UNIVERSITY OF KERALA

B. TECH. DEGREE COURSE
(2013 SCHEME)

SYLLABUS FOR
VI SEMESTER
MECHANICAL - STREAM - AUTOMOBILE ENGINEERING
### SCHEME -2013

**VI SEMESTER**

**MECHANICAL - STREAM - AUTOMOBILE ENGINEERING (U)**

<table>
<thead>
<tr>
<th>Course No</th>
<th>Name of subject</th>
<th>Credits</th>
<th>Weekly load, hours</th>
<th>CA Marks</th>
<th>Exam Duration Hrs</th>
<th>U E Max Marks</th>
<th>Total Marks</th>
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<td>13.601</td>
<td>Vehicle Maintenance (U)</td>
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<td>13.602</td>
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<td>13.604</td>
<td>Heat and Mass Transfer (MSU)</td>
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<td>13.606</td>
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**13.606 ELECTIVE II**

- 13.606.1 Artificial Intelligence Systems (MPU)
- 13.606.2 Mechanical Working Methods (MPU)
- 13.606.3 System Modeling & Simulation (MPU)
- 13.606.4 Materials Handling (MPU)
- 13.606.5 Total Quality Management (MPU)
- 13.606.6 Advanced Manufacturing Processes (MPU)
- 13.606.7 Material Characterisation (MPU)
- 13.606.8 Micromachining Methods (MPU)
- 13.606.9 Vehicle Body Engineering (U)
- 13.606.10 Production Process of Automotive Components (U)
- 13.606.11 Automotive Safety (U)
13.601 VEHICLE MAINTENANCE (U)

Teaching Scheme: 4(L) - 0(T) - 0(P)  
Credits: 4

Course Objective: To make the students familiar about

- The various maintenance procedures involved in a vehicle as per the maintenance schedule, maintenance of various records in a service station.
- To be familiar with various troubles and troubleshooting related to the automobile components.
- Familiar with Diagnostic tools used in Automobiles for detection of problems.

Module – I

Maintenance, Records and Schedules: Importance of maintenance, types of maintenance, Inspection, scheduled maintenance, Job card, PDI chart, requirement of service station, service station records (stores & maintenance), layout and personnel for service station, Typical maintenance schedule for two wheeler, LMV and HMV

Engine trouble diagnosis and tune-up: Overhauling of engine - types of overhauling (Top overhauling and major overhauling), specific tools used for overhauling, de-carbonizing and degreasing, engine time up, Engine fault diagnosing instruments, use of automobile stethoscope, computerized engine analyzers/scanners, OBD II usage for troubleshooting, troubles and troubleshooting related to engines.

Module – II

Maintenance and Repair of chassis components: Servicing of clutch assembly, gear box, propeller shaft, troubles and troubleshooting chart on transmission, differential maintenance and repair, backlash adjustment, servicing of braking system, identification and rectification of brake faults, brake testing, steering system maintenance and repair, tyre rotation, tyre re-treading, checking and adjusting of suspension system, wheel balancing, wheel alignment.

Module – III

Maintenance and repair of fuel supply, Lubrication and cooling system: Fuel pump testing, Carburetor servicing and tuning, servicing of gasoline injection system, FIP calibration and phase setting, injector testing, types of engine oils and additives, engine oil change intervals, radiator service, checking of the thermostat, servicing of coolant pump.

Module – IV

Maintenance of Auxiliaries: Maintenance of starter motor, dynamo and alternator, regulator unit, battery maintenance, methods of testing & servicing various electrical accessories like
horn, headlight (aiming and focusing), gauges, Testing the spark plug and ignition coil with special equipments, checking and setting the ignition timing in conventional engines.

References:


Internal Continuous Assessment *(Maximum Marks-50)*

50% - Tests *(minimum 2)*

30% - Assignments *(minimum 2)* such as home work, problem solving, quiz, literature survey, seminar, term-project, software exercises, etc.

20% - Regularity in the class

University Examination Pattern:

*Examination duration: 3 hours*  
*Maximum Total Marks: 100*

*The question paper shall consist of 2 parts.*

**Part A (20 marks)** - Ten *Short answer questions of 2 marks each. All questions are compulsory. There should be at least two questions from each module and not more than three questions from any module.*

**Part B (80 Marks)** - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

Course Outcome:

*At the end of the course the students would be equipped with the management of service station/garage with the knowledge of various maintenance activities connected with.*
13.602 MACHINE DESIGN (U)

Teaching Scheme: 3(L) - 1(T) - 0(P)  
Credits: 4

Course Objectives:

To provide basic knowledge on the fundamentals of design considerations and methodology for designing of various machine elements by making use of Design Data Hand Book.

