<table>
<thead>
<tr>
<th>Course code</th>
<th>Course Name</th>
<th>L-T-P –Credits</th>
<th>Year of Introduction</th>
</tr>
</thead>
<tbody>
<tr>
<td>AU403</td>
<td>VEHICLE DYNAMICS</td>
<td>3-0-0-3</td>
<td>2016</td>
</tr>
</tbody>
</table>

Prerequisite: Nil

Course Objectives
- To familiarize the students with vibrating systems
- To understand the characteristics of the tires.
- To know about the stability and handling characteristics of vehicles at different tracks.

Syllabus
Stability of vehicles-Braking requirements-Road Loads-Over steer, under steer, steady state cornering-Suspension-Tires-Performance of road vehicles-Classification of vibration-aerodynamic forces

Expected outcome.
- The students will be able to solve simple design problems based on the vehicle stability and various design parameter based problems.

Text Book:
1. Giri N.K, Automobile Mechanics, 8/e, Khanna Publishers

References

Course Plan

<table>
<thead>
<tr>
<th>Module</th>
<th>Contents</th>
<th>Hours</th>
<th>Sem.ExamMarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Classification of vibration, Specification and Vibration, Vibration System and human comforts, Modal Analysis, One DOF, Two DOF, Free and Forced Vibration, Damped Vibration, Magnification and Transmissibility, Vibration Absorber. Performance of road vehicles: Tractive resistance, tractive effort, power required for propulsion, grade ability, drawbar pull and the problems related to these terms. Road performance curves- acceleration, gradability and drawbar pull, acceleration time and Elasticity.</td>
<td>7</td>
<td>15%</td>
</tr>
<tr>
<td>II</td>
<td>Tires: tire dynamics Ride characteristics, Behavior while Cornering, Slip angle, Cornering force, Power consumed by Tire, Oversteer, under steer, steady state cornering, aligning moment-combined braking and Cornering, effect of camber &amp; transient effects in cornering. Tire vibrations</td>
<td>7</td>
<td>15%</td>
</tr>
</tbody>
</table>

FIRST INTERNAL EXAMINATION

| III    | Suspension: Vehicle dynamics and suspension                              | 7     | 15%           |
| Requirements, choice of suspension spring rate, chassis springs and theory of chassis springs, Gas & hydraulic dampers and choice of damper, damper characteristics, mechanics of an independent suspension system, Roll axis and the vehicle under the action of side forces. |
| Stability of vehicles: Load distribution (Three wheeled and four wheeled vehicles), Calculation of acceleration, tractive effort and reactions for different drives, stability of a vehicle on a curved track, slope and a banked road. Gyroscopic effects, weight transfer during acceleration, Cornering and braking, stability of a rigid vehicle and equations of motion of a rigid vehicle, cross wind handling. |

**SECOND INTERNAL EXAMINATION**

| VI | Road Loads: Air resistance-Mechanics of air flow around a vehicle, pressure distribution on a vehicle, factors affecting rolling resistance, aerodynamic forces – aerodynamic drag, drag components, drag coefficient, aerodynamic aids, aerodynamic side force, lift force, pitching moment, yawing moment, rolling moment, cross wind sensitivity |

**END SEMESTER EXAM**

**Question Paper Pattern**

Maximum marks: 100, Time: 3 hrs

The question paper should consist of three parts

**Part A**
3 questions uniformly covering modules I and II. Each question carries 15 marks
Students will have to answer any two questions out of 3 (2X15 marks =30 marks)

**Part B**
3 questions uniformly covering modules III and IV. Each question carries 15 marks
Students will have to answer any two questions out of 3 (2X15 marks =30 marks)

**Part C**
3 questions uniformly covering modules V and VI. Each question carries 20 marks
Students will have to answer any two questions out of 3 (2X20 marks =40 marks)

**Note:** In all parts, each question can have a maximum of four sub questions, if needed
<table>
<thead>
<tr>
<th>Course code</th>
<th>Course Name</th>
<th>L-T-P – Credits</th>
<th>Year of Introduction</th>
</tr>
</thead>
<tbody>
<tr>
<td>AU407</td>
<td>ADVANCED IC ENGINES</td>
<td>3-0-0-3</td>
<td>2016</td>
</tr>
</tbody>
</table>

