

## **Engineering Mathematics-II**

### **1. Calculus of two or more variables**

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**

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**

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**

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**

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

### 6.1 Introduction

### 6.2 Series with positive terms

### 6.3 Convergence and divergence

### 6.4 Alternating series, Absolute convergence

### 6.5 Radius and interval of convergence

#### Reference Book:

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

Chapter	Hours	Mark Distribution
1.	6	10
2	6	10
3	11	20
4	9	15
5	8	15
6	5	10
<b>Total</b>	<b>45</b>	<b>80</b>

There may be minor deviation in marks distribution.

## Engineering Drawing-II

### **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 Classifications: Advantages and Disadvantages

#### 2.3 Axonometric Projection: Isometric Projection and Isometric Drawing

##### 2.3.1 Procedure for making an isometric drawing

##### 2.3.2 Isometric and Non-isometric Lines; Isometric and Non-isometric Surfaces

##### 2.3.3 Angles in Isometric Drawing

##### 2.3.4 Circles and Circular Arcs in Isometric Drawing

### 2.3.5 Irregular Curves in Isometric Drawing

### 2.3.6 Isometric sectional Views

## 2.4 Oblique Projection and Oblique Drawing

### 2.4.1 Procedure for making an Oblique drawing

### 2.4.2 Rules for Placing Objects in Oblique drawing

### 2.4.3 Angles, Circles and Circular Arcs in Oblique drawing

## 2.5 Perspective Projection

### 2.5.1 Terms used in Perspective Projection

### 2.5.2 Parallel and Angular Perspective

### 2.5.3 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 Publishing Co, 1992.
3. “Technical Drawing”, F. E. Giescke, A . Mitchell, H. C. Spencer and J. T. Dygdone, Macmillan Publishing Co, 10th Edition.



4. “Machine Drawing”, N. D. Bhatt, Charotar Publishing 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 evaluation scheme for the final examination is indicated as follows:

#### **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**

### **1. Basic Circuits Concepts**

1.1 Passive components: Resistance, Inductance, Capacitance: series, parallel combinations, Kirchoff'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**

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 (center tapped, bridge), zener regulated power supply

### **3. Transistor**

3.1 BJT configuration and biasing, small and large signal model

3.2 T and U 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**

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**

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**

6.1 Number system: Binary arithmetic

6.2 Logic gates: OR, NOT, AND, NAND, XOR, XNOR gate, Truth tables

6.3 Multiplexer, 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**

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

## **References**

1. Thomas L. Floyd, "Electronic Devices" 8th Edition, Pearson Education, Inc.

2. A.S. Sedra and K.C. Smith, "Microelectronic Circuits", 6th Edition, Oxford University Press.

3. Robert Boylestad and Louis Nashelsky, "Electronic Devices and Circuit Theory" PHI; 4th Edition.1987

4. Digital Electronics by Floyd.

## **Evaluation Scheme:**

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

Chapter Hours Mark distribution \*

Circuits Concepts 8 14

Two-terminal Nonlinear Devices 8 14

Bipolar Junction Transistor,

a Three-Terminal Nonlinear Device

8 14

Operational Amplifier 6 14

Introduction to Communication System 4 5

Digital Electronics 8 14

Example of Instrumentation System 3 5

Total 45 80

\* There may be minor deviation in marks distribution.

## Engineering Chemistry

### 1. **Electro-chemistry and Buffer (6 hours)**

1. Electro-chemical cells
2. Electrode Potential and Standard Electrode Potential
3. Measurement of Electrode Potential
4. Nernst equation
5. EMF of Cell
6. Application of Electrochemical and Electrolytic cells
7. Electrochemical Series and its Application
8. Buffer: its type and mechanism
9. Henderson's equation for pH of buffer and related problems
10. Corrosion and its type
11. Factors influencing corrosion
12. Prevention of corrosion

### 2. **Catalyst (4 hours)**

1. Introduction
2. Action of Catalyst (Catalytic Promoters and Catalytic Poisons)
3. Characteristics of Catalyst
4. Types of Catalyst
5. Theories of Catalysis
6. Industrial Applications of Catalysts

### 3. **Environmental Chemistry (5 hours)**

1. Air Pollution
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. Effects of Air Pollutants on human beings and their possible remedies
4. Ozone depletion and its photochemistry
5. Water Pollution (Ref of surface water and pound water)
6. Water Pollutants (Ref of surface water) their adverse effect and remedies
7. Soil pollution
8. Pollutants of soil their adverse effects and possible remedies

#### 4. **Engineering Polymers (6 hours)**

1. Inorganic polymers
2. General properties of inorganic polymers
3. Polyphosphazines
4. Sulphur Based Polymers
5. Chalcogenide Glasses
6. Silicones
7. Organic Polymers
8. Types of Organic Polymers
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
10. Concept of bio-degradable, non-biodegradable and conducting polymers

#### 5. **3-d Transition elements and their applications (5 hours)**

1. Introduction
2. Electronic Configuration
3. Variable oxidation states
4. Complex formation tendency
5. Color formation
6. Magnetic properties
7. Alloy formation