Module – I


Module – II

Detachable joints - Pins, Keys, Splines, cotters, set screws, threaded fasteners, power screws, shaft couplings,
Welded joints, types of joints, strength of welds, fillet welds, stress distribution in welded joints, Eccentric loaded welded joints.
Riveted joints-Types of riveted joints, Failures of riveted joints, Strength of rivets, Design of boiler joints-longitudinal and circumferential joints, Joints for structural use, lozenge joint, Eccentric loaded riveted joints.

Module – III

Springs - Classification and use of springs - spring materials - Effect of end turns, Stress concentration - Energy absorbed, deflection, design for fluctuating loads, Vibration in springs, buckling of springs. Design of helical, coaxial and leaf springs - Length of leaf springs. Pressure vessels-thin cylinders and thick cylinders, Stresses due to internal and external pressures, hydraulic accumulators, Dilation of Pressure Vessels, Compound cylinders, Membrane stresses in built-up cylinders.

Module – IV

Shafts – Types of Shafts, Stresses in shafts, Design of shafts, Shafts subjected to combined twisting moment and bending moment, shafts subjected to fluctuating loads, Shafts
subjected to axial load in addition to combined Torsion and bending loads, Design of hollow shafts, Design of shafts on the basis of rigidity. Effect of key ways. Design of Crank shafts and propeller shafts.

**Design Data Handbooks**


**References**


**Internal Continuous Assessment (Maximum Marks-50)**

50% - Tests (minimum 2)

30% - Assignments (minimum 2) such as home work, problem solving, literature survey, seminar, term-project, software exercises, etc.

20% - Regularity in the class

**University Examination Pattern:**

*Examination duration: 3 hours*  
Maximum Total Marks: 100

The question paper shall consist of 2 parts.

**Part A (20 marks)** - Ten Short answer questions of 2 marks each. All questions are compulsory. There should be at least two questions from each module and not more than three questions from any module.

**Part B (80 Marks)** - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

*Note: Use of approved data book is permitted in the examination hall.*

**Course outcome:**

At the end of the course the students will be familiar in designing the components of the machine.
13.603 COMPUTER AIDED DESIGN (MPU)

Teaching Scheme: 2(L) - 1(T) - 0(P) Credits: 3

Course Objectives:

To equip students with fundamentals of computer aided design and to provide elementary algorithms in computer graphics and finite element analysis for basic engineering problems

Module – I


Module – II


Module – III


Module – IV


References:


**Internal Continuous Assessment** *(Maximum Marks-50)*

- 50% - Tests *(minimum 2)*
- 30% - Assignments *(minimum 2)* such as home work, problem solving, quiz, literature survey, seminar, term-project, software exercises, etc.
- 20% - Regularity in the class

**University Examination Pattern:**

*Examination duration: 3 hours*  
*Maximum Total Marks: 100*

The question paper shall consist of 2 parts.

**Part A (20 marks)** - Ten Short answer questions of 2 marks each. All questions are compulsory. There should be at least two questions from each module and not more than three questions from any module.

**Part B (80 Marks)** - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

**Course Outcome:**

*Students successfully completing this course are expected to have basic knowledge in computer aided design, capability to prepare fundamental graphics algorithms and solve basic structural problems using finite element method.*
13.604 HEAT AND MASS TRANSFER (MSU)

Teaching Scheme: 3(L) - 1(T) - 0(P)  
Credits: 4

Course Objective:

- To introduce a basic study of the phenomena of heat and mass transfer, to develop methodologies for solving a wide variety of practical engineering problems,
- To apply analytical and numerical methods to solve conduction problems.
- To combine thermodynamics and fluid mechanics principles to analyze heat convection processes.
- To provide useful information concerning the performance and design complex heat transfer applications, such as heat exchangers and fins
- To integrate radiation aspects into real-world global heat transfer problems.

Module – I


Module – II

Elementary ideas of hydrodynamics and thermal boundary layers-Thickness of Boundary layer-Displacement, Momentum and Energy thickness (description only).

Convection heat transfer: Newton’s law of cooling- Laminar and Turbulent flow, Reynold’s Number, Critical Reynold’s Number, Prandtl Number, Nusselt Number, Grashoff’s Number and Rayleigh’s Number. Dimensional analysis Buckingham’s Pi theorem- Application of dimensional analysis to free and forced convection- empirical relations- problems using empirical relations.

