection- Trouble shooting and Servicing of compressor, evaporator, condenser, heater core etc. – HVAC equipment , recovery and charging. Air routing system service.

TOTAL: 45 PERIODS

TEXTBOOK:

REFERENCES
5) SAE paper No: 931121,900084, 850040,931137,870029 etc.
6) Vehicle service manuals.

AM7008  COMBUSTION THERMODYNAMICS AND HEAT TRANSFER  L T P C
3 0 0 3

OBJECTIVE:
• The objective of this course is to make the students to know and understand the principle of engine combustion and to introduce the various heat transfer models and its measuring methods.

UNIT I  THERMODYNAMICS OF COMBUSTION  10
Premixed and diffusion combustion process in IC engines. First and Second Law of Thermodynamics applied to combustion- combustion Stoichiometry- chemical equilibrium, spray formation and droplet combustion.

UNIT II  CHEMICAL KINETICS OF COMBUSTION  10
Combustion kinetics, rate of reaction, equation of Arrhenius, activation energy. Chemical thermodynamic model for Normal Combustion.

UNIT III  FLAMES  9
Laminar - premixed and diffusion flames – flame speed correlations- quenching, flammability, and ignition, flame stabilization, turbulent premixed, diffusion flames-Damkohler number.

UNIT IV  HEAT TRANSFER IN IC ENGINES  8
UNIT V INSTRUMENTATION
Pressure sensors, crank angle encoder. Hot wire and laser Doppler anemometry and velocimetry for flow and combustion analysis in IC engines. In-cylinder pressure measurement and Rate of heat release calculation.

REFERENCES

AM7009 ELECTRIC AND HYBRID VEHICLES

OBJECTIVES:
- To understand the methods of representation of system and thier transfer function models
- To provide adquate knowledge in the time response of systems and steady state error analysis
- To give basic knowledge in obtainig the open loop and closed loop frequency responses of system
- To understand the concept of stablity of control system and methos of stablity analysis
- To study the three way of designing compensators for a control system

UNIT I NEED FOR ALTERNATIVE SYSTEM
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 ENERGY SOURCES : BATTERIES AND FUEL CELLS

UNIT III PROPULSION MOTORS AND CONTROLLERS
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 VEHICLE DESIGN CONSIDERATIONS FOR ELECTRIC VEHICLES
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
Power split device – Energy Management System - Design consideration - Economy of hybrid vehicles

TOTAL: 45 PERIODS

TEXT BOOKS:

REFERENCES:

AM7010  FINITE ELEMENT METHODS IN AUTOMOBILE ENGINEERING  L T P C
3 0 0 3

OBJECTIVE:
• The objective of this course is to make the students to know and understand the principle of FEM and its application in automotive component design.

UNIT I  INTRODUCTION  9

UNIT II  1D ELEMENTS  9

UNIT III  2D ELEMENTS  9

UNIT IV  STRUCTURAL AND DYNAMIC ANALYSIS  9
UNIT V  HEAT TRANSFER ANALYSIS AND FLOW ANALYSIS  

1D & 2D problems in fluid mechanics and heat transfer by conduction and convection. Transient thermal analysis. Case Studies like Heat transfer analysis of piston, fins.  

TOTAL : 45 PERIODS

TEXT BOOK: 

REFERENCES 

AM7011  SIMULATION OF VEHICLE SYSTEMS  

OBJECTIVE: 
• The objective of this course is to introduce the essential principles of simulation of various vehicle systems like longitudinal, lateral dynamics, modeling of suspension and tyre system etc.

UNIT I  LONGITUDINAL DYNAMICS AND CONTROL  

UNIT II  LATERAL DYNAMICS AND ELECTRONIC STABILITY CONTROL  
Lateral Systems - Kinematic Model - Bicycle Model. Motion of Particle Relative to a rotating Frame. Dynamic Model in Terms of Error with Respect to Road, Yaw Rate and Slip Angle. Road Model. Differential Braking Systems - Steer-By-Wire Systems - Independent All Wheel Drive Torque Distribution

UNIT III  MODELING OF PASSIVE AUTOMOTIVE SUSPENSIONS  

UNIT IV  MODELING OF SEMIACTIVE AND ACTIVE AUTOMOTIVE SUSPENSIONS  
Semi-Active Suspension Model - Optimal Semi-Active Control Law - Calculation of Transfer Function Plots - Performance of Semi-Active Suspension Systems. Active Automotive Suspensions - Trade-offs and Limitations - Invariant Points and Their Influence - Hydraulic Actuators for Active Suspensions
UNIT V LATERAL AND LONGITUDINAL TYRE FORCES


TOTAL: 45 PERIODS

TEXTBOOK

AM7012 TWO AND THREE WHEELERS

OBJECTIVE:
- The objective of this course is to make the students to know and understand the constructional details, operating characteristics and design aspects of Two and Three wheelers.