Prerequisite: NIL

Course Objectives
- To impart the basic concepts of non-conventional IC Engines
- To know the new concepts of automotive engine combustion technologies
- To discuss about future engine technologies

Syllabus
Types of engines -Dual fuel engine concepts and significance-Multi fuel engines-Lean burn engines -Gas turbine plants -Stratified charge combustion in direct injection SI engines -HCCI and CAI engines

Expected outcome.
- The students will become aware of the latest developments and advancement in the field of IC engines.

Text Books:

Reference books
3. H Zhao, HCCI and CAI Engines for the Automotive Industry, Woodhead publishing

<table>
<thead>
<tr>
<th>Module</th>
<th>Contents</th>
<th>Hours</th>
<th>Sem. Exam Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Types of engines - Wankel engine - Stirling engine - free piston engine. – light duty DI diesel engines (HSDI), high pressure pump technology, multiple injection diesel combustion</td>
<td>7</td>
<td>15%</td>
</tr>
<tr>
<td>II</td>
<td>Dual fuel engine concepts and significance, factors affecting combustion in dual fuel engines, performance of dual fuel engines. Multi fuel engines, characteristics of multi fuel engines, performance of multi fuel engines. Concept and working of flexi fuel vehicles (FFV).</td>
<td>7</td>
<td>15%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>FIRST INTERNAL EXAMINATION</th>
<th></th>
<th></th>
</tr>
</thead>
</table>
Limitations of gas turbine in automotive sector. Comparison of gas turbine Vs. I.C engine. Condition for perfect reheating and inter cooling. simple problems

SECOND INTERNAL EXAMINATION


END SEMESTER EXAM

**Question Paper Pattern**

Maximum marks: 100
Time: 3 hours

The question paper shall consist of three parts

**Part A**
4 questions uniformly covering modules I and II. Each question carries 10 marks Students will have to answer any three questions out of 4 (3X10 marks =30 marks)

**Part B**
4 questions uniformly covering modules III and IV. Each question carries 10 marks Students will have to answer any three questions out of 4 (3X10 marks =30 marks)

**Part C**
6 questions uniformly covering modules V and VI. Each question carries 10 marks Students will have to answer any four questions out of 6 (4X10 marks =40 marks)

**Note:** In all parts, each question can have a maximum of four sub questions, if needed
<table>
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<th>L-T-P - Credits</th>
<th>Year of Introduction</th>
</tr>
</thead>
<tbody>
<tr>
<td>AU411</td>
<td>Engine and Driveline Design</td>
<td>3-1-0 - 4</td>
<td>2016</td>
</tr>
</tbody>
</table>

**Prerequisite**: ME316 Principle of machine design

**Course Objectives**
- To study the design aspects of various components of an automobile.
- To know the selection criteria of various standard parts.

**Syllabus**
Design of IC engine components: cylinder, piston, piston rings, connecting rod, crank shaft, fly wheel-. Bearings: Theories of Lubrication- journal bearing, ball and roller bearings Design of Clutches & brakes - Design of gears- design of gear box.

**Expected outcome**
- The students will be able to design the components of an automobile engine

**Design Data Hand books permitted in the examination:**

**Text Books:**

**References:**

**Course Plan**

<table>
<thead>
<tr>
<th>Module</th>
<th>Contents</th>
<th>Hours</th>
<th>Sem Exam Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Design of IC engine components; Design of cylinder, Selection of materials for cylinders. Design of piston, piston rings, Materials for connecting rod, connecting rod design, Design of Crank shaft, Design of fly wheel- turning moment diagram, functions of flywheel, fluctuations of energy, Fluctuation of speed, size of the flywheel.</td>
<td>9</td>
<td>15%</td>
</tr>
<tr>
<td>II</td>
<td>Bearings: Types of lubrication; Classification of bearings, Journal bearings, Mechanisms of film lubrication, Theories of Lubrication, viscosity, bearing modulus, coefficient of friction, Petroff’s equation and bearing characteristic number, minimum oil film thickness, heat dissipation of bearings, bearing materials.</td>
<td>9</td>
<td>15%</td>
</tr>
</tbody>
</table>