Module – III

Combined conduction and convection heat transfer-Overall heat transfer coefficient - Heat exchangers: Types of heat exchangers, AMTD, Fouling factor, Analysis of Heat exchangers-LMTD method, Correction factor, Effectiveness- NTU method, Special type of heat exchangers (condenser and evaporator, simple problems only)
Fins: Types of fins - Heat transfer from fins of uniform cross sectional area- Fin efficiency and effectiveness. Boiling and condensation heat transfer (elementary ideas only).

Introduction to heat pipe.

**Module – IV**

Radiation- Nature of thermal radiation-definitions and concepts- monochromatic and total emissive power-Intensity of radiation- solid angle- absorptivity, reflectivity and transmissivity-Concept of black body- Planck’ law- Kirchoff’s law- Wein’s displacement law- Stefan Boltzmann’s law- black, gray and real surfaces-Configuration factor (derivation for simple geometries only)- Electrical analogy- Heat exchange between black/gray surfaces-infinite parallel plates, equal and parallel opposite plates-perpendicular rectangles having common edge- parallel discs (simple problems using charts and tables). Radiation shields (no derivation).


Convective mass transfer- Evaluation of mass transfer coefficient- empirical relations- simple problems- analogy between heat and mass transfer.


**References:**


**Internal Continuous Assessment (Maximum Marks-50)**

50% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, quiz, literature survey, seminar, term-project etc.
20% - Regularity in the class
University Examination Pattern:

Examination duration: 3 hours  
Maximum Total Marks: 100

The question paper shall consist of 2 parts.

Part A (20 marks) - Ten Short answer questions of 2 marks each. All questions are compulsory. There should be at least two questions from each module and not more than three questions from any module.

Part B (80 Marks) - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

Note: Use of approved data book is permitted in the examination hall.

Course Outcome:

After successful completion of the course, the student will be able to:

• understand the basic laws of heat transfer.
• apply principles of heat and mass transfer to basic engineering systems
• demonstrate general knowledge of heat transfer [conduction, convection, radiation], and general knowledge of mass transfer [molecular diffusion, convection].
• analyse the performance and design of heat exchangers.
• design heat and mass transfer processes and equipment.
Course Objectives:

- To provide the fundamental concepts and principles of performance aspects of automobiles.
- To gain the knowledge about the Stability of Vehicles
- To know about dynamics aspects related to suspension and tyres.

Module – I

Performance of cars and light trucks: Vehicle drag-deformation of the wheel, deformation of the ground, Total resistance to a moving vehicle- air, rolling and grade resistance, power for propulsion, traction and tractive effort,

Road performance curves- acceleration, gradability and drawbar pull, acceleration time and Gear ratio for maximum acceleration(simple problems), fuel consumption and fuel economy, strategy for lowest fuel consumption, factors affecting fuel economy, CAFÉ standards, driving schedules – EPA urban and highway cycles, European driving cycles.

Module – II

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

Vehicle handling: Steering angle, cornering force, low speed turning, high speed cornering, suspension effects on cornering, self righting torque, slip angle, over steer, under steer, steady state cornering, driving torques on steering, effect of camber, camber thrust, transient effects in cornering.

Module – III

Stability of vehicles: Distribution of weight (Three wheeled and four wheeled vehicles), stability of a vehicle on a slope, Dynamics of vehicle running on a banked track, Stability of a vehicle taking a turn, vehicle vibration and its effects, vehicle vibration with single degree of freedom, vehicle vibration due to road roughness. Transmissibility of engine mountings.

Road testing methods: Measurement of aerodynamic drag force in a coast – down test, cross wind tests, engine cooling road test, wind noise measurement on the road.

Module – IV

Suspension: Vehicle dynamics and suspension 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.

Tyres: Tyre types, relative merits and demerits, tyre dimensions and specifications, Ride characteristics of tyres, wheel hop, wheel wobble, wheel wander, wheel shimmy, behavior while cornering, cornering force, power consumed by a tyre, effect of driving and braking torque, factors affecting tyre life, tread design.

References:
3. Wolf, Heinrich, Hucho – Aerodynamics of Road Vehicles, SAE.

Internal Continuous Assessment (Maximum Marks-50)

50% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, quiz, literature survey, seminar, term-project, software exercises, etc.
20% - Regularity in the class

University Examination Pattern:

Examination duration: 3 hours Maximum Total Marks: 100

The question paper shall consist of 2 parts.

Part A (20 marks) - Five Short answer questions of 4 marks each. All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

Part B (80 Marks) - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

Course Outcome:

At the end of the course the students will gain sufficient knowledge on dynamics of vehicle and the sub systems along with the performance characteristics of vehicles.
13.606.1 ARTIFICIAL INTELLIGENCE SYSTEMS (MPU) (Elective II)

Teaching Scheme: 3(L) - 1(T) - 0(P)  
Credits: 4

Course Objectives:

The main objectives of this course are

- To understand the importance of artificial intelligence in the current scenario
- To provide brief idea about various languages, logical ideas in LISP and streams
- To implement the technology of AIS in planning and production systems

Module – I

Definition - history and applications - propositional calculus – predicate calculus - inference rules - structures and strategies for state space search - heuristic search algorithms - heuristics in games - complexity issues – control and implementation of state space search - production systems - planning - the blackboard architecture.