UNIT I INTRODUCTION
Classifications- design considerations –weight and dimension limitations –requirements, stability problems, gyroscopic effect- pendulum effect of two and three wheelers.

UNIT II POWER UNITS, IGNITION SYSTEMS AND OTHER ELECTRICAL SYSTEMS
2 stoke and 4 stoke engines. Design criteria for engines – design of cylinders, cylinder head, cooling fins, crank case, connecting rod and crank shaft. Carburettor types and design. Battery coil ignition, magneto ignition and electronic ignition. Lighting and other electrical systems.

UNIT III CLUTCHES AND TRANSMISSION

UNIT IV FRAMES, SUSPENSION, WHEELS AND TYRES
Types of frames. Wheel frames- construction design of frames for fatigue strength, torsional stiffness and lateral stability. Front and rear forks. Springs for suspension, Dampers, constructional details of wheel and tyres.

UNIT V THREE WHEELERS
Auto rickshaws, different types, Pick-Ups and delivery type vehicle, frames and transmission, wheel types, wheel mountings attachment, tyre types. Brake systems.

TOTAL: 45 PERIODS

TEXTBOOK:

REFERENCES:
4. Servicing Manuals- various motor cycles, Scooters, Mopeds and three wheelers.
AM7013 AUTOMOTIVE AERODYNAMICS  L T P C
3 0 0 3

OBJECTIVE
- At the end of the course, the students will be able to apply basic principles of aerodynamics for the design of vehicle body.

UNIT I INTRODUCTION

UNIT II AERODYNAMIC DRAG OF CABS

UNIT III SHAPE OPTIMIZATION OF CABS
Front end modification – front and rear wind shield angle – Boat tailing – Hatch back, fast back and square back – Dust flow patterns at the rear – Effect of gap configuration – effect of fasteners.

UNIT IV VEHICLE HANDLING

UNIT V WIND TUNNELS FOR AUTOMOTIVE AERODYNAMICS
Principles of wind tunnel technology – Types, Stress with scale models – full scale wind tunnels – measurement techniques – Equipment and transducers – road testing methods. Introduction to CFD.

TOTAL : 45 PERIODS

TEXTBOOK:

REFERENCES:

AM7014 AUTOMOTIVE SAFETY  L T P C
3 0 0 3

OBJECTIVE:
- At the end, the student will have good exposure to Automotive safety aspects including safety equipments.

UNIT I INTRODUCTION
Automotive safety – Introduction, Types. Active safety: driving safety, conditional safety, perceptibility safety, operating safety- Passive safety: exterior safety, interior safety-Advantages
UNIT II  PASSIVE SAFETY CONCEPTS  9
Design of body for safety, engine location, deceleration of vehicle, passenger compartment, deceleration on impact with stationary and movable obstacles. Deformation behavior of vehicle body. Concept of crumble zone, Safety Cage.

UNIT III  PASSIVE SAFETY EQUIPMENTS  9
Regulations, Seat belt, automatic seat belt tightener system and importance, collapsible steering column, tiltable steering column with advantages, air bags, Designing aspects of automotive bumpers and materials for bumpers.

UNIT IV  ACTIVE SAFETY AND CONVENIENCE SYSTEM  9
Antiskid braking system, Secondary braking system, Stability Control. Steering and mirror adjustment, central locking system, Garage door opening system, tyre pressure control system, rain sensor system, environment information system, manual and automated wiper system, Driver alertness detection system.

UNIT V  VEHICLE INTEGRATION AND NAVIGATION SYSTEM  9

TOTAL: 45 PERIODS

TEXT BOOK:

REFERENCES:
3. ARAI Safety standards

AM7015  INSTRUMENTATION AND EXPERIMENTAL TECHNIQUES  L T P C
3 0 0 3

OBJECTIVE:
- Study of the theory, construction and operation of different measurement technology, instruments transducers and their application in automotive industry.

UNIT I  MEASUREMENT SYSTEMS  8
Static and Dynamic Measurement systems-importance of measurement system – methods of measurement -applications - characteristics of measuring system-static and dynamic characteristics of measuring system – Analysis of experimental detail, Error analysis-types of errors-limiting errors

UNIT II  TRANSUDCERS, MODIFIERS AND TERMINATING DEVICES  8
Transducers for Automotive Applications – Amplifiers-Classifications and application in automobile – filters -types – Data Acquisition system - analog and digital type DAS- Indicators, Printers and display device –Signal Analyzing with example of automobile applications.

