University of Calicut

Syllabus: 3rd – 8th Semesters
B. Tech. - Mechanical Engineering
2014
### Scheme of III Semester B. Tech Mechanical Engineering

<table>
<thead>
<tr>
<th>Code</th>
<th>Subject</th>
<th>Hours/ Week</th>
<th>Marks</th>
<th>Duration of End Semester examination</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>EN14 301</td>
<td>Engineering Mathematics III</td>
<td>3 1 0</td>
<td>50 100</td>
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<tr>
<td>EN14 302</td>
<td>Computer Programming in C</td>
<td>2 0 1</td>
<td>50 100</td>
<td>3</td>
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<tr>
<td>ME14 303</td>
<td>Fluid Mechanics</td>
<td>4 1 0</td>
<td>50 100</td>
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<tr>
<td>ME14 304</td>
<td>Mechanics of Solids</td>
<td>3 1 0</td>
<td>50 100</td>
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<tr>
<td>ME14 305</td>
<td>Electrical Technology</td>
<td>3 1 0</td>
<td>50 100</td>
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<tr>
<td>ME14 306</td>
<td>Metallurgy and Materials Science</td>
<td>3 1 0</td>
<td>50 100</td>
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<tr>
<td>ME14 307 (P)</td>
<td>Computer Assisted Machine Drawing</td>
<td>0 0 3</td>
<td>50 100</td>
<td>3</td>
<td>2</td>
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<tr>
<td>ME14 308 (P)</td>
<td>Electrical Technology Lab</td>
<td>0 0 3</td>
<td>50 100</td>
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<td><strong>TOTAL</strong></td>
<td></td>
<td><strong>18 5 7</strong></td>
<td><strong>50 100</strong></td>
<td></td>
<td><strong>28</strong></td>
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</tbody>
</table>

**Note:**
- For EN 14 302 Computer Programming in C, the end semester examination will be held by the University as a theory paper.
- Even though the subject ME14 307 (P) Computer Assisted Machine Drawing is considered as a practical, the end semester examination will be conducted by the University.

### Scheme of IV Semester B. Tech Mechanical Engineering

<table>
<thead>
<tr>
<th>Code</th>
<th>Subject</th>
<th>Hours/ Week</th>
<th>Marks</th>
<th>Duration of End Semester examination</th>
<th>Credits</th>
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<tbody>
<tr>
<td>EN14 401A</td>
<td>Engineering Mathematics IV</td>
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<tr>
<td>EN14 402</td>
<td>Environmental Science</td>
<td>2 1 0</td>
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<tr>
<td>ME14 403</td>
<td>Thermodynamics</td>
<td>4 1 0</td>
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<tr>
<td>ME14 404</td>
<td>Advanced Mechanics of Solids</td>
<td>3 1 0</td>
<td>50 100</td>
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<tr>
<td>ME14 405</td>
<td>Fluid Machinery</td>
<td>3 1 0</td>
<td>50 100</td>
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<tr>
<td>ME14 406</td>
<td>Casting and joining</td>
<td>3 1 0</td>
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<tr>
<td>ME14 407 (P)</td>
<td>Materials Testing Lab</td>
<td>0 0 3</td>
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<td>ME14 408 (P)</td>
<td>Production Engineering Lab I</td>
<td>0 0 3</td>
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<td><strong>TOTAL</strong></td>
<td></td>
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### Scheme of V Semester B. Tech Mechanical Engineering

### Scheme of VI Semester B. Tech Mechanical Engineering

<table>
<thead>
<tr>
<th>Code</th>
<th>Subject</th>
<th>Hours/ Week</th>
<th>Marks</th>
<th>Duration of End Semester examination</th>
<th>Credits</th>
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<tbody>
<tr>
<td>ME14 501*</td>
<td>Engineering Economics and Principles of Management*</td>
<td>3 1 0</td>
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<tr>
<td>ME14 502</td>
<td>Metal Cutting and Forming</td>
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<tr>
<td>ME14 503</td>
<td>Heat and Mass Transfer</td>
<td>4 1 0</td>
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<td>ME14 504</td>
<td>Thermal Engineering</td>
<td>3 1 0</td>
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<td>ME14 505</td>
<td>Mechanics of Machinery</td>
<td>3 1 0</td>
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<tr>
<td>ME14 506</td>
<td>Finite Element Methods</td>
<td>3 1 0</td>
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<td>ME14 507 (P)</td>
<td>Fluids Lab</td>
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<td>ME14 508 (P)</td>
<td>Production Engineering lab II</td>
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<td><strong>18 6 6</strong></td>
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*Common for ME, AI, CE, CS, EC, EE, BM and IC

### Scheme of VII Semester B. Tech Mechanical Engineering

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<thead>
<tr>
<th>Code</th>
<th>Subject</th>
<th>Hours/ Week</th>
<th>Marks</th>
<th>Duration of End Semester examination</th>
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<tbody>
<tr>
<td>ME14 601</td>
<td>Refrigeration and Air Conditioning</td>
<td>3 1 0</td>
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<td>ME14 602</td>
<td>Metrology and Instrumentation</td>
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<td>ME14 603</td>
<td>Dynamics of Machinery</td>
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<td>ME14 604</td>
<td>Machine Design I</td>
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<td>ME14 605</td>
<td>Operations Research</td>
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<td>ME14 606</td>
<td>Computational Methods in Engineering</td>
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<td>ME14 607 (P)</td>
<td>Thermal Lab I</td>
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<td>ME14 608 (P)</td>
<td>CAD/CAM Lab</td>
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<td><strong>TOTAL</strong></td>
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### Scheme of VIII Semester B. Tech Mechanical Engineering

<table>
<thead>
<tr>
<th>Code</th>
<th>Subject</th>
<th>Hours/ Week</th>
<th>Marks</th>
<th>Duration of End Semester examination</th>
<th>Credits</th>
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<tbody>
<tr>
<td>ME14 801</td>
<td>Machine Design II</td>
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<tr>
<td>ME14 802</td>
<td>Power Plant Engineering</td>
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<td>ME14 803</td>
<td>Operations Management</td>
<td>2 1 0</td>
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<tr>
<td>ME14 804</td>
<td>Elective III</td>
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<td>ME14 805</td>
<td>Elective IV</td>
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<td>ME14 806 (P)</td>
<td>Seminar</td>
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<td>ME14 807 (P)</td>
<td>Project</td>
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<td>ME14 808 (P)</td>
<td>Viva Voce</td>
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<td><strong>15 5 10</strong></td>
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Total Credits = 212

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**ELECTIVES**

**ELECTIVE I**
ME14 704(A) Financial Management
ME14 704(B) Industrial Safety Engineering
ME14 704(C) Heating Ventilation and Air Conditioning Design
ME14 704(D) Energy Conservation in Thermal Systems
ME14 704(E) Industrial Automation
ME14 704(F) Combustion Engineering
ME14 704(G) Automobile Engineering

**ELECTIVE II**

ME14 705(A) Logistics and Supply Chain Management
ME14 705(B) Design of Heat Transfer Equipments
ME14 705(C) Computational Fluid Dynamics
ME14 705(D) Design of Jigs and Fixtures
ME14 705(E) Fracture Mechanics
ME14 705(F) Composite Materials

**ELECTIVE III**

ME14 804(A) Marketing Management
ME14 804(B) Aerospace Engineering
ME14 804(C) Energy Engineering and Management
ME14 804(D) Cryogenic Engineering
ME14 804(E) Control System Engineering
ME14 804(F) Industrial Tribology
ME14 804(G) Wind Energy and its utilization

**ELECTIVE IV**

ME14 805(A) Quality Engineering and Management
ME14 805(B) Renewable Energy Technology (Global)
ME14 805(C) Advanced Fluid Mechanics
ME14 805(D) Computerized Materials Management
ME14 805(E) Design of Pressure Vessels and Piping
ME14 806(F) Industrial Maintenance
ME14 806(G) Tool Engineering and Design

**EN14 301 Engineering Mathematics III**
(Common for all branches)

**Teaching scheme**

Credits: 4
3 hours lecture and 1 hour tutorial per week

**Objective**
To provide a quick overview of the concepts and results in complex analysis that may be useful in engineering.

To introduce the concepts of linear algebra and Fourier transform which are wealth of ideas and results with wide area of application.

**Module I: Functions of a Complex Variable (13 hours)**
Functions of a Complex Variable – Limit – Continuity – Derivative of a Complex function – Analytic functions – Cauchy-Riemann Equations – Laplace equation – Harmonic Functions – Conformal Mapping – Examples: $e^z$, $\sin z$, $\cosh z$, $(z+1/z)$ – Mobius Transformation.

**Module II: Functions of a Complex Variable (14 hours)**

**Module III: Linear Algebra (13 hours)**

**Module IV: Fourier Transforms (14 hours)**

**Text Books**

**Module I:**
Sections: 12.3, 12.4, 12.5, 12.6, 12.7, 12.9

**Module II:**
Sections: 13.1, 13.2, 13.3, 13.4, 14.4, 15.1, 15.2, 15.3, 15.4

**Module III:**
Sections: 6.1, 6.2, 6.3, 6.4, 6.8, Appendix.B.1

**Module IV:**
Sections: 9.1, 9.3, 9.5
University of Calicut

Reference books

Internal Continuous Assessment (Maximum Marks-50)
60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Attendance and Regularity in the class

University Examination Pattern

PART Analytical/problem solving SHORT questions
A: 8x 5 marks=40 marks
Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

PART Analytical/Problem solving DESCRIPTIVE questions
B: 4 x 15 marks=60 marks
Two questions from each module with choice to answer one question.

Maximum Total Marks: 100

EN14 302 Computer Programming in C
(Common for all branches)
Teaching scheme
Credits: 3
2 hours lectures and 1hour lab per week
Objectives
1. To impart the basic concepts of computer and information technology
2. To develop skill in problem solving concepts through learning C programming in practical approach.

Module I (8 hours)
Introduction to Computers: CPU, Memory, input-output devices, secondary storage devices, Processor


Module II (9 hours)

**Basic elements of C**: Flow chart and algorithm – Development of algorithms for simple problems. Structure of C program – Operators and expressions – Procedure and order of evaluation – **Input and Output functions**, while, do-while and for statements, if, if-else, switch, break, continue, goto, and labels. Programming examples.

Module III (10 hours)


Module IV (9 hours)

**Structures** – declaration, definition and initialization of structures, unions. **Pointers**: Concepts, declaration, initialization of pointer variables simple examples **Concept of a file** – File operations File pointer.

**Text Books**


**Reference Books**


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

50% - Lab Practical Tests
20% - Assignments
20% - Main Record
10% - Regularity in the class
University of Calicut

University Examination Pattern

PART Analytical/problem solving SHORT questions
A: 8 x 5 marks=40 marks
Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

PART Analytical/Problem solving DESCRIPTIVE questions
B: 4 x 15 marks=60 marks
Two questions from each module with choice to answer one question.

Maximum Total Marks: 100

ME14 303 Fluid Mechanics
Teaching scheme Credits: 4
4 hours lecture and 1 hour tutorial per week

Objective
1. To study the physical behaviour of fluids and fluid systems, and laws governing this behaviour
2. To study the action of forces on fluids and of the resulting flow pattern

Module I (16 hours)
Fundamentals Concepts: Characteristics of fluids – continuum – properties of fluids – density, specific weight, specific volumes, specific gravity, viscosity, capillarity, compressibility and bulk modulus, surface tension, vapour pressure

Module II (16 hours)
System and control volume approach - basic equations – Reynold’s transport equations – differential and integral form of continuity , momentum and energy equations – application of the above equations for one dimensional flow – velocity and momentum corrections - one dimensional flow along streamline and stream tubes - Euler’s equation – Bernoulli’s equation – applications - Venturimeter, Orificemeter, Pitot tube, Orifice , Mouthpiece, Notches and weirs.

Module III (16 hours)

Module IV (16 hours)
friction – boundary layer separation Introduction to turbulence, classification, scales of turbulence – Reynolds’s stresses- turbulence models- Prandtl mixing length concept.

Text Books
1. Douglas, Fluid Mechanics, Pearson Education
2. Balachandran, Fluid Mechanics, prentice hall , India
3. J K Jain, Fluid Mechanics, S Chand

Reference Books
5. D. Ramadingeih, Fluid Mechanics, New Age International

Internal Continuous Assessment (Maximum Marks-50)
60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Attendance and Regularity in the class

University Examination Pattern

PART Analytical/problem solving SHORT questions
A: 8x 5 marks=40
Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

PART Analytical/Problem solving DESCRIPTIVE questions
B: 4x 15 marks=60
Two questions from each module with choice to answer one question.

Maximum Total Marks: 100

ME14 304 Mechanics of Solids
Teaching scheme  Credits: 4
3 hours lecture and 1 hour tutorial per week

Objectives
1. To acquaint with the basic concepts of stress and deformation in solids.
2. To practise the methodologies to analyse stresses and strains in simple structural members, and to apply the results in simple design problems.
Module I (14 hours)

Module II (14 hours)

Module III (13 hours)

Module IV (13 hours)

Text Books

Reference Books

University of Calicut

**Internal Continuous Assessment** *(Maximum Marks-50)*
60% - Tests (minimum 2)  
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.  
10% - Attendance and Regularity in the class

**University Examination Pattern**

**PART A:** Analytical/problem solving **SHORT questions**

8x 5 marks=40 marks

Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

**PART B:** Analytical/Problem solving **DESCRIPTIVE questions**

4 x 15 marks=60 marks

Two questions from each module with choice to answer one question.

Maximum Total Marks: 100

**ME14 305 Electrical Technology**

**Teaching scheme** Credit: 4

3 hours lecture and 1 hour tutorial per week

**Objectives**

1. To study the operation, performance and characteristics of different types of electrical machines  
2. To familiarise various electrical measuring instruments.  
3. To study an overview of power electronic converters & electric drives

**Module I (12 hours)**

Principle of indicating instruments – moving coil, moving iron and dynamometer type instruments - principle and working of induction type energy meter

**Module II (15 hours)**

Power semiconductor devices – symbol & static characteristics of SCR – turn-on by gate triggering – RC-firing circuit – comparison of SCR, power MOSFET & IGBT – Controlled rectifier – 1-phase fully controlled rectifier with R load & waveforms (load voltage & current only) – expression for average output voltage - 1-phase full-bridge inverter with R load & waveforms – expression for RMS output voltage - 1-phase full-wave ac voltage controller with R load & waveforms – expression for RMS output voltage – 1-phase full-wave ac voltage controller with R load & waveforms – expression for RMS output voltage – Step-down dc-dc converter with RL load & waveforms (output voltage & current only) (Reference Book 1 or 2)  

Module III (14 hours)
Review of DC generators – DC generator on no load – open circuit characteristics – Armature reaction and
commutation (basics only) - load characteristics of shunt, series and compound generators – Review of dc motors
– performance characteristics of shunt, series and compound motors – starter – need of starter - 3 point starter –
losses in DC machines – power flow diagram – efficiency – speed control – armature voltage control of a
separately excited dc motor – 1-phase full converter drive.
Review of alternators – distribution and chording factor – EMF equation – armature reaction – phasor diagram –
voltage regulation – predetermination of voltage regulation by EMF method

Module IV (13 hours)
equation – torque-slip characteristics – losses and efficiency – power flow diagram – no-load and blocked rotor
tests – starting of 3-phase induction motors – direct-on-line, auto transformer, star-delta and rotor resistance
starting - 3-phase induction motor drives – stator voltage control by using a 3-phase AC voltage controller
(concept only; no waveform analysis) – stator voltage & frequency control (block diagram approach)

Text Books

Reference Books

Internal Continuous Assessment (Maximum Marks-50)
60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey,
seminar, term-project, software exercises, etc.
10% - Attendance and Regularity in the class.