Module – II


Module – III

Languages - issues - network representation – conceptual graphs - structured representation Languages and programming techniques for AI - overview of LISP - search - higher order functions and procedural abstractions - search strategies - pattern matching - recursion - interpreters.

Module – IV

Logic programming in LISP - streams and delayed evaluation - expert system shell in LISP – network representations and inheritance – CLOS Introduction to understanding natural language - introduction to automated reasoning - introduction to machine learning.

References

Internal Continuous Assessment *(Maximum Marks-50)*

- 50% - Tests *(minimum 2)*
- 30% - Assignments *(minimum 2)* such as home work, problem solving, literature survey, seminar, term-project, software exercises, etc.
- 20% - Regularity in the class

University Examination Pattern:

*Examination duration: 3 hours*  
*Maximum Total Marks: 100*

The question paper shall consist of 2 parts.

**Part A** (20 marks) - Ten Short answer questions of 2 marks each. All questions are compulsory. There should be at least two questions from each module and not more than three questions from any module.

**Part B** (80 Marks) - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

Course outcome:

*At the end of the course students will be able:*

- To know about the uses and applications of AIS.
- To understand the issues and solutions about AI languages.
- To understand the fuzzy sets, reasoning techniques and pattern matching.
13.606.2 MECHANICAL WORKING METHODS (MPU) (Elective II)

Teaching Scheme: 3(L) - 1(T) - 0(P)  
Credits: 4

Course Objectives:

The main objectives of this course are

- To impart an idea about various mechanical working methods, their design, uses and problems encountered
- To create a skill in selecting appropriate working methods as per design requirement.
- To identify the relative advantages, disadvantages in selecting a machining process.

Module – I


Module – II

Materials for mechanical working - A brief survey of the characteristics and composition of the common ferrous and nonferrous alloys and nonmetallic materials used for mechanical working.
Rolling Metals – Fundamental principles of metal rolling classification of rolled products, types and sizes –Basic principles of draughting schedule design and roll pass design (simple examples ) Roll load and power required in rolling – Problems encountered and defects in rolling practice.

Module – III

Forging, Extrusion and Wire drawing – Principles of product design and die design in forging – Calculation of forging loads and selection of hammers and process for forging – Design of extrusion and wire – drawing dies –Computation of power requirements problems encountered and defects in the above processes.

Module – IV

Press working of metals – Description and classification of the processes – Product and die design for shearing, blanking drawing and bending –Compound and progressive dies – Computation of capacities and tonnage requirements for blanking, piercing and drawing operations – Process selection and selection of process problems and defects in press working.
References


Internal Continuous Assessment *(Maximum Marks-50)*

50% - Tests *(minimum 2)*

30% - Assignments *(minimum 2)* such as home work, problem solving, literature survey, seminar, term-project, software exercises, etc.

20% - Regularity in the class

University Examination Pattern:

*Examination duration: 3 hours*  
*Maximum Total Marks: 100*

The question paper shall consist of 2 parts.

Part A (20 marks) - Ten Short answer questions of 2 marks each. All questions are compulsory. There should be at least two questions from each module and not more than three questions from any module.

Part B (80 Marks) - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

Course outcome:

At the end of the course students will be able

- To understand the features of different mechanical working methods
- To get sufficient knowledge in hot and cold working, rolling, forging, extrusion and wire drawing and press working
- To design and develop elements of mechanical processing systems.
13.606.3 SYSTEM MODELING & SIMULATION (MPU) (Elective II)

Teaching Scheme: 3(L) - 1(T) - 0(P)  
Credits: 4

Course Objectives:

The main objectives of this course are

- To introduce different system modelling and simulation techniques.
- To illustrate about analytical models, random number generations, validation of models and simulation software.
- To provide a brief idea about simulation languages, alternative modelling and simulators.

Module – I

System concepts - components of a system - discrete and continuous systems - types of system study - system analysis - system design and system postulation - system modelling - types of models - system simulation - steps in a simulation study - comparison of simulation and analytical models - Monte Carlo simulation – examples of simulation of single server, single queue systems and simple inventory systems - concepts in discrete event system simulation - event scheduling/time advance algorithm - modelling world views.

