# Electrical,
# Electronics & Communication,
# Computer, Agricultural
# &
# Industrial Engineering

## 1st Year

# ENGINEERING MATHEMATICS I

EG ……SH

**Lecture: 3** **Year: I**
**Tutorial: 2** **Part: I**
**Practical :**
**Course Objectives:** To provide students a sound knowledge of calculus and analytic geometry to apply them in their relevant fields.

**1. Derivatives and their Applications** **(14 hours)**

1.1. Introduction
1.2. Higher order derivatives
1.3. Mean value theorem
  1.3.1. Rolle's Theorem
  1.3.2. Lagrange's mean value theorem
  1.3.3. Cauchy's mean value theorem
1.4. Power series of single valued function
  1.4.1. Taylor's series
  1.4.2. Maclaurin's series
1.5. Indeterminate forms; L'Hospital rule
1.6. Asymptotes to Cartesian and polar curves
1.7. Pedal equations to Cartesian and polar curves; curvature and radius of curvature

**2. Integration and its Applications** **(11 hours)**

2.1. Introduction
2.2. Definite integrals and their properties
2.3. Improper integrals
2.4. Differentiation under integral sign
2.5. Reduction formula; Beta Gama functions
2.6. Application of integrals for finding areas, arc length, surface and solid of revolution in the plane for Cartesian and polar curves

**3. Plane Analytic Geometry** **(8 hours)**

3.1. Transformation of coordinates: Translation and rotation
3.2. Ellipse and hyperbola; Standard forms, tangent, and normal
3.3. General equation of conics in Cartesian and polar forms

**4. Ordinary Differential Equations and their Applications**

4.1. First order and first degree differential equations
4.2. Homogenous differential equations
4.3. Linear differential equations
4.4. Equations reducible to linear differential equations; Bernoulli's equation
4.5. First order and higher degree differential equation; Clairaut's equation
4.6. Second order and first degree linear differential equations with constant coefficients.
4.7. Second order and first degree linear differential equations with variable coefficients; Cauchy's equations
4.8. Applications in engineering field

**Reference books:**


1. Erwin Kreyszig, Advance Engineering Mathematics , John Wiley and Sons Inc
2. Thomas,Finney,Calculus and Analytical geometry Addison- Wesley
3. M. B. Singh, B. C. Bajrachrya, Differential calculus, Sukunda Pustak Bhandar,Nepal
4. M. B. Singh, S. P. Shrestha, Applied Mathematics,
5. G.D. Pant, G. S. Shrestha, Integral Calculus and Differential Equations, Sunila Prakashan,Nepal
6. M. R. Joshi, Analytical Geometry, SukundaPustak Bhandar,Nepal
7. S. P. Shrestha, H. D. Chaudhary, P. R. Pokharel, A Textbook of Engineering Mathematics - Vol I
8. Santosh Man Maskey, Calculus, Ratna Pustak Bhandar, Nepal


**Evaluation Scheme**

The questions will cover all the chapters in the syllabus. The evaluation scheme will be as indicated in the table below:

| Chapters | Hours | Mark distribution* |
|---|---|---|
| 1. | 14 | 25 |
| 2. | 11 | 20 |
| 3. | 08 | 15 |
| 4. | 12 | 20 |
| **Total** | **45** | **80** |

*** There may be minor deviation in marks distribution.**

# COMPUTER PROGRAMMING

CT 401

**Lecture : 3** **Year : I**
**Tutorial :** **Part : I**
**Practical : 3**

**Course Objective:** To acquaint the student with computer software and high level programming languages. Emphasis will be given on developing computer programming skills using computer programming in C and FORTRAN languages.

**1. Overview of computer software & programming languages (2 hours)**

1.1. System software
1.2. Application software
1.3. General software features and recent trends
1.4. Generation of programming languages
1.5. Categorization of high level languages

**2. Problem solving using Computer (2 hours)**

2.1. Problem analysis
2.2. Algorithm development and Flowchart
2.3. Compilation and Execution
2.4. Debugging and Testing
2.5. Programming Documentation

**3. Introduction to 'C' programming (3 hours)**

3.1. Character set, Keywords, and Data types
3.2. Preprocessor Directives
3.3. Constants and Variables
3.4. Operators and statements

**4. Input and Output (2 hours)**

4.1. Formatted input/output
4.2. Character input/output
4.3. Programs using input/output statements

**5. Control statements (6 hours)**

5.1. Introduction
5.2. The goto, if, if … … else, switch statements
5.3. The while, do … while, for statements

**6. User-Defined Functions (4 hours)**

6.1. Introduction
6.2. Function definition and return statement
6.3. Function Prototypes
6.4. Function invocation, call by value and call by reference, Recursive Functions

**7. Arrays and Strings (6 hours)**

7.1. Defining an Array
7.2. One-dimensional Arrays
7.3. Multi-dimensional Arrays
7.4. Strings and string manipulation
7.5. Passing Array and String to function

**8. Structures (4 hours)**

8.1. Introduction
8.2. Processing a Structure
8.3. Arrays of Structures
8.4. Arrays within Structures
8.5. Structures and Function

**9. Pointers (4 hours)**

9.1. Introduction
9.2. Pointer declaration
9.3. Pointer arithmetic
9.4. Pointer and Array
9.5. Passing Pointers to a Function
9.6. Pointers and Structures

**10. Data Files (4 hours)**

10.1. Defining opening and closing a file
10.2. Input/Output operations on Files
10.3. Error handling during input/output operations

**11. Programming Language: FORTRAN (8 hours)**

11.1. Character set
11.2. Data types, Constants and variables

11.3. Arithmetic operations, Library Functions
11.4. Structure of a Fortran Program
11.5. Formatted and Unformatted Input/Output Statements
11.6. Control Structures: Goto, Logical IF, Arithmetic IF, Do loops
11.7. Arrays: one dimensional and two dimensional

**Laboratory:**

- Minimum 6 sets of computer programs in C (from Unit 4 to Unit 10) and 2 sets in FORTRAN (from unit 11) should be done individually. (30 marks out of 50 marks)
- Student (maximum 4 persons in a group) should submit mini project at the end of course. (20 marks out of 50 marks)

**References:**


1. Kelly & Pohl, "*A Book on C*", Benjamin/Cumming
2. Brian W. Keringhan & Dennis M. Ritchie, "*The 'C' Programming Language*", PHI
3. Bryons S. Gotterfried, "*Programming with C*", TMH
4. Yashavant Kanetkar, "*Let Us C*", BPB
5. D. M. Etter, "*Structured Fortran & for Engineers and Scientist*", The Benjamin/Cummings Publishing Company, Inc.
6. Rama N. Reddy and Carol A. Ziegler, "*FORTRAN 77 with Applications for Scientists and Engineers*", Jaico Publishing House
7. Alexis Leon, Mathews Leon, "*Fundamentals of Information Technology*", Leon Press and Vikas Publishing House


**Evaluation Scheme**

There will be questions covering all the chapters in the syllabus. The evaluation scheme for the question will be as indicated in the table below:

| Chapter | Hours | Mark distribution* |
|---|---|---|
| 1, 2 | 4 | 8 |
| 3, 4 | 5 | 8 |
| 5 | 6 | 10 |
| 6 | 4 | 8 |
| 7 | 6 | 10 |
| 8 | 4 | 8 |
| 9 | 4 | 8 |
| 10 | 4 | 8 |
| 11 | 8 | 12 |
| Total | 45 | 80 |

*** There may be minor deviation in marks distribution.**

# ENGINEERING DRAWING I

ME 401

**Lectures : 1** **Year : I**
**Tutorial :** **Part : I**
**Practical : 3**

**Course Objective:** To develop basic projection concepts with reference to points, lines, planes and geometrical solids. Also to develop sketching and drafting skills to facilitate communication.

