

# B.E. DEGREE IN COMPUTER ENGINEERING

Year : I

Part : II

Teaching Schedule							Examination Scheme						Total	Remark
S. N.	Course Code	Course Title	L	T	P	Total	Theory			Practical				
							Assesment Marks	Final		Assesment Marks	Final			
								Duaration hours	Marks		Duaration hours	Marks		
1	SH 451	Engineering Mathematics -II	3	2		5	20	3	80				100	
2	ME 451	Engineering Drawing II	1		3	4				60	3	40	100	
3	EX 451	Basic Electronics Engineering	3	1	1.5	5.5	20	3	80	25			125	
4	SH 453	Enginerig Chemistry	3	1	3	7	20	3	80	20	3	30	150	
5	ME 452	Fundamental of Thermodynamics and Heat Transfer	3	1	1.5	5.5	20	3	80	25			125	
6	ME 453	Workshop Technology	1		3	4	10			40			50	
Total			14	5	12	31	90	12	320	170	6	70	650	

## ENGINEERING MATHEMATICS II

### SH 451

Lecture : 3  
Tutorial : 2  
Practical : 0

Year : I  
Part : II

#### Course Objective:

To develop the skill of solving differential equations and to provide knowledge of vector algebra and calculus. 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 Extreme 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

## References:

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 Engineering Mathematics", RTU, Department of Engineering Science and Humanities.
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

## ENGINEERING DRAWING II

ME 451

**Lecture : 1**

**Tutorial : 0**

**Practical : 3**

**Year : I**

**Part : II**

### 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.

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

- 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 hours)

- 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

#### Practical:

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

## BASIC ELECTRONICS ENGINEERING

### EX 451

**Lecture : 3**  
**Tutorial : 1**  
**Practical : 3/2**

**Year : I**  
**Part : II**

#### Course Objectives:

To understand the electronics elements and their functionality, basic understanding of analog and digital systems and their applications

#### 1. Basic Circuits 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 (6 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, varactors diode, Tunnel diodes
- 2.5 DC power supply: rectifier-half wave, full wave (center tapped, bridge), Zener regulated power supply

#### 3. Transistor (8 hours)

- 3.1 BJT configuration and biasing, small and large signal model
- 3.2 T and  $\mu$  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; shift 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, data logging, audio video system

**Practical:**

- 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
- 2. Thomas L. Floyd, "Electronic Devices" Pearson Education, Inc.
- 3. A.S. Sedra and K.C. Smith, "Microelectronic Circuits", Oxford University Press.



**ENGINEERING CHEMISTRY****SH 453****Lecture : 3****Tutorial : 1****Practical : 3****Year : I****Part : II****Course Objective:**

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  $\text{SO}_x$ ,  $\text{NO}_x$ ,  $\text{CO}$ ,  $\text{CO}_2$ ,  $\text{O}_3$  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 Sulphur 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 (3 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  $E1$  and  $E2$
- 10.5 Factors governing  $SN^1$ ,  $SN^2$ ,  $E1$  and  $E2$  reaction mechanism path

**References:**

1. Jain and Jain, "Engineering Chemistry", Dhanpat Rai Publishing Co.
2. Shashi Chawala, "A Text Book of Engineering Chemistry", Dhanpat Rai Publishing Co.
3. J. D. Lee, "A New Concise Inorganic Chemistry", Wiley India Pvt. Limited.
4. Marron and Prutton, "Principles of Physical Chemistry", S. Macmillan and Co. Ltd.
5. Bahl and Tuli, "Essential of Physical Chemistry", S. Chand and Co. Ltd.
6. Satya Prakash and Tuli, "Advanced Inorganic Chemistry Vol 1 and 2", S. Chand and Co. Ltd
7. Morrison and Boyd, "Organic chemistry"
8. Moti Kaji Sthapit, "Selected Topics in Physical Chemistry", Taleju Prakashan, Kathmandu.
9. Peavy, Rowe and Tchobanoglous, "Environmental Engineering", McGraw-Hill, New York.
10. R. K. Sharma, B. Panthi and Y. Gotame, "Textbook of Engineering Chemistry", Athrai Publication.

**Practical:**

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

## FUNDAMENTALS OF THERMODYNAMICS AND HEAT TRANSFER

ME 452

**Lectures : 3**  
**Tutorial : 1**  
**Practical : 3/2**

**Year : I**  
**Part : II**

### Course Objective:

To develop basic concepts, laws of thermodynamics and heat transfer and their applications.

### 1. Introduction (3 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 Thermodynamic State
  - 1.4.5 Thermodynamic Process, Cyclic Process, Quasi-equilibrium Process, Reversible and Irreversible Process
- 1.5 Common Properties: Pressure, Specific Volume, Temperature
- 1.6 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 (9 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 (9 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 Formulation of Second Law
- 5.6 Control Volume Formulation of Second Law
- 5.7 Isentropic Process for an Ideal Gas and for an Incompressible Substances
- 5.8 Carnot Cycle, Heat Engine, Heat Pump and Refrigerator
- 5.9 Kelvin-Planck and Clausius Statements of the Second Law of Thermodynamics and their Equivalence

#### **6. Thermodynamic Cycles (9 hours)**

- 6.1 Classification of Cycles
- 6.2 Air Standard Brayton Cycle
- 6.3 Rankine Cycle
- 6.4 Internal Combustion Cycles
  - 6.4.1 Air standard Analysis
  - 6.4.2 Air Standard Otto Cycle
  - 6.4.3 Air Standard Diesel Cycle
- 6.5 Vapor Compression Refrigeration Cycle

#### **7. Introduction to Heat Transfer (6 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 Transmissivity; Black Body, White Body and Gray Body

**Practical:**

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

**References:**

- 1. M. C. Luintel, "Fundamentals of Thermodynamics and Heat Transfer", Athrai Publication (P) Limited.
- 2. R. Gurung, A. Kunwar & T. R. Bajracharya, "Fundamentals of Engineering Thermodynamics and Heat Transfer", Asmita Books Publishers and Distributors (P) Limited.
- 3. J. R. Howell & R. O. Buckius, "Fundamentals of Engineering Thermodynamics", McGraw Hill Publishers
- 4. V. Wylen, Sonntag & Borgnakke, "Fundamentals of Thermodynamics", John Wiley & Sons, Inc.
- 5. M. J. Moran & H. N. Shapiro, "Fundamentals of Engineering Thermodynamics", John Wiley & Sons, Inc.
- 6. Y. A. Cengel & M.A. Boles, "Thermodynamics: An Engineering Approach", McGraw-Hill.
- 7. J. P. Holman, "Heat Transfer", McGraw-Hill
- 8. Y. A. Cengel, "Heat Transfer: A Practical Approach", McGraw-Hill.

## WORKSHOP TECHNOLOGY

ME 453

Lecture : 1

Tutorial : 0

Practical : 3

Year : I

Part : II

### Course Objective:

To impart knowledge and skill components in the field of basic workshop technology. To be familiar with different hand and machine tools required for manufacturing simple metal components and articles.

#### 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 Scribes
- 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)

**Practical:**

- 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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