Module – II


Module – III

Validation of model assumptions and validating input-output transformations - output analysis for a single model - types of simulations with respect to output analysis, Measures of performance and their estimation - output analysis for terminating simulations - confidence interval estimation for a fixed number of replication - confidence intervals with specified precision - output analysis for steady-state simulations - initialization bias - replication method - sample size determination for a specified precision - batch means method.

Module – IV

Simulation modelling and analysis of manufacturing systems - objectives - performance measures - issues in simulation of manufacturing systems – simulation of simple job shop manufacturing systems - Introduction to simulation software for manufacturing applications - salient features of simulation languages such as general purpose simulation system (GPSS)
and simulation language for alternative modeling (SLAM) - salient features of simulators such as WITNESS and ARENA.

References


Internal Continuous Assessment *(Maximum Marks-50)*

50% - Tests (minimum 2)

30% - Assignments (minimum 2) such as home work, problem solving, literature survey, seminar, term-project, software exercises, etc.

20% - Regularity in the class

University Examination Pattern:

*Examination duration: 3 hours  Maximum Total Marks: 100*

The question paper shall consist of 2 parts.

Part A (20 marks) - Ten Short answer questions of 2 marks each. All questions are compulsory. There should be at least two questions from each module and not more than three questions from any module.

Part B (80 Marks) - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

Course outcome:

*At the end of the course students will be able*

- To understand the principles, uses and applications of modeling and simulations.
- To get an overall idea about GPSS, SLAM, WITNESS and ARENA.
- To develop simulation software for manufacturing applications.
13.606.4 MATERIALS HANDLING (MPU) (Elective II)

Teaching Scheme: 3(L) - 1(T) - 0(P)  
Credits: 4

Course Objectives:
The main objectives of this course are

- To aware about the significance of material handling in production industry
- To learn the basics of material handling techniques and how they can be effectively and efficiently used to support facility objectives.
- To understand the underlying mechanisms to design, and develop material handling devices.

Module – I
Importance of Materials Handling- Principles of Materials Handling – Principal groups of Materials handling equipment – General characteristics and applications of materials handling equipment – Modern trends in Materials handling.


Module – II

Module – III

Module – IV
Overhead Conveyors – Principal types and applications – Overhead pusher conveyor
References


Internal Continuous Assessment (*Maximum Marks*-50)

50% - Tests (minimum 2)

30% - Assignments (minimum 2) such as home work, problem solving, literature survey, seminar, term-project, software exercises, etc.

20% - Regularity in the class

University Examination Pattern:

*Examination duration: 3 hours*  
*Maximum Total Marks: 100*

The question paper shall consist of 2 parts.

Part A (20 marks) - Ten Short answer questions of 2 marks each. All questions are compulsory. There should be at least two questions from each module and not more than three questions from any module.

Part B (80 Marks) - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

Course outcome:

At the end of the course students will be able

- To effectively design and analyze material handling devices.
- To describe the safe work practices utilizing various types of hoisting and conveying equipment.
- To identify industry regulations necessary for material handling operations.
13.606.5 TOTAL QUALITY MANAGEMENT (MPU) (Elective II)

Teaching Scheme: 3(L) - 1(T) - 0(P)  
Credits: 4

Course Objectives:

The main objectives of this course are

- To introduce the main principles of business and social excellence, to generate knowledge and skills of students to use models and quality management methodology for the implementation of total quality management in various business organizations.
- To introduce about TQM principles, customer orientation and management tools.
- To provide an idea about quality standards.

Module – I


Module – II


Module – III


Module – IV


References


**Internal Continuous Assessment (Maximum Marks-50)**

50% - Tests (minimum 2)

30% - Assignments (minimum 2) such as home work, problem solving, literature survey, seminar, term-project, software exercises, etc.

20% - Regularity in the class

**University Examination Pattern:**

*Examination duration: 3 hours*  
*Maximum Total Marks: 100*

The question paper shall consist of 2 parts.

**Part A (20 marks)** - Ten Short answer questions of 2 marks each. All questions are compulsory. There should be at least two questions from each module and not more than three questions from any module.

**Part B (80 Marks)** - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

**Course outcome:**

At the end of this course the students will be able:

- To know the principles of total quality management and peculiarities of their implementation.
- To be able to use quality management methods analyzing and solving problems of organization.
- To know business excellence models and be able to assess organization’s performance making reference to their criteria.
13.606.6 ADVANCED MANUFACTURING PROCESSES (MPU) (Elective II)

Teaching Scheme: 3(L) - 1(T) - 0(P)  
Credits: 4

Course Objectives:
The main objectives of this course are

- To provide an idea about the advanced machining theory and practice techniques used in industry.
- To develop an ability to look for the unconventional manufacturing process to machine the objects
- To understand appreciate the latest manufacturing process in fabrication.