8. Applications of 3-d transition elements

**6. Coordination Complexes (5 hours)**

1. Introduction

2. Terms used in Coordination Complexes

3. Werner's Theory Coordination Complexes

4. Sidgwick's model and Sidgwick's effective atomic number rule

5. Nomenclature of coordination compounds (Neutral type, simple cation and complex anion and complex cation and simple anion type)

6. Valence Bond Theory of Complexes

7. Application of valence bond theory in the formation of i) Tetrahedral Complexes ii) Square planar Complexes and iii) Octahedral Complexes

8. Limitations of Valence Bond Theory

9. Applications of Coordination Complexes

**7. Explosives (3 hours)**

1. Introduction

2. Types of explosives: Primary, Low and High explosives

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

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

1. Introduction

2. Function of Lubricants

3. Classification of Lubricants (Oils, Greases and Solid)

4. Paints

5. Types of Paint

6. Application of Paints

**9. Stereochemistry (4 hours)**

1. Introduction



2. Geometrical Isomerism (Cis Trans Isomerism) Z and E concept of Geometrical Isomerism
3. Optical Isomerism with reference to two asymmetrical carbon center molecules
4. Terms Optical activity, Enantiomers, Diastereomers, Meso structures, Racemic mixture and Resolution

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

1. Substitution reaction
2. Types of substitution reaction SN1 and SN2
3. Elimination reaction
4. Types of elimination reaction E1 and E2
5. Factors governing SN1, SN2, E1 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 (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)

### 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
<b>Total</b>	<b>45</b>	<b>80</b>

\* There may be minor deviation in marks distribution.

# **Fundamentals of Heat and Thermodynamics**

## **1. Introduction**

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, Surrounding, Boundary and Universe, Closed Systems, Open Systems, and Isolated Systems

1.4.2 Thermodynamic Properties: Intensive, Extensive and Specific Properties

1.4.3 Thermodynamics 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 Thermodynamics, Equality of Temperature

## **2. Energy and Energy Transfer**

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 Expression for displacement work Transfer

2.5 Power

### **3. Properties of Common Substance**

3.1 Pure Substance and State Postulate

3.2 Ideal Gas and Ideal Gas Relations

3.3 Two Phase (Liquid and Vapor) System: 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**

4.1 First Law of thermodynamics for Control mass, and 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**

5.1 Necessity of formation 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 Heat Engine and Thermal Efficiency, Heat Pump, Refrigerator and coefficient of Performance(COP)

5.7.2 Kelvin-Planck and Clausius Statements of the Second law of thermodynamics and their equivalence

## **6. Thermodynamic Cycles**

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

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

### EVALUATION:

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
<b>Total</b>	<b>45</b>	<b>80</b>

There may be minor deviation in marks distribution.

### 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



## Workshop Technology

### **. 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**

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

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#### 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**

Bench Tools and hand operations: Measuring, Marking, Layout, Cutting, Filling,

Drilling, Tapping, Assembly

1. Bench Tools and hand operations: (Contd.)

2. Drilling machines

3. Measuring and Gauging Instruments

4. Engine lathe: Basic operations such as Plain turning, facing, cutting off, knurling.

5. Engine lathe: Taper turning, drilling and boring

6. Basic Shaper Operations

7. Milling Machines

8. Grinding Machines

9. Sheet Metal works

10. Foundry Practice

11. Forging Practice

12. Electric Arc Welding

13. Gas Welding

## **References**

1. “Shop Theory”, J. Anderson and E. E. Tatro, McGraw – Hill, 5th Edition, 1942

2. “Machine shop operations and setups”, O. D. Lascoe, C. A. Nelson and H. W.

Porter, American Technical society, 1973

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

4. “Machine shop Practice – Vol. I” , Industrial Press, New York, 1971

5. “ Technology of Machine Tools”, Mc Graw Hill – Ryerson, 3rd Edition

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6. “Machinery’s Handbook”, Oberg, Jones and Horton, 23rd Edition, Industrial

Press, New York.

7. “Elements of Workshop Technology – Vol. I ( Manufacturing Processes)” – S. K.

Hajra Choudhury and A. K. Hajra Choudhury – Media Promoters and Publishers

Pvt. Ltd. , Bombay, INDIA, Tenth Edition, 1993

8. “Elements of Workshop Technology – Vol. II: (Machine Tools)” – S. K. Hajra

Choudhury, S. K. Bose and A. K. Hajra Choudhury – Media Promoters and

Publishers Pvt. Ltd. , Bombay, INDIA, Eight Edition, 1988

9. “A Course in Workshop Technology – Vol. I” – Prof. B. S. Raghuwanshi – Dhanpat

Rai and Co. (P) Ltd, Delhi, INDIA, Ninth Edition, 2002

10. “A Course in Workshop Technology – Vol. II” – Prof. B. S. Raghuwanshi –

Dhanpat Rai and Co. (P) Ltd, Delhi, INDIA, Ninth Edition, 2002

11. “Workshop Technology – Vol. I” – H. S. Bawa – Tata Mc – Graw Hill publishing

company Limited, New Delhi, INDIA,

12. “Workshop Technology – Vol. II” – H. S. Bawa – Tata Mc – Graw Hill publishing

company Limited, New Delhi, INDIA,

A text book of Workshop Technology – R. S. Khurmi and J. K. Gupta – S. Chand and

Company Ltd, New Delhi. INDIA