UNIT III  MECHANICAL MEASUREMENT  10
Instrumentation for Measuring Weight, Force, torque , pressure, power, temperature, fluid flow and special methods, vibration piezo electric effect, rotational speed. Measuring Velocity, acceleration and angular motion with respect to automobile applications.

26
UNIT IV ENGINE EXPERIMENTAL TECHNIQUES
10

UNIT V VEHICLE EXPERIMENTAL TECHNIQUES
9

TEXTBOOK:

REFERENCES
1. A.W. Judge, ‘Engineering Precision Measurement’, Chapman and Hall Ltd, Essex Street W.C.,1951,

AM7016 SPECIAL TYPE OF VEHICLES

OBJECTIVE:
• The main objective of this course is to introduce the concept and principle of operation of special vehicles such as Bulldozers, Ditchers, Bucket excavators, farm equipments, military vehicles etc. At the end of the course, the students can have a better understanding of the application of the special types of vehicles in the excavation of earth.

UNIT I EARTH MOVING AND CONSTRUCTIONAL EQUIPMENTS
10
Construction details, capacity and applications of earthmovers for dumpers, front-end loaders, bulldozers, excavators, backhoe loaders, scrapers, motor graders etc. criteria for selection of prime mover for dumpers and front end loaders based on vehicle performance characteristics.

UNIT II POWER TRAIN CONCEPTS
7

UNIT III VEHICLE SYSTEMS AND FEATURES
14
dumper body, loader bucket and water tank of sprinkler. Articulated vehicles, double decker. Fire fighting equipment.

UNIT IV SPECIAL PURPOSE VEHICLES FOR INDUSTRIAL APPLICATIONS 5

UNIT V FARM EQUIPMENTS, MILITARY AND COMBAT VEHICLES 9
Ride and stability characteristics, power take off, special implementations. Special features and constructional details of tankers, gun carriers and transport vehicles. Harvesting vehicles.

REFERENCES

AM7017 VEHICLE CONTROL SYSTEMS

OBJECTIVE:
- To explain the principle of chassis management system and different sensors used in the systems.

UNIT I INTRODUCTION 9
Components of chassis management system – role of various sensors and actuators pertaining to chassis system – construction – working principle of wheel speed sensor, steering position, tyre pressure, brake pressure, steering torque, fuel level, Engine and vehicle design data.

UNIT II DRIVELINE CONTROL SYSTEM 9
Speed control – cylinder cut - off technology, Gear shifting control – Traction / braking control, brake by wire – Adaptive cruise control, throttle by wire. Steering - power steering, collapsible and tilttable steering column – steer by wire.

UNIT III SAFETY AND SECURITY SYSTEM 9
Airbags, seat belt tightening system, collision warning systems, child Lock, anti lock braking systems, Vision enhancement, road recognition system, Anti theft technologies, smart card system, number plate coding, central locking system.

UNIT IV COMFORT SYSTEM 9
Active suspension systems, requirement and characteristics, different types, Vehicle Handling and Ride characteristics of road vehicle, pitch, yaw, bounce control, power windows, thermal management system, adaptive noise control.

UNIT V INTELLIGENT TRANSPORTATION SYSTEM 9
Traffic routing system - Automated highway systems - Lane warning system – Driver Information System, driver assistance systems - Data communication within the car, Driver conditioning warning -

TOTAL: 45 PERIODS

TEXT BOOKS:

REFERENCES:
4. Internet References

AM7018 VEHICLE MAINTENANCE

L T P C
3 0 0 3

OBJECTIVE
• At the end of the course, the students will be able to have a complete knowledge of the vehicle maintenance procedures and acquire skills in handling situations where the vehicle is likely to fail.

UNIT I MAINTENANCE TOOL, SHOP, SCHEDULE, RECORDS


UNIT II POWER PLANT REPAIR AND OVERHAULING


UNIT III MAINTENANCE, REPAIR AND OVERHAULING OF THE CHASSIS

Maintenance, servicing and repair of clutch, fluid coupling, gearbox, torque converter, propeller shaft. Maintenance of front axle, rear axle, brakes, steering systems.

UNIT IV MAINTENANCE AND REPAIR OF VEHICLE BODY

Body panel tools for repairing. Tinkering and painting. Use of soldering, metalloid paste. Tyre maintenance, metallic, plastics

UNIT V MAINTENANCE AND REPAIR OF ELECTRICAL SYSTEMS

Care, maintenance, testing and trouble shooting of battery, starter motor, dynamo, alternator and regulator. Transistorized regulator problems.

TOTAL : 45 PERIODS

TEXTBOOK:
REFERENCES:
2. Frazee, fledell, Spicer,-Automobile collision Work, American technical publications, Chicago, 1953.
3. John Dolce, Fleet maintenance, Mcgraw Hill, Newyork, 1984