**1. Instrumental Drawing, Technical Lettering Practices and Techniques (2 hours)**

1.1. Equipment and materials
1.2. Description of drawing instruments, auxiliary equipment and drawing materials
1.3. Techniques of instrumental drawing
1.4. Pencil sharpening, securing paper, proper use of T- squares, triangles, scales dividers, compasses, erasing shields, French curves, inking pens
1.5. Lettering strokes, letter proportions, use of pencils and pens, uniformity and appearance of letters, freehand techniques, inclined and vertical letters and numerals, upper and lower cases, standard English lettering forms

**2. Dimensioning (2 hours)**

2.1. Fundamentals and techniques
2.2. Size and location dimensioning, SI conversions
2.3. Use of scales, measurement units, reducing and enlarging drawings
2.4. Placement of dimensions: aligned and unidirectional

**3. Applied Geometry (6 hours)**

3.1. Plane geometrical construction: Proportional division of lines, arc & line tangents
3.2. Methods for drawing standard curves such as ellipses, parabolas, hyperbolas, involutes, spirals, cycloids and helices (cylindrical and conical)
3.3. Techniques to reproduce a given drawing (by construction)

**4. Basic Descriptive Geometry (14 hours)**

4.1. Introduction to Orthographic projection, Principal Planes, Four Quadrants or Angles
4.2. Projection of points on first, second, third and fourth quadrants
4.3. Projection of Lines: Parallel to one of the principal plane, Inclined to one of the principal plane and parallel to other, Inclined to both principal planes
4.4. Projection Planes: Perpendicular to both principal planes, Parallel to one of the principal planes and Inclined to one of the principal planes, perpendicular to other and Inclined to both principal planes
4.5. True length of lines: horizontal, inclined and oblique lines
4.6. Rules for parallel and perpendicular lines
4.7. Point view or end view of a line
4.8. Shortest distance from a point to a line
4.9. Edge View and True shape of an oblique plane
4.10. Angle between two intersecting lines
4.11. Intersection of a line and a plane
4.12. Angle between a line and a plane
4.13. Dihedral angle between two planes
4.14. Shortest distance between two skew lines
4.15. Angle between two non- intersecting (skew) lines

**5. Multi view (orthographic) projections (18 hours)**

5.1. Orthographic Projections
5.1.1. First and third angle projection
5.1.2. Principal views: methods for obtaining orthographic views, Projection of lines, angles and plane surfaces, analysis in three views, projection of curved lines and surfaces, object orientation and selection of views for best representation, full and hidden lines
5.1.3. Orthographic drawings: making an orthographic drawing, visualizing objects (pictorial view) from the given views
5.1.4. Interpretation of adjacent areas, true-length lines , representation of holes, conventional practices
5.2. Sectional Views: Full, half, broken revolved, removed (detail) sections, phantom of hidden section, Auxiliary sectional views, specifying cutting planes for sections, conventions for hidden lines, holes, ribs, spokes
5.3. Auxiliary views: Basic concept and use, drawing methods and types, symmetrical and unilateral auxiliary views. Projection of curved lines and boundaries, line of intersection between two planes, true size of dihedral angles, true size and shape of plane surfaces

**6. Developments and Intersections (18 hours)**

6.1. Introduction and Projection of Solids
6.2. Developments: general concepts and practical considerations, development of a right or oblique prism, cylinder, pyramid, and cone, development of truncated pyramid and cone, Triangulation method for approximately developed surfaces, transition pieces for connecting different shapes, development of a sphere
6.3. Intersections: lines of intersection of geometric surfaces, piercing point of a line and a geometric solid, intersection lines of two planes, intersections of - prisms and pyramids, cylinder and an oblique plane. Constructing a development using auxiliary views, intersection of - two cylinders, a cylinder & a cone

**Practical: 3 hours/week; 15 weeks**

1. Drawing Sheet Layout, Freehand Lettering, Sketching of parallel lines, circles, Dimensioning
2. Applied Geometry(Sketch and Instrumental Drawing)
3. Descriptive Geometry I: Projection of Point and Lines (4.1 to 4.3)(Sketch and Instrumental Drawing)
4. Descriptive Geometry II: Projection of Planes (4.4) (Sketch and Instrumental Drawing)
5. Descriptive Geometry III: Applications in Three dimensional Space (4.5 to 4.15) (Sketch and Instrumental Drawing)
6. Multiview Drawings (5.1) (Sketch and Instrumental Drawing)
7. Multiview, Sectional Drawings and Dimensioning I (5.2)(Sketch and Instrumental Drawing)
8. Multiview, Sectional Drawings and Dimensioning II (5.2) (Sketch and Instrumental Drawing)
9. Auxiliary View, Sectional Drawings and Dimensioning (5.3) (Sketch and Instrumental Drawing)
10. Projection of Regular Geometrical Solids (Sketch and Instrumental Drawing)
11. Development and Intersection I (6.1) (Sketch and Instrumental Drawing)
12. Development and Intersection II (6.2) (Sketch and Instrumental Drawing)
13. Development and Intersection III (6.3) (Sketch and Instrumental Drawing)

**References**


1. "Fundamentals of Engineering Drawing", W. J. Luzadder, Prentice Hall.
2. "Engineering Drawing and Graphic Technology", T. E. French, C. J. Vierck, and R. J. Foster, Mc Graw Hill Publshing Co.
3. "Technical Drawing", F. E. Giescke, A . Mitchell, H. C. Spencer and J. T. Dygdone, Macmillan Publshing Co.
4. "Elementary Engineering Drawing", N. D. Bhatt, Charotar Publshing House, India.
5. "A Text Book of Engineering Drawing", P. S. Gill, S. K. Kataria and Sons, India
6. "A Text Book of Engineering Drawing", R. K. Dhawan, S. Chand and Company Limited, India


**Evaluation Scheme**

The questions will cover all the chapters in the syllabus. The evaluation scheme will be as indicated in the table below:

| Chapter | Hours | Marks distribution * |
|---|---|---|
| 3 | 6 | 3 to 5 |
| 4 | 14 | 7 to 10 |
| 1, 2, 5 | 22 | 14 |
| 6 | 18 | 14 |
| Total | 60 | 40 |

*** There may be minor deviation in marks distribution.**

# ENGINEERING PHYSICS
SH 402

**Theory : 4** **Year : I**
**Tutorial : 1** **Part : I/II**
**Practical : 2**

**Course objectives:** To provide the concept and knowledge of physics with the emphasis of present day application. The background of physics corresponding to Proficiency Certificate Level is assumed.