**FIRST INTERNAL EXAMINATION**

| III    | Rolling contact bearings:- ball and roller bearings, types, mechanics of rolling friction, bearing life, static and dynamic load rating, equivalent bearing load, Selection of ball and roller bearings. | 9     | 15%            |
| IV     | Design of Clutches: Design of single plate, multi plate, centrifugal and cone clutches Energy dissipation in clutches, torque carrying capacity of clutches. Materials for clutch liners, design of clutch components. | 9     | 15%            |
### SECOND INTERNAL EXAMINATION

<table>
<thead>
<tr>
<th>Module</th>
<th>Description</th>
<th>Marks</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>V</td>
<td>Design of internal expanding shoe brakes, Design of disc brakes, heat rejected during braking, torque transmitted by leading and trailing shoes during braking.</td>
<td>10</td>
<td>20%</td>
</tr>
<tr>
<td>VI</td>
<td>Design of gears: Classification of Gears, Nomenclature, Lewis equation and Lewis form factor, working stresses in gear teeth, dynamic load on gear teeth, wear load, Design of spur gear, helical gear, bevel gear and worm gear, AGMA standards. Analysis of forces on spur, helical, bevel and worm gears. Design of Gear box: Structure and ray diagram (up to 6 speeds).</td>
<td>10</td>
<td>20%</td>
</tr>
</tbody>
</table>

### END SEMESTER EXAM

#### Question Paper Pattern

Maximum marks: 100, Time: 3 hrs

The question paper should consist of three parts

**Part A**
3 questions uniformly covering modules I and II. Each question carries 15 marks
Students will have to answer any two questions out of 3 (2X15 marks =30 marks)

**Part B**
3 questions uniformly covering modules III and IV. Each question carries 15 marks
Students will have to answer any two questions out of 3 (2X15 marks =30 marks)

**Part C**
3 questions uniformly covering modules V and VI. Each question carries 20 marks
Students will have to answer any two questions out of 3 (2X20 marks =40 marks)

**Note:** In all parts, each question can have a maximum of four sub-questions, if needed.
<table>
<thead>
<tr>
<th>Course No.</th>
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<th>L-T-P - Credits</th>
<th>Year of Introduction</th>
</tr>
</thead>
<tbody>
<tr>
<td>AU413</td>
<td>Automotive Mechatronics</td>
<td>3-0-0 - 3</td>
<td>2016</td>
</tr>
</tbody>
</table>

**Prerequisite : Nil**

**Course Objectives**
- To study about fundamentals of Mechatronics.
- To know about the implementation of Mechatronics in automobiles.
- To familiarize various sensors, microprocessor control systems and Engine management systems.

**Syllabus**

**Expected outcome.**

The students will be
i. able to understand the fundamentals of Mechatronics and its implementation in automobile
ii. familiar with the various Microprocessor control systems and engine management systems used in automobiles.

**Text Books:**

**References:**
7. Robert Bosch GmbH, Automotive Electrics & Electronics, , 5/e, Springer Verlag
9. Tom Denton, Automotive Electronics, SAE
10. Vijay K. Varadan, K. J. Vinoy, S. Gopalakrishnan, Smart Material Systems and MEMS, John Wiley & Sons, 2006:
## Course Plan