Module – I

Module – II

Module – III

Module – IV
References


**Internal Continuous Assessment (Maximum Marks-50)**

50% - Tests (minimum 2)

30% - Assignments (minimum 2) such as home work, problem solving, literature survey, seminar, term-project, software exercises, etc.

20% - Regularity in the class

**University Examination Pattern:**

*Examination duration: 3 hours*  
*Maximum Total Marks: 100*

The question paper shall consist of 2 parts.

**Part A (20 marks)** - Ten Short answer questions of 2 marks each. All questions are compulsory. There should be at least two questions from each module and not more than three questions from any module.

**Part B (80 Marks)** - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

**Course outcome:**

At the end of this course the students will be able:

- To learn the art of manufacturing new products due to the development of new materials and process.
- To select suitable process while fabricating new machine parts.
- To get information in SCREAM, SIMPLE, LIGA process.
Course Objectives:

The main objectives of this course are

- To provide basic descriptions of a range of common characterization methods for the determination of the structure and composition of solids.
- To introduce the Scope of optical metallographic studies.
- To understand the major components of material characterization essential to the understanding of the physical properties of solids.

Module – I

Scope of metallographic studies in materials science. Understanding image formation, resolution of a microscope, numerical aperture, magnification, depth of field and depth of focus. Important lens defects and their correction, principles of phase contrast. Bright field and dark field contrast, sample preparation. Optical microscopy, interference and polarized light microscopy, quantitative analysis using optical microscopy (inclusion analysis, grain size determination volume fraction of phases etc.).

Module – II

Production and properties of X-rays, X-ray diffraction, Bragg’s law of diffraction, Scattering of an electron by an atom, by a unit cell, structure factor and intensity calculations. Stereographic projection, Effect of texture, particle size, micro and macro strain on diffraction lines. Indexing of powder photographs. Chemical analysis by X-rays, Stress measurement, Particle size determination.

Module – III

Construction and working principles of transmission electron microscopes. Image formation, resolving power, magnification, depth of focus, elementary treatment of image contrast. Bright field and dark field images, sample preparation techniques. Selected area diffraction, reciprocal lattice and Ewald sphere construction, indexing of selected area diffraction patterns.

Module – IV


References


**Internal Continuous Assessment** *(Maximum Marks-50)*

50% - Tests *(minimum 2)*

30% - Assignments *(minimum 2)* such as home work, problem solving, literature survey, seminar, term-project, software exercises, etc.

20% - Regularity in the class

**University Examination Pattern:**

*Examination duration: 3 hours*  
*Maximum Total Marks: 100*

The question paper shall consist of 2 parts.

**Part A (20 marks)** - Ten Short answer questions of 2 marks each. All questions are compulsory. There should be at least two questions from each module and not more than three questions from any module.

**Part B (80 Marks)** - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

**Course outcome:**

At the end of the course students will be able

- To understand microstructure investigations using optical microscopes.
- To explain construction of working principles of electron microscopes.
- To gain knowledge on different types of analyses using XRD.
13.606.8 MICROMACHINING METHODS (MPU) (Elective II)

Teaching Scheme: 3(L) - 1(T) - 0(P) Credits: 4

Course Objectives:
The main objectives of this course are

- To get an overview of various techniques used for machining in the micro scale.
- To understand the theory of micromachining.
- To give an introduction about various applications of MEMS.

Module – I

Module – II

Module – III

Module – IV

References

**Internal Continuous Assessment (Maximum Marks-50)**

50% - Tests (minimum 2)

30% - Assignments (minimum 2) such as home work, problem solving, literature survey, seminar, term-project, software exercises, etc.

20% - Regularity in the class

**University Examination Pattern:**

*Examination duration: 3 hours  Maximum Total Marks: 100*

The question paper shall consist of 2 parts.

**Part A (20 marks)** - Ten Short answer questions of 2 marks each. All questions are compulsory. There should be at least two questions from each module and not more than three questions from any module.

**Part B (80 Marks)** - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

**Course outcome:**

At the end of this course the students will be able:

- To gain knowledge on the structure of materials in the micro scale.
- To explain various micro machining processes and to differentiate its uses.
- To do micro machining tool design.
13.606.9 VEHICLE BODY ENGINEERING  (U) (Elective II)

Teaching Scheme: 3(L) - 1(T) - 0(P)  
Credits: 4

Course Objectives:
The main objectives of this course are to provide knowledge on
- Body material and mechanisms
- Different vehicle body details such as Car body details, Bus body, Commercial Vehicle details
- Fundamentals of Vehicle aerodynamics
- Testing of vehicles for safety.

