UNIVERSITY OF KERALA

B. TECH. DEGREE COURSE
(2013 SCHEME)

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

#### VII 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>
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<tbody>
<tr>
<td>13.701</td>
<td>Principles of Management and Decision Modeling (MPU)</td>
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<td>Automotive Air Conditioning Systems (U)</td>
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<td>13.704</td>
<td>Engine and Drive Line Design (U)</td>
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<td>Modern Automotive Technology (U)</td>
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<td>13.706</td>
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<td>13.707</td>
<td>Vehicle Reconditioning lab (U)</td>
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#### 13.706 Elective III

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<th>Course No</th>
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<td>13.706.1</td>
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<td>13.706.11</td>
<td>Vehicle Performance And Testing (U)</td>
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<td>13.706.12</td>
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<td>13.706.13</td>
<td>Tractors &amp; Farm Equipments (U)</td>
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13.701 PRINCIPLES OF MANAGEMENT AND DECISION MODELING (MPU)

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

Course Objective:

The main objectives of this course are

- To understand evolution of scientific management and principles of management in organizations.
- To understand different types of industrial ownerships and organizational structures.
- To learn the methods and techniques to effectively manage human resource in an organization.
- To understand various quantitative techniques in decision making.

Module – I

Evolution of Scientific management: Principles and functions of scientific management, Levels and skills of management.

Organizational structure: Authority, responsibility and span of control - system concept of management - Line and staff, project and matrix organization.

Formation of companies: Proprietary Partnership and joint stock companies – private limited, public limited companies, cooperative organizations and Government organizations.

Module – II

Selection of site - factors to be considered – Economic vs. social significance of location.

Plant layout - different types - process, product, fixed position and group technology layout.

Personnel management - objectives and function-recruitment, selection, orientation and training of workers Industrial safety and health - Labour welfare - Industrial psychology.

Module – III


Decision making - Types of decisions-The decision making process - decision tree - linear programming and its application in management, transportation and assignment problems.

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*  \hspace{1cm} *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 be able to have an understanding of various tools and techniques for the efficient and effective use of resources in an organization and application of these techniques for better management of the organization.
13.702 MECHATRONICS (MPSU)

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

Course Objectives:

The main objectives of this course are

- To understand the features of various sensors used in CNC machines and robots.
- To study the fabrication and functioning of MEMS pressure and inertial sensors.
- To develop hydraulic/pneumatic circuit and PLC program for simple applications.

Module – I


Module – II


Module – III


System modeling - Mathematical models and basic building blocks of general mechanical, electrical, fluid and thermal systems.

Module – IV

finders. Robotic vision system - Image acquisition: Vidicon, charge coupled device (CCD) and charge injection device (CID) cameras. Image processing techniques: histogram processing: sliding, stretching, equalization and thresholding.

Case studies of Mechatronics systems: Automatic camera, bar code reader, pick and place robot, automatic car park barrier system, automobile engine management system.

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 discuss mechanical systems used in mechatronics
- To integrate mechanical, electronics, control and computer engineering in the design of mechatronics systems.
13.703 AUTOMOTIVE AIR CONDITIONING SYSTEMS (U)

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

Credits: 4

Course Objectives:

To know about the construction and working of components related to Automotive Air-conditioning and refrigeration.

Module – I

Air conditioning Fundamentals: Definition of Air Conditioning, Psychrometry and air composition Adiabatic saturation and Thermodynamic wet bulb temperature Basic air conditioning system - Location of air conditioning components in a car - Schematic layout of a refrigeration system. Compressor components - Condenser and high pressure service ports. Thermostatic expansion value - Expansion value calibration - Controlling evaporator temperature - Evaporator pressure regulator - Evaporator temperature regulator.

Module – II


Module – III

Refrigerant: Containers - Handling refrigerants - Tapping into the refrigerant container - Refrigeration system diagnosis - Diagnostic procedure - Ambient conditions affecting system pressures.

Module – IV

Air Routing & Temperature Control: Objectives - Evaporator care air flow through the Dash recirculating unit - Automatic temperature control – Duct system - Controlling flow - Vacuum reserve - Testing the air control and handling systems.

Air Conditioning Service: Air conditioner maintenance and service - Servicing heater system - Removing and replacing components. Trouble shooting of air controlling system – Compressor service.