**1. Oscillation: (7 hours)**
- 1.1. Mechanical Oscillation: Introduction
- 1.2. Free oscillation
- 1.3. Damped oscillation
- 1.4. forced mechanical oscillation
- 1.5. EM Oscillation: Free, damped and Forced electromagnetic oscillation

**2. Wave motion (2 hours)**
- 2.1. Waves and particles,
- 2.2. Progressive wave,
- 2.3. Energy, power and intensity of progressive wave

**3. Acoustics (3 hours)**
- 3.1. Reverberation,
- 3.2. Sabine' Law
- 3.3. ultrasound and its applications

**4. Physical Optics (12 hours)**

**4.1. Interference,**
- 4.1.1. Intensity in double slit interference,
- 4.1.2. Interference in thin films,
- 4.1.3. Newton's rings,
- 4.1.4. Hadinger fringes

**4.2. Diffraction,**
- 4.2.1. Fresnel and Fraunhoffer's diffraction,
- 4.2.2. intensity due to a single slit;
- 4.2.3. diffraction grating,
- 4.2.4. x-ray diffraction, x-ray for material test

**4.3. Polarization,**
- 4.3.1. double refraction,
- 4.3.2. Nichol prism, wave plates,
- 4.3.3. optical activity, specific rotation

**5. Geometrical Optics (3 hours)**
- 5.1. Lenses, combination of lenses,
- 5.2. cardinal points,
- 5.3. chromatic aberration

**6. Laser and Fiber Optics (4 hours)**

**6.1. Laser production,**
- 6.1.1. He-Ne laser,
- 6.1.2. Uses of laser

**6.2. Fiber Optics,**
- 6.2.1. self focusing,
- 6.2.2. applications of optical fiber

**7. Electrostatics (8 hours)**
- 7.1. Electric charge and force,
- 7.2. electric field and potential,
- 7.3. electrostatic potential energy,
- 7.4. capacitors, capacitor with dielectric,
- 7.5. charging and discharging of a capacitor

**8. Electromagnetism (11 hours)**

8.1. **Direct current:** Electric current,
- 8.1.1. Ohm's law, resistance and resistivity,
- 8.1.2. semiconductor and superconductor

**8.2. Magnetic fields:**
- 8.2.1. Magnetic force and Torque,
- 8.2.2. Hall effect,
- 8.2.3. cyclotron, synchrotron,
- 8.2.4. Biot-savart law,
- 8.2.5. Ampere's circuit law; magnetic fields straight conductors,
- 8.2.6. Faraday's laws, Induction and energy transformation, induced field,
- 8.2.7. LR circuit, induced magnetic field,
- 8.2.8. displacement current

**9. Electromagnetic waves (5 hours)**
- 9.1. Maxwell's equations,
- 9.2. wave equations, speed,
- 9.3. E and B fields,
- 9.4. continuity equation,
- 9.5. energy transfer

**10. Photon and matter waves** **(5 hours)**

10.1. Quantization of energy;
10.2. electrons and matter waves;
10.3. Schrodinger wave equation;
10.4. probability distribution;
10.5. one dimensional potential well;
10.6. uncertainty principle;
10.7. barrier tunneling

**References:**

Fundamentals of Physics: Halliday, Resnick, Walker (Latest Edition)
A text book of Optics: Brij Lal and Subrahmanyam (Latest edition)
Modern Engineering Physics: A. S. Basudeva
Engineering Physics: R. K. Gaur and S. L. Gupta
Waves and Oscillation: Brij Lal and Subrahmanyam

**Evaluation Scheme:**

There will be questions covering all the chapters in the syllabus. The evaluation scheme for the question will be as indicated in the table below:

| Chapter | Hours | Mark distribution* |
|---|---|---|
| 1. | 7 | 10 |
| 2. | 5 | 5 |
| 3. | 12 | 15 |
| 4. | 3 | 5 |
| 5. | 4 | 5 |
| 6. | 19 | 30 |
| 7. | 5 | 5 |
| 8. | 5 | 5 |
| **Total** | **60** | **80** |

*** There may be minor deviation in mark distribution.**

# BASIC ELECTRICAL ENGINEERING
## EE 401

**Lecture : 3** **Year : I**
**Tutorial : 1** **Part : I/II**
**Practical : 3/2**

**Course Objectives:** After completion of this course the student will understand the fundamental concept of DC, AC & 3-phase electrical circuits.

**1. General Electric System** **(6 hours)**
- 1.1. Constituent parts of an electrical system (source, load, communication & control)
- 1.2. Current flow in a circuit
- 1.3. Electromotive force and potential difference
- 1.4. Electrical units
- 1.5. Ohm's law
- 1.6. Resistors, resistivity
- 1.7. Temperature rise & temperature coefficient of resistance
- 1.8. Voltage & current sources

**2. DC circuits** **(4 hours)**
- 2.1. Series circuits
- 2.2. Parallel networks
- 2.3. Krichhhof's laws
- 2.4. Power and energy

**3. Network Theorems** **(12 hours)**
- 3.1. Application of Krichhof's laws in network solution
  - 3.1.1. Nodal Analysis
  - 3.1.2. Mesh analysis
- 3.2. Star-delta & delta-star transformation
- 3.3. Superposition theorem
- 3.4. Thevninn's theorem
- 3.5. Nortan's theorem
- 3.6. Maximum power transfer theorem
- 3.7. Reciprocity theorem

**4. Inductance & Capacitance in electric circuits** **(4 hours)**
- 4.1. General concept of capacitance
  - 4.1.1. Charge & voltage
  - 4.1.2. Capacitors in series and parallel
- 4.2. General concept of inductance
  - 4.2.1. Inductive & non-inductive circuits
  - 4.2.2. Inductance in series & parallel

**5. Alternating Quantities**
- 5.1. AC systems
- 5.2. Wave form, terms & definitions
- 5.3. Average and rms values of current & voltage
- 5.4. Phasor representation

**6. Single-phase AC Circuits**
- 6.1. AC in resistive circuits
- 6.2. Current & voltage in an inductive circuits
- 6.3. Current and voltage in an capacitive circuits
- 6.4. Concept of complex impedance and admittance
- 6.5. AC series and parallel circuit
- 6.6. RL, RC and RLC circuit analysis & phasor representation

**7. Power in AC Circuits**
- 7.1. Power in resistive circuits
- 7.2. Power in inductive and capacitive circuits
- 7.3. Power in circuit with resistance and reactance
- 7.4. Active and reactive power
- 7.5. Power factor, its practical importance
- 7.6. Improvement of power factor
- 7.7. Measurement of power in a single-phase AC circuits

**8. Three-Phase Circuit Analysis**
- 8.1. Basic concept & advantage of Three-phase circuit
- 8.2. Phasor representation of star & delta connection
- 8.3. Phase and line quantities
- 8.4. Voltage & current computation in 3-phase **balance & unbalance** circuits
- 8.5. Real and reactive power computation
- 8.6. Measurements of power & power factor in 3-phase system

**Laboratory works:**
1. Measurement of Voltage, current& power in DC circuit

Verification of Ohm's Law
Temperature effects in Resistance

2. Krichoff's Voltage & current Law
   Evaluate power from V & I
   Note loading effects of meter
3. Measurement amplitude, frequency and time with oscilloscope
   Calculate & verify average and rms value
   Examine phase relation in RL & RC circuit
4. Measurements of alternating quantities
   R, RL,RC circuits with AC excitation
   AC power, power factor, VARs, phasor diagrams
5. Three-phase AC circuits
   Measure currents and voltages in three-phase balanced AC circuits
   Prove Y-Δ transformation
   Exercise on phasor diagrams for three-phase circuits
6. Measurement of Voltage, current& power in a three-phase circuit
   Two-wattmeter method of power measurement in R, RL and RC three phase circuits
   Watts ratio curve

**References:**


1. J.R Cogdell, " Foundations of Electrical Engineering", printice Hall, Englewood Chiffs, New Jersy, 1990.
2. I.M Smith," Haughes Electrical Technology", Addison-Wesley, ISR Rprint,2000


**Evaluation Scheme**

The questions will cover all the chapters in the syllabus. The evaluation scheme will be as indicated in the table below:

| Chapter | Hours | Marks Distribution* |
|---|---|---|
| 1. | 6 | 10 |
| 2. | 4 | 5 |
| 3. | 12 | 25 |
| 4. | 4 | 5 |
| 5. | 2 | 15 |
| 6. | 6 | |
| 7. | 4 | 10 |
| 8. | 6 | 10 |

*** There may be minor deviation in marks distribution.**

# APPLIED MECHANICS

CE 401

**Lecture** : 3 **Year :** I
**Tutorial** : 2 **Part :** II

**Course Objective** : This course has been designed to provide basic knowledge of engineering mechanics to the students of all branches of engineering so that it would be helpful for them to understand structural engineering stress analysis principles in later courses or to use basics of mechanics in their branch of engineering. This course shall be considered as an introduction: common for all engineering faculties of Tribhuvan University in the first year of undergraduate. Emphasis has been given to Statics.