University Examination Pattern

<table>
<thead>
<tr>
<th>PART</th>
<th>Analytical/problem solving SHORT questions</th>
<th>8x 5 marks=40 marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>A:</td>
<td><strong>Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.</strong></td>
<td></td>
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</table>

<table>
<thead>
<tr>
<th>PART</th>
<th>Analytical/Problem solving DESCRIPTIVE questions</th>
<th>4 x 15 marks=60 marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>B:</td>
<td>Two questions from each module with choice to answer one question.</td>
<td></td>
</tr>
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</table>

Maximum Total Marks: 100

ME14 306 Metallurgy and Material Science
Teaching scheme Credits: 4

University of Calicut

3 hours lecture and 1 hour tutorial per week

**Objective:**

To impart knowledge on engineering materials, deformation of the crystals, equilibrium diagrams of selected alloy systems, heat treatment of steels, properties of steels, cast iron and other alloys, and its application

**Module I (10 hours)**


**Module II (16 hours)**


**Module III (14 hours)**


**Module IV (14 hours)**


**Text Books**

1. William D Callister, *Material Science and Engineering, Johniley and Sons*
2. Raghavan V, *Material science and engineering*

**Reference Books**

2. Van Vlack, *Materials science and Engineering,Pearson Education*

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

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Attendance and Regularity in the class
University Examination Pattern

PART Analytical/problem solving SHORT questions  
A:  
Candidates have to answer EIGHT questions out of TEN. There shall be minimum of 
TWO and maximum of THREE questions from each module with total TEN questions.

PART Analytical/Problem solving DESCRIPTIVE questions  
B:  
Two questions from each module with choice to answer one question.

Maximum Total Marks: 100

ME14 307 Computer Assisted Machine Drawing

Teaching scheme:  
Credits: 2
3 hours drawing per week

Objectives
1  To impart the fundamental concepts of machine drawing.
2  To develop primary knowledge of working drawings.
3  To produce orthographic drawing of different machine parts.
4  To develop skill to produce assembly drawings.
5  To develop skill to produce detailed drawings of machines parts from assembly drawing.
6  To develop skill to produce drawings by using any standard CAD software.

Module 0: (6 Hours).
Preparation of working Drawings with specification using any popular drafting software.

Module I (9 hours - 1 Printout, 2 Drawing sheets)
Preparation of Sketch & working drawings for:

a) Joints: Sleeve and cotter joints, knuckle joints, Socket and spigot joints, Flanged hydraulic joints, Lap and butt joint, Zigzag and chain structure.

b) Couplings and pulleys: Solid and split muff couplings, Universal coupling, Flat pulleys, Stepped cone pulleys.

Module II (9 Hrs. - 1 Printouts, 2 Drawing sheets)
Preparation of Sketch & working drawings for:

a) Tolerances and Fits - Hole system and shaft system of tolerances, Indication of dimensional tolerances and fits on simple machine parts - Geometrical tolerances, Indication of geometrical tolerances on simple machine parts, Indication of surface finish on drawings - Preparation of shop floor drawings of simple machine parts.

b) Bearings - Solid journal bearings, Plummer block and footstep bearings.

Module III (18 Hrs. - 3 Printouts, 6 Drawing sheets)
Preparation of Sketch & assembly drawings for:

1  Stuffing boxes - cross heads, Eccentrics, Petrol Engine connecting rod - Piston assembly - Screws jacks - Machine Vices – Tailstock – Crane hook.

2  Steam stop valve - Spring loaded safety valve – Blow-off-cock - Gate valve- Glob valve- Ball valve- Non return valve.

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Note:
1. University examination (3 Hours) shall be conducted by using drawing instruments only.
2. All drawing exercises mentioned above are for class work. Additional exercises where ever necessary may be given as home assignments.

Text Books:

References:

Internal Assessment
Printouts = 10
Drawing sheets = 20
Tests = 15
Attendance and Regularity = 05
Total = 50

University examination pattern

**Question I**: Answer any one question out of two questions of 25 marks each from (a) and (b) sections of module I. 
1 x 25 = 25 marks

**Question II**: Answer any one question out of two questions of two questions of 30 marks each from (a) and (b) sections of module II. 
1 x 30 = 30 marks

**Question III**: Answer any one question out of two questions of two questions of 45 marks each from (a) and (b) sections of module III. 
1 x 45 = 45 marks

Total = 100 marks

**ME14 308(P) Electrical Technology Lab**

**Teaching scheme**  
Credits: 2
3 hours lecture and 1 hour tutorial per week

**Objectives**
1. To familiarize various electrical measuring instruments
2. To obtain the performance characteristics of dc and ac machines

1. Determination of V-I characteristics of linear resistance and incandescent lamp
2. Calibration of 1-phase energy meter (Induction and Static type) by direct loading
3. Measurement of L, M & K of i) transformer windings and ii) air cored coil
4. OC & SC tests on single phase transformer
1. Determine equivalent circuit parameters
2. Predetermine efficiency & voltage regulation at various loads and different power factors
3. Load test on single phase transformer to determine efficiency & voltage regulation at various loads and unity power factor
4. Open circuit characteristics of dc shunt generator
5. Plot OCC at rated speed
6. Predetermine OCC for other speeds
7. Determine critical field resistance for a specified speed
8. Determine critical speed for a specified shunt field resistance
9. Load test on DC shunt generator
10. Plot external characteristics
11. Deduce internal characteristics
12. Predetermine the torque, line current and efficiency from equivalent circuit corresponding to a specified slip.
13. Plot OCC at rated speed
14. Predetermine OCC for other speeds
15. Determine critical field resistance for a specified speed
16. Determine critical speed for a specified shunt field resistance
17. Load test on DC shunt generator
18. Plot external characteristics
19. Deduce internal characteristics
20. Predetermine the torque, line current and efficiency from equivalent circuit corresponding to a specified slip.
21. Plot external characteristics
22. Deduce internal characteristics
23. Predetermine the torque, line current and efficiency from equivalent circuit corresponding to a specified slip.
24. Plot external characteristics
25. Deduce internal characteristics
26. Predetermine the torque, line current and efficiency from equivalent circuit corresponding to a specified slip.

Internal Continuous Assessment (Maximum Marks-50)
60% - Laboratory practical and record
30% - Test/s
10% - Regularity in the class

Semester End Examination (Maximum Marks-100)
70% - Procedure, conducting experiment, results, tabulation, and inference
20% - Viva voce
10% - Fair record

EN14 401A Engineering Mathematics IV
(Common for ME, CE, PE, CH, BT, PT, AM, and AN)

Teaching scheme Credits: 4
3 hours lecture and 1 hour tutorial per week

Objective
1. To provide a comprehensive introduction to those models and methods most likely to be encountered and used by students in their careers in engineering.
2. To provide an introduction to some important partial differential equations

Module I: Probability Distributions (13 hours)

Module II: Theory of Inference (14 hours)
Population and Samples – Sampling Distribution – Sampling distribution of Mean (σ known) – Sampling distribution of Mean (σ unknown) – Sampling distribution of Variance – Interval Estimation – Confidence

**Module III: Series Solutions of Differential Equations (14 hours)**


**Module IV: Partial Differential Equations (13 hours)**

Introduction – Formation of PDE – Complete Solution – Equations solvable by direct integration – Linear PDE of First order, Legendre’s Equation: $Pp + Qq = R$ – Non-Linear PDE of First Order, $F(p,q) = 0$ , Clairaut’s Form: $z = px + qv + F(p,q) , F(z,p,q) = 0 , F_1(x,q) = F_2(y,q)$ – Classification of Linear PDE’s – Derivation of one dimensional wave equation and one dimensional heat equation – Solution of these equation by the method of separation of variables.

Text Books  
Module I: Richard A Johnson, CB Gupta, *Miller and Freund’s Probability and statistics for Engineers, 7e*, Pearson Education- Sections: 4.1, 4.2, 4.3, 4.4, 4.6, 4.8, 5.1, 5.2, 5.5, 5.7  

**Reference books**


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

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Attendance and Regularity in the class

University Examination Pattern

PART Analytical/problem solving SHORT questions

A: 8x 5 marks=40

Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

PART Analytical/Problem solving DESCRIPTIVE questions

B: 4 x 15 marks=60

Two questions from each module with choice to answer one question.

Maximum Total Marks: 100

EN14 402 Environmental Science

(Common for all branches)

Teaching scheme

Credits: 4

2 hours lecture and 1 hour tutorial per week

Objectives

1. To understand the problems of pollution, loss of forest, solid waste disposal, degradation of environment, loss of biodiversity and other environmental issues
2. To create awareness among the students to address these issues and conserve the environment in a better way.

Module I (10 hours)

The Multidisciplinary nature of environmental science. Definition-scope and importance-need for public awareness. Natural resources. Renewable and non-renewable resources: Natural resources and associated problems-forest resources: Use and over exploitation, deforestation, case studies. Timber extraction, mining, dams and their defects on forests and tribal people- water resources: Use and over utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems.- Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies.- Food resources: World food problems, changes caused by agriculture over grazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.-Energy resources: Growing energy needs, renewable and non-renewable energy resources, use of alternate energy resources, Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification.

Module II (10 hours)

Ecosystems-Concept of an ecosystem-structure and function of an ecosystem – producers, consumers, decomposers-energy flow in the ecosystem-Ecological succession- Food chains, food webs and Ecological pyramids-Introduction, types, characteristics features, structure and function of the following ecosystem-Forest ecosystem- Grassland ecosystem –Desert ecosystem-Aquatic ecosystem(ponds, streams, lakes, rivers, oceans , estuaries)

Biodiversity and its consideration Introduction- Definition: genetic, species and ecosystem diversity-Biogeographical; classification of India –value of biodiversity: consumptive use, productive use, social ethical , aesthetic and option values Biodiversity at Global, national , and local level-India at mega-diversity nation- Hot spot of biodiversity-Threats to biodiversity: habitat loss, poaching of wild life, man , wild life conflicts – Endangered and endemic species of India-Conservation of biodiversity : In-situ and Ex-situ conservation of
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biodiversity.

Module III (12 hours)
Environmental pollution Definition-Causes, effects and control measures of Air pollution-Water pollution-soil pollution-Marine pollution-Noise pollution-Thermal pollution-Nuclear hazards-Solid waste management: Causes, effects and control measures of urban and industrial wastes-Role of an individual in prevention of pollution.
Pollution case studies-Disaster management: floods, earth quake, cyclone and landslides-Environmental impact assessment

Module IV (12 hours)
Environment and sustainable development-Sustainable use of natural resources-Conversion of renewable energy resources into other forms-case studies-Problems related to energy and Energy auditing-Water conservation, rain water harvesting, water shed management-case studies-Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust-Waste land reclamation Consumerism and waste products-Reduce, reuse and recycling of products-Value education.

Text Books:
1. Daniels & Krishnaswamy, Environmental studies, Wiley India pvt ltd, 2009

References:
2. S.P Misra, S.N Pandey, Essential Environmental studies, An e books, Pvt Ltd, 2009

Internal Continuous Assessment (Maximum Marks-50)
60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Attendance and Regularity in the class

Note: Field work can be Visit to a local area to document environmental assets-river/forest/grass land/mountain or Visit to local polluted site-urban/rural/industrial/agricultural etc. or Study of common plants, insects, birds etc. or Study of simple ecosystems-pond, river, hill slopes etc. or mini project work on renewable energy and other natural resources , management of wastes etc.

ME14 403 Thermodynamics

Teaching scheme  
Credits: 4
4 hours lecture and 1 hour tutorial per week

Objectives:
1. To impart the basic concepts of thermodynamics

Note: Students are permitted to refer property tables and charts of liquids, steam, gases, refrigerants, Psychrometric chart and compressibility chart for the University examination.

Module I (16 Hours)
Basic concepts and definitions – Macroscopic and microscopic approach, Continuum concept, system and control volume, properties, processes and cycles, Method of checking of properties, Quasi-static process, homogeneous and heterogeneous systems, thermodynamic equilibrium, Zeroth law of thermodynamics – measurement of temperature, Temperature scales, Concept of absolute temperature scale.
Different forms of energy- Stored energy and transition energy, work and heat, different types of work transfer, pdV work, Free expansion, First law of thermodynamics, Joule’s experiment, First law applied for a cycle and change of state – internal energy and enthalpy, PMM1, first law applied for open system, Steady flow energy equation and applications.

Module II (16 Hours)

Module III (18 Hours)
Properties of pure substances, p-v, p-T, T-s diagram for a pure substances, critical point and triple point, saturation states, liquid vapour mixtures, dry, wet and superheated steam. Use of steam table and Mollier diagram.
Properties of gases and mixtures – Avogadro’s law, Equations of state – ideal gas equation, van der Waal’s equation, RedlichKwong equation, Beattie-Bridgeman equation, Viral expansions, simple problems, Law of...
corresponding states, Compressibility chart, Properties of mixtures of gases – Dalton’s law of partial pressures, Amagat Leduc law, mole fraction, Cp and Cv of the mixtures, simple problems. Thermodynamic relations – Maxwell’s Equations, Tds equations, Joule Thomson effect, Clausius – Clapeyron equation

Module IV (14 Hours)

Text Books
2. R. Yadav, A Text book on Thermodynamics, Central Publishing House

Reference Books
1. Sonntag, Van Wylen, Fundamentals of Thermodynamics, Sixth edn John Wiley & Sons
4. John Francis Lee, Francis Weston Sears, A Text book on thermodynamics,
5. Zemansky, A Text book on thermodynamics
6. Spalding &Cole, Engineering thermodynamics, ELBS

Internal Continuous Assessment (Maximum Marks-50)
60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Attendance and Regularity in the class

University Examination Pattern

PART Analytical/problem solving SHORT questions
A: 8x 5 marks=40
Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

B: 4 x 15 marks=60
Two questions from each module with choice to answer one question.