<table>
<thead>
<tr>
<th>Module</th>
<th>Contents</th>
<th>Hours</th>
<th>Sem. Exam Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>III</td>
<td>Application of sensors in Automobiles: Throttle position, air mass flow, crank shaft position, cam position, engine and wheel speed, steering position, tire pressure, brake pressure, steering torque, fuel level, crash, exhaust oxygen level (two step and linear lambda), knock, engine temperature, manifold temperature and pressure sensors.</td>
<td>7</td>
<td>15%</td>
</tr>
<tr>
<td>IV</td>
<td>Fundamentals of Automotive Electronics and Microprocessor control system: Microprocessor architecture, open and closed loop control strategies, PID control, Look up tables, introduction to modern control strategies like Fuzzy logic and adaptive control. Parameters to be controlled in SI and CI enignes and in the other parts of the automobile.</td>
<td>7</td>
<td>15%</td>
</tr>
<tr>
<td>V</td>
<td>Engine Management system I : Three way catalytic converter, conversion efficiency versus lambda. Layout and working of SI engine management systems like Bosch L-Jetronic and LH-Jetronic. Working of the fuel system components. Cold start and warm up phases, idle speed control, acceleration and full load enrichment, deceleration fuel cutoff. Fuel control maps, open loop control of fuel injection and closed loop lambda control.</td>
<td>8</td>
<td>20%</td>
</tr>
</tbody>
</table>

**FIRST INTERNAL EXAMINATION**

**SECOND INTERNAL EXAMINATION**

**END SEMESTER EXAM**
Question Paper Pattern

Maximum marks: 100

Time: 3 hours

The question paper should consist of three parts

**Part A**
4 questions uniformly covering modules I and II. Each question carries 10 marks
Students will have to answer any three questions out of 4 (3X10 marks = 30 marks)

**Part B**
4 questions uniformly covering modules III and IV. Each question carries 10 marks
Students will have to answer any three questions out of 4 (3X10 marks = 30 marks)

**Part C**
6 questions uniformly covering modules V and VI. Each question carries 10 marks
Students will have to answer any four questions out of 6 (4X10 marks = 40 marks)

Note: In all parts, each question can have a maximum of four sub questions, if needed.
Course code | Course Name | L-T-P - Credits | Year of Introduction
--- | --- | --- | ---
AU415 | Automotive Pollution & Control | 3-0-0 - 3 | 2016

**Prerequisite : Nil**

**Course Objectives**
- To impart knowledge on automotive pollution control.
- To know about formation and control techniques of pollutants like UBHC, CO, NOx, particulate matter and smoke for both SI and CI.
- To introduce measurement standards, instruments for pollution measurement and emission standards.

**Syllabus**

**Expected outcome.**
The students will
  i. get knowledge on automotive pollution formation and control techniques
  ii. be able to know about the measurement standards, measuring instruments and emission standards.

**Text Books:**

**References:**
1. Automobiles and Pollution SAE Transaction, 1995

**Course Plan**

<table>
<thead>
<tr>
<th>Module</th>
<th>Contents</th>
<th>Hours</th>
<th>Sem. Exam Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Introduction: General Scenario on automotive Pollution, Pollutants-sources-formation-effects on human beings and environment, Green house gases and global warming, Engine Combustion and Pollutant Formation: HC, CO, NOx, Particulate Matters, Aldehyde emissions, Vehicle population assessment in metropolitan cities and contribution to pollution</td>
<td>7</td>
<td>15%</td>
</tr>
<tr>
<td>II</td>
<td>Emissions in SI Engines: Chemistry of SI engine combustion – HC and CO formation in SI engines – NO formation in SI engines – Smoke formation in SI Engines- effect of operating variables on emission formation.</td>
<td>7</td>
<td>15%</td>
</tr>
</tbody>
</table>
III  Emissions in CI Engines - Basics of diesel combustion – Smoke emission and its types in diesel engines – NOx emission and its types from diesel engines – Particulate emission in diesel engines. Odor, sulfur and Aldehyde emissions from diesel engines  7  15%


SECOND INTERNAL EXAMINATION

V  Emission Control Efforts, Design changes, optimization of operating factors, Fuel modification, Control of Crankcase emission, Evaporative emission, SCR –Canisters, Fumigation – Particulate Trap – CCS, Exhaust emission - exhaust gas recirculation, air injector PCV system, thermal reactors, catalytic converters  8  20%

VI  Test Procedure & Instrumentation for Emission Measurement: Measurements of invisible emissions - ORSAT apparatus, NDIR analyzer, Flame ionization detectors, Chemiluminescent analyzer, Gas analyzer, Gas Chromatograph. Measurements of visible emissions – Comparison methods & Obscure methods - Smoke meters,  8  20%