**1. Introduction (2 hours)**

1.1 Definitions and scope of Applied Mechanics
1.2 Concept of Rigid and Deformed Bodies
1.3 Fundamental concepts and principles of mechanics: Newtonian Mechanics

**2. Basic Concept in Statics and Static Equilibrium (4 hours)**

2.1 Concept of Particles and Free Body Diagram
2.2 Physical meaning of Equilibrium and its essence in structural application
2.3 Equation of Equilibrium in Two Dimension

**3. Forces acting on particle and rigid body (6 hours)**

3.1 Different types of Forces: Point, Surface Traction and Body Forces - Translational Force and Rotational Force: Relevant Examples
3.2 Resolution and Composition of Forces: Relevant Examples
3.3 Principle of Transmissibility and Equivalent Forces: Relevant Examples
3.4 Moments and couples: Relevant Examples
3.5 Resolution of a Force into Forces and a Couple: Relevant Examples
3.6 Resultant of Force and Moment for a System of Force: Examples

**4. Center of Gravity, Centroid and Moment of Inertia (6 hours)**

4.1 Concepts and Calculation of Centre of Gravity and Centroid: Examples
4.2 Calculation of Second Moment of Area / Moment of Inertia and Radius of Gyration: And Relevant usages
4.3 Use of Parallel axis Theorem: Relevant Examples

**5. Friction (2 hours)**

5.1 Laws of Friction, Static and Dynamic Coefficient of Friction, Angle of Friction: Engineering Examples of usage of friction
5.2 Calculations involving friction in structures: Example as High Tension Friction Grip bolts and its free body diagram

**6. Analysis of Beams and Frames (9 hours)**

6.1 Introduction to Structures: Discrete and Continuum
6.2 Concept of Load Estimating and Support Idealizations: Examples and Standard symbols
6.3 Use of beams/frames in engineering: Concept of rigid joints/distribute loads in beams/frames.
6.4 Concept of Statically/Kinematically Determinate and Indeterminate Beams and Frames: Relevant Examples
6.5 Calculation of Axial Force, Shear Force and Bending Moment for Determinate Beams and Frames
6.6 Axial Force, Shear Force and Bending Moment Diagrams and Examples for drawing it.

**7. Analysis of Plane Trusses (4 hours)**

7.1 Use of trusses in engineering: Concept of pin joints/joint loads in trusses.
7.2 Calculation of Member Forces of Truss by method of joints: Simple Examples
7.3 Calculation of Member Forces of Truss by method of sections: Simple Examples

**8. Kinematics of Particles and Rigid Body (7 hours)**

8.1 Rectilinear Kinematics: Continuous Motion
8.2 Position, Velocity and Acceleration of a Particle and Rigid Body
8.3 Determination of Motion of Particle and Rigid Body
8.4 Uniform Rectilinear Motion of Particles
8.5 Uniformly Accelerated Rectilinear Motion of Particles
8.6 Curvilinear Motion: Rectangular Components with Examples of Particles

**9. Kinetics of Particles and Rigid Body: Force and Acceleration (5 hours)**

9.1 Newton's Second Law of Motion and momentum
9.2 Equation of Motion and Dynamic Equilibrium: Relevant Examples
9.3 Angular Momentum and Rate of Change
9.4 Equation of Motion-Rectilinear and Curvilinear
9.5 Rectangular: Tangential and Normal Components and Polar Coordinates: Radial and Transverse Components

**Tutorials:**

***There shall be related tutorials exercised in class and given as regular homework exercises. Tutorials can be as following for each specified chapters.***

1. **Introduction** **(1 hour)**
   A. Theory; definition and concept type questions.
2. **Basic Concept in Statics and Static Equilibrium** **(2 hours)**
   A. Theory; definition and concept type questions.
3. **Concept of Force acting on structures** **(3 hours)**
   A. Practical examples; numerical examples and derivation types of questions.
   B. There can be tutorials for each sub-section.
4. **Center of Gravity, Centroid and Moment of Inertia** **(4 hours)**
   A. Concept type; numerical examples and practical examples type questions.
5. **Friction** **(2 hours)**
   A. Definition type; Practical example type and numerical type questions.
6. **Analysis of Beam and Frame** **(6 hours)**
   A. Concept type; definition type; numerical examples type with diagrams questions.
   B. There can be tutorials for each sub-section.
7. **Analysis of Plane Trusses**
   A. Concept type; definition type; numerical examples type questions.
   B. There can be tutorials for each sub-section.
8. **Kinematics of Particles and Rigid Body** **(4 hours)**
   A. Definition type; numerical examples type questions.
   B. There can be tutorials for each sub-section.
9. **Kinetics of Particles and Rigid Body: Force and Acceleration** **(4 hours)**
   A. Concept type; definition type; numerical examples type questions.
   B. There can be tutorials for each sub-section.

**References:**


1. "Mechanics of Engineers- Statics and Dynamics", F.P. Beer and E.R.Johnston, Jr. 4th Edition, Mc Graw-Hill, 1987.
2. "Engineering Mechanics-Statics and Dynamics", R.C. Hibbeler, Ashok Gupta. 11th edition., New Delhi, Pearson, 2009.
3. "Engineering Mechanics- Statics and Dynamics", I.C. Jong and B.G. Rogers
4. "Engineering Mechanics- Statics and Dynamics", D.K. Anand and P.F. Cunnif
5. "A Text Book of Engineering Mechanics", R.S. Khurmi
6. "Applied Mechanics and Strength of Materials", R.S.Khurmi
7. "A Text Book of Applied Mechanics", I.B.Prasad
8. "Engineering Mechanics-Statics and Dynamics", Shame, I.H. 3rd ed., New Delhi, Prentice Hall of India, 1990.


**Evaluation Scheme**

The questions will cover all the chapters of the syllabus. The evaluation scheme will be as indicated in the table below:

| Chapter | Hours | Mark Distribution* |
|---|---|---|
| 1 | 2 | 3 |
| 2 | 4 | 8 |
| 3 | 6 | 12 |
| 4 | 6 | 12 |
| 5 | 2 | 4 |
| 6 | 9 | 13 |
| 7 | 4 | 8 |
| 8 | 7 | 10 |
| 9 | 5 | 10 |
| **Total** | **45** | **80** |

*** There may be minor deviation in marks distribution.**

# ENGINEERING MATHEMATICS II
SH 451

**Lecture: 3** **Year: 1**
**Tutorial: 2** **Part: II**
**Practical**

**Course Objectives:**
i) To develop the skill of solving differential equations and to provide knowledge of vector algebra and calculus
ii) To make students familiar with calculus of several variables and infinite series

**1. Calculus of two or more variables (6 hours)**
- 1.1. Introduction: limit and continuity
- 1.2. Partial derivatives
  - 1.2.1. Homogeneous function, Euler's theorem for the function of two and three variables
  - 1.2.2. Total derivatives
- 1.3. Extrema of functions of two and three variables; Lagrange's Multiplier

**2. Multiple Integrals (6 hours)**
- 2.1. Introduction
- 2.2. Double integrals in Cartesian and polar form; change of order of integration
- 2.3. Triple integrals in Cartesian, cylindrical and spherical coordinates;
- 2.4. Area and volume by double and triple integrals