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 students will be familiar about the working principle and various components related to Air-conditioning and Refrigeration.
13.704 ENGINE AND DRIVE LINE DESIGN (U)

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

Credits: 4

Course Objective:

- To know about the fundamentals about the design of automotive engine and drive line components.
- To get the idea about the application of the design concept in automotive industries.

Module – I

Design of IC engine components: Design of cylinder, piston, connecting rod, Crank shaft, design of fly wheel - turning moment diagram, functions of flywheel, fluctuations of energy and speed in flywheel, size of the flywheel.

Module – II

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, selection of bearing, bearing design

Rolling contact bearings:- ball and roller bearings, types, mechanics of rolling friction, bearing life, static and dynamic load rating, equivalent bearing load, Design of ball and roller bearings, selection of bearing.

Module – III

Clutches & brakes: Design of single plate, multi plate, centrifugal and cone clutches, design factors for brakes, Design of internal expanding shoe brakes, Design of disc brakes, heat rejected during braking, torque transmitted by leading and trailing shoes during braking, braking force, weight shifted during braking, Problems.

Axle & Steering systems: Design of front and rear axles - live and dead axles, Condition for true rolling, turning circle radius of wheels, angle of inside lock and outside lock - problems.

Module – IV

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), design of gear box.
Design Data Handbooks:

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 charts and tables are permitted in the examination hall.

**Course Outcome:**

At the end of the course students will be familiar about the design of Automotive Engine and Drive Line Components. Students will be familiar about the application of the concept in projects and automotive industry.
13.705 MODERN AUTOMOTIVE TECHNOLOGY (U)

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

Course Objectives:

To know the recent developments in Automotive Technology and Trends. Familiar with various developments and components with latest technologies used in Automobile Industry.

Module – I

Electric and Hybrid Vehicle technology: Introduction, LEV, TLEV, ULV & ZEV, Basic components of Electric vehicles, Batteries suitable for electric vehicles, motor and controllers, constructional features,

Basic factors to be considered for converting automobiles to electric vehicle, electric hybrid vehicle, types - series and parallel hybrid, layouts, comparison, Power systems and control systems, Different modes of operation for best usage. Regenerative braking.

Module – II


Vehicle Operation and Control: Computer Control for pollution and noise control and for fuel economy-Transducers and operation of the vehicle like optimum speed and direction.

Module – III

Fuel Cells and Alternative energy systems: Introduction to fuel cells, Operational fuel cell voltages, Proton Exchange membrane fuel cells, Alkaline Electrolyte fuel cells, Medium and high temperature fuel cells, fuel and fuel chose, fuel processing, fuel cell stacks, Delivering fuel cell power, Integrated Air supply and humidification concepts for fuel cell systems, A comparison of High pressure and low pressure operation PEM Fuel cell systems, Fuel cell Auxiliary systems,


Module – IV

Modem electronic and micro control systems in automobiles: Electronically controlled concealed headlight systems, LED and Audible warning systems Electro chromic mirrors, automatic review mirrors, OBD II, Day time running lamps (DRL), Head up display, Travel information systems, On board navigation system, Electronic climate control, Electronic
cruise control, Antilock braking system, Electronically controlled sunroof, Anti-theft systems, Automatic door locks (ADL), engine management system, Electronic transmission control, chassis control system, Integrated system.

References:

1. Bob Brant, Build Your Own Electric Vehicle.
2. SAE, Electric and Hybrid Electric Vehicles and Fuel Cell Technology, SAE.
3. Andrew Dicks and James Laminine, Fuel Cell Systems Explained, SAE.
4. SAE, Fuel cells and alternative fuels / Energy systems
6. Rickard Stobart, Fuel Cell Technology for Vehicles, SAE.
8. Tom Denton, Automotive Electronics, 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.

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

Course Outcome:

At the end of the course students will be familiar about latest developments in Automobile Industry and familiar with the construction and working of various latest components used in new generation vehicles.
13.706.1 PLANT ENGINEERING & MAINTENANCE (MPU) (Elective III)

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

Course Objectives:
The main objectives of this course are

- To gain knowledge in plant engineering and maintenance.
- To become familiar with maintenance management.
- To study the different maintenance management schemes.

Module – I
Wear – fundamentals and analysis – Classification – Theories of wear – Wear – fundamentals
Synthetic – General properties and applications – Tests and classifications – Additives -
Testing of lubricants selection of lubricants-lubricating mechanisms.

Module – II
Estimation of parameters for failure distributions – Maintainability - availability.