END SEMESTER EXAM

Question Paper Pattern

Maximum marks: 100  Time: 3 hrs

The question paper should consist of three parts

Part A
4 questions uniformly covering modules I and II. Each question carries 10 marks Students will have to answer any three questions out of 4 (3X10 marks =30 marks)

Part B
4 questions uniformly covering modules III and IV. Each question carries 10 marks Students will have to answer any three questions out of 4 (3X10 marks =30 marks)

Part C
6 questions uniformly covering modules V and VI. Each question carries 10 marks Students will have to answer any four questions out of 6 (4X10 marks =40 marks)

Note: In all parts, each question can have a maximum of four sub questions, if needed.
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<thead>
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<th>L-T-P - Credits</th>
<th>Year of Introduction</th>
</tr>
</thead>
<tbody>
<tr>
<td>AU433</td>
<td>Automotive Mechatronics Lab</td>
<td>0-0-3- 1</td>
<td>2016</td>
</tr>
</tbody>
</table>

**Prerequisite:** AU413 Automotive mechatronics

**Course Objectives**
- To understand the working of sensors and electronic components in an automobile
- To know how to control them using PLC / microcontrollers and software

**List of exercises/experiments:** (Minimum 12 are mandatory)

1. Design and execution of pick and place
2. Design and execution of water level control
3. Design and execution of air pressure control
4. Study of characteristics of P-I controller
5. Comparison of the characteristics of RTD and thermocouple
6. Stepper motor interfacing with microcontroller (i) full step resolution (ii) half step resolution
7. Computerised data logging system with control for process variables like pressure and temperature
8. Design and execution of seven segment display module
9. Simulation of basic hydraulic, pneumatic and electric circuits using software
10. Circuits with multiple cylinder sequences in electro pneumatic system
11. Direct operation of double acting cylinder
12. Designing a circuit for speed control of double acting cylinder meter by employing 4/2 dc solenoid valve
13. Design of a simple pneumatic direct control circuit to open and close the gate of a factory by operating a push button valve
14. PLC-Simple ladder programming using PLC trainer kit
15. Arduino programming

**Expected outcome**
- At the end of the program the students will be familiar with the implementation of the knowledge of Mechatronics in automobile field.
Prerequisite : Nil

Course Objectives
- To impart the basic concepts of automotive ergonomics
- To impart the basic concepts of creating workspace for driver
- To impart the idea of automotive safety

Syllabus
Ergonomics in vehicle design - Driver information acquisitions and processing - Field of view - Entrance and Exit from automobiles - effect of body style - Driver performance measurement - Vehicle evaluation - Issue in designing global vehicles - Automotive safety - Crash testing

Expected outcome.
The students will be able to
i. apply principles of ergonomics in vehicle design
ii. implement safety features in automobiles

Text Books:
1. Nikolas Gkikas , Automotive ergonomics; driver vehicle interaction, CRC press publications
2. Vivek D Bhise , Ergonomics in automotive design process, CRC press publications

Reference books
1. Aurther W Hoffmann, Don’t be a dummy; primer on automotive safety, Universe, Inc, Newyork.
2. Brian Peacock & Waldemar Karwowski, Automotive Ergonomics, Taylor & Francis publications
3. George A Peters & Barbara J Peters, Automotive vehicle safety, Taylor & Francis publications
4. U Seifferet & L Wech, Automotive safety handbook, 2/e, SAE international

Course Plan

<table>
<thead>
<tr>
<th>Module</th>
<th>Contents</th>
<th>Hours</th>
<th>Sem. Exam Marks</th>
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</thead>
</table>
FIRST INTERNAL EXAMINATION

**III**

Entrance and Exit from automobiles – problems during entrance and exit – features and dimensions – door handles, lateral sections, body opening clearance, hinge angles, seat bolsters, location and material, tyres and rocker panels, running board, third row and rear seat entry, heavy truck cab entry & exit – methods to evaluate – effect of body style

7 15%

**IV**

Driver performance measurement – driving and non-driving tasks. Performance measures – types and category – range – studies – deviation from lateral position, steering wheel angle, velocity, task time, glance duration – application. Driver workload measurement present situation – methods to measure – studies

7 15%

SECOND INTERNAL EXAMINATION

**V**

Vehicle evaluation – methods of data collection and analysis – subjective methods – rating on a scale, paired comparison, thurstone method. Application of evaluation techniques – checklists, observational studies, user interviews, driving simulator studies, field studies.