**3. Three Dimensional Solid Geometry (11 hours)**
- 3.1. The straight line; Symmetric and general form
- 3.2. Coplanar lines
- 3.3. Shortest distance
- 3.4. Sphere
- 3.5. Plane Section of a sphere by planes
- 3.6. Tangent Planes and lines to the spheres
- 3.7. Right circular cone
- 3.8. Right circular cylinder

**4. Solution of Differential Equations in Series and Special Functions (9 hours)**
- 4.1. Solution of differential equation by power series method
- 4.2. Legendre's equation
- 4.3. Legendre polynomial function; Properties and applications.
- 4.4. Bessel's equation
- 4.5. Bessel's function of first and second kind. Properties and applications

**5. Vector Algebra and Calculus (8 hours)**
- 5.1. Introduction
- 5.2. Two and three dimensional vectors
- 5.3. Scalar products and vector products
- 5.4. Reciprocal System of vectors
- 5.5. Application of vectors: Lines and planes
- 5.6. Scalar and vector fields
- 5.7. Derivatives – Velocity and acceleration
- 5.8. Directional derivatives

**6. Infinite Series (5 hours)**
- 6.1. Introduction
- 6.2. Series with positives terms
- 6.3. convergence and divergence
- 6.4. Alternating series. Absolute convergence
- 6.5. Radius and interval of convergence

**Reference books:**

1. Erwin Kreyszig, Advanced Engineering Mathematics , John Wiley and Sons Inc
2. Thomas, Finney, Calculus and Analytical geometry Addison- Wesley
3. M. B. Singh, B. C. Bajrachrya, Differential calculus, Sukunda Pustak Bhandar,Nepal
4. M. B. Singh, B. C. Bajrachrya, A text book of Vectors, Sukunda Pustak Bhandar,Nepal
5. M. B. Singh, S. P. Shrestha, Applied Mathematics,
6. G.D. Pant, G. S. Shrestha, Integral Calculus and Differential Equations, Sunila Prakashan,Nepal
7. Y. R. Sthapit, B. C. Bajrachrya, A text book of Three Dimensional Geometry, Sukunda Pustak Bhandar,Nepal
8. Santosh Man Maskey, Calculus, Ratna Pustak Bhandar, Nepal


**Evaluation Scheme:**
The questions will cover all the chapters in the syllabus. The evaluation scheme will be as indicated in the table below:

| Chapter | Hours | Mark distribution * |
|---|---|---|
| 1. | 06 | 10 |
| 2. | 06 | 10 |
| 3. | 11 | 20 |
| 4. | 09 | 15 |
| 5. | 08 | 15 |
| 6. | 05 | 10 |
| **Total** | **45** | **80** |

*** There may be minor deviation in marks distribution.**

# ENGINEERING DRAWING II

ME 451

**Lecture: 1** **Year: 1**
**Tutorial: 0** **Part: II**
**Practical: 3**

**COURSE OBJECTIVE:** To make familiar with the conventional practices of sectional views. To develop basic concept and skill of pictorial drawing and working drawings. Also to make familiar with standard symbols of different engineering fields.

**COURSE OUTLINE:**

**1. Conventional Practices for Orthographic and Sectional Views (12hours)**

- **1.1** Conventional Practices in Orthographic views: Half Views and Partial Views, Treatment of Unimportant Intersections, Aligned Views, Treatment for Radially Arranged Features, Representation of Fillets and Rounds
- **1.2** Conventional Practices in Sectional views: Conventions for Ribs, Webs and Spokes in Sectional View, Broken Section, Removed Section, Revolved Section, Offset Section, Phantom Section and Auxiliary Sectional Views
- **1.3** Simplified Representations of Standard Machine Elements

**2. Pictorial Drawings (20 ours)**

- **2.1** Classifications: Advantages and Disadvantages
- **2.2** Axonometric Projection: Isometric Projection and Isometric Drawing
  - **2.2.1** Procedure for making an isometric drawing
  - **2.2.2** Isometric and Non-isometric Lines; Isometric and Non-isometric Surfaces
  - **2.2.3** Angles in Isometric Drawing
  - **2.2.4** Circles and Circular Arcs in Isometric Drawing
  - **2.2.5** Irregular Curves in Isometric Drawing
  - **2.2.6** Isometric sectional Views
- **2.3** Oblique Projection and Oblique Drawing
  - **2.3.1** Procedure for making an Oblique drawing
  - **2.3.2** Rules for Placing Objects in Oblique drawing
  - **2.3.3** Angles, Circles and Circular Arcs in Oblique drawing
- **2.4** Perspective Projection
  - **2.4.1** Terms used in Perspective Projection
  - **2.4.2** Parallel and Angular Perspective
  - **2.4.3** Selection of Station Point

**3. Familiarization with Different Components and Conventions (8 hours)**

- **3.1 Limit Dimensioning and Machining Symbols**
  - **3.1.1** Limit, Fit and Tolerances
  - **3.1.2** Machining Symbols and Surface Finish
- **3.2 Threads, Bolts and Nuts**
  - **3.2.1** Thread Terms and Nomenclature, Forms of Screw Threads
  - **3.2.2** Detailed and Simplified Representation of Internal and External Threads
  - **3.2.3** Thread Dimensioning
  - **3.2.4** Standard Bolts and Nuts: Hexagonal Head and Square Head
  - **3.2.5** Conventional Symbols for Bolts and Nuts
- **3.3 Welding and Riveting**
  - **3.3.1** Types of Welded Joints and Types of Welds, Welding Symbols
  - **3.3.2** Forms and Proportions for Rivet Heads, Rivet Symbols, Types of Riveted Joints: Lap Joint, Butt Joint
- **3.4 Familiarization with Graphical Symbols and Conventions in Different Engineering Fields**
  - **3.4.1** Standard Symbols for Civil, Structural and Agricultural Components
  - **3.4.2** Standard Symbols for Electrical, Mechanical and Industrial Components
  - **3.4.3** Standard Symbols for Electronics, Communication and Computer Components
  - **3.4.4** Topographical Symbols
- **3.5 Standard Piping Symbols and Piping Drawing**

**4. Detail and Assembly Drawings (20 hours)**

- **4.1** Introduction to Working Drawing
- **4.2** Components of Working Drawing: Drawing Layout, Bill of Materials, Drawing Numbers
- **4.3** Detail Drawing
- **4.4** Assembly Drawing
- **4.5** Practices of Detail and Assembly Drawing: V-block Clamp, Centering Cone, Couplings, Bearings, Antivibration Mounts, Stuffing Boxes, Screw Jacks, etc

**Practicals: 3 hrs/week**

1. Conventional Practices for Orthographic and Sectional Views (Full and Half Section)
2. Conventional Practices for Orthographic and Sectional Views (Other Type Sections)
3. Isometric Drawing
4. Isometric Drawing (Consisting of Curved Surfaces and Sections)
5. Oblique Drawing
6. Perspective Projection
7. Familiarization with Graphical Symbols (Limit, Fit, Tolerances and Surface Roughness Symbols)
8. Familiarization with Graphical Symbols (Symbols for Different Engineering Fields)
9. Detail Drawing
10. Assembly Drawing I
11. Assembly Drawing II
12. Building Drawing

**References:**


1. " Fundamentals of Engineering Drawing", W. J. Luzadder, Prentice Hall, 11th Edition.
2. "Engineering Drawing and Graphic Technology", T. E. French, C. J. Vierck, and R. J. Foster, Mc Graw Hill Publshing Co,1992.
3. "Technical Drawing", F. E. Giescke, A . Mitchell, H. C. Spencer and J. T. Dygdone, Macmillan Publshing Co, 10th Edition.
4. "Machine Drawing", N. D. Bhatt, Charotar Publshing House, India, 1991.
5. "Machine Drawing", P. S. Gill, S. K. Kataria and Sons, India,7th Edition, 2008.
6. "Machine Drawing", R. K. Dhawan, S. Chand and Company Limited, India, 1992.