Maximum Total Marks: 100

ME14 404 Advanced Mechanics of Solids
Teaching scheme Credits: 4
3 hours lecture and 1 hour tutorial per week
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Objectives
1. To impart concepts of stress and strain analysis in a solid.
2. To study the methodologies in theory of elasticity at a basic level.
3. To acquaint with energy methods to solve structural problems.

Module I (14 hours)

Module II (14 hours)

Module III (13 hours)

Module IV (13 hours)
Torsion of non-circular bars: Saint Venant’s theory – Prandtle’s method - solutions for circular and elliptical cross-sections - membrane analogy - torsion of thin walled open and closed sections – shear flow.

Text Books
3. Dr. L. Govindaraju&Dr. TG Sitharaman, Applied elasticity for Engineers, NPTEL

Reference Books

Internal Continuous Assessment (Maximum Marks-50)
60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Attendance and Regularity in the class

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University Examination Pattern

PART Analytical/problem solving SHORT questions
A: 8x 5 marks=40
Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

PART Analytical/Problem solving DESCRIPTIVE questions
B: 4 x 15 marks=60
Two questions from each module with choice to answer one question.

Maximum Total Marks: 100

ME14 405 Fluid Machinery
Teaching scheme Credits: 4
3 hours lecture and 1 hour tutorial per week

Objectives:
1. To impart the basic principles on the relationship between forces and its resulting motion of bodies due to impact of fluid jets.
2. To understand the working and design principles of hydraulic turbines and pumps.

Module I (14 Hours)

Module II (14 Hours)

Module III (14 Hours)

Module IV (12 Hours)

Text Books
1. R K Bensal, Fluid mechanics and Hydraulic machines,

**Reference Books**


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

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Attendance and Regularity in the class

**University Examination Pattern**

**PART Analytical/problem solving SHORT questions**

A: $8 \times 5$ marks = 40 marks

Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

**PART Analytical/Problem solving DESCRIPTIVE questions**

B: $4 \times 15$ marks = 60 marks

Two questions from each module with choice to answer one question.

*Maximum Total Marks: 100*

**ME14 406 Casting and Joining**

**Teaching scheme**

Credits: 4

3 hours lecture and 1 hour tutorial per week

**Objectives:**

1. *To provide knowledge on theory of solidification of metals*
2. *To acquire knowledge on different casting processes*
3. *To impart conception on various welding processes*
4. *To understand fundamentals of soldering, brazing, adhesive bonding and ceramic joining.*

**Module I (10 Hours)**

Introduction- solidification of metals and alloys-homogeneous and heterogeneous nucleation-cast structures-casting alloys- foundries-furnaces and melting practices- pattern- pattern allowances- casting design- gating system design- risering - flow of molten metal in moulds.

**Module II (16 Hours)**

Casting processes- comparison-sand casting-shell moulding-CO$_2$ process-expended polystyrene process – plaster mould casting- ceramic mould casting-investment casting-permanent mould casting-slush casting-pressure
casting-die casting-centrifugal casting-squeeze casting-semisolid casting- rapid solidification- casting of single
 crystal components- defects- inspection and testing of castings.

Module III (14 Hours)
Welding processes-classification-welding power source-Duty cycle - Arc characteristics- filler materials-
 Electrodes- Coding of the electrodes- Classification of electrodes-- metal transfer – solid state-solid liquid state
 process-OFW, SMAW, SAW, GMAW, FCAW, GTAW, PAW, ESW, EGW, RW, RSEW, HFRW, RPW, FW,
 SW, PEW, FOW, CW, USW, FRW, EXW, TW, EBW, LBW, DFW- Metallurgy of welding-HAZ-weld quality-
 weldability - welding defects- inspection and testing of welded joints.

Module IV (14 Hours)
Brazing, Soldering and Adhesive bonding –Physical aspects – Surface energy and contact angle – Capillary action
- Theory of soldering and Brazing -Fluxes-Heat sources and heat transfer- Filler materials- Different types of
 brazing- Braze welding- Adhesives bonding- Contact adhesives- Polyester, polyamide and polyurethane melt
 adhesives- Toughened acrylic and epoxy adhesives- Silicone adhesives Joint design -Joining of Ceramics -
 Metal/ceramic joining and ceramic/ceramic joining-Diffusion bonding.

Text Books:
1. R K Jain, Production technology,
2. P C Sharma, Manufacturing Technology.

Reference Books:
1. C. Davies, The Science and Practice of Welding, Addison Wesley 2001
5. P Khanna, Welding Metallurgy
7. SeropeKalpakjian, Manufacturing Engineering and Technology, Addison Wesley.

Internal Continuous Assessment (Maximum Marks-50)
60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey,
 seminar, term-project, software exercises, etc.
10% - Attendance and Regularity in the class

University Examination Pattern

PART Analytical/problem solving SHORT questions
A: 8x 5 marks=40

Candidates have to answer EIGHT questions out of TEN. There shall be minimum of
 TWO and maximum of THREE questions from each module with total TEN questions.

PART Analytical/Problem solving DESCRIPTIVE questions
B: 4 x 15 marks=60

Two questions from each module with choice to answer one question.

Maximum Total Marks: 100
ME14 407(P) Material Testing Lab

Teaching scheme Credits: 2
3 hours practical per week

Objectives
1. To provide knowledge on the mechanical behaviour of materials.
2. To acquaint with the experimental methods to determine the mechanical properties of materials.

List of Experiments
1. Standard tension test on mild steel using Universal Testing Machines and suitable extensometers
2. Stress-strain characteristics of brittle materials – cast iron
3. Spring test – open and closed coiled springs – determination of spring stiffness and modulus of rigidity
4. Determination of modulus of rigidity of wires
5. Hardness tests – Brinnell hardness, Rockwell hardness (B S C scales), Rockwell superficial hardness (N & T scales), and Vickers hardness
6. Impact test – Izod and Charpy
7. Bending test on wooden beams
8. Fatigue testing – study of testing machine
9. Photo elastic method of stress measurements (two dimensional problems)
10. Torsion test on mild steel rod
11. Shear test on mild steel rod

Reference Books

Internal Continuous Assessment (Maximum Marks-50)
60%-Laboratory practical and Record (30 marks)
30%- Test/s (15 marks)
10%- Regularity in the class (5 marks)
Semester End Examination  
(Maximum Marks-100)
70% - Procedure, conducting experiment, results, tabulation, and inference (70 marks)
20% - Viva voce (20 marks)
10% - Fair record (10 marks)

ME14 408(P) Production Engineering Lab – I

Teaching scheme  
Credits: 2  
3 hours practical per week

Objectives
1. To acquaint with the basics of centre lathe and CNC lathe.
2. To impart training on centre lathe and CNC lathe.

Study of Machines
2. Study of centre lathe – general features, parts and functions – different machining operations on centre lathe – turning, taper turning, thread cutting, drilling, boring, reaming, tapping, profile turning, knurling.
4. Study of tolerances and surface finish – measuring tools and gauges.
5. Study of CNC lathe.

Exercises
1. Exercises on centre lathe requiring simple turning, taper turning, knurling, boring and thread cutting.
2. Exercises on centre lathe including multi-start thread, square thread, and internal thread.
3. Exercises on CNC lathe: Turning, step turning

Reference Books
2. R. Quesada, T. Jeyapoovan, Computer Numerical Control, Pearson Education
5. E. D. Lawrence, Manufacturing Processes & Materials for Engineers, Prentice Hall

Internal Continuous Assessment
(Maximum Marks-50)
60%-Workshop practical (models) and Record (30 marks)
30%- Test/s (15 marks)
10%- Regularity in the class (5 marks)

Semester End Examination
(Maximum Marks-100)
70% - Making of models considering completion, dimensional accuracy, finishing, methods, choice of proper tools etc. (70 marks)
20% - Viva voce (20 marks)
10% - Fair record (10 marks)

ME14 501 Engineering Economics and Principles of Management  
(Common for ME, PE, CS, IC, IT, PT and AM)

Teaching scheme          Credits: 4  
3 hours lecture and 1 hour tutorial per week

Section 1 Engineering Economics  
Teaching scheme          Credits: 2  
2 hour lecture per week

Objective
1. The prime objective of the Engineering Economics course is to make students familiar with the economic way of thinking. This course provides the students with the foundations of economic theory, tools and techniques for use in the process of efficient economic decision-making in their engineering and managerial profession.

Module I (14 Hrs)

Module II (13 Hrs)

Investment criteria: Pay Back Period, Net Present Value, Internal Rate of Return, Benefit-cost ratio.
Text Books

Reference Books

Internal Continuous Assessment (Maximum Marks-25)
60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Attendance and Regularity in the class

University Examination Pattern for Section 1

PART Analytical/problem solving SHORT questions
A: 4x 5 marks=20

Candidates have to answer FOUR questions out of FIVE. There shall be minimum of TWO and maximum of THREE questions from each module with total FIVE questions.

PART Analytical/Problem solving DESCRIPTIVE questions
B: 2 x 15 marks=30

Two questions from each module with choice to answer one question.

Maximum Total Marks: 50

Note: Section 1 and Section 2 are to be answered in separate answer books
Maximum 50 marks each for Section 1 and Section 2

Section 2 Principles of Management
Teaching scheme Credits: 2
1 hour lecture and 1 hour tutorial per week

Objective
1. To provide knowledge on principles of management, decision making techniques, accounting principles and basic management streams

Module I (13 hours)
Principles of management – Evolution of management theory and functions of management
Organizational structure – Principle and types. Decision making – Strategic, tactical & operational decisions,
decision making under certainty, risk & uncertainty and multistage decisions & decision tree Human resource management – Basic concepts of job analysis, job evaluation, merit rating, wages, incentives, recruitment, training and industrial relations.

**Module II (14 hours)**

**Reference Books**
8. Weist and Levy, *A Management guide to PERT and CPM*, Prantice Hall of India

**Internal Continuous Assessment (Maximum Marks-25)**
60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Attendance and Regularity in the class

**University Examination Pattern for Section 2**

**PART A:** Analytical/problem solving SHORT questions

4x 5 marks=20 marks

Candidates have to answer FOUR questions out of FIVE. There shall be minimum of TWO and maximum of THREE questions from each module with total FIVE questions.

**PART B:** Analytical/Problem solving DESCRIPTIVE questions

2 x 15 marks=30 marks

Two questions from each module with choice to answer one question.

Note: Section 1 and Section 2 are to be answered in separate answer books
Maximum 50 marks each for Section 1 and Section 2

ME14 502 Metal Cutting and Forming
Teaching scheme: 4
2 hours lecture and 1 hour tutorial per week
Objectives:
1. To impart fundamental knowledge on theory of machine tools, metal cutting principles, advanced machining processes and press working operations.

Module I (9 Hours)
Metal cutting: cutting variables - mechanics of chip formation - types of chips produced - orthogonal and oblique cutting - velocity relationships - cutting forces - cutting power temperature in cutting - single point and multipoint tools - tool geometry - tool designation - tool wear and tool life - machinability - cutting tool materials - cutting fluids - economics of machining.

Module II (11 Hours)

Module III (12 Hours)
Advanced Machining Processes: Electrical Discharge Machining - wire EDM - Electro Chemical machining - laser beam machining - abrasive jet machining - ultrasonic machining - electron beam machining - plasma arc machining - water jet machining - nano fabrication - micro machining - machining time - economics of advanced machining process.

Module IV (12 Hours)
Text books

Reference Books
1. HMT, Production Technology, Tata McGraw Hill Pvt. Ltd.
2. ASTME, Fundamentals of Tool Design, Prentice Hall of India

Internal Continuous Assessment (Maximum Marks-50)
60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Attendance and Regularity in the class

University Examination Pattern

PART Analytical/problem solving SHORT questions
A: 8x 5 marks=40 marks
Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

PART Analytical/Problem solving DESCRIPTIVE questions
B: 4 x 15 marks=60 marks
Two questions from each module with choice to answer one question.

Maximum Total Marks: 100

ME14 503 Heat and Mass Transfer
Teaching scheme                   Credits: 4
4 hours lecture and 1 hour tutorial per week
Objectives
1. To impart the concept of various modes of heat and mass transfer.
2. To develop understanding about the method of determination of heat transfer rates in conduction, convection and radiation.

Module I (16 hours)
periodic change in surface temperature.

**Module II (16 hours)**

**Module III (16 hours)**

**Module IV (16 hours)**

**Text Books**

**Reference Books**

**Internal Continuous Assessment** *(Maximum Marks-50)*
60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Attendance and Regularity in the class
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University Examination Pattern

**PART A:** Analytical/problem solving SHORT questions

8x 5 marks = 40 marks

Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

**PART B:** Analytical/Problem solving DESCRIPTIVE questions

4 x 15 marks = 60 marks

Two questions from each module with choice to answer one question.

**ME14 504 Thermal Engineering**

**Teaching scheme**

Credits: 4

3 hours lecture and 1 hour tutorial per week

**Objectives**

1. To provide knowledge on actual engine cycles, components of SI and CI engines, performance testing of IC engines, theory of combustion in IC engines, fundamental principles of air compressors.

**Module I (14 hours)**


**Module II (13 hours)**

**Systems and components of IC engines** - fuel systems - ignition systems - cooling - starting - lubrication - governing of IC engines - supercharging of SI and CI engines - turbocharging - exhaust emissions of IC engines - alternate potential engines - free piston engine - Wankel engine and stratified charged engine - automotive transmission systems and its components - engine testing

**Performance characteristics of SI and CI engines** - constant speed and variable speed characteristics - heat balance test - Morse test - retardation test - volumetric efficiency - mean effective pressure - specific fuel consumption - fuel air ratio

**Module III (14 hours)**

**Combustion in SI engines** - flame propagation - normal and abnormal combustion - detonation - pre ignition - after burning - fuel rating - Octane number - additives in petrol - combustion chambers of SI engines.

**Combustion in CI engines** - phase of normal combustion - diesel knock - effect of engine variables on diesel knock - Cetane number - additives in diesel - combustion chambers of CI engines - IC Engine exhaust emission control standards.

**Module IV (13 hours)**

**Gas turbine plants** - open and closed cycles - thermodynamic cycles - regeneration - reheating -
intercooling - efficiency and performance of gas turbines - rotary compressors - analysis - centrifugal and axial flow compressors - combustion chambers of gas turbines - cylindrical - annular and industrial type combustion chamber - combustion efficiency - axial flow turbines - elementary and vortex theories - design of nozzles and blades for turbines - limiting factors in turbine design

Text Books

Reference Books

Internal Continuous Assessment (Maximum Marks-50)
60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Attendance and Regularity in the class

University Examination Pattern

PART Analytical/problem solving SHORT questions

A: 8x 5 marks = 40 marks

Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

PART Analytical/Problem solving DESCRIPTIVE questions

B: 4 x 15 marks = 60 marks

Two questions from each module with choice to answer one question.