Understanding users – issues and considerations – vehicle types, market segments, female and old drivers, geographic locations. Issue in designing global vehicles.

7 20%

**VI**


Crash testing – human testing – crash worthiness – deceleration curves, square wave, injury tolerance, control of deceleration, pole testing, roll over testing. Compliance testing, component testing, in-field testing

7 20%

END SEMESTER EXAM

**Question Paper Pattern**

Maximum marks: 100  
Time: 3 hours

The question paper shall consist of three parts

**Part A**

4 questions uniformly covering modules I and II. Each question carries 10 marks

Students will have to answer any three questions out of 4 (3X10 marks =30 marks)

**Part B**

4 questions uniformly covering modules III and IV. Each question carries 10 marks

Students will have to answer any three questions out of 4 (3X10 marks =30 marks)

**Part C**

6 questions uniformly covering modules V and VI. Each question carries 10 marks

Students will have to answer any four questions out of 6 (4X10 marks =40 marks)

**Note:** In all parts, each question can have a maximum of four sub questions, if needed
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<th>Year of Introduction</th>
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</thead>
<tbody>
<tr>
<td>AU469</td>
<td>Earth Moving Equipment</td>
<td>3-0-0 - 3</td>
<td>2016</td>
</tr>
</tbody>
</table>

**Prerequisite:** Nil

**Course Objectives**
- To impart the working and operational features of various Earth moving equipments.

**Syllabus**

- Power plants for earth moving equipment - Performance characteristics - Land Clearing Machines
- Earth Moving Machines - Power and capacity of earth moving machines - Scrapers and Graders - Shovels and Ditchers - Construction & Industrial Equipment

**Expected outcome.**
- The students will get an idea of types, features, working principle and applications of various earth moving machines

**Text Books:**

**References:**

**Course Plan**

<table>
<thead>
<tr>
<th>Module</th>
<th>Contents</th>
<th>Hour(s)</th>
<th>Sem. Exam Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Introduction: Power plants, chassis and transmission, Multiaxle vehicles. Heavy duty petrol engines and high speed diesel engines, air cooled and water cooled engines and air filters as in off highway vehicles.</td>
<td>7</td>
<td>15%</td>
</tr>
<tr>
<td>II</td>
<td>Performance characteristics of vehicles, resistance to digging and motion. Land Clearing Machines: Construction and working of Bush cutter, stampers,</td>
<td>7</td>
<td>15%</td>
</tr>
<tr>
<td>III</td>
<td>Earth Moving Machines.: Crawler track, running and steering gears, scrapers, drag and self powered types - Dump trucks and dumpers</td>
<td>7</td>
<td>15%</td>
</tr>
<tr>
<td>IV</td>
<td>Loaders, single bucket, multi bucket and rotary types - Power and capacity of earth moving machines,</td>
<td>7</td>
<td>15%</td>
</tr>
</tbody>
</table>

**FIRST INTERNAL EXAMINATION**

**SECOND INTERNAL EXAMINATION**
**V**
Shovels and Ditchers: Power shovel, revolving and stripper shovels – drag lines - ditchers - Capacity of shovels. Tree dozer, Rippers

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</thead>
<tbody>
<tr>
<td>V</td>
<td>Shovels and Ditchers: Power shovel, revolving and stripper shovels – drag lines - ditchers - Capacity of shovels. Tree dozer, Rippers</td>
<td>7</td>
</tr>
<tr>
<td>VI</td>
<td>Construction &amp; Industrial Equipments: Construction and operational aspects of mobile cranes, road rollers, elevators / Man lifters, Fork Lifters. Bulldozers, cable and hydraulic dozers</td>
<td>7</td>
</tr>
</tbody>
</table>