**Evaluation Scheme**

The questions will cover all the chapters in the syllabus. The evaluation scheme will be as indicated in the table below:

| Chapter | Hours | Mark Distribution* |
|---|---|---|
| 1 | 12 | 6 to 8 |
| 2 | 20 | 13 to 15 |
| 3 | 8 | 5 |
| 4 | 20 | 13 to 15 |
| **Total** | **60** | **40** |

*There may be minor deviation in mark distribution.

# BASIC ELECTRONICS ENGINEERING

EX 451

**Lecture : 3** **Year : I**
**Tutorial : 1** **Part : II**
**Practical : 3/2**

**Course Objectives:**

- To understand the language of electronics, elements and their functionality
- Basic understanding of analog systems and their applications
- Basic understanding of digital systems and their applications

**1. Basic Cirtuits Concepts (4 hours)**

1.1 Passive components: Resistance, Inductance, Capacitance; series, parallel combinations; Kirchhoff's law: voltage, current; linearity
1.2 Signal sources: voltage and current sources; nonideal sources; representation under assumption of linearity; controlled sources: VCVS, CCVS, VCCS, CCCS; concept of gain, transconductance, transimpedance.
1.3 Superposition theorem; Thevenin's theorem; Norton's theorem
1.4 Introduction to filter

**2. Diodes (7 hours)**

2.1 Semiconductor diode characteristics
2.2 Modeling the semiconductor diode
2.3 Diode circuits: clipper; clamper circuits
2.4 Zener diode, LED, Photodiode, varacters diode, Tunnel diodes
2.5 DC power supply: rectifier-half wave, full wave (center tapped, bridge), Zener regulated power supply

**3. Transistor (4 hours)**

3.1 BJT configuration and biasing, small and large signal model
3.2 T and μ model
3.3 Concept of differential amplifier using BJT
3.4 BJT switch and logic circuits
3.5 Construction and working principle of MOSFET and CMOS
3.6 MOSFET as logic circuits

**4. The Operational Amplifier and Oscillator (7 hours)**

4.1 Basic model; virtual ground concept; inverting amplifier; non-inverting amplifier; integrator; differentiator, summing amplifier and their applications
4.2 Basic feedback theory; positive and negative feedback; concept of stability; oscillator
4.3 Waveform generator using op-amp for Square wave, Triangular wave Wien bridge oscillator for sinusoidal waveform

**5. Communication System (4 hours)**

5.1 Introduction
5.2 Wired and wireless communication system
5.3 EMW and propagation, antenna, broadcasting and communication
5.4 Internet / intranet
5.5 Optical fiber

**6. Digital Electronics (11 hours)**

6.1 Number systems, Binary arithmetic
6.2 Logic gates: OR, NOT, AND NOR, NAND, XOR, XNOR gate; Truth tables
6.3 Multiplexers; Demux, Encoder, Decoder
6.4 Logic function representation
6.5 Combinational circuits: SOP, POS form; K-map;
6.6 Latch, flip-flop: S-R flip-flop; JK master slave flip-flop; D-flip flop
6.7 Sequential circuits: Generic block diagram; sift registers; counters

**7. Application of Electronic System (5 hours)**

7.1 Instrumentation system: Transducer, strain gauge, DMM, Oscilloscope
7.2 Regulated power supply
7.3 Remote control, character display, clock, counter, measurements, date logging, audio video system

**Laboratory:**

1. Familiarization with passive components, function generator and oscilloscope
2. Diode characteristics, rectifiers, Zener diodes
3. Bipolar junction transistor characteristics and single stage amplifier
4. Voltage amplifiers using op-amp, Comparators, Schmitt
5. Wave generators using op-amp
6. Combinational and sequential circuits

**References**


1. Robert Boylestad and Louis Nashelsky, "Electronic Devices and Circuit Theory" PHI; 8th Edition.200
2. Thomas L. Floyd, "Electronic Devices" 8th Edition, Pearson Education, Inc., 2007
3. A.S. Sedra and K.C. Smith, "Microelectronic Circuits", 6th Edition, Oxford University Press, 2006

**Evaluation Scheme**

**The questions will cover all the chapters of the syllabus. The evaluation scheme will be as indicated in the table below:**

| Chapter | Hour | Mark Distribution* |
|---|---|---|
| 1 | 4 | 8 |
| 2 | 7 | 12 |
| 3 | 7 | 10 |
| 4 | 7 | 10 |
| 5 | 4 | 10 |
| 6 | 11 | 12 |
| 7 | 5 | 10 |
| 2, 3, 4, 5, 7 | | 8 |
| **Total** | **45** | **80** |

***There may be minor deviation in marks distribution.**

# ENGINEERING CHEMISTRY
SH 453

**Theory : 3** **Year : I**
**Tutorial : 1** **Part : I/II**
**Practical : 3**

**Course objectives:** To develop the basic concepts of Physical Chemistry, Inorganic Chemistry and Organic Chemistry relevant to problems in engineering.

**1. Electro-chemistry and Buffer (6 hours)**
- 1.1. Electro-chemical cells
- 1.2. Electrode Potential and Standard Electrode Potential
- 1.3. Measurement of Electrode Potential
- 1.4. Nernst equation
- 1.5. EMF of Cell
- 1.6. Application of Electrochemical and Electrolytic cells
- 1.7. Electrochemical Series and its Application
- 1.8. Buffer: its type and mechanism
- 1.9. Henderson's equation for pH of buffer and related problems
- 1.10. Corrosion and its type
- 1.11. Factors influencing corrosion
- 1.12. Prevention of corrosion

**2. Catalyst (4 hours)**
- 2.1. Introduction
- 2.2. Action of Catalyst (Catalytic Promoters and Catalytic Poisons)
- 2.3. Characteristics of Catalyst
- 2.4. Types of Catalyst
- 2.5. Theories of Catalysis
- 2.6. Industrial Applications of Catalysts

**3. Environmental Chemistry (5 hours)**
- 3.1. Air Pollution
- 3.2. Air Pollutants i) gases $SO_x$,$NO_x$,CO,$CO_2$,$O_3$ and hydrocarbons ii)particulates dust, smoke and fly ash
- 3.3. Effects of Air Pollutants on human beings and their possible remedies
- 3.4. Ozone depletion and its photochemistry
- 3.5. Water Pollution (Ref of surface water and pound water)
- 3.6. Water Pollutants (Ref of surface water) their adverse effect and remedies
- 3.7. Soil pollution
- 3.8. Pollutants of soil their adverse effects and possible remedies

**4. Engineering Polymers (6 hours)**
- 4.1. Inorganic polymers
- 4.2. General properties of inorganic polymers
- 4.3. Polyphosphazines
- 4.4. Sulpher Based Polymers
- 4.5. Chalcogenide Glasses
- 4.6. Silicones
- 4.7. Organic Polymers
- 4.8. Types of Organic Polymers
- 4.9. Preparation and application of i) Polyurethane ii) Polystyrene iii) Polyvinylchloride iv) Teflon v) Nylon 6,6 and vi) Bakelite vii) Epoxy Resin viii) Fiber Reinforced Polymer
- 4.10. Concept of bio-degradable, non-biodegradable and conducting polymers

**5. 3-d Transition elements and their applications (5 hours)**
- 5.1. Introduction
- 5.2. Electronic Configuration
- 5.3. Variable oxidation states
- 5.4. Complex formation tendency
- 5.5. Color formation
- 5.6. Magnetic properties
- 5.7. Alloy formation
- 5.8. Applications of 3-d transition elements