Maximum Total Marks: 100

ME14 505 Mechanics of Machinery
Teaching scheme  Credits: 4
3 hours lecture and 1 hour tutorial per week

Objectives
1. **To provide knowledge on kinematics of selected mechanisms, design of cams, Theory and Analysis of gears, Gear Trains and Synthesis of Mechanisms. These are the topics based on which the student will develop the design and practical problem solving skills in the area of Mechanisms in the future courses.**

Module I (14 hours)
Introduction to kinematics and mechanisms - Various mechanisms, kinematic diagrams, degree of freedom-
Grashof’s criterion, inversions of four bar, single slider crank and double slider crank linkages, Coupler curves - straight line mechanisms exact, approximate – Ackerman Steering Mechanism – Hooke’s joint – Intermittent motion mechanisms like ratchet mechanism, Geneva Mechanism - Mechanical advantage, Transmission angle - Instant centre – Kennedy’s theorem - Displacement Velocity and Acceleration analysis - Relative motion – Relative velocity - Relative acceleration - Coriolis acceleration – Graphical and analytical methods – Complex number methods - Computer oriented methods

Module II (13 hours)
Cams - Classification of Cam and followers - Displacement diagrams, Velocity and Acceleration analysis of Simple Harmonic Motion, Uniform Velocity, Uniform acceleration, Cycloidal – Graphical Cam profile synthesis – Pressure angle- Analysis of Tangent cam with roller follower and Circular cam with flat follower- Introduction to Polynomial cams

Module III (14 hours)

Module IV (13 hours)
Kinematic synthesis ( Planar Mechanisms) - Tasks of kinematic synthesis – Type, Number and dimensional synthesis – Precision points - Graphical synthesis for motion - Path and prescribed timing - Function generator – 2 position and 3 position synthesis – Overlay Method - Analytical synthesis techniques Freudenstein’s equation – Complex number methods - One case study in synthesis of mechanism

Text Books

Reference Books
1. 1. C. E. Wilson, P. Sadler, *Kinematics and Dynamics of Machinery*, 3rd edition, Pearson Education.

Internal Continuous Assessment *(Maximum Marks-50)*
60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Attendance and Regularity in the class
University Examination Pattern

PART A: Analytical/problem solving SHORT questions
8x 5 marks=40 marks
Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions
4 x 15 marks=60 marks
Two questions from each module with choice to answer one question.

Maximum Total Marks: 100

ME14 506 Finite Element Method
Teaching scheme
3 hours lecture and 1 hour tutorial per week

Objectives
1. To acquaint with basic concepts of finite element formulation methods.
2. To practise finite element methodologies through simple structural and heat transfer problems.

Module 0 (2 hours)

Module I (13 hours)
Introduction: Finite element method as a numerical tool for design – basic concepts – formulation procedures – historical development.
Beam element: Beam relationships – 1-D beam element FE formulation - element stiffness matrix – load considerations – boundary conditions – member end forces.

Module II (13 hours)
Interpolation – shape function – Lagrange interpolation - 1D linear and quadratic, 2D linear triangle and bilinear rectangular elements.

Module III (13 hours)


Module IV (13 hours)

Text Books
1. T. R. Chandrupatla, *Finite Element Analysis for Engineering and Technology*, University Press

Reference Books
3. K. J. Bathe, *Finite Element Procedures in Engineering Analysis*, Prentice Hall of India


Internal Continuous Assessment (Maximum Marks-50)
60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Attendance and Regularity in the class

University Examination Pattern

**PART A:** Analytical/problem solving SHORT questions
8x5 marks=40

Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

**PART B:** Analytical/Problem solving DESCRIPTIVE questions
4 x 15 marks=60

Two questions from each module with choice to answer one question.

Maximum Total Marks: 100
ME14 507(P) Fluids Lab

Teaching scheme: 3 hours lab per week

Credits: 2

Objectives
1. To strengthen the knowledge on fluid mechanics principles, and hydraulic machinery through lab experiments.
2. To equip the students to carry out independent experiments, and to train them to analyse, report and infer the results.

List of Experiments
1. Study of plumbing tools and pipe fittings
2. Measurement of metacentric height and radius of gyration of floating bodies
3. Measurement of viscosity of fluids
4. Study of discharge measuring instruments
5. Measurement of pressure and velocity
6. Calibration of venturimeter, orifice meter, notches and weirs, nozzle meters, and rotameters
7. Pipe friction – minor losses in pipes - verification of Bernoulli’s theorem
8. Demonstration of laminar and turbulent flow in pipes – critical velocity
9. Experiment on flow through open channels – venturiflume
10. Demonstration of forces on curved and plane surfaces
11. Evaluation of torque & performance of turbines – operating characteristics – Muschel’s curves

Reference Books

Internal Continuous Assessment (Maximum Marks-50)
60%-Laboratory practical and Record (30 marks)
30%- Test/s (15 marks)
10%- Regularity in the class (5 marks)

Semester End Examination (Maximum Marks-100)
70% - Procedure, conducting experiment, results, tabulation, and inference (70 marks)
20% - Viva voce (20 marks)
10% - Fair record (10 marks)

ME14 508(P) Production Engineering Lab-II

Teaching scheme: 3 hours practical per week

Credits: 2

Objectives
1. To acquaint with basic machine tools.
2. To impart training on shaper, slotting, milling and grinding machines.

Introduction:
1. a) Limits, fits and tolerances.
3. c) Spindle drives – milling cutter – indexing head.

d) Simple, compound, differential and angular indexing.

**Study of machines:**
1  a) Shaper  
2  b) Planer  
3  c) Slotting machine  
4  d) Drilling machine  
5  e) Milling machine  
6  f) Grinding machine  
7  g) Power saws

**Exercises:**
1  1. Exercises on shaper and slotting machines – cube with V-groove, slot and guide ways.  
2  2. Exercise on milling machine – spur gear and helical gear milling by simple and differential indexing, surface milling, slot and key way milling.  
3  3. Exercise on grinding and tool grinding

**Reference Books**
2  2. ASTME, *Tool Engineers Hand Book*.  

**Internal Continuous Assessment** *(Maximum Marks-50)*
- 60%-Workshop practical (models) and Record  
- 30%- Test/s  
- 10%- Regularity in the class

**Semester End Examination** *(Maximum Marks-100)*
- 70% - Making of models considering completion, dimensional accuracy, finishing, methods, choice of proper tools etc.  
- 20% - Viva voce  
- 10% - Fair record

**ME14 601 Refrigeration and Air Conditioning**
**Teaching scheme**  Credits: 4  
3 hours lecture and 1 hour tutorial per week

**Objectives**
1  To impart the concept of the basic principles, working, scientific analysis and system components of different types of refrigeration and air conditioning systems.  
2  To impart the knowledge of various types of refrigerants, their properties, selection criteria and environmental aspects

**Pre-requisites:** Fundamentals of thermodynamics, heat & mass transfer and air compressors
Note: Students are permitted to refer refrigeration tables/charts and Psychrometric charts for the University examination.

Module I (13 hours)

Module II (14 hours)

Module III (14 hours)

Module IV (13 hours)

Text Books

Reference Books
1  1. R.C Arora, *Refrigeration and Air conditioning*, PHI Learning Pvt. Ltd

8 Carrier Air conditioning Company (Corporate author), Hand Book of Air Conditioning System Design, McGraw Hill, New York

Internal Continuous Assessment (Maximum Marks-50)
60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Attendance and Regularity in the class

University Examination Pattern

PART Analytical/problem solving SHORT questions
A: 8x 5 marks = 40 marks
Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

PART Analytical/Problem solving DESCRIPTIVE questions
B: 4 x 15 marks = 60 marks
Two questions from each module with choice to answer one question.

Maximum Total Marks: 100

ME14 602 Metrology & Instrumentation
Teaching scheme  Credits: 4
2 hours lecture and 1 hour tutorial per week

Objectives
1. To provide the fundamental concepts and principles of metrology and instrumentation
2. To impart the various methods of measurement of physical and mechanical quantities

Module I (11 hours)

Module II (11 hours)

Module III (11 hours)


Module IV (11 hours)


The coordinate measuring machine construction – operation and programming – Machine vision
Image acquisition and digitization - image processing and analysis

Text Books

Reference Books
1. 1. R K Jain, Mechnicial & Industrial Measurements, Khanna Publishers, Delhi
2. 2. D S Kumar, Mechanical Measurements, Prentice Hall of India.
3. 3. A.K. Thayal; Instrumentation and mechanical measurements
6. 6. R.K. Rajput; Mechanical Measurement and Instrumentation; S.K. Kataria and Sons
7. 7. RegaRajendra; Principles of Engineering Metrology; Jaico Publication
8. 8. R.K. Rajput; Engineering Metrology and Instrumentation; S.K. Kataria and Sons
10. 10. ASME, Hand book of Industrial Metrology

University of Calicut

Internal Continuous Assessment (Maximum Marks-50)
60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Attendance and Regularity in the class

University Examination Pattern

PART Analytical/problem solving SHORT questions
A: 8x 5 marks=40 marks
Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

PART Analytical/Problem solving DESCRIPTIVE questions
B: 4 x 15 marks=60 marks
Two questions from each module with choice to answer one question.

Maximum Total Marks: 100

ME14 603 Dynamics of Machinery
Teaching scheme Credits: 4
4 hours lecture and 1 hour tutorial per week

Objectives
1. To impart knowledge on Force analysis of machinery, balancing go f rotating and reciprocating masses, Gyroscopes, Energy fluctuation in Machines. This forms the second part of the basic needed in the area of Mechanisms for Design courses in future.
2. To introduce the fundamentals in Vibration, Vibration analysis of Single degree and multi degree freedom systems.
3. To impart knowledge required to understand the physical significance and design parameters related to vibration in mechanical systems.

Module I (12hours)
Static Force analysis of plane motion mechanisms – Conditions of equilibrium - Graphical method – Static force analysis with friction – Friction circle - Force Analysis of Spur, Helical, Bevel and Worm gear –Analytical methods like Matrix methods, method of virtual work and Superposition principle

Dynamic force analysis of plane motion mechanisms- D’Alembert’s principle-Determination of inertia forces—Graphical method-Complex number method-shaking forces-Dynamics of reciprocating engines-Turning moment on the crank shaft-effect of inertia of the piston, crank and connecting road in turning moment- Equivalent system of the connecting rod-Graphical analysis using Klein’s construction

Module II (16 hours)

Gyroscope – Gyroscopic action and reaction couples – Effect of gyroscopic couple on bearing reactions- Effect of

gyroscopic couple on wheel reactions of two wheeled and four wheeled vehicles-- Gyroscopic Stabilization of ships and aeroplanes-- Fly wheel analysis –Coefficient of fluctuation of speed- Calculation of the flywheel mass.

**Module III (14 hours)**


Harmonically excited vibrations – Response of Undamped and Damped system -Vibration due to unbalance - Analysis of vibration due to support motion -Transmissibility and isolation – whirling of shafts (only undamped system) – Critical speed.

**Module IV (14 hours)**

Free vibrations of undamped two degree of freedom systems – Generalized coordinates-Frequency equations - Lagrange’s equation of motion – Beat phenomenon - Coordinate coupling - Equations of Motion for Forced Vibration – Dynamic vibration absorbers

Torsionally equivalent shaft - Free vibration of two and three rotor systems – Geared system-Determination of Mode shape-Fundamental natural frequency of loaded beams through Dunkerley’s Empirical equation-Rayleigh’s rule.

Vibration measurement - accelerometer – seismometer – vibration exciters- Vibration control-Vibration nomograph and Vibration criteria-Vibration Isolation

**TextBooks**


**ReferenceBooks**

5. 5. A. Ghosh, A. K. Malik, Theory of Mechanisms and Machines, Affiliated East West Press

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

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Attendance and Regularity in the class
University of Calicut

University Examination Pattern

PART A: Analytical/problem solving SHORT questions

Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

\[ 8 \times 5 \text{ marks} = 40 \text{ marks} \]

PART B: Analytical/Problem solving DESCRIPTIVE questions

Two questions from each module with choice to answer one question.

\[ 4 \times 15 \text{ marks} = 60 \text{ marks} \]

Maximum Total Marks: 100

ME14 604 Machine Design - I

Teaching scheme: 3 hours lecture and 1 hour tutorial per week

Credits: 4

Objectives

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

Module I (15 Hours)

Module II (13 Hours)
Threaded joints – thread standards- thread nomenclature - stresses in screw threads- bolted joints- preloading of bolts- eccentric loading- gasketed joints- power screws - design of riveted joints- Failure of riveted joints and efficiency of joint -boiler and tank joints- structural joints- cotter and knuckle joints

Module III (14 Hours)
Design of welded joints- Representation of welds - stresses in fillet and butt welds- design for static loads - bending and torsion in welded joints- eccentrically loaded welds - design of welds for variable loads. Springs-stresses and deflection of helical springs with axial loading – curvature effect – resilience - design of spring for static and fatigue loading- surging- critical frequency- stress analysis and design of leaf springs- nipping.

Module IV (12 Hours)
Shafts and axles design- stresses- causes of failure in shafts - design based on strength, rigidity and critical speed-design for static and fatigue loads- repeated loading- reversed bending-design of couplings- rigid and flexible couplings-design of keys and pins.

Note: The following data books are permitted for reference in the final examination:

Text Books

Reference Books

Internal Continuous Assessment (Maximum Marks: 50)
- 60% - Tests (minimum 2)
- 30% - Assignments (minimum 2) such as home work, problem solving, design etc. At least one assignment should be programming / problem solving using computers.
- 10% - Regularity in the class

University Examination Pattern 4 x 25 = 100
There will be total of EIGHT questions - TWO questions from each module with choice to answer one question. Each main question carries 25 marks. This will enable to have the freedom of setting lengthy, design question or combination of short answer/problems/ essay/design in each main question.
Maximum Total Marks: 100

ME14 605 Operations Research
Teaching scheme: 4
3 hours lecture and 1 hour tutorial per week
Objectives
1. To impart knowledge on linear programming, transportation problem, assignment problem, game theory and queuing theory.

Module I (13 hours)
Formulation and application of linear programming to production, marketing, finance and other areas – Concepts of Solution space, convex region, basic feasible solution, optimal solution – Solving LPP by graphical method

Module II (14 hours)

Module III (13 hours)
in transportation problems

Assignment problem as a maximally degenerate transportation problem – Koning’s method

Module IV (14 hours)
Game theory – Two person zero sum games – saddle points – pure and mixed strategies - dominance – graphical solutions

Basic structure of queuing models – exponential and Poisson distributions - queuing models based on Poisson inputs and exponential service times – basic model with constant arrival rate and service rate – Poisson-
exponential single server model, infinite population– Poisson-exponential single server model, finite population -

Poisson-exponential multiple server model, infinite population Dynamic programming – Bellman’s principle of

optimality – formulation and solution of simple problems

Text Books

2. J.K.sharma, Operations Research, Macmillan India Limited

Reference Books

2. Hadley G., Linear Programming, Addison Wesley
8. Hira and Gupta, Operation Research, S. Chand and Co.

Internal Continuous Assessment (Maximum Marks-50)

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Attendance and Regularity in the class
University Examination Pattern

PART Analytical/problem solving SHORT questions
A: 8x 5 marks=40

Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

PART Analytical/Problem solving DESCRIPTIVE questions
B: 4 x 15 marks=60

Two questions from each module with choice to answer one question.