**END SEMESTER EXAM**

**Question Paper Pattern**

Maximum marks: 100  
Time: 3 hrs

The question paper should consist of three parts

**Part A**
4 questions uniformly covering modules I and II. Each question carries 10 marks
Students will have to answer any three questions out of 4 (3X10 marks =30 marks)

**Part B**
4 questions uniformly covering modules III and IV. Each question carries 10 marks
Students will have to answer any three questions out of 4 (3X10 marks =30 marks)

**Part C**
6 questions uniformly covering modules V and VI. Each question carries 10 marks
Students will have to answer any four questions out of 6 (4X10 marks =40 marks)

**Note:** In all parts, each question can have a maximum of four sub questions, if needed.
Course code: AU471
Course Name: Embedded System in Automobile Engineering
L-T-P - Credits: 3-0-0 - 3
Year of Introduction: 2016

Prerequisite: Nil

Course Objectives
- To impart the fundamentals of embedded system
- To give insight to the various components of embedded systems used in Automobiles and their application.

Syllabus
8 bit microprocessor and its architecture, 8085, z-80 and mc 6800 mpu - Assembly language programming - Data transfer schemes - Introduction to basic concepts of RTOS, Basics of real time & embedded system operating systems - Action plan, use of target system, emulator, use of software tools -Applications data acquisitions

Expected outcome.
- The students will know the fundamentals of embedded system and in-depth knowledge about various components related to embedded systems used in Automobiles systems.

Text Books:
1. Ahson.S.I. " Microprocessors with Applications in Process Control ", Tata McGraw-Hill,

References:
4. SAE Transactions, 1986 Sec 3.

Course Plan

<table>
<thead>
<tr>
<th>Module</th>
<th>Contents</th>
<th>Hours</th>
<th>Sem. Exam Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Architecture: general 8 bit microprocessor and its architecture 8085, z-80 and mc 6800 mpu and its pin function - architecture - function of different sections.</td>
<td>7</td>
<td>15%</td>
</tr>
<tr>
<td>II</td>
<td>Instruction set - instruction format - addressing modes - instruction set of 8085, mpu-t-state - machine cycle and instruction cycles - timing diagrams - different machine cycles - fetch and execute operations - estimation of execution times.</td>
<td>7</td>
<td>15%</td>
</tr>
<tr>
<td>III</td>
<td>Assembly language programming - construct of the language programming - assembly format of 8085 - assembly directive - multiple precision addition and subtraction - bcd to binary and binary to bcd, multiplication, division, code conversion using look up tables - stack and subroutines.</td>
<td>7</td>
<td>15%</td>
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</tbody>
</table>
Data transfer schemes - interrupt structure - programmed i/o - interrupt driven i/o, dma - serial i/o. Interfacing devices - types of interfacing devices - input / output ports 8212, 8255, 8251, 8279. Octal latches and tristate buffers - a/d and d/a converters - switches, led's rom and ram interfacing.

SECOND INTERNAL EXAMINATION

V
- 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.

VI
- Applications data acquisitions - temperature control - stepper motor control - automotive applications engine control, suspension system control, driver information systems), development of a high speed, high precision learning control system for the engine control.

END SEMESTER EXAM

Question Paper Pattern

Maximum I marks: 100

Time: 3 hrs

The question paper should consist of three parts

Part A
4 questions uniformly covering modules I and II. Each question carries 10 marks
Students will have to answer any three questions out of 4 (3X10 marks =30 marks)

Part B
4 questions uniformly covering modules III and IV. Each question carries 10 marks
Students will have to answer any three questions out of 4 (3X10 marks =30 marks)

Part C
6 questions uniformly covering modules V and VI. Each question carries 10 marks
Students will have to answer any four questions out of 6 (4X10 marks =40 marks)

Note: In all parts, each question can have a maximum of four sub questions, if needed.
Course code | Course Name | L-T-P - Credits | Year of Introduction
--- | --- | --- | ---
AU473 | Computer Simulation and Analysis of Automotive Components | 2-0-1- 3 | 2016

Prerequisite: Nil

Course Objectives
- To study about the design and analysis of automotive components using computer aided simulation.