Module – I
Modern materials for vehicle design: Introduction, Structure and manufacturing technology of automotive materials, Mechanical and physical properties of automotive materials, Material selection for automotive components, Introduction to vehicle aerodynamics, Vehicle drag and types; various types of forces and moments, effects of forces and moments, side wind effects on forces and moments, Various body optimization techniques for minimum drag, wind tunnel testing: flow visualization techniques, scale model testing.

Module – II
Body design: coach and bus body styles, typical layout of bus and coach bodies, typical layout of commercial vehicle types, passenger car body styles, Chassis design and analysis: Chassis type, structural analysis by simple structural surface method, body frame construction, unitized frame and body construction, FR, FF, & MR body structure details.

Module – III
Ergonomics method and tool to promote occupant accommodation: standards guidelines and recommendations, Anthropometry, 2-dimentional manikins, package drawing, Quick and dirty mock ups, vehicle seating configuration (based on SAE). Crash testing: Human testing, Crash worthiness, Compliance testing. Introduction to vehicle safety: Basic concept of vehicle safety-underlying principles, safety factors, warning and instructions, shielding, interlocking. Minor auto body repairs: types of body fillers and its application, repairing rust damage.

Module – IV
Painting: Corrosion and anticorrosion method. Paint and painting process Diagnosing major collision damage: impact and its effect on a vehicle, determining the conditions of the collision, Porto power, the dozer technique, operation of conventional Porto power,
operation of dozers, body bay systems (flexi-force), general repair techniques. Body alignment- straightening equipment, in-floor systems, chainless anchoring systems.

References

1. Pauloski, *Vehicle Body Engineering*

Internal Continuous Assessment (Maximum Marks-50)

50% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, literature survey, seminar, term-project, software exercises, etc.
20% - Regularity in the class

University Examination Pattern:

Examination duration: 3 hours Maximum Total Marks: 100

The question paper shall consist of 2 parts.

Part A (20 marks) - Ten Short answer questions of 2 marks each. All questions are compulsory. There should be at least two questions from each module and not more than three questions from any module.

Part B (80 Marks) - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

Course outcome:

At the end of the course students would be familiar with the Vehicle body related aspects inclusive of the testing.
13.606.10 PRODUCTION PROCESS OF AUTOMOTIVE COMPONENTS (U)  
(Elective II)

Teaching Scheme: 3(L) - 1(T) - 0(P)  
Credits: 4

Course Objectives:

- To give an insight into the various production processes incorporated in the manufacturing sector of automotive components.
- To make the students aware about Recent Materials used and recent trends in manufacturing of automotive components.

Module – I


Casting and Machining: 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 carburettor other small auto parts. Machining of connecting rods - crank shafts - cam shafts - pistons - piston pins - piston rings - valves - front and rear axle housings - fly wheel - Honing of cylinder bores - Copy turning and profile grinding machines.

Module – II


Module – III


Module – IV

Recent Trends in Manufacturing of Auto Components: Powder injection moulding - Shotpeen hardening of gears - Production of aluminium MMC liners for engine blocks - Plasma spray coated engine blocks and valves - Recent developments in auto body panel forming - Squeeze casting of pistons - aluminium composite brake rotors.
References

Internal Continuous Assessment *(Maximum Marks-50)*

50% - Tests (minimum 2)  
30% - Assignments (minimum 2) such as home work, problem solving, literature survey, seminar, term-project, software exercises, etc.  
20% - Regularity in the class

University Examination Pattern:

*Examination duration: 3 hours  Maximum Total Marks: 100*

The question paper shall consist of 2 parts.

**Part A (20 marks)** - Ten Short answer questions of 2 marks each. All questions are compulsory. There should be at least two questions from each module and not more than three questions from any module.

**Part B (80 Marks)** - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

Course outcome:

*At the end of the course the students will have thorough knowledge about various production processes used in manufacturing of automobile components in the industry.*
13.606.11 AUTOMOTIVE SAFETY (U) (Elective II)

Teaching Scheme: 3(L) - 1(T) - 0(P)  Credits: 4

Course Objectives:

- To know the fundamentals of the Automotive Safety and the need.
- To know the various regulations related to Automotive Safety.
- To give an overview about the safety of passengers and the vehicle along.

Module – I

Design of the body for safety, engine location, deceleration of vehicle inside passenger compartment, deceleration on impact with stationary and movable obstacle. Driver assistance systems in automobiles, Design of crash crumple zones, Modelling and simulation studies, Optimization of vehicle structures for crash worthiness.