Maximum Total Marks: 100

ME14 606 Computational Methods in Engineering

Teaching scheme Credits: 4
3 hours lecture and 1 hour tutorial per week

Objectives
1. To impart the concept of various numerical methods in engineering.
2. To develop understanding about the method of applying numerical techniques with the help of computers for solving complex problems.

Pre-requisites: Basic knowledge of engineering mathematics

Module I (13 hours)

Module II (13 hours)

Module III (14 hours)

Module IV (14 hours)
Text Books

Reference Books

Internal Continuous Assessment (Maximum Marks-50)
60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Attendance and Regularity in the class

University Examination Pattern

**PART A:** Analytical/problem solving SHORT questions

 Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

**PART B:** Analytical/Problem solving DESCRIPTIVE questions

 Two questions from each module with choice to answer one question.

Maximum Total Marks: 100

ME14 607(P) Thermal Lab – I

Teaching scheme                Credits: 2
3 hours lab per week

Objectives
1. To strengthen the knowledge on heat engine, and heat transfer principles through lab Experiments.
2. To equip the students to carry out independent experiments, and to train them to analyse, Report and infer the results.

List of Experiments
1. Study of systems of petrol and diesel engines, automotive parts, heat transfer equipments
2. Constant speed performance characteristics of petrol and diesel engines.
3. Valve timing diagram
4. Heat transfer experiments:
5. Experimental study on natural convection heat transfer
6. Experimental determination on Steffan Boltzmann Constant
7. Emissivity measurement of a radiating surface
8. Measurement of solar radiation
9. Thermal conductivity of a metal rod
10. Measurement of unsteady state conduction heat transfer
11. Experimental study on forced convection heat transfer

Reference Books

Internal Continuous Assessment  
(Maximum Marks-50)
60%-Laboratory practical and Record  
(30 marks)
30%- Test/s  
(15 marks)
10%- Regularity in the class  
(5 marks)

Semester End Examination  
(Maximum Marks-100)
70% - Procedure, conducting experiment, results, tabulation, and inference
20% - Viva voce
10% - Fair record

ME14 608 (P) CAD/CAM Lab

Teaching scheme  
Credits: 2
3 hour practical per week

Objectives
1. To train the students in solid modeling
2. To practice static and dynamic analyses using FEM
3. To practice computer controlled manufacturing methods

1. Exercises on solid modeling (12 hours)
   Introduction to computer graphics - viewing transformations, curves and surfaces generation, curve fitting and curve fairing techniques - 2D, wire frame, 3D shading - familiarity with Boolean operations - sweep, revolve, loft, extrude, filleting, chamfer, splines etc. - windowing, view point, clipping, scaling and rotation transformations using commercial solid modeling packages

2. Exercises on finite element analysis (12 hours)
   Introduction to FEM - 1D, 2D and 3D elements - shape functions - preprocessing - boundary conditions, structured and free mesh generation - analysis - linear and non linear analysis - static and dynamic analysis - post processing - display, animation, extraction of nodal data - exercises on heat conduction and elasticity may be given using commercial FEM packages

3. Assembly and mechanism design (6 hours)
   Assembling of various parts and tolerance analysis - synthesis and design of mechanisms - animations - exercises on various mechanisms like four bar linkages and its variations - cam and follower - two and four stroke engines

4. Computer aided manufacturing (9 hours)
   Part programming fundamentals - manual part programming and computer aided part programming - hands on training in computer controlled turning and milling operations - familiarity with windows based software packages - tool path generation and simulation - exercises on CNC lathe and machining center/milling machines

5. Programming of industrial robots (6 hours)
   Introduction to robotics - structure, workspace analysis and various components - actuators - sensors - encoders - end effectors - applications - hands on training on industrial robots - manual and programmed path planning

6. Computer aided inspection and quality control (3 hours)
Introduction to CMM - classification - structure - components - familiarity with measurement software packages and its modules - demonstration of the capability of coordinate measuring machine using a sample component e.g.: engine block - concepts of reverse engineering and rapid prototyping technology

Reference Books

Internal Continuous Assessment *(Maximum Marks-50)*
60% - Practical and Record (30 marks)
30% - Test(s) (15 marks)
10% - Regularity in the class (5 marks)

Semester End Examination *(Maximum Marks-100)*
70% - Procedure, conducting experiment, results, tabulation, and inference
20% - Viva voce
10% - Fair record

ME14 701 Mechatronics
Teaching scheme Credits: 4
3 hours lecture and 1 hour tutorial per week

Course Objectives:
1  i. To impart knowledge on the fundamentals of the following
2  ii. Controls in NC machine
3  iii. Fluidic Controls and

Course Outcome
1  The students will become familiar with the different aspects of mechatronic engineering.
2  They will have working knowledge to handle problems involving mechatronic and control elements.

Module I (13 Hours)
Introduction - multidisciplinary scenario - evolution of mechatronics - scope of Mechatronics - measurement systems - control systems - servomechanisms and regulators - control system fundamentals - block diagrams and block diagram reduction.

Module II (13 Hours)
Mechatronic elements - data presentation systems - displays - analog and digital indicators - analogous chart recorders - visual display units - CRO - printers - magnetic recorders – light indicators - liquid crystal display units - alarm indicators data loggers - computers with plug in boards-data acquisition systems.

Module III (14 Hours)

Module IV (14 Hours)
Controls in NC Machines and fluidic control
Controls in NC Machines-hydraulic systems - direct current motors - stepping motors - feedback devices-encoders - resolvers - inductosyn – tacho generators - principles of fluid logic control -Coanda effect - basic fluidic devices - fluidic logic gates - bistable – flip flop - OR and NOR gates - exclusive OR gates - fluidic sensors - backpressure sensor - cone jet proximity sensor -interruptible jet sensor.

Text books

Reference Books:
2  2. Ogata Katsuhiko , „Modern Control Engineering”, Printice Hall of India, 2005.

Internal Continuous Assessment (Maximum Marks:-50)
60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Attendance and Regularity in the class

PART Analytical/problem solving SHORT questions
A:
8x 5 marks=40 marks
Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

PART Analytical/Problem solving DESCRIPTIVE questions
B:
4 x 15 marks=60 marks
Two questions from each module with choice to answer one question.

Maximum Total Marks: 100

ME14 702 Gas Dynamics & Jet Propulsion
Teaching scheme                   Credits: 4
3 hours lecture and 1 hour tutorial per week

Objectives:
1  To impart concept of compressible fluid flow and flow through duct and nozzle under various conditions.
2  To provide knowledge on jet propulsion and rocket propulsion.
Note: Students are permitted to refer gas tables/charts for the University examination.

Module I (16 hours)
Introduction to compressible flow – continuity, momentum and energy equations for compressible flow –
equation for acoustic velocity – Mach number – flow regimes – Mach angle – Mach cone – wave propagation in
incompressible, subsonic, sonic and supersonic flows.

One dimensional isentropic flow with variable area – stagnation properties – reference velocities – dimensionless
Mach number M*– Compressibility factor & effect of Mach number on compressibility – impulse function and
thrust – area velocity relation – choking – mass flow rate for choked flow – operation of convergent and
convergent-divergent nozzle under varying pressure ratio – over expanded and under expanded mode.

Module II (14 hours)
across normal shock – impossibility of a shock in subsonic flow.

Flow with oblique shock waves – nature of flow through oblique shock waves – Prandtl’s equation – Rankine-
Hugoniot equations – change of entropy across oblique shock – oblique shock relations from the normal shock
equations – θβm curves – shock polar diagram.

Module III (14 hours)
Adiabatic flow through constant area duct with friction – equation of fanno line – illustration of fanno line on h-s
diagram – choking due to friction, effect of friction on flow parameters
Isothermal flow with friction-governing equations.
Flow through constant area duct with heat transfer – equation of Rayleigh line – illustration of Rayleigh line on h-
s diagram – condition for maximum heat transfer - thermal choking, effect of heat transfer on flow parameters.

Module IV (10 hours)
propulsion theory – propeller thrust and jet thrust – propulsive, thermal and overall efficiencies – specific fuel
consumption, specific thrust and impulse - ramjet engine – pulsejet engine.
Rocket propulsion – types of rocket engines – liquid propellant rocket engines - solid propellant rocket motors –
rocket propulsion theory – rocket applications.

Text books
1. S.M. Yahya, Fundamentals of compressible fluid flow with aircraft and rocket propulsion, New Age
   International publishers

Reference books
1. P. Balachandran, fundamentals of compressible fluid dynamics, PHI learning pvt. Ltd.
   company
3. A. H. Shapiro, dynamics and thermodynamics of compressible flow, ronald press
4. M.j. Zucro&d.h. Hofman, gas dynamics, Mcgraw-hill publishing company
5. V. Babu, fundamentals of gas dynamics, ane books pvt. Ltd.
6. E. Radhakrishnan, gas dynamics, prentice hall of indiapvt. Ltd.
7. ZoebHussain, Gas Dynamics
Internal Continuous Assessment  *(Maximum Marks-50)*
60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Attendance and Regularity in the class

University Examination Pattern

**PART A:** Analytical/problem solving SHORT questions
- Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.
- 8x 5 marks=40 marks

**PART B:** Analytical/Problem solving DESCRIPTIVE questions
- Two questions from each module with choice to answer one question.
- 4 x 15 marks=60 marks

*Maximum Total Marks: 100*

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**ME14 703 Computer Integrated Manufacturing**

**Teaching scheme**  
Credits: 4  
2 hours lecture and 1 hour tutorial per week

**Objectives**
1. To impart fundamental knowledge of Numerical Control, NC part programming, Controls in CIM, material handling systems.
2. To acquire comprehensive idea on FMS and Robotics.

**Module I (10 hours)**
Introduction- fundamentals of numerical control- advantages of NC system - classification of NC system - NC and CNC - open loop and closed loop systems - features of NC machine tools - fundamentals of machining- design considerations of NC machine tools- methods of improving machine accuracy and productivity- special tool holders.

**Module II (12 hours)**
NC part programming - manual programming- part programming examples- point to point programming and contour programming- computer aided programming concepts - post processor - program languages- APT-programming - part programming examples.

**Module III (12 hours)**
Controls in CIM- material handling in CIM- AGV- Vehicle guidance- vehicle management and safety automated storage systems- ASRS components and operations- features of ASRS- automatic data capture- barcode technology- magnetic strips- optical character recognition- group technology- part family- part classification and coding - features OPITZ classification and multi class coding system.

**Module IV (10 hours)**
Flexible manufacturing system- types of FMS- components of FMS- FMS workstations- material
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handling and storage systems- FMS layout- configurations- computer control systems in FMS applications and benefits of FMS- industrial robotics- robot anatomy- configurations- joints- drive systems- robot control systems- end effectors- sensors in robots- industrial robot applications- robot programming- on line and off line programming

Text Books

Reference Books

Internal Continuous Assessment (Maximum Marks-50)
60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Attendance and Regularity in the class

University Examination Pattern

PART Analytical/problem solving SHORT questions
A: 8x 5 marks=40
Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

PART Analytical/Problem solving DESCRIPTIVE questions
B: 4 x 15 marks=60
Two questions from each module with choice to answer one question.

Maximum Total Marks: 100

ME14 704(A) Financial Management (Global)
Teaching scheme Credits: 4
3 hours lecture and 1 hour tutorial per week
Objectives
1. To impart knowledge on financial management of organisations

Module I (14 hours)
Scope of financial management- Investment financing and asset management decisions. Type of business organisations- sole proprietorship, partnership, private company and public company. Goals of the firm: Profit maximization, wealth maximization - management verses owners, social responsibility. Major financial decision areas: Investment financing and dividend decisions. Basic factors influencing financial decisions-internal and external factors.

**Module II (14 hours)**

**Module III (13 hours)**

**Module IV (13 hours)**

**Reference Books**
3. H Beeman Jr. And S. Smdidi, *Capital budgeting decisions*
4. Prasanna Chandra, *Financial management theory and practice*
5. M Y Khan & P K Jain, *Financial management*

**Internal Continuous Assessment (Maximum Marks-50)**
60% - Tests (minimum 2)  
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.  
10% - Attendance and Regularity in the class

**University Examination Pattern**

<table>
<thead>
<tr>
<th>PART</th>
<th>Analytical/problem solving SHORT questions</th>
<th>Analytical/problem solving DESCRIPTIVE questions</th>
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</thead>
<tbody>
<tr>
<td>A:</td>
<td><strong>8x 5 marks</strong>=40**</td>
<td><strong>4 x 15 marks</strong>=60**</td>
</tr>
</tbody>
</table>

Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

Two questions from each module with choice to answer one question.

*Maximum Total Marks: 100*

ME14 704(B) Industrial Safety Engineering (Global)

Teaching scheme  
Credits: 4
3 hours lecture and 1 hour tutorial per week

Objectives
1. To provide on concept of safety in industry, principle of accident prevention, major hazards, consequences and concept of reliability.

Pre-requisites: Nil

Module I (14 Hours)
Introduction to the concept of safety-Need-safety provisions in the factory Act-Laws related to the industrial safety-Measurement of safety performance, Safety Audit, Work permit system, injury and accidents-Definitions-Unsafe act –unsafe condition- causes, investigations and prevention of accidents, hazards, type of industrial hazards-nature, causes and control measures, hazard identifications and control techniques-HAZOP, FMEA,FMECA etc.

Module II (14 Hours)

Module III (13 Hours)
Logics of consequence analysis-Estimation-Toxic release and toxic effects-Threshold limit values, Emergency planning and preparedness, Air pollution-classification- Dispersion modeling –pollution source and effects- control method and equipments-Gravitational settling chambers-cyclone separators- Fabric filter systems- scrubbers etc.

Module IV (13 Hours)
Concept of reliability-Definition-Failure rate and Hazard function, System reliability models-series, parallel systems, reliability hazard function for distribution functions-exponential-normal –log normal weibull and gamma distribution.

Text books
3. C.S.Rao, Environmental Pollution Control Engineering, New Age International Limited

Reference books

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

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Attendance and Regularity in the class

**University Examination Pattern**

*PART A: Analytical/problem solving SHORT questions*

8x5 marks = 40 marks

Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

*PART B: Analytical/Problem solving DESCRIPTIVE questions*

4 x 15 marks = 60 marks

Two questions from each module with choice to answer one question.