Module – III
Replacement – Analysis of different models - Causes of deterioration and obsolescence –

Module – IV
Safety engineering, accident prevention programme, safety design concepts, fire protection -
industrial noise-Legislations on safety in industry. Recent Developments in maintenance methods – RCM - CBM – DMS – TPM etc.

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 discuss wear and theories of failure.
- To suggest maintenance schemes.
- To discuss safety issues and related rules.
13.706.2 FRACTURE MECHANICS (MPU) (Elective III)

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

Course Objectives:
The main objectives of this course are

- To get knowledge in fracture phenomena in metals and non-metals.
- To become familiar with testing methods.

Module – I

Module – II

Module – III

Module – IV
Sustained load fracture: Time-to-failure (TTF) tests - crack growth rate testing - experimental problems - method of predicting failure of a structural component - practical significance of
sustained load fracture testing Practical problems: Through cracks emanating from holes - corner cracks at holes - cracks approaching holes - fracture toughness of weldments - service failure analysis - applications in pressure vessels - pipelines and stiffened sheet structures.

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 predict material failure for any combination of applied stresses.
- To estimate failure conditions of a structure.
- To predict the likelihood of failure of a structure containing a defect.
13.706.3 ENTREPRENEURSHIP DEVELOPMENT (MPU) (Elective III)

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

Course Objectives:
The main objectives of this course are

- To gain knowledge entrepreneurship process.
- To become familiar industrial policies.
- To know process strategies for starting a venture.

Module – I
Entrepreneurial perspectives - understanding of entrepreneurship process - entrepreneurial decision process - entrepreneurship and economic development - characteristics of entrepreneur - entrepreneurial competencies- managerial functions for enterprise.

Module – II

Module – III
Process and strategies for starting a venture - stages of small business growth, Entrepreneurship in international environment - achievement motivation – time management - creativity and innovation structure of the enterprise - planning, implementation and growth.

Module – IV
Technology acquisition for small units - formalities to be completed for setting up a small scale unit - forms of organizations for small scale units – financing of project and working capital - venture capital and other equity assistance available - break even analysis and economic ratios technology transfer and business incubation.

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 discuss the strategies for starting an a venture.
- To discuss industrial policies.
13.706.4 FINITE ELEMENT METHODS (MPU) (Elective III)

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

Course Objectives:
The main objectives of this course are

- To understand the fundamental concepts of the theory of the finite element method.
- To solve simple structural and heat transfer problems using finite element methods.

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 the course students will be able

- To identify mathematical models for solution of common engineering problems.
- To formulate simple problems into finite elements.
- To solve simple structural and heat transfer problems using finite element method.
13.706.5 METAL FORMING (MPU) (Elective III)

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

**Course Objectives:**

The main objectives of this course are

- To gain deeper knowledge on metal forming under different conditions and in various processes.
- To do analyses of rolling and forging processes.

**Module – I**


**Module – II**

Plastic potential theory - plastic work - maximum work hypothesis - stability postulates - isotropic and kinematic hardening - plastic flow - temperature and strain rate effects in plastic flow Processes - drawing and extrusion - process classification - lubrication - temperature effects - analysis of the processes of drawing and extrusion of wire and strip through friction less dies and dies with friction - production of seamless pipe and tubes - analysis - residual stresses in rods - wires - tubes, deep drawing.

**Module – III**

Classification of rolling processes - hot rolling - cold rolling - rolling of bars and shapes - analysis of rolling process in conditions of plane strain. Classification of forging process - open die forging - closed die forging - analysis of forging process in conditions of plane strain - forging allowances and tolerances - sheet metal forming, shearing, blanking, bending and stretch forming.

**Module – IV**

Slip line field theory - incompressible two-dimensional flow - slip lines - equilibrium equations referred to slip lines - Henkeys theorem - hodographs - simple slip line field analysis in extrusion - compression of block between parallel plates - strip load on semi-infinite body - lower and upper bound theorems with proofs and applications.

**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 identify suitable process for a particular application.
- To discuss various processes such as rolling, forging etc. and also the theories
**13.706.6 NON-CONVENTIONAL MACHINING TECHNIQUES (MPU) (Elective III)**

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

**Course Objectives:**

*The main objective of this course is to introduce the various non traditional machining techniques.*

**Module – I**


**Module – II**


**Module – III**

Ultrasonic Machining Process-working principles-types of transducers concentrators- nodal point clamping-feed mechanism-metal removal rate- Process parameters. Applications.

