UNIVERSITY OF KERALA

B. TECH. DEGREE COURSE
(2013 SCHEME)

SYLLABUS FOR
VI SEMESTER
MECHANICAL ENGINEERING
## SCHEME -2013
### VI SEMESTER
#### MECHANICAL ENGINEERING (M)

<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>UE Max Marks</th>
<th>Total Marks</th>
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<tr>
<td>13.601</td>
<td>Metrology &amp; Instrumentation (MP)</td>
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<td>Dynamics of Machinery (MP)</td>
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<td>13.603</td>
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<td>13.604</td>
<td>Heat and Mass Transfer (MSU)</td>
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<td>13.605</td>
<td>Design of Machine Elements - I (M)</td>
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<td>13.606</td>
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<tr>
<td>13.608</td>
<td>Machine Tools Lab (M)</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  | New Energy Systems (MP)                              |
| 13.606.10 | Object Oriented Programming (MP)                      |
| 13.606.11 | Nuclear Engineering (MP)                             |
| 13.606.12 | Instrumentation and Control (MP)                     |
| 13.606.13 | Precision Engineering (MP)                           |
| 13.606.14 | Tool Engineering (M)                                 |
Course Objective:
The main objectives of this course are

- To understand the basic principles of measurements.
- To learn the various linear and angular measuring equipments, their principle of operation and applications.
- To learn about various methods of measuring Mechanical parameters.

Module – I

General principles of measurement: Precision, accuracy and the influencing factors.
Angular measurements: Bevel protractor, spirit level, clino-meter, angle gauges, sine bar, Sine centre.

Module – II

Geometric forms and measurements: Straightness, Flatness, Squareness, Circularity.
Geometric tolerances: Types, Representation.

Module – III


Module – IV

Co-ordinate measuring machine – Types, features, measurement process.
Transducers: Classification - Static and Dynamic characteristics.


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:**

*After successful completion of this course, the students will be able,*

- To know about quality control and quality assurances.
- To design a sensors and transducers used for measurements.
- To understand the importance of quality in engineering products.
13.602 DYNAMICS OF MACHINERY (MP)

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

Course Objectives:  
This course aims to equip the students with fundamental knowledge of dynamics of machines so that they can appreciate problems of force analysis, balancing of systems & vibrations.

Module – I  

Module – II  

Module – III  

Module – IV  
Types of vibrations – Basic elements of a vibrating system - Undamped force vibrations, different methods of analysis, Free vibrations with viscous damping, logarithmic decrement, forced vibrations, vibration isolation and transmissibility. Force due to unbalance - Force due to support motion – Vibration measuring instruments - vibrometers – accelerometers.  
Torsional vibrations Free torsional vibrations – Single rotor - Two rotor, three rotor systems – Torsionally equivalent shaft - geared systems.
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:

After successful completion of this course, the students will be able,

- To develop sufficient background in the application of knowledge in force analysis of mechanisms
- To understand the fundamentals of free and forced response of single degree of freedom vibration.
- To understand the dynamic balancing of revolving and reciprocating masses. Understand the fundamentals of gyroscopes and its applications and governors.
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.
13.605 DESIGN OF MACHINE ELEMENTS – I (M)

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

Course Objectives:

To provide basic knowledge on the design considerations and methodology of various machine elements.

Module – I


Module – II

Shafts design- stresses in shafts- causes of failure in shafts - design based on strength and rigidity, design for static and fatigue loads- repeated loading- reversed bending and steady torsion. Bolted joints, preloading of bolts. Design of couplings- rigid and flexible couplings- design of keys, pins and cotters.

Module – III


Module – IV


Design Data hand book


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) - 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:

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

• demonstrate the fundamentals of stress analysis and theories of failure in the design of machine components.
• make proper assumptions with respect to material, factor of safety, static and dynamic loads for various machine components.
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.
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


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 modelling (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

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.
13.606.7 MATERIAL CHARACTERISATION (MPU) (Elective II)

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

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 NEW ENERGY SYSTEMS (MP) (Elective II)

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

Course Objectives:

The main objectives of this course are

- To provide an overview of various energy sources and its applications.
- To aware about the need of newer energy sources to meet the extending demands.
- To understand the theories and principles behind various energy systems.

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  \quad 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 explain the use of newer energy sources and their applications.
- To design and develop various bio-gas plants.
- To understand the various practical fuel cells.
13.606.10 OBJECT ORIENTED PROGRAMMING (MP) (Elective II)

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

**Course Objectives:**
The main objectives of this course are

- To develop an understanding of the principles underpinning object oriented programming.
- To apply object-based approaches for programming.
- To understand the essential features of an object oriented programming language.

**Module – I**
OOPS and Java basics - Java virtual machine - Java platform API – extended security model - applet classes - exceptions and abstract classes – Java applet writing basics - GUI building with canvas - applet security – creating window applications - writing console applications - utility and math packages.

**Module – II**
Swing programming - working with swing components - using the clipboard - input/output streams - printing - working with 2D and 3D Graphics – using audio and video - creating animations Java beans development kit - developing beans - notable beans.