**6. Coordination Complexes (5 hours)**
- 6.1. Introduction
- 6.2. Terms used in Coordination Complexes
- 6.3. Werner's Theory Coordination Complexes
- 6.4. Sidgwick's model and Sidgwick's effective atomic number rule
- 6.5. Nomenclature of coordination compounds (Neutral type, simple cation and complex anion and complex cation and simple anion type)
- 6.6. Valence Bond Theory of Complexes
- 6.7. Application of valence bond theory in the formation of i) Tetrahedral Complexes ii) Square planar Complexes and iii) Octahedral Complexes
- 6.8. Limitations of Valence Bond Theory
- 6.9. Applications of Coordination Complexes

**7. Explosives (3 hours)**
- 7.1. Introduction
- 7.2. Types of explosives: Primary, Low and High explosives

7.3. Preparation and application of TNT, TNG, Nitrocellulose and Plastic explosives

**8. Lubricants and Paints (2 hours)**

8.1. Introduction
8.2. Function of Lubricants
8.3. Classification of Lubricants (Oils, Greases and Solid)
8.4. Paints
8.5. Types of Paint
8.6. Application of Paints

**9. Stereochemistry (4 hours)**

9.1. Introduction
9.2. Geometrical Isomerism (Cis Trans Isomerism) Z and E concept of Geometrical Isomerism
9.3. Optical Isomerism with reference to two asymmetrical carbon center molecules
9.4. Terms Optical activity, Enantiomers, Diastereomers, Meso structures, Racemic mixture and Resolution

**10. Reaction Mechanism in Organic reactions (4 hours)**

10.1. Substitution reaction
10.2. Types of substitution reaction $SN^1$ and $SN^2$
10.3. Elimination reaction
10.4. Types of elimination reaction El and E2
10.5. Factors governing $SN^1$, $SN^2$, El and E2 reaction mechanism path

**References**


- Engineering Chemistry by Jain and Jain
- A Text Book of Engineering Chemistry by Shashi Chawala
- A New Concise Inorganic Chemistry by J.D. Lee
- Principles of Physical Chemistry by Marron and Prutton
- Essential of Physical Chemistry by Bahl and Tuli
- Advanced Inorganic Chemistry Vol 1 and 2 by Satya Prakash and Tuli
- Organic chemistry by Morrison and Boyd
- Selected Topics in Physical Chemistry by Moti Kaji Sthapit
- Environmental Engineering by Peavy, Rowe and Tchobanoglous


**Chemistry Practical Course for all**
**Practical 3 Periods per Week**

1. Compare the alkalinity of different water samples by double indicator method
2. Determine the temporary and permanent hardness of water by EDTA Complexo-metric method
3. Determine residual and combined chlorine present in the chlorinated sample of water by Iodometric method
4. Prepare organic polymer nylon 6,6/ Bakelite in the laboratory
5. Determine the pH of different sample of buffer solution by universal indicator method
6. Prepare inorganic complex in the laboratory
7. Determine surface tension of the given detergent solution and compare its cleansing power with other detergent solutions
8. Construct an electrochemical cell in the laboratory and measure the electrode potential of it
9. Estimate the amount of iron present in the supplied sample of ferrous salt using standard potassium permanganate solution (redox titration)

6 Periods

**Evaluation Scheme**

There will be questions covering all the chapters in the syllabus. The evaluation scheme for the question will be as indicated in the table below:

| Chapter | Hours | Marks distribution* |
|---|---|---|
| 1 | 6 | 10 |
| 2 | 4 | 5 or 10 |
| 3 | 5 | 10 |
| 4 | 6 | 10 |
| 5 | 5 | 10 |
| 6 | 5 | 10 |
| 7 | 3 | 5 |
| 8 | 3 | 5 |
| 9 | 4 | 5 or 10 |
| 10 | 4 | 5 or 10 |
| **Total** | **45** | **80** |

* **There may be minor deviation in marks distribution.**

# FUNDAMENTALS OF THERMODYNAMICS AND HEAT TRANSFER

ME 452

**Lectures : 3** **Year : I**
**Tutorial : 1** **Part : I/II**
**Practical : 1.5**

**Course Objectives:** After the completion of this course, students will able to understand basic concepts, laws of thermodynamics and heat transfer and their applications as well.

**1. Introduction (4 hours)**

1.1. Definition and Scope of Engineering Thermodynamics
1.2. Value of energy to society
1.3. Microscopic versus Macroscopic Viewpoint
1.4. Concepts and Definitions
  1.4.1. System, Surroundings, Boundary and Universe; Closed Systems, Open Systems, and Isolated Systems
  1.4.2. Thermodynamic Properties: Intensive, Extensive and Specific Properties
  1.4.3. Thermodynamic Equilibrium
  1.4.4. State, Process, and Path
    Cyclic Process, Quasi-equilibrium Process, Reversible and Irreversible Process
  1.4.5. Common Properties: Pressure, Specific Volume, Temperature
1.5. Zeroth Law of Thermodynamics, Equality of Temperature

**2. Energy and Energy Transfer (3 hours)**

2.1. Energy and its Meaning
2.2. Stored Energy and Transient Energy; Total Energy
2.3. Energy Transfer
  2.3.1. Heat Transfer
  2.3.2. Work Transfer
2.4. Expressions for displacement work transfer
2.5. Power

**3. Properties of Common Substances (6 hours)**

3.1. Pure Substance and State Postulate
3.2. Ideal Gas and Ideal Gas Relations
3.3. Two Phase (Liquid and Vapor) Systems: Phase Change; Subcooled Liquid, Saturated Liquid, Wet Mixture, Critical Point, Quality, Moisture Content, Saturated Vapor and Superheated Vapor
3.4. Properties of Two Phase Mixtures
3.5. Other Thermodynamic Properties: Internal Energy, Enthalpy, and Specific Heats
3.6. Development of Property Data: Graphical Data Presentation and Tabular Data Presentation

**4. First Law of Thermodynamics (8 hours)**

4.1. First Law of Thermodynamics for Control Mass; First Law of Thermodynamics for Control Mass Undergoing Cyclic Process
4.2. First Law of Thermodynamics for Control Volume
4.3. Control Volume Analysis: Steady State Analysis and Unsteady State Analysis
4.4. Control Volume Application: Steady and Unsteady Work Applications and Steady and Unsteady Flow Applications
4.5. Other Statements of the First Law

**5. Second Law of Thermodynamics (8 hours)**

5.1. Necessity of Formulation of Second Law
5.2. Entropy and Second Law of Thermodynamics for an Isolated System
5.3. Reversible and Irreversible Processes
5.4. Entropy and Process Relation for an Ideal Gases and Incompressible Substances
5.5. Control Mass and Control Volume Formulation of Second Law
5.6. Isentropic Process for an Ideal Gas and for an Incompressible Substances
5.7. Carnot Cycle, Carnot Efficiency
  5.7.1.1. Heat Engine and Thermal Efficiency, Heat Pump, Refrigerator and coefficient of Performance (COP)
5.8. Kelvin-Planck and Clausius Statements of the Second Law of Thermodynamics and their Equivalence

**6. Thermodynamic Cycles (8 hours)**

6.1. Classification of Cycles
6.2. Air Standard Analysis
  6.2.1. Otto Cycle
  6.2.2. Diesel Cycle
  6.2.3. Brayton Cycle
6.3. Rankine Cycle
6.4. Vapor Compression Refrigeration Cycle

**7. Introduction to Heat Transfer (8 hours)**

7.1. Basic Concepts and Modes of Heat Transfer
7.2. One dimensional steady state heat conduction through a plane wall
7.3. Radial steady state heat conduction through a hollow cylinder
7.4. Heat flow through composite structures
  7.4.1. Composite Plane Wall
  7.4.2. Multilayer tubes
7.5. Electrical Analogy for thermal resistance