**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 identify suitable process for a particular application.
- To discuss the various non traditional machining techniques.
Course Objectives:

The main objective of this course is to introduce the various measuring instruments.

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 the course students will be able

- To identify the suitable instrument for measuring transport parameters
- To detect suitable range of pressure gauge and compute
- To distinguish different flow visualization methods and temperature measurements.
- To determine thermal conductivity in solids, liquids and gases and radiation measurements.
13.706.8 MECHANICAL VIBRATION & NOISE CONTROL (MPU) (Elective III)

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

Course Objectives:
The main objectives of this course are

- To apply the laws of motion to oscillating systems
- To examine the effects of energy-removal mechanisms; i.e. damping.
- To introduce modes of vibration in terms of system physical parameters.
- To introduce types of noise and noise control.

Module – I


Module – II


Module – III

Introduction to sound and vibratic wave motion – One dimensional plane waves – Characteristics impedance – Decibel seats power, density and intensity – Sound transmission through one and two intervening media. Measurement of Sound – Loud speakers and microphones – Their characteristics, Band pass filters, graphic level recorder, Narrow Band Analysers - Measurement in reverberation and Vachaic chamber – Hearing mechanism of hearing and perception of sound (Description only).

Module – IV

Auditorium – Acoustical requirements – Elimination of room acoustical defects – Articulation index – Sound reinforce systems – Design of time delays (Brief description only).

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 appreciate the need and importance of vibration analyses in mechanical systems.
- To analyze the mathematical model of vibratory systems.
- To discuss source of noise and types of noise.
13.706.9 FAILURE ANALYSIS (MPU) (Elective III)

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

Course Objectives:

The main objectives of this course are

- To get knowledge in failure investigation and analysis.
- To introduce experimental stress analysis.
- To get knowledge in fracture mechanics.

Module – I

Introduction: Objectives of failure investigation, Collection of background data service history, photographic records, Selection of samples for various conditions, Preliminary examination of the failed part – visual inspection and non destructive techniques for failure investigation- Magnetic particle inspection, Liquid penetrant inspection, Eddy current inspection, ultrasonic inspection, radiography, acoustic emission inspection.

Module – II

Experimental stress Analysis Mechanical testing, limitations of tensile testing, Selection preservation and cleaning of fracture surfaces- cleaning, sectioning, opening secondary cracks Macroscopic examination of fracture surfaces, Microscopic examination of fracture surfaces – optical microscopy, scanning electron microscopy, transmission electron microscopy, Selection and preparation of metallographic sections, Examination and analysis of metallographic sections.

Module – III

Determination of fracture type- Failure mechanisms and Fractography of ductile fracture, brittle fracture, transgranular brittle fracture, Intergranular brittle fracture Fatigue fracture-Mechanisms and general features of fatigue fracture Stress corrosion cracking, Liquid metal embrittlement, Hydrogen embrittlement, Creep and stress rupture failures, ductile to brittle fracture transition Chemical analysis- Analysis of bulk materials, analysis of surfaces and deposits, spot tests.

Module – IV

Applications of fracture mechanics: Fracture mechanics concepts- Linear elastic fracture mechanics, Elastic-Plastic fracture mechanics (basic concepts), plane stress and plane strain, Fatigue crack growth rate their use in failure analysis, fracture toughness testing- Plane strain fracture toughness test, COD test, Simulated service testing, Analyzing the evidences
formulating conclusions and report writing, Case studies of failures: failures of shafts, failures of heat exchangers.

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 investigate failure using various techniques.
- To discuss the various tools/equipment used for investigations of failure.
- To discuss the various types of fracture and also application of fracture mechanics.
13.706.10 INDUSTRIAL AUTOMATION (MPU) (Elective III)

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

Course Objectives:
The main objectives of this course are

- To introduce the automation and types of automation
- To gain knowledge in pneumatics
- To introduce robotics and automatic assembly process.

Module – I
Introduction: Basic concept of Automation, Types of Automation, Feasibility etc. Industrial Hydraulics: Introduction, basic concepts, Hydraulic fluids, Classification and properties of hydraulic fluids, Contaminates in hydraulic system, control and cleanliness standards, Fluid power generators, i.e. Gear, Vane, Piston pumps, linear and Rotary Actuators, Direction Control Valves, types, actuation methods, pressure control valves; pressure reducing valves, pressure relief valve, Unloading valve, Sequence valve, Counterbalance valve, Flow control valves simple and pressure compensated type.