**Module – III**
Network programming - client and server Programs - naming and directory services - working with Java management APIs Distributed application architecture - CORBA - RMI and distributed applications.

**Module – IV**
Working with remote objects - object serialization and Java spaces - Java IDL and ORBs, connecting to database - using JDBC - integrating database - support into web applications - Java servlets - JSDK - JAR files - Java native interface.

**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 produce class diagrams, object interaction diagrams and object state transition diagrams for a given problem.
- To produce and/or debug code fragments that illustrate principles of object oriented software development.
- To evaluate the quality of programs according to object oriented principles.
13.606.11 NUCLEAR ENGINEERING (MP) (Elective II)

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

Course Objectives:

The main objectives of this course are

- *To explore the engineering design of nuclear power plants using the basic principles of reactor physics, thermodynamics, fluid flow and heat transfer.*
- *To provide an overview on reactor principles, nuclear safety, and reactor dynamic behaviour.*
- *To explain the standards of radiation protection and need for nuclear waste disposal.*

Module – I


Module – II


Module – III


Module – IV

Reactor heat removal / equations of heat transfer as applied to reactor cooling – Reactor heat transfer systems – Heat removed in fast reactors. 

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 theories and principles behind the nuclear engineering.
- To understand the heat removal techniques applied to reactor heat transfer systems.
- To acquire knowledge about nuclear physics, nuclear reactor, nuclear fuels, reactors and safe disposal of nuclear wastes.
13.606.12 INSTRUMENTATION AND CONTROL (MP) (Elective II)

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

Course Objectives:
The main objectives of this course are

- To provide an overview of different types of measurement systems.
- To introduce various measuring devices for temperature, pressure and flow and the transducers used.
- To explain the need, design techniques and importance of control systems.

Module – I

Module – II

Module – III

Module – IV
Control system- Classification of control system- Block diagram- Rule of Block diagram algebra- Transfer functions, Set point- Identification of plat, Characteristics- First order proportional and second order proportional elements- Dynamic response – Analogues circuits stability of control systems- Routh – Hurwitz criterion- Nyquist criterion.
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 functions of instrumentations and its various types.
- To select suitable measuring devices depending upon the nature of measurement.
- To draw the control system block diagrams and able to check the stability of the control systems.
13.606.13 PRECISION ENGINEERING (MP) (Elective II)

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

**Course Objectives:**

The main objectives of this course are

- *To provide an overview of micro manufacturing process and lithography.*
- *To introduce principles applied to precision engineering systems, including: accuracy, errors, spindle accuracy and advanced CNC systems.*
- *To introduce various micro systems.*

**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 understand the accuracy-errors in NC systems.
- To use and understand the various micro manufacturing process.
- To know the different and micro systems and their applications.
13.606.14 TOOL ENGINEERING (M) (Elective II)

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

Course Objectives:
The main objectives of this course are

- To build the fundamental knowledge and skills for tool design especially Jigs and Fixtures, cutting tools and Press Tools.
- To analyse the use of CAD/CAM in tool engineering applications.

Module – I

Module – II
Work holding devices for flat, round and irregular surface. Design of drill jigs, bush specifications. Fixture for lathe operations, milling, broaching and welding fixtures, Fixtures for CNC machines, Analysis of number of clamping forces required & their magnitude, concept of modular fixtures & tool presetting fixtures.

Module – III

Module – IV

References
4. Jigs and Fixtures – Calving-Hoose, 2004

**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 select proper tool for a given manufacturing operation.
- To select and design jig and fixture and to select a die for a given simple component.
- To classify and explain various press tools and press tools operations.
13.607 COMPUTER AIDED MODELING 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 MACHINE TOOLS LAB (M)

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

Course Objective:

- To acquaint with milling machines, grinding machines and drilling machines and to impart training on these machines.
- To acquaint with CNC machines and to impart training on these machines.
- To introduce the students to various welding techniques.

List of Experiments:

1. Study of Milling Machines (Universal Milling Machine & Vertical Milling Machine, parts and accessories)
2. Study of different types of Milling Cutters
3. Study of Grinding machines (Surface and Cylindrical grinding machines) & grinding wheel nomenclature
4. Study of radial drilling machine.
5. Study of CNC machines, important CNC codes, programming & simulation.
6. Exercises on Milling machines (face milling, end milling, spur and helical gear cutting, milling of keyways).
7. Exercise on Surface Grinding Machine & Cylindrical Grinding Machine
8. Exercise on drilling machine.
9. Exercises on CNC Lathe: Turning, Taper turning, Thread cutting, Ball and cup turning.
10. Exercises on CNC Milling machine: Surface milling, Pocket milling, Contour milling and Drilling.
11. Study & practice on different welding techniques - Arc welding, Gas welding, TIG welding, MIG welding. (Demonstration only and no University examination)

Note: Students should do all the exercises mentioned above except serial no.11

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 experiments prescribed.
80% - Procedure, calculations if any, working/machining, accuracy.

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 various operations using milling machines, grinding machines, drilling machines and CNC machines.