Module – II

Types of impacts, and Impact with rebound, movable barrier tests, Analysis and simulation of vehicle in barrier impacts, Roll over crash tests, Behaviour of specific body structures in crash testing, Photographic analysis of impact tests, Regulatory requirements for crash testing.

Module – III

Vehicle safety systems: Survival space requirements, Restraints systems used automobiles, Types of safety belts, Head restraints, Air bags used in automobiles, Use of energy absorbing systems in automobiles, Impact protection from steering controls, Design of seats for safety, types of seats used in automobiles.

Module – IV

Types of sensors and working principle, construction, characteristics etc. used in different equipment. Collision warning system, causes of rear end collision, frontal object detection, rear vehicle object detection system, object detection system with braking system interactions, National and international Regulations, Safety regulations: As Issued from time to time by Government Of India as per AIS 037 (Automotive Indian Standard) test requirements and testing procedure, Recent developments in Automotive Safety & Automotive lighting.

References


**Internal Continuous Assessment (Maximum Marks-50)**

50% - Tests (minimum 2)

30% - Assignments (minimum 2) such as home work, problem solving, literature survey, seminar, term-project, software exercises, etc.

20% - Regularity in the class

**University Examination Pattern:**

- Examination duration: 3 hours
- Maximum Total Marks: 100

The question paper shall consist of 2 parts.

**Part A (20 marks)** - Ten Short answer questions of 2 marks each. All questions are compulsory. There should be at least two questions from each module and not more than three questions from any module.

**Part B (80 Marks)** - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

**Course outcome:**

At the end of the course students would be familiar with the vehicle and passenger safety incorporated in Automobiles along with regulations related to Automobile Safety.
13.607 COMPUTER AIDED MODELLING AND ANALYSIS LAB. (MPU)

Teaching Scheme: 0(L) - 0(T) - 3(P)  
Credits: 3

Course Objective:
- To train the students in Solid Modelling and Assembly of machine parts.
- To practice finite element approach in the design of engineering systems.

PART: A – MODELLING & ASSEMBLY

Introduction to various modelling and assembly tools in CAD software. Exercise on the creation of solid models. Exercise on the creation of assembled models of riveted joints, cotter joints, shaft couplings and machine parts

PART: B - FINITE ELEMENT ANALYSIS

Introduction to pre-processing and post processing tools in finite element software. Exercise on the application of Finite Element Method to Engineering systems:
1. Structural Analysis
2. Thermal Analysis

Internal Continuous Assessment (Maximum Marks-50)

40% - Test  
40% - Class work and Record  
20% - Regularity in the class

University Examination Pattern:

Examination duration: 3 hours  
Maximum Total Marks: 100
Questions based on the list of exercises prescribed.
The question paper shall consist of 2 parts.

PART- I :  50 Marks from Part-A  
PART -II : 30 Marks from Part-B
20% - Viva voce

Candidate shall submit the certified fair record for endorsement by the external examiner.

Course Outcome:

At the end of the course, students shall be able to understand various phases in engineering design process through modelling, assembly and finite element analysis.
13.608 ELECTRICAL AND ELECTRONICS LAB (U)

Teaching Scheme: 0(L) - 0(T) - 3(P)  
Credits: 3

Course Objective:

- To obtain the performance characteristics of dc and ac machines, transformer
- To familiarize various electrical measurement equipments and measurement methods

List of Experiments:

1. OCC on a DC shunt generator- determination of critical resistance, critical speed, additional resistance required in the field circuit.
2. Load characteristics of a dc shunt generator.
3. Load characteristics of DC compound generator
4. Load test on DC series motor
5. Load test on DC shunt motor
6. Load test on single phase transformer
7. Starting of three phase squirrel cage induction motor by star delta switch, load test on three phase squirrel cage induction motor
8. Load test on three phase slip ring induction motor
9. V-I characteristics of diodes and zener diode
10. Input and output characteristics of CE and CB configurations of BJTs.  
   Determination of β, input resistance and output resistance
11. Drain and transfer characteristics of JFET
12. Static V-I characteristics of SCR
13. Half wave and full wave rectifiers with and without filters- observe the waveforms on CRO

Note: Students should complete at least 10 experiments from the above during the semester

Internal Continuous Assessment (Maximum Marks-50)

20% - Test
60% - Class work and Record
20% - Regularity in the class

University Examination Pattern:

Examination duration: 3 hours  
Maximum Total Marks: 100
Questions based on the list of experiments prescribed.

80% - Procedure, conducting experiment, results, tabulation, and inference.

20% - Viva voce

Candidate shall submit the certified fair record for endorsement by the external examiner.

Course Outcome:

At the end of the course, the students will be familiar with the testing of electrical equipments.