Module – II
Pneumatics: Introduction, Basic components, Source, storage and distribution, treatment of compressed air, linear and Rotary actuators, Direction control valves – types, actuation methods, pressure control valves, logic devices – twin pressure valve, shutter valve, time delay valve, Pneumatic circuit design and analysis, conventional as well as computer aided design.

Module – III
Robotics: Basic concepts, classification based on Geometry, programming, drives, work volume of robots world and joint coordinates various joints, DOF, end effectors – Types and uses, Sensors in Robots, programming – Teach pendant and Computer programming, Introduction to forward and inverse kinematics, Applications of Robots.

Module – IV
Automatic Assembly System: Development of Automatic Assembly process, Transfer devices – continuous, Intermittent, synchronous and asynchronous, Vibratory feeders – Mechanics, effect of frequency, acceleration, track angle, friction, load sensitivity, orientation of parts – active and passive devices, Mechanical feeders – computation and operational details, feed
tracks, Escapement devices. Product design for high-speed automatic assembly examples of design modifications.

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 discuss automation and various components used
- To discuss robotics and applications of robots
- To implement automatic assembly system.
13.706.11 VEHICLE PERFORMANCE AND TESTING (U) (Elective III)

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

Course Objectives:  
To know about various performance parameters and testing equipments used in Automotive Industry.

Module – I
Laboratory testing: Basic engine parameters, Measurement of BHP, IHP, Engine testing on dynamometers, different types of dynamometers- hydraulic, eddy current etc, engine analyzers- for petrol and diesel engines, FIP calibrating and testing, exhaust gas analyzers - various types- Orsat apparatus, infrared gas analyzers, smoke meter.  
Vehicle testing on chassis dynamometers: two wheel & four wheel dynamometers, vehicle testing lanes - side slip testers, wheel alignment testing, wheel balancing, brake testers, head light alignment testing.

Module – II
Noise vibration and Harshness: Review of vibration fundamentals, vibration control, fundamentals of acoustics, human response to sound, automotive noise criteria, Standard noise measurement methods, Noise inside and outside the vehicle, sources of vehicle noise- intake and exhaust noise, combustion noise, mechanical noise, noise from auxiliaries, wind noises, transmission noises, brake squeal, structure noise, noise control methods.

Module – III
Vehicle performance: Methods for evaluating vehicle performance- energy consumption in conventional automobiles, performance, emission and fuel economy, Operation of full load and part conditions, effect of vehicle condition, tyre and road condition and traffic condition and driving habits on fuel economy, CAFÉ standards.

Module – IV
Road and track testing: Initial inspection, PDI, Initial free services, engine running in and durability, intensive driving, maximum speed and acceleration, brake testing on the road, hill climbing, handling and ride characteristics, safety, mechanism of corrosion, three chamber corrosion testing, wind tunnel testing, road testing, test tracks.

References
4. SAE Transaction papers- 831814,820346,820367,820371 and 820375

**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 knowing about the various parameters related to vehicle performance and testing methods adopted in the Automotive Industry.
13.706.12 AUTOMOTIVE AERODYNAMICS (U) (Elective III)

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

Course Objectives:
To know the importance and various factors related to Automotive Aerodynamics.

Module – I

Module – II

Module – III
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.
Wind tunnels for automotive aerodynamic introduction - principle of wind tunnel technology - limitation of simulation - stress with scale models – full scale wind tunnels - measurement techniques - equipment and transducers - road testing methods – numerical.

Module – IV
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.

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 familiarize with the Aerodynamics fundamentals and its implementation in Automobiles.
13.706.13 TRACTORS AND FARM EQUIPMENTS (U) (Elective III)

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

Course Objectives:
The main objectives of this course are

- To know the construction working of various types of tractors and the components.
- To know about the various implements used for the tractors.

Module – I

General Description of Tractors: Classification of tractors - Components of tractor - Safety rules. Layout of wheeled tractor, hydraulic control system, power take off, tractor stability and ride characteristics.

Module – II

Layout of crawler tractors, crawler details, methods of selection of equipments, selection of machines, basic rules for matching machines, selection of equipments including the nature of operating selection based on the type of soil, selection based on haul distance, selection based on weather conditions.

Module – III


Cooling system - Classification - Liquid cooling system - Components, Lubricating system servicing and troubles - Air cleaner and turbo charger - Fuel tanks and filters - Fuel pumps.