*Maximum Total Marks: 100*

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**ME14 704(C) Heating, Ventilation and Air-conditioning Design**

*Teaching scheme:*

3 hours lecture and 1 hour tutorial per week

**Objectives**

1. To impart knowledge on principles of refrigeration, cooling and heating load calculation, design of air conditioning system and selected systems in comfort engineering

**Pre-requisites:** Basics of thermodynamics, fluid mechanics, and heat transfer

**Module I (14 Hours)**


**Module II (13 Hours)**

Cooling and heating load calculation - selection of design temperatures - sources of heat load- heat transfer through structures - solar radiation - Infiltration and ventilation- Heat generation inside the conditioned space - heat storage, Diversity and stratification.

**Module III (13 Hours)**

Module IV (14 Hours)
Heating systems-warm air systems-hot water systems steam heating systems-panel and central heating systems-heat pump circuit. Applications- comfort air conditioning-effective temperature-thermal analysis of human body-Air conditioning systems- evaporate cooling- low humidity applications Automobile and Train car air conditioning.

Text Book
1. Faye C. McQuiston, Jerald D. Parker, Jeffrey D. Spitler, Heating, ventilating, and air conditioning: analysis and design, John Wiley & Sons, 2005
3. ASHARE handbook

Reference Books:
1. C. P. Arora, Refrigeration and Air Conditioning.
3. W. P. Jones, Air-conditioning Engineering
4. Carriers Handbook system design of Air Conditioning

Internal Continuous Assessment (Maximum Marks-50)
60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Attendance and Regularity in the class

University Examination Pattern

PART Analytical/problem solving SHORT questions
A: 8x 5 marks=40
Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

PART Analytical/Problem solving DESCRIPTIVE questions
B: 4 x 15 marks=60
Two questions from each module with choice to answer one question.

Maximum Total Marks: 100

ME14  704 (D) Energy Conservation in Thermal Systems
Teaching scheme Credits: 4
3 hours lecture and 1 hour tutorial per week
Module I – (14 Hours)

Module II – (14 Hours)

Module III – (13 Hours)

Module IV – (13 Hours)

Text Book:

References:

Internal Continuous Assessment (Maximum Marks-50)
60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Attendance and Regularity in the class

University Examination Pattern

PART Analytical/problem solving SHORT questions
A: 8x 5 marks=40
Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

PART Analytical/Problem solving DESCRIPTIVE questions
B: 4 x 15 marks=60
Two questions from each module with choice to answer one question.

Maximum Total Marks: 100

ME14  704 (E) Industrial Automation

Teaching scheme  credits: 4
3 hours lecture and 1 hour tutorial per week

Objectives
1. To impart knowledge on basics of automation, sensors, robots and its application

Module I (13 hours)
Introduction to automation: basic notions and definitions, technical and economic requisites. Automation as a means of control and inspection- basic control system concepts - control system analysis, systems of automatic control.

Module II (14 hours)
Sensors: sensory equipment, range sensing - proximity sensing - touch sensing - force and torque sensing - signal conditioning equipment.
Introduction to machine vision, sensing and digitizing - image processing and analysis - applications.
Introduction to robots: definition of robot - basic concepts - robot configurations - types of robot drives - basic robot motions - point to point control - continuous path control.

Module III (14 hours)
Components and operations: basic actuation mechanisms - robot actuation and feedback, manipulators –director and inverse kinematics, coordinate transformation - brief robot dynamics. Types of robot and effectors - grippers - tools as end effectors – robot end - effort interface.
Robot programming: methods - languages - capabilities and limitation - artificial intelligence –
Knowledge representation – search techniques - AI and robotics.

Module IV (13 hours)

Text books:

Reference books:
3. Yu.kozyrev, industrial robots,
4. V. Tergan, i. Andreev, b. Liberman, fundamentals of industrial automation,

Integrated approach, prentice hall inc, englewoods cliffs, nj, usa, 1989.

Internal Continuous Assessment (Maximum Marks-50)
60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Attendance and Regularity in the class
University of Calicut

University Examination Pattern

PART Analytical/problem solving SHORT questions
A: 8x5 marks=40
Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

PART Analytical/Problem solving DESCRIPTIVE questions
B: 4x15 marks=60
Two questions from each module with choice to answer one question.

Maximum Total Marks: 100

ME14 704 (F) Combustion Engineering
Teaching scheme
3 hours lecture and 1 hour tutorial per week

Objectives
1. To impart the concept of principles of combustion.
2. To develop understanding about principles of thermodynamics of combustion.

Pre-requisites: Basic knowledge of thermodynamics and heat transfer.

Module I (14 hours)

Module II (14 hours)

Module III (13 hours)

Module IV (13 hours)

Text Books

Reference Books

University of Calicut

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

- 60% - Tests (minimum 2)
- 30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
- 10% - Attendance and Regularity in the class

**University Examination Pattern**

**PART A:** Analytical/problem solving SHORT questions

A:  

Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

\[
\text{8 questions} \times 5 \text{ marks} = 40 \text{ marks}
\]

**PART B:** Analytical/Problem solving DESCRIPTIVE questions

B:  

Two questions from each module with choice to answer one question.

\[
2 \text{ questions} \times 15 \text{ marks} = 60 \text{ marks}
\]

Maximum Total Marks: 100

**ME14  704 (G) Automobile Engineering**

**Teaching scheme**  

Credits: 4  

3 hours lecture and 1 hour tutorial per week

**Objectives**

1. To develop understanding about various automobile components and systems
2. To impart concepts modern automotive controls and safety features

**Pre-Requisites**

1. Knowledge of theory of IC engines and power transmission by belt, chain, pulleys and gears

**Module I (13 hours)**


Chassis and body – body parts, functions, types, material and construction. Engines - component details and materials for cylinder head, cylinder block, piston, piston rings , connecting rod, crank shaft, valve actuating mechanism, VVT(Variable Valve Timing).

Modern Fuel systems: Working and advantages of: Petrol injection – MPFI (Multi Point Fuel Injection), GDI (Gasoline Direct Injection), High pressure pump &Injectors, Diesel Injection- CRDI (Common Rail Direct Injection), Electronic Diesel Control (EDC).

**Module II (14 hours)**


function and working, Front axle and rear axle – functions and classes.

Brake system – functions and classification - band brake - shoe brake and disc brake – Working of mechanical brake, hydraulic brake, air brake, power assisted brakes, regenerative brake, anti-lock braking system (ABS), Electronic brake force distribution system (EBFD) - brake drum and shoes, brake lining - brake effectiveness.

**Module III (13 hours)**


**Module IV (14 hours)**

Heating ventilation and air conditioning – ventilation – heating – air conditioning – climatic control.

Automotive safety and driver assisting systems – air bags – inflation mechanism, seat belt – types – working, electronic stability control systems(ECS), GPS, side impact protection system (SIPS), alternative controls – steer by wire and drive by wire – anti-collision systems – visibility assistance – head up display (HUD), advanced frontline system (AFS), night vision system (NVS), cruise control system-(Basics Only).


**Text Book.**


**Reference Books**

Internal Continuous Assessment  *(Maximum Marks-50)*
60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Attendance and Regularity in the class

University Examination Pattern

**Part A:** Analytical/problem solving SHORT questions

<table>
<thead>
<tr>
<th>Questions</th>
<th>Marks</th>
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<tbody>
<tr>
<td>8</td>
<td>40</td>
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</table>

Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

**Part B:** Analytical/Problem solving DESCRIPTIVE questions

<table>
<thead>
<tr>
<th>Questions</th>
<th>Marks</th>
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<tbody>
<tr>
<td>4</td>
<td>60</td>
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</table>

Two questions from each module with choice to answer one question.

Maximum Total Marks: 100

**ME14 705(A) Logistics and Supply Chain Management**

**Teaching scheme**

<table>
<thead>
<tr>
<th>Credits</th>
<th>4</th>
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3 hours lecture and 1 hour tutorial per week

**Objectives**

1. To visualize the major issues in supply chain domain
2. To understand how the environment affects the design, implementation and management of supply chains.
3. To develop competence in distribution and logistics management

**Pre-requisites:** nil

**Module I (13 hours)**

Concept of Supply Chain – Value Chain for supply chain management, Integrated Supply chain, Drivers for supply chain management, Growth of supply chain, Major trends in supply chain management, Strategic decisions in supply chain, Supply Chain flows - Supply Chain and competitive performance – performance measures of Supply Chain – Strategic fit – Drivers and Obstacles

**Module II (14 hours)**

Managing supply, Managing demand and Managing variability – Inventory Management in Supply Chain – Uncertainties of demand, Inventory related costs, Types of inventory, Demand, Tools and techniques in inventory management, Managing supply chain inventory: Pitfalls and opportunities.

**Module III (13 hours)**

Sourcing decisions in Supply Chain – management, Buyers perspective to supply chain management, Suppliers perspective to supply chain management, Buyer supplier relations, Supplier relations in managing faster supply chain, Pricing and revenue management in Supply Chain – Coordination in Supply Chain – IT and Supply Chain

**Module IV (14 hours)**

Logistics Management – Definition of Logistics and concept of Logistics – Logistic activities – Functions of Logistics system – Transportation in Supply Chain – Design options for a transportation network – Trade offs in transportation design – Designing distribution network

Text Books
1. Dr.R..P Mohanty and Dr.S.G.Deshmukh Essentials of Supply Chain Management, Jaico Publishing.

Reference Books
1. Janat Shah, Supply Chain Management: Text and Cases, Pearson Education South Asia, 2009

Internal Continuous Assessment (Maximum Marks-50)
60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Attendance and Regularity in the class

University Examination Pattern

PART Analytical/problem solving SHORT questions
A: 8x 5 marks=40
Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

PART Analytical/Problem solving DESCRIPTIVE questions
B: 4 x 15 marks=60
Two questions from each module with choice to answer one question.

Maximum Total Marks: 100

ME14 705(B) Design of Heat Transfer Equipments
Teaching scheme
Credits: 4
3 hours lecture and 1 hour tutorial per week

Objectives
1. To impart the concepts of design of heat transfer equipments.
2. To develop understanding about design of various heat exchangers
Pre-requisites: Basic knowledge of fluid mechanics and heat transfer

Module I (14 hours)

Module II (13 hours)

Module III (13 hours)

Module IV (14 hours)

Text Books

Reference Books

Internal Continuous Assessment *(Maximum Marks-50)*
60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Attendance and Regularity in the class

University Examination Pattern

**PART A**
Analytical/problem solving SHORT questions
EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

**PART B**
Analytical/Problem solving DESCRIPTIVE questions
Two questions from each module with choice to answer one question.

Maximum Total Marks: 100
Teaching scheme

Credits: 4
3 hours lecture and 1 hour tutorial per week

Objectives:
1. To impart the concept of computational methods in fluid flow and heat transfer
2. To develop understanding about principles of fluid flow modelling.

Pre-requisites: Basic knowledge of fluid mechanics and heat transfer

Module I (14 hours)
Classification of partial differential equations - system of first and second-order partial differential equations - initial and boundary conditions - finite difference formulations - finite difference equations – simple applications in steady state conduction and convection.

Module II (13 hours)

Module III (14 hours)

Module IV (13 hours)
Introduction to finite volume method – regular finite volume – approximations in the discretization technique – discretization procedure – semi-explicit method – implementation of boundary conditions (only elementary theory and no direct problems).

Text Books
1. T. Sundararajan, *Computational fluid flow and heat transfer*, Narosa publishing House

Reference Books
1. Hoffmann Klaus, *Computational Fluid Dynamics for Engineers - Volume I*, Engineering Education System, Wichita

Internal Continuous Assessment (Maximum Marks-50)
60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Attendance and Regularity in the class
University Examination Pattern

PART Analytical/problem solving SHORT questions
A: 8x 5 marks=40
Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

PART Analytical/Problem solving DESCRIPTIVE questions
B: 4 x 15 marks=60
Two questions from each module with choice to answer one question.

Maximum Total Marks: 100

ME14 705 (D) Designs of Jigs & Fixtures

Teaching scheme: 3 hours lecture and 1 hour tutorial per week

Objectives
1. To provide knowledge on design of different cutting tools
2. To develop comprehensive idea on design of jigs and fixtures

Pre-requisites: Metal cutting and Forming

Module I (12 Hours)

Module II (14 Hours)

Module III (14 Hours)

Module IV (14 Hours)

Text books:

Internal Continuous Assessment (Maximum Marks-50)
60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Attendance and Regularity in the class

University Examination Pattern

PART A: Analytical/problem solving SHORT questions

Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

8x 5 marks = 40 marks

PART B: Analytical/Problem solving DESCRIPTIVE questions

Two questions from each module with choice to answer one question.

4 x 15 marks = 60 marks

Maximum Total Marks: 100

ME14 705(E) Fracture Mechanics

Teaching scheme
3 hours lecture and 1 hour tutorial per week

Objectives
1. To impart knowledge on linear elastic fracture mechanics, crack tip plasticity, Elastic – Plastic Fracture Mechanics, Fatigue crack growth and application of fracture mechanics concepts to design

Module I (14 hours)

Module II (13 hours)

Module III (14 hours)

Module IV (13 hours)

Text Books
1. Prashant Kumar, *Elements of fracture mechanics*, Wheeler publishing

Reference Books

**Internal Continuous Assessment (Maximum Marks-50)**
60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Attendance and Regularity in the class

**University Examination Pattern**

**PART A:** Analytical/problem solving SHORT questions

Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

\[8 \times 5 = 40 \text{ marks}\]

**PART B:** Analytical/Problem solving DESCRIPTIVE questions

Two questions from each module with choice to answer one question.

\[4 \times 15 = 60 \text{ marks}\]

Maximum Total Marks: 100

**ME14 705(F) Composite Materials**

**Teaching scheme** Credits: 4
3 hours lecture and 1 hour tutorial per week

**Objectives**
1. To provide knowledge on characteristics of composites, manufacturing and testing methods, mechanical behavior, recent trends and its application.
2. Pre-requisites: Basic knowledge of material science and mechanics of solids

**Module I (14 hours)**
Introduction to composites: Characteristics and classifications of composites – study of fibers, flake and particulate composites. Manufacturing methods: Production of various fibers – matrix materials and surface
Module I (13 hours)

Module II (13 hours)

Module III (13 hours)

Module IV (14 hours)

Text Books

Reference Books

Internal Continuous Assessment (Maximum Marks-50)
60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Attendance and Regularity in the class

University Examination Pattern

PART A: Analytical/problem solving SHORT questions

A: 8x 5 marks=40
Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions

B: 4 x 15 marks=60
Two questions from each module with choice to answer one question.

Maximum Total Marks: 100

ME14 706(P) Thermal Lab II

Teaching scheme Credits: 2
3 hours practical per week

Objectives
1. To strengthen the knowledge on heat engines and heat transfer principles through experiments.
2. To equip the students to carry out independent experiments, and to train them to analyse, report and infer the results.