Syllabus
Computer aided design of frame, leaf springs, coil springs, torsion bar springs, clutch components, three speed and four speed gear boxes, propeller shaft, final drive gearing, full floating, semi-floating and three quarter floating rear shafts and rear axle housings. Diesel engine simulation - SI engine simulation - Analysis of front axle and steering systems.

Expected outcome.
At the end of the course the student’s gains the knowledge of computer aided simulation and analysis of automobile components with design ideas.

Text Book:

References:

Course Plan

<table>
<thead>
<tr>
<th>Module</th>
<th>Contents</th>
<th>Hours</th>
<th>Sem. Exam Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Vehicle frame and suspension study of loads - moments and stresses on frame members. computer aided design of frame for passenger and commercial vehicle - computer aided design of leaf springs - coil springs and torsion bar springs.</td>
<td>7</td>
<td>15%</td>
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<tr>
<td>II</td>
<td>Clutch torque capacity of clutch. computer aided design of clutch components, design details of roller and sprag type of clutches. Gear box computer aided design of three speed and four speed gear boxes.</td>
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FIRST INTERNAL EXAMINATION

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<tbody>
<tr>
<td>III</td>
<td>Drive line and read axle computer aided 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.</td>
<td>7</td>
<td>15%</td>
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<tr>
<td>IV</td>
<td>Diesel engine simulation multi zone model for combustion, different heat transfer models, equilibrium calculations, simulation of engine performance, simulation for pollution estimation.</td>
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<td><strong>SECOND INTERNAL EXAMINATION</strong></td>
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<tr>
<td>V</td>
<td>SI engine simulation with air as working medium deviation between actual and ideal cycle - problems, si engine simulation with adiabatic combustion, temperature drop due to fuel vaporization, full throttle operation - efficiency calculation, part-throttle operation, super charged operation.</td>
<td>7</td>
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<tr>
<td>VI</td>
<td>Front axle and steering systems- analysis of loads - moments and stresses at different sections of front axle, determination of bearing loads at kingpin bearings, wheel spindle bearings, choice of bearings, determination of optimum dimensions and proportions for steering linkages ensuring minimum error in steering.</td>
<td>7</td>
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**END SEMESTER EXAM**

**Question Paper Pattern**

Maximum marks: 100  
Time: 3 hrs

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**Note:** In all parts, each question can have a maximum of four sub questions, if needed.
**Course code** | **Course Name** | **L-T-P - Credits** | **Year of Introduction**
--- | --- | --- | ---
AU475 | Automotive Aerodynamics | 3-0-0-3 | 2016

**Prerequisite:** Nil

**Course Objectives**
- To broaden the understanding of vehicle aerodynamics
- To familiarize the application of computational fluid dynamics in aerodynamics study.
- To introduce the use of wind tunnels in testing vehicles.

**Syllabus**


**Expected outcome.**
- The students will be able to appreciate the use of wind tunnels and the different testing techniques and apply CFD for aerodynamic design of vehicle.

**Text Books:**

**References:**

**Course Plan**

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<tbody>
<tr>
<td>I</td>
<td>Introduction scope - historical development trends - fundamental of fluid mechanics - flow phenomenon related to vehicles - external &amp; 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.</td>
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<tr>
<td>II</td>
<td>Aerodynamic drag of cars- 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.</td>
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<tbody>
<tr>
<td>III</td>
<td>Shape optimization of cars 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.</td>
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<tr>
<td>IV</td>
<td>Wind tunnels for automotive aerodynamic introduction - principle of</td>
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<tr>
<td>Wind tunnel technology - limitation of simulation - stress with scale models – full scale wind tunnels - measurement techniques - equipment and transducers - road testing methods – numerical</td>
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**SECOND INTERNAL EXAMINATION**

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<td>V</td>
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<tr>
<th></th>
<th>Vehicle handling the origin of forces and moments on a vehicle - side wind 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.</th>
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<tbody>
<tr>
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**END SEMESTER EXAM**

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