Module – IV

Control System of Tractors: power transmission, steering system, brakes and braking system, wheels, rims and tyres and accessories of wheeled tractors, power transmission, steering clutch and braking system in crawler tractors.

Agricultural Implements: Working attachment of tractors - Farm equipment - Classification - Auxiliary equipment - Trailers and body tipping mechanism.

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 familiarize with the Tractors and Farm Equipments construction and working.
13.707 VEHICLE RECONDITIONING AND TESTING LAB (U)

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

Course Objective:
To make the students aware about various reconditioning equipments and their use. To know about the testing equipments of Automobile. The students should know about total reconditioning procedure and the testing techniques for checking the performance of the engine.

List of Experiments:
Reconditioning work of the following engine components and accessories with the help of special tools and Machines
1. Cylinder reconditioning: Checking the cylinder bore, setting the tool, re-boring operation (Work with portable re-boring machine, bore dial gauge, venire caliper, etc)
2. Checking the exhaust of gasoline vehicle with infra red gas analyzer and timing the carburetor. (Work with Infrared Exhaust gas analyzer)
3. Checking the emission of diesel vehicle with smoke meter. (Work with Diesel smoke meter)
4. Wheel alignment: Checking the camber, caster, kingpin inclination, toe in & out with optical aligner or computerized wheel aligner. (Work with computerized wheel aligning machine)
5. Wheel balancing: Balancing of wheels by using computerized wheel balancing machine.
6. Vehicle testing - Performance Testing of vehicle with chassis dynamometers (2 / 4 wheelers)
7. Checking the engine with Scan tool and familiar with DTC.
8. Brake testers: Testing of brakes using brake testers
11. Testing auto electrical components:
   a) Battery testing - Specific gravity test, open volt test, HRD test.
   b) Testing generator and regulator - testing the generator for short circuit, open circuit, testing the regulator unit
   c) Testing and checking of spark plugs - Cleaning and testing the spark plug with spark plug cleaner & testing machine.
   d) Testing of ignition coil
   e) Checking of dwell angle and rpm.

Note: At least 8 Experiments to be completed from the above experiments
**Internal Continuous Assessment** *(Maximum Marks-50)*

- 20% - Test/s
- 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 exercises prescribed.*

- 70% - Procedure, conducting experiment, results, tabulation and inference.
- 10% - Fair record
- 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 would know about the various reconditioning techniques and testing of automobiles.*
13.708 MECHATRONICS LAB (U)

**Teaching Scheme:** O(L) - O(T) - 2(P)  
**Credits:** 2

**Course Objective:**

To make the students familiar with
- Use of Lab view and its applications.
- Programming and interfacing of PLCs and Microcontrollers.

**List of Experiments:**

1. Virtual instrumentation using Lab view
2. Programming and Interfacing with PLCs and Microcontrollers
3. Temperature, Flow, Liquid level, Pressure control
4. Motion Control Experiments using
   a). Stepper Motor
   b). Servo Trainer kit

*Note: At least 8 Experiments to be completed from the above instruments*

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

- 20% - Test/s
- 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.
- 70% - Procedure, conducting experiment, results, tabulation and inference.
- 10% - Fair record
- 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 would be familiar with the usage of Lab view, programming and interfacing of PLCs and Microcontrollers.
Course Objective:

- To identify a problem for the final-year project, outline a solution, and prepare a preliminary design for the solution.
- To do a detailed study on the selected topic based on current journals or published papers and present seminars.
- To improve the ability to perform as an individual as well as a team member in completing a project work.
- The seminar based on the project provides students adequate exposure to presentations to improve their communication skills.

The student shall do a project (project phase 1) in the seventh semester, which shall be continued in the eighth semester. He/she shall submit an interim report at the end of the seventh semester and the final project report shall be submitted at the end of the eighth semester. The student shall present two seminars in the seventh semester on the work carried out during project phase 1. The first seminar should highlight the definition of problem, novelty of the project, literature survey and work plan/ methodology. The second seminar should include preliminary results. The students may be assessed individually/ and in groups.

**Internal Continuous Assessment (Maximum Marks-100)**

- 40% - Assessment by the Guide
- 40% - Assessment by the Committee.
- 20% - Regularity in the class

Course Outcome:

At the end of the course, the students would have acquired the basic skills to perform literature survey and paper presentation. This course shall provide students better communication skills and improve their leadership quality as well as the ability to work in groups, and thus aid them in building a successful career as an engineer.