7.6. Combined Heat Transfer and Overall Heat Transfer Coefficient for Plane Wall and Tube
7.7. Nature of Convection; Free and Forced Convection
7.8. Heat Radiation, Stefan's Law, Absorptivity, Reflectivity and Transmisivity; Black Body, White Body and Gray Body

**Lab Works**

**1.** Temperature Measurements
**2.** Experiment related to first law
**3.** Heat Pump
**4.** Heat Conduction
**5.** Heat Radiation

**References**


**1.** "Engineering Thermodynamics", E. Rathakrishnan, Tata Mc Graw Hill.
**2.** "Fundamentals of Engineering Thermodynamics", J. R. Howell & R. O. Buckius, McGraw Hill Publishers
**3.** "Fundamentals of Thermodynamics", V. Wylen, Sonntag & Borgnakke, 6th Edition, Wiley
**4.** "Fundamentals of Engineering Thermodynamics", M. J. Moran & H. N. Shapiro, 5th Edition, John Wiley & Sons, Inc.
**5.** "Thermodynamics: An Engineering Approach", Y. A. Cengel & M.A. Boles, 5th Edition, McGraw-Hill, 2006
**6.** "Heat Transfer", J. P. Holman, McGraw-Hill
**7.** "Heat Transfer: A Practical Approach", Y. A. Cengel, 2nd Edition, McGraw-Hill


**Evaluation Scheme**

The questions will cover all the chapters in the syllabus. The evaluation scheme will be as indicated in the table below:

| Chapter | Hours | Marks distribution * |
|---|---|---|
| 1 | 4 | 10 |
| 2 | 4 | 4 |
| 3 | 6 | 12 |
| 4 | 8 | 14 |
| 5 | 9 | 14 |
| 6 | 8 | 14 |
| 7 | 6 | 12 |
| **Total** | **45** | **80** |

*** There may be minor deviation in marks distribution.**

# WORKSHOP TECHNOLOGY

ME 453

**Lecture : 1** **Year: I**
**Practical : 3** **Part: I/II**

**Course Objective:** The subject aims at imparting knowledge and skill components in the field of basic workshop technology. It deals with different hand and machine tools required for manufacturing simple metal components and articles.

**Objectives:**

After the completion of the course, the student shall be able to

1. Practice workshop safety rules effectively
2. Acquire knowledge and use simple hand tools
3. Acquire knowledge and use simple measuring and gauging instruments
4. Operate simple drilling machines for producing small holes
5. Operate various machine tools for producing simple metal components and articles
6. Acquire knowledge and practice on foundry, forging and welding

**1. General safety Considerations (2 hours)**

- 1.1. Bench Tools
- 1.2. Machinist's Hammers
- 1.3. Screw Drivers
- 1.4. Punches
- 1.5. Chisels
- 1.6. Scrapers
- 1.7. Scribers
- 1.8. Files
- 1.9. Pliers and Cutters
- 1.10. Wrenches
- 1.11. Hacksaw
- 1.12. Bench Vise
- 1.13. Hand drill
- 1.14. Taps and Dies
- 1.15. Hand Shears
- 1.16. Rules, Tapes and Squares
- 1.17. Soldering Iron
- 1.18. Rivets

**2. Hand Working Operations (1 hours)**

- 2.1. Sawing
- 2.2. Filing
- 2.3. Threading
- 2.4. Scribing
- 2.5. Shearing
- 2.6. Soldering
- 2.7. Riveting

**3. Measuring and Gauging (1hours)**

- 3.1. Introduction
- 3.2 Semi – Precision Tools – Calipers, depth Gauge, Feeler Gauge
- 3.3 Precision Tools – Micrometers, Vernier Calipers, Vernier Height Gauge, Telescopic Gauge, Hole Gauge, Bevel Protractor, Dial Indicator, Gauge Blocks and Surface Plate

**4. Drills and Drilling Processes (1 hours)**

- 4.1 Introduction
- 4.2 Types of Drill Presses
- 4.3 Work Holding Devices and Accessories
- 4.4 Cutting Tools
- 4.5 Geometry of Drill Bits
- 4.6 Grinding of Drill Bits
- 4.7 Operations – Drilling, Counter - boring, Counter - sinking, Reaming, Honning, Lapping
- 4.8 Cutting Speeds
- 4.9 Drilling Safety

**5. Machine Tools (4 hours)**

- 5.1. General Safety Considerations
- 5.2 Engine Lathes
  - 5.2.1 Introduction
  - 5.2.2 Physical Construction
  - 5.2.3 Types of Lathe
  - 5.2.4 Lathe Operations – Facing, Turning, Threading
- 5.3 Shapers
  - 5.3.1 Introduction
  - 5.3.2 Types of Shapers
  - 5.3.3 Physical Construction
  - 5.3.4 General Applications
- 5.4 Milling Machines
  - 5.4.1 Introduction
  - 5.4.2 Types of Milling Machines
  - 5.4.3 Physical Construction
  - 5.4.4 Milling Cutters – Plain, Side, Angle, End, Form
  - 5.4.5 Milling Operations – Plain, Side, Angular, Gang, End, Form, Keyway
  - 5.4.6 Work Holding Devices

5.4.7 Cutter Holding Devices

5.5 Grinding Machines

5.5.1 Abrasives, Bonds, Grinding Wheels

5.5.2 Rough Grinders – Portable Grinders, Bench Grinders, Swing Frame Grinders, Abrasive Belt Grinders

5.5.3 Precision Grinders – Cylindrical Grinders, Surface Grinders

**6. Material Properties (1 hours)**

6.1. Tool materials – Low, medium and high carbon steels; Hot and cold rolled steels; Alloy steels; Carbide and Ceramic materials

6.2. Heat treating methods for steels – Annealing, Tempering, Normalizing, Hardening and Quenching

6.3. Non – ferrous metals – Brass, Bronze, Aluminum – Comparative Properties

**7. Sheet Metal Works (1 hours)**

7.1. Introduction

7.2. Sheet Metal Tools

7.3. Marking and Layout

7.4. Operations – Bending, Cutting, Rolling

**8. Foundry Practice (1 hours)**

8.1. Introduction

8.2. Pattern Making

8.3. Foundry Tools

8.4. Core Making

8.5. Melting Furnace – Cupola

8.6. Sand Casting Process

**9. Forging Practice (1 hours)**

9.1. Introduction

9.2. Forging Tools

9.3. Operations – Upsetting, Drawing, Cutting, Bending, Punching

9.4. Forging Presses and Hammers

9.5. Advantages and Limitations

**10. Metal Joining (2 hours)**

10.1 Safety Considerations

10.2 Introduction

10.3 Soldering

10.4 Brazing

10.5 Welding – Gas Welding, Arc Welding, Resistance Welding, Tungsten Inert Gas Welding (TIG), Metal Inert Gas Welding (MIG)

**Workshop Practice: 3 hours/week; 15 weeks**

1. Bench Tools and hand operations: Measuring, Marking, Layout, Cutting, Filling, Drilling, Tapping, Assembly
2. Bench Tools and hand operations: (Contd.)
3. Drilling machines
4. Measuring and Gauging Instruments
5. Engine lathe: Basic operations such as Plain turning, facing, cutting off, knurling.
6. Engine lathe: Taper turning, drilling and boring
7. Basic Shaper Operations
8. Milling Machines
9. Grinding Machines
10. Sheet Metal works
11. Foundry Practice
12. Forging Practice
13. Electric Arc Welding
14. Gas Welding

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3. "Machine shop Practice – Vol. I" , Industrial Press, New York, 1971
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