List of Experiments
1. Test on IC engines:
   1. Variable speed performance test on petrol and diesel engines
   2. Determination of friction power – retardation test and Morse test
   3. Study of the effect of cooling water on engine performance
   4. Heat balance test
   5. Analysis of the exhaust gas of IC engines

2. Heat transfer experiments:
   1. Performance studies on a shell and tube heat exchanger
   2. Performance studies on parallel and counter flow arrangements in a concentric pipe heat exchanger

3. Performance tests on air compressor and blower
4. Performance test on refrigeration plant

Reference Books

Internal Continuous Assessment (Maximum Marks-50)
60% - Practical and Record (30 marks)
30% - Test /s (15 marks)
10% - Regularity in the class (5 marks)

Semester End Examination (Maximum Marks-100)
70% - Procedure, conducting experiment, results, tabulation, and inference (70 marks)
20% - Viva voce (20 marks)
10% - Fair record (10 marks)

ME14 707(P) Instrumentation Lab

Teaching scheme Credits: 2
3 hours practical per week

Objectives
1. To provide knowledge of uncertainties involved in any measurement.
2. To train the students in the calibration and use of different measuring instruments.

List of Experiments
I. (a) Determination of uncertainties in computed quantities such as the following
1. Volume of a rectangular block or cylinder computed from measurements of length, width, height and diameter
   1. Water power computed from measurements of density, local acceleration due to gravity, volumetric flow rate and head
   2. Shaft power computed from measurements of speed and torque
   3. Electrical power computed from measurements of “number of rotations of
vii. Energy meter disk”, time taken and “energy meter constant”

(b) Selection of instruments for computing quantities with desired uncertainties

II. Determination of bias and random error of the following instruments by calibrating them using proper standards
1 a) Load cells such as strain-gauge-load cells, strain-gauge-beam transducer etc.
2 b) Rotameter
3 c) Bourdon-tube pressure gauge
4 d) LVDT
5 e) Thermocouples
6 f) Tachometers
7 g) Constant area flow meters

III. Preparation of a Psychrometric chart for the laboratory and determination of Psychrometric properties of atmospheric air - use of Sling psychrometer
0 a. Analysis of exhaust gases and flue gases with the help of orsats apparatus,

Gas chromatograph, paramagnetic oxygen analyser, smokemeter etc.
1 b. Acoustic measurements: sound level meter-octave band filter- preparation of noise contours
1 c. Plotting of velocity profiles using pitot tubes and hot wire anemometers

IV. Study of and making measurements with: Water meter, velocimeters, pH meter, slip gauges, comparators, planimeter, pyrometers, RTDs, thermistors, CRO, multimeters, linear capacitance meters & LDR (light depended resistance)

V. Determination of static and dynamic characteristics of zero, first and second order instruments

Reference Books

Internal Continuous Assessment *(Maximum Marks-50)*
60% - Practicals and Record (30 marks)
30% - Tests /s (15 marks)
10% - Regularity in the class (5 marks)

Semester End Examination *(Maximum Marks-100)*
70% - Procedure, modelling steps, analysis, results, and inference (70 marks)
20% - Viva voce (20 marks)
10% - Fair record (10 marks)

ME14 708(P) Project

Objectives
1  To judge the capacity of the students in converting the theoretical knowledge into practical systems/investigative analysis.
Project work is for duration of two semesters and is expected to be completed in the eighth semester. Each student group consisting of not more than five members is expected to design and develop a complete system or make an investigative analysis of a technical problem in the relevant area. The project may be implemented using software, hardware, or a combination of both. Project evaluation committee consisting of the guide and three/four faculty members specialised in the above field shall perform the screening and evaluation of the projects. Each project group should submit project synopsis within three weeks from start of seventh semester. Project evaluation committee shall study the feasibility of each project work before giving consent. Literature survey and 40% of the work has to be completed in the seventh semester. Students should execute the project work using the facilities of the institute. However, external projects can be taken up in reputed industries, if that work solves a technical problem of the external firm. Prior sanction should be obtained from the head of department before taking up external project work and there must be an internal guide for such projects.

Each student has to submit an interim report of the project at the end of the 7th semester. Members of the group will present the project details and progress of the project before the committee at the end of the 7th semester. 50% of the mark is to be awarded by the guide and 50% by the evaluation committee.

**Internal Continuous Assessment**

- 20% - Technical relevance of the project
- 40% - Literature survey and data collection
- 20% - Progress of the project and presentation
- 10% - Report
- 10% - Regularity in the class

**ME14 801 Machine Design-II**

**Teaching scheme:**

Credits: 4

4 hours lecture and 1 hour tutorial per week

**Objectives**

1. To provide basic design skill with regard to clutches, brakes, belt drives, bearings, gears and connecting rod.

**Module I (16 Hrs)**


**Module II (16 Hrs)**


**Module III (16 Hrs)**


Module IV (16 Hrs)

Note: The following data books are permitted for reference in the final examination:
1. PSG Design Data, DPV Printers, Coimbatore.

Text Books

Reference Books

Internal Continuous Assessment (Maximum Marks-50)
60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, design etc. Atleast one assignment should be programming / problem solving using computers.
10% - Regularity in the class

University Examination Pattern 4 x 25 = 100
There will be total of EIGHT questions - TWO questions from each module with choice to answer one question. Each main question carries 25 marks. This will enable to have the freedom of setting lengthy, design question or combination of short answer/problems/ essay/design in each main question.

Maximum Total Marks: 100

ME14 802 Power Plant Engineering
Teaching scheme Credits: 4
3 hours lecture and 1 hour tutorial per week
Objectives
1. To impart the concept of power plant technology.
2. To develop understanding about power plant cycles, power generation devices, and power plant economics.

Module I (14 hours)

Module II (14 hours)
Modern high pressure boilers- Sub critical and super critical steam generation-rating of boilers-boiler efficiency- equivalent evaporation-boiler draught-guidelines for selection of boilers for steam power plants. Boiler testing and trials-inspection and safety regulations (simple problems).

Thermal power plant systems- fuel handling and ash handling systems-combustion equipments-super heaters, economizers, air-pre heaters and feed water heaters

Module III (13 hours)
Steam nozzles- mass flow relations- area ratio- critical pressure ratio- effect of back pressure – supersaturated flow in nozzles

Steam turbines-velocity diagrams-efficiencies-turbine performance and governing

Pollution from thermal power plant- pollution control

Module IV (13 hours)
Gas turbine power plants -combustion chambers of gas turbines - cylindrical - annular and industrial type combustion chamber - combustion efficiency - axial flow turbines - design of nozzles and blades for turbines - limiting factors in turbine design

Nuclear power plants- pressurized water reactors-boiling water reactors-gas cooled reactors-fast breeder reactors –pollution

Economics of power plant-terms and definitions-types of load-typical load curves-- fixed cost- operating cost-variable load operation-economics of load sharing and power generation. Cost of electricity and energy Tariffs.

Text Books

Reference Books

Internal Continuous Assessment (Maximum Marks-50)
60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Attendance and Regularity in the class
University Examination Pattern

PART Analytical/problem solving SHORT questions
A: 8x 5 marks=40

Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

PART Analytical/Problem solving DESCRIPTIVE questions
B: 4 x 15 marks=60

Two questions from each module with choice to answer one question.

Maximum Total Marks: 100

ME14  803 Operations Management

Teaching scheme
Credits: 4
2 hours lecture and 1 hour tutorial per week

Objectives
1. To impart knowledge on production, planning and control functions, method study, materials management, inventory models, maintenance management and project management

Module I (12 hours)

Module II (10 hours)

Module III (12 hours)

Module IV (10 hours)

Text Book

Reference Books
Internal Continuous Assessment (Maximum Marks-50)

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Attendance and Regularity in the class

University Examination Pattern

PART A: Analytical/problem solving SHORT questions
A: 8x 5 marks=40

Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions
B: 4 x 15 marks=60

Two questions from each module with choice to answer one question.

Maximum Total Marks: 100

ME14  804(A) Marketing Management

Teaching scheme  Credits: 4
3 hours lecture and 1 hour tutorial per week

Objectives
1. To impart knowledge on fundamentals of marketing, marketing environment market oriented strategic planning, marketing research and marketing communications.

Pre-requisites: Basic knowledge of principles of management

Module I (14 hours)
Introduction to marketing: Defining marketing for the twenty first century, marketing – scope, tasks, concept of market and marketing, company orientations towards the market place – production, product, selling, marketing, customer and societal marketing concepts.

Marketing environment: Controllable factors, identifying and responding to the major macro environment – uncontrollable factors – demographic, economic, natural technological, political- legal and social – cultural environment.

Module II (13 hours)

Module III (13 hours)

Module IV (14 hours)
Marketing communications – process – developing effective communications – Identification of the target audience, determination of communication objectives, Designing the message, select the communication channels, establishing the total marketing communications budget – Deciding on the marketing communications mix – promotional tools an over view – advertising, sales promotion, public relations and publicity, sales force and direct marketing- developing and managing an advertising program – setting objectives, deciding budget, choosing message – an overview on measuring effectiveness of a media – sales promotion – purpose, major decisions.

Text Books

Reference Books

**Internal Continuous Assessment** *(Maximum Marks-50)*
60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Attendance and Regularity in the class
University Examination Pattern

**PART A:** Analytical/problem solving SHORT questions

8x 5 marks = 40 marks

Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

**PART B:** Analytical/Problem solving DESCRIPTIVE questions

4 x 15 marks = 60 marks

Two questions from each module with choice to answer one question.

*Maximum Total Marks: 100*

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**ME14 804(B) Aerospace Engineering**

**Teaching scheme**

Credits: 4

3 hours lecture and 1 hour tutorial per week

**Objectives**

1. To impart the concepts of aerospace engineering.
2. To develop understanding about aerofoil theory and airplane performance.

**Pre-requisites:** Basic knowledge of fluid mechanics and gas dynamics

**Module I (14 hours)**


**Module II (13 hours)**


**Module III (14 hours)**


**Module IV (13 hours)**


**Text Books**


**Reference Books**
Dommasch, *Airplane Aerodynamics*,
Houghton, Brock, *Aerodynamics for Engineering Students*,

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

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Attendance and Regularity in the class

**University Examination Pattern**

PART Analytical/problem solving SHORT questions

A: 8x 5 marks=40

Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

PART Analytical/Problem solving DESCRIPTIVE questions

B: 4 x 15 marks=60

Two questions from each module with choice to answer one question.

Maximum Total Marks: 100

**ME14  804(C) Energy Engineering and Management**

**Teaching scheme**  Credits: 4
3 hours lecture and 1 hour tutorial per week

**Objectives**

1. To provide knowledge on energy conservation and management.
2. To impart the basics of renewable energy technology

**Module I (13 hours)**


**Module II (14 hours)**

**Energy conservation**: Industrial energy use – energy surveying and auditing – energy index – energy cost – energy conservation in engineering and process industry, in thermal systems, in buildings and non conventional energy resources schemes.

**Module III (14 hours)**

**Energy technologies**: Fluidized bed combustion – fluidized bed boilers – waste heat recovery systems – heat pump and refrigerators – wind energy collectors and storage systems – insulated pipe work systems.

**Module IV (13 hours)**

Text Books

Reference Books

Internal Continuous Assessment (Maximum Marks-50)
60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Attendance and Regularity in the class

University Examination Pattern

PART Analytical/problem solving SHORT questions

A: 8x 5 marks=40

Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

PART Analytical/Problem solving DESCRIPTIVE questions

B: 4x 15 marks=60

Two questions from each module with choice to answer one question.

Maximum Total Marks: 100

ME14  804(D) Cryogenic Engineering

Teaching scheme  Credits: 4
3 hours lecture and 1 hour tutorial per week

Objectives
1. To provide knowledge on basics of low temperature production and applications

Pre-requisites: Basic knowledge of thermodynamics and refrigeration

Module I (13 hours)
Introduction to Cryogenic Systems, Historical development, Low Temperature properties of Engineering Materials, Mechanical properties- Thermal properties- Electric and magnetic properties –Cryogenic fluids and their properties. Applications of Cryogenics: Applications in space, Food Processing, super Conductivity, Electrical Power, Biology, Medicine, Electronics and Cutting Tool Industry.

Module II (16 hours)
Gas liquefaction systems: Introduction - Production of low temperatures- General Liquefaction systems-
Liquefaction systems for Neon, Hydrogen and Helium – Critical components of Liquefaction systems.

Module III (12 hours)
Cryogenic Refrigeration systems: Ideal Refrigeration systems - Refrigeration using liquids and gases as refrigerant - Refrigerators using solids as working media, cryogenic fluid storage and transfer systems.

Module IV (13 hours)

Text Books

Reference Books
2. R. B. Scott, *Cryogenic Engineering*
3. J. H. Boll Jr., *Cryogenic Engineering*

Internal Continuous Assessment (Maximum Marks-50)
60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Attendance and Regularity in the class

University Examination Pattern

**PART A:** Analytical/problem solving SHORT questions

Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

\[ 8 \times 5 \text{ marks} = 40 \text{ marks} \]

**PART B:** Analytical/Problem solving DESCRIPTIVE questions

Two questions from each module with choice to answer one question.

\[ 4 \times 15 \text{ marks} = 60 \text{ marks} \]

Maximum Total Marks: 100

**ME14 804(E) Control System Engineering**

Teaching scheme: 3 hours lecture and 1 hour tutorial per week

Objectives

*To provide knowledge on basics of control system*

**Pre-requisites: Basic mathematics**

**Module I (14 hours)**

**Module II (13 hours)**
Classification of control systems-Transient response analysis-first and second order representations- Derivation of Transfer functions.

**Module III (14 hours)**

**Module IV (13 hours)**
Math lab fundamentals- linear and non linear systems –matrix, tensor representations of control systems – solutions by math lab (simple examples).

**Reference Books**
1. R. K. Jain, *Mechanical and Industrial Measurements*
3. E. O. Doeblin, *Measurements System, Application and Design*
5. B. Kuo, *Control Systems, Prentice Hall*

**Internal Continuous Assessment (Maximum Marks-50)**
60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Attendance and Regularity in the class

**University Examination Pattern**

**PART A: Analytical/problem solving SHORT questions**

$8 \times 5$ marks = 40 marks

Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

**PART B: Analytical/Problem solving DESCRIPTIVE questions**

$4 \times 15$ marks = 60 marks

Two questions from each module with choice to answer one question.

*Maximum Total Marks: 100*

**ME14  804 (F) Industrial Tribology**

Teaching scheme: Credits: 4

University of Calicut

3 hours lecture and 1 hour tutorial per week

**Objectives**

To impart knowledge on theory of lubrication, finite journal and thrust bearings, hydrodynamic gas bearing and theory of friction and wear

**Pre-requisites:** Basics of material science and mechanics

**Module I (13 Hours)**


**Module II (13 Hours)**


**Module III (14 Hours)**


**Module IV (14 Hours)**


**Text books:**


**Referne Books:**


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

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Attendance and Regularity in the class

University of Calicut

University Examination Pattern

PART A: Analytical/problem solving SHORT questions

Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

\[ 8 \times 5 \text{ marks} = 40 \text{ marks} \]

PART B: Analytical/Problem solving DESCRIPTIVE questions

Two questions from each module with choice to answer one question.

\[ 4 \times 15 \text{ marks} = 60 \text{ marks} \]

ME14 804 (G) Wind Energy and its Utilization

Teaching scheme: 3 hours lecture and 1 hour tutorial per week

Credits: 4

Maximum Total Marks: 100

Module I – (14 Hours)
- Historical developments, latest developments, state of art of wind energy technology, turbine rating, cost of energy, wind power plant economics, installation and operation costs, decommissioning, Indian scenario and worldwide developments, present status and future trends.
- Nature of atmospheric winds; wind resource characteristics and assessment; anemometry; wind statistics; speed frequency distribution, effect of height, wind rose, Weibull distribution, atmospheric turbulence, gust wind speed, effect of topography.

Module II – (13 Hours)
- Aerodynamics of aerofoil; lift; drag; stall; effect of Reynold’s number; actuator disc; momentum theory and Betz coefficient; design of wind turbine blade; effect of stall and blade pitch on coefficient of power vs tip speed ratio and cut-out wind speeds, blade materials. Vertical and horizontal axis turbines, design characteristics, multiple stream tube theory, vortex wake structure; tip losses; rotational sampling, wind turbine design programs, aerodynamic loads, tower shadow, wind shear, blade coning, gyroscopic, transient and extreme loads.
- Aerodynamic damping and stability, teetering motion, stiff and soft towers, Power train dynamics.

Module III – (14 Hours)
- Pitch control, yaw control, Electrical and Mechanical aerodynamic braking, teeter mechanism. Wind turbine dynamics with DC and AC generators: induction and synchronous generators, variable speed operation, effect of wind turbulence.
- Power electronics Converter and Inverter interfaces for wind energy utilization system for isolated and grid connected system.

Module IV – (13 Hours)
- Wind farm electrical design, Planning of wind farms, special application for developing countries, maintenance and operation, wind farm management, site selection. Environmental assessment; noise, visual impact etc. Instrumentation, data loggers, remote monitoring and control.

Text Book:

References:

Internal Continuous Assessment *(Maximum Marks-50)*
60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Attendance and Regularity in the class

University Examination Pattern

Analytical/problem solving SHORT questions 8x 5 marks=40 marks

PART A:
Candidates have to answer EIGHT questions out of TEN.
There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

Analytical/Problem solving DESCRIPTIVE questions 4 x 15 marks=60 marks

PART B:
Two questions from each module with choice to answer one question.

Total Marks: 100

ME14  805(A) Quality Engineering and Management
Teaching scheme  Credits: 4
3 hours lecture and 1 hour tutorial per week
Objectives
1. To analyse key definitions of quality, focusing on a customer-centric approach.
2. To provide knowledge on the managerial tools and techniques on quality
3. To analyze the relationship of statistics to a process and to use the statistical tools
4. To analyze and generate acceptance sampling plans
5. To provide knowledge on the reliability and life testing of components and systems

Module I (14 hours)

Module II (13 hours)
Management tools and techniques: Benchmarking – ISO quality management systems – Quality function
deployment – Quality by design – Failure mode and effect analysis – Affinity diagram – Block diagram – Pareto chart – Fish bone diagram – Flow chart – Run chart – Scatter diagram – Tree diagram – Matrix diagram

Module III (14 hours)
Statistical tools Control charts: Basic concepts - Attributes and variables - Random and assignable causes of variations - Patterns of variation - Measures of central tendency and dispersion – Probability distributions: Binomial, Poisson and Normal Control charts for variables, X , R and sigma charts – Details of construction and uses Control charts for attributes: p, np, c and u charts – Details of construction and uses (Numerical problems included)

Module IV (13 hours)
Statistical tools 2- Acceptance sampling, Reliability and Life testing: Sampling Vs inspection - OC curve - Single and double sampling plans - ATI - AOQL - Life testing - Bathtub curve – MTBF - OC curve for Life testing - System reliability (Numerical problems included)

Reference Books
1. M Mahajan, Statistical Quality Control, Dhanpath Rai & Co
4. Grant E.L., Stastical Quality Control, McGraw Hill

Company

Internal Continuous Assessment (Maximum Marks-50)
60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Attendance and Regularity in the class

University Examination Pattern

PART Analytical/problem solving SHORT questions
A: 8x 5 marks=40 marks
Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

PART Analytical/Problem solving DESCRIPTIVE questions
B: 4 x 15 marks=60 marks
Two questions from each module with choice to answer one question.

Maximum Total Marks: 100
ME14 805(B) Renewable Energy Technology (Global)

Teaching scheme  
Credits: 4
3 hours lecture and 1 hour tutorial per week

Module I – (14 Hours)

Module II – (13 Hours)

Module III- (13 Hours)

Module IV – (14 Hours)
Wind energy – Principles of wind energy conversion – Site selection considerations – Wind power plant design – Types of wind power conversion systems – Operation, maintenance and economics – Geothermal energy – Availability, system development and limitations – Ocean thermal energy conversion – Wave and tidal energy – Scope and economics – Introduction to integrated energy systems.

Text Books

References:

Internal Continuous Assessment (Maximum Marks-50)
60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Attendance and Regularity in the class

University of Calicut

University Examination Pattern

**PART A:** Analytical/problem solving SHORT questions  
8x 5 marks=40 marks

Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

**PART B:** Analytical/Problem solving DESCRIPTIVE questions  
4 x 15 marks=60 marks

Two questions from each module with choice to answer one question.

*Maximum Total Marks: 100*

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**ME14 805(C) – Advanced Fluid Mechanics**

**Teaching scheme**  
Credits: 4

3 hours lecture and 1 hour tutorial per week

**Module I (14 hours)**

**Basic equations of fluid flow:** Reynolds transport equation - integral and differential formulations - integral form of the equations of continuity - momentum and energy equations - use of the integral equations - differential form of these equations - Stokes postulates and constitutive equations - Navier-Stokes equations and energy equations for Newtonian fluids

**Non-dimensionalisation of the equations of motion and order of magnitude analysis:** Choice of characteristic quantities - identification of the non-dimensional parameters - classification of flows based on the characteristic Reynolds number - approximate equations for low Re and high Re flows and boundary layer equations - boundary conditions

**Module II (13 hours)**

**Some exact solutions of the Navier-Stokes equations:** Couette flows - plane Poisseuille flow - flow between rotating cylinders - Stokes problems - fully developed flow through circular and non-circular pipes

**Approximate solutions:** Creeping flow past a sphere - theory of hydrodynamic lubrication - boundary layer on a flat plate - Blassius solution and use of momentum integral equation

**Module III (14 hours)**


**Module IV (13 hours)**

**Turbulence:** Some characteristics of Turbulence flows – Randomness, non-linearity, diffusivity, vorticity and

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Text:

Reference:

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

60% - Tests (minimum 2)

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

10% - Attendance and Regularity in the class

**University Examination Pattern**

**PART A:** Analytical/problem solving SHORT questions

$8 \times 5$ marks = $40$ marks

Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

**PART B:** Analytical/Problem solving DESCRIPTIVE questions

$4 \times 15$ marks = $60$ marks

Two questions from each module with choice to answer one question.

Maximum Total Marks: 100

**ME14 805(D) Computerised Materials Management**

**Teaching scheme**

Credits: 4

3 hours lecture and 1 hour tutorial per week

**Objectives**

1. To provide knowledge on basics of advances in materials management

**Pre-requisites:** Basic knowledge of management principles
Module I (14 hours)

Module II (13 hours)
Inventory control – Basic methods in Inventory – Assumptions used in deriving models. Inventory costs and EOQ model.Price breaks and quantities – Effects of variations in lead-time and demand. Effects of shortage cost on EOQ. Systems of Inventory control, Design of Inventory control systems. Development of Computer Programme for forecasting.

Module III (14 hours)

Module IV (13 hours)

Reference Books
1. Bnchan, Kbenigsberg, Scientific Inventory Management
2. Starr, Miller, Inventory Management
4. P.Gopalakrishnan, Integrated Material management
5. Tershine, Principles of Inventory management

Internal Continuous Assessment (Maximum Marks-50)
60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Attendance and Regularity in the class

University Examination Pattern

PART Analytical/problem solving SHORT questions
A: 8x5 marks=40 marks
Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

PART Analytical/Problem solving DESCRIPTIVE questions
B: 4x15 marks=60 marks
Two questions from each module with choice to answer one question.

ME14  805 (E) Design of Pressure Vessels and Piping

Teaching scheme
3 hours lecture and 1 hour tutorial per week

Objectives
To provide knowledge on design of pressure vessels and piping

Pre-requisites: Basic knowledge of solid mechanics

Module I (13 Hours)
Methods for determining stresses - terminology and ligament efficiency - applications.

Module II (13 Hours)
Design of vessels: Design of tall cylindrical self supporting process columns - supports for short vertical vessels – stress concentration - at a variable thickness transition section in a cylindrical vessel, about a circular hole, elliptical openings. Theory of reinforcement - pressure vessel design.

Module III (14 Hours)
Bucking and fracture analysis in vessels : Buckling phenomenon - elastic Buckling of circular ring and cylinders under external pressure - collapse of thick walled cylinders or tubes under external pressure - effect of supports - elastic buckling of cylinders - buckling under combined external pressure and axial loading

Module IV (14 Hours)

Text book

Reference books
University of Calicut

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

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, design, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Attendance and Regularity in the class

**University Examination Pattern**

**PART A:** Analytical/problem solving SHORT questions

\[ 8 \times 5 \text{ marks} = 40 \text{ marks} \]

Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

**PART B:** Analytical/Problem solving DESCRIPTIVE questions

\[ 4 \times 15 \text{ marks} = 60 \text{ marks} \]

Two questions from each module with choice to answer one question.

*Maximum Total Marks: 100*

**ME14 805 (F) Industrial Maintenance**

**Teaching scheme**

3 hours lecture and 1 hour tutorial per week

**Credits:** 4

**Objectives**

1. To provide knowledge on basic concepts of maintenance, vibration monitoring, non destructive testing and concepts of reliability

**Module I (12 hours)**

Basic concepts purpose and functions of maintenance – types of maintenance – condition monitoring – principles and method – Transducers for vibration measurement.

**Module II (14 hours)**


**Module III (14 hours)**

Ferrography – spectral oil analysis procedure – non destructive testing – liquid penetrant testing – radio graphic inspection – ultra sonic testing acoustic emission corrosion monitoring – resistance techniques – technique providing information on plant regarding corrosion monitoring

**Module IV (14 hours)**


**Text Books**

Reference Books

Internal Continuous Assessment *(Maximum Marks=50)* 60% - Tests (minimum 2) 30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc. 10% - Attendance and Regularity in the class

University Examination Pattern

**PART A:** Analytical/problem solving SHORT questions

8x 5 marks=40

Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

**PART B:** Analytical/Problem solving DESCRIPTIVE questions

4 x 15 marks=60

Two questions from each module with choice to answer one question.

*Maximum Total Marks: 100*

ME14 805 (G) Tool Engineering and Design

**Teaching scheme**

Credits: 4

3 hours lecture and 1 hour tutorial per week

**Objectives**

1. To impart knowledge on basic concepts of tool design.

**Module I (14 hours)**

Design of chips forming tool, chip removal process, principle, classification of tools, tool geometry – tool materials – multi point tools – milling cutter, drills, reamer, taps, broaches, Machining time estimation for milling, drilling, cutting power estimation in milling, drilling operations, boring bar, vibration damping of bar boring.

**Module II (13 hours)**

Power presses, types, die cutting operation, press tonnage calculations – scrap-strip layout, compound & progressive dyes, design of dies for simple components, drawing dies, blank development, press tonnage and blank holding pressure, draw dies for simple components.

**Module III (14 hours)**


**Module IV (13 hours)**

Design of work holders: Purpose of work holders, function, principle of location and clamping, locators, toll forces, design of work holder for tapping, fixture components, work holders for round work pieces – mandrels, collets.

Reference Books

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

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Attendance and Regularity in the class

**University Examination Pattern**

**PART A:** Analytical/problem solving SHORT questions

Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

**PART B:** Analytical/Problem solving DESCRIPTIVE questions

Two questions from each module with choice to answer one question.

*Maximum Total Marks: 100*

**ME14  806(P) Seminar**

**Teaching scheme**

3 hours practical per week

**Credits:** 2

**Objectives**

1. To assess the ability of the student to study and present a seminar on a topic of current relevance in the field of Mechanical Engineering or allied areas

It enables the students to gain knowledge in any of the technically relevant current topics and acquire the confidence in presenting the topic. The student will undertake a detailed study on the chosen topic under the supervision of a faculty member, by referring papers published in reputed journals and conferences. Each student has to submit a seminar report, based on these papers; the report must not be reproduction of any original paper. A committee consisting of three/four faculty members will evaluate the seminar.
ME14 807(P) Project

**Teaching scheme**

Credits: 5

7 hours practical per week

**Objectives**

1. To estimate the ability of the student in transforming the theoretical knowledge studied so far into a working model or a system.

This project work is the continuation of the project initiated in seventh semester. The performance of the students in the project work shall be assessed on a continuous basis by the project evaluation committee through progress seminars and demonstrations conducted during the semester. Each project group should maintain a log book of activities of the project. It should have entries related to the work done, problems faced, solution evolved etc. There shall be at least an Interim Evaluation and a final evaluation of the project in the 8th semester. Each project group has to submit an interim report in the prescribed format for the interim evaluation. Each project group should complete the project work in the 8th semester. Each student is expected to prepare a report in the prescribed format, based on the project work. Members of the group will present the relevance, design, implementation, and results of the project before the project evaluation committee comprising of the guide, and three/four faculty members specialised in different streams in Mechanical Engineering i.e. Thermal Sciences/ Manufacturing/ Design/ Management. etc. 50% of the mark is to be awarded by the guide and 50% by the evaluation committee.

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

40% - Design and development/Simulation and analysis
30% - Presentation & demonstration of results
20% - Report
10% - Regularity in the class

ME14 808(P) Viva Voce

Credits: 3

**Objectives**

1. To examine the knowledge acquired by the student during the B.Tech. course, through an oral examination

The students shall prepare for the oral examination based on the theory and laboratory subjects studied in the B.Tech. course, seminar, and project. There is only university examination for viva-voce. University will appoint two external examiners and an internal examiner for viva-voce. These examiners shall be senior faculty members having minimum five years teaching experience at engineering degree level. For final viva-voce, candidates should produce certified reports of mini project, seminar, and project. If he/she has
undergone industrial training/industrial visit/educational tour or presented a paper in any conference, the certified report/technical paper shall also be brought for the viva-voce.

Allotment of marks for viva-voce shall be as given below.

**Assessment in Viva-voce (Maximum marks – 100)**

- 40% - Subjects
- 30% - Project
- 20% - Seminar
- 10% - Industrial training/industrial visit/educational tour or Paper presented at National-level