

**Syllabus: D.Voc. (Mechanical-Manufacturing)**

**Industry Partner: Roop Auto Ltd.**

**Shri Vishwakarma Skill University**  
**Scheme: First Year (D.Voc. in Mechanical-Manufacturing, Level-5)**

Semester-I														
Category	Subject Name	Credits			Marks							Hrs		
					Theory			Practical			Total			
		T	P	TO	I	E	TO	I	E	TO	(T+P)	T	P	TO
General Education Component	Language (English)	3	1	4	15	35	50	35	15	50	100	45	30	75
	Workshop Technology	3	1	4	15	35	50	35	15	50	100	45	30	75
	Applied Mathematics-1	4	0	4	30	70	100	-	-	-	100	60		60
	Basics of Computer	3	1	4	15	35	50	35	15	50	100	45	30	75
	Fundamental of Industrial Management	3	1	4	15	35	50	35	15	50	100	45	30	75
	<b>Total</b>	16	4	20	90	210	300	140	60	200	500	240	120	360
Skill Education Component	Workshop Practice lab	0	4	4	-	-	-	70	30	100	100	0	120	120
	Inspection & Quality Control	3	1	4	15	35	50	35	15	50	100	45	30	75
	Engineering Graphics and Drawing	0	4	4	-	-	-	70	30	100	100	-	120	120
	<b>Total</b>	3	9	12	15	35	50	175	75	250	300	45	270	315
<b>Grand Total</b>		19	13	32	105	245	350	315	135	450	800	285	390	675

Semester-II														
Category	Subject Name	Credits			Marks							Hrs		
					Theory			Practical			Total			
		T	P	TO	I	E	TO	I	E	TO	(T+P)	T	P	TO
General Education Component	MOOC Course	2	0	2	30	70	100	0	0	0	100	30	0	30
	Entrepreneurship Management	2	0	2	30	70	100	0	0	0	100	30	0	30
	<b>Total</b>	4	0	4	60	140	200	0	0	0	200	60	0	60
Skill Education Component	OJT	0	24	24	-	-	0	245	105	350	350	0	1080	1080

	<b>Total</b>	0	24	24	0	0	0	245	105	350	350	0	1080	1080
<b>Grand Total</b>		4	24	28	60	140	200	245	105	350	550	60	1080	1140

Type	No. of hrs.	Credit
Theory	15	1
Practical	30	1
On-the-Job Training (OJT)	45	1

**Job Roles (After 1<sup>st</sup> Year of completion):** Machining and quality Technician (ASC/Q3509)

**Scheme: Second Year (D.Voc. in Mechanical-Manufacturing, Level-5)**

Semester-III														
Category	Subject Name	Credits			Marks							Hrs		
					Theory			Practical			Total			
		T	P	TO	I	E	TO	I	E	TO	(T+P)	T	P	TO
General Education Component	Basics of Electrical and Electronics Engg.	3	1	4	15	35	50	35	15	50	100	45	30	75
	Applied Physics	3	1	4	15	35	50	35	15	50	100	45	30	75
	Estimating & Costing	4	0	4	30	70	100	-	-	-	100	60		60
	EVS	4	0	4	30	70	100	-	-	-	100	60		60
	Applied Mechanics	3	1	4	15	35	50	35	15	50	100	45	30	75
	<b>Total</b>	17	3	20	105	245	350	105	45	150	500	255	90	345
Skill Education Component	CAD lab	0	4	4	-	-	-	70	30	100	100	0	120	120
	CNC machines & Automation	3	1	4	15	35	50	35	15	50	100	45	30	75
	CNC Programming	0	4	4	-	-	-	70	30	100	100	-	120	120
	<b>Total</b>	3	9	12	15	35	50	175	75	250	300	45	270	315
<b>Grand Total</b>		20	12	32	120	280	400	280	120	400	800	300	360	660

Semester-IV														
Category	Subject Name	Credits			Marks							Hrs		
					Theory			Practical			Total			
		T	P	TO	I	E	TO	I	E	TO	(T+P)	T	P	TO

General Education Component	MOOC Course	2	0	2	30	70	100	0	0	0	100	30	0	30
	Industrial Ethics	2	0	2	30	70	100	0	0	0	100	30	0	30
	<b>Total</b>	4	0	4	60	140	200	0	0	0	200	60	0	60
Skill Education Component	OJT	0	24	24	-	-	0	245	105	350	350	0	1080	1080
	<b>Total</b>	0	24	24	0	0	0	245	105	350	350	0	1080	1080
<b>Grand Total</b>		4	24	28	60	140	200	245	105	350	550	60	1080	1140

**Job Roles (After 2<sup>nd</sup> Year of completion):** Machining Technician/ CNC Operator (ASC/Q3503)

**Scheme: Third Year (D.Voc. in Mechanical-Manufacturing, Level-5)**

Semester-V														
Category	Subject Name	Credits			Marks							Hrs		
					Theory			Practical			Total			
		T	P	TO	I	E	TO	I	E	TO	(T+P)	T	P	TO
General Education Component	Materials and Metallurgy	3	1	4	15	35	50	35	15	50	100	45	30	75
	Hydraulics & Pneumatics	3	1	4	15	35	50	35	15	50	100	45	30	75
	Plant Maintenance & Material Handling	4	0	4	30	70	100	-	-	-	100	60		60
	Fabrication Processes	3	1	4	15	35	50	35	15	50	100	45	30	75
	Strength of Materials	3	1	4	15	35	50	35	15	50	100	45	30	75
	<b>Total</b>	16	4	20	90	210	300	140	60	200	500	240	120	360
Skill Education Component	CAD/ CAM	0	4	4	-	-	-	70	30	100	100	0	120	120
	Jigs fixtures & Guage design	3	1	4	15	35	50	35	15	50	100	45	30	75
	Minor Project	0	4	4	-	-	-	70	30	100	100	-	120	120
	<b>Total</b>	3	9	12	15	35	50	175	75	250	300	45	270	315
<b>Grand Total</b>		19	13	32	105	245	350	315	135	450	800	285	390	675

Semester-VI														
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Category	Subject Name	Credits			Marks							Hrs		
					Theory			Practical			Total			
		T	P	TO	I	E	TO	I	E	TO	(T+P)	T	P	TO
General Education Component	MOOC Course	2	0	2	30	70	100	0	0	0	100	30	0	30
	Major Project (Live)	2	0	2	30	70	100	0	0	0	100	30	0	30
	<b>Total</b>	4	0	4	60	140	200	0	0	0	200	60	0	60
Skill Education Component	OJT	0	24	24	-	-	0	245	105	350	350	0	1080	1080
	<b>Total</b>	0	24	24	0	0	0	245	105	350	350	0	1080	1080
<b>Grand Total</b>		4	24	28	60	140	200	245	105	350	550	60	1080	1140

**Job Roles (After 3<sup>rd</sup> Year of completion):** Machine Shop Supervisor (ASC/Q3505)

**Semester: First**  
**Subject: Language (English)**

**Objectives**

- Develop effective communication skills among the students for the business world.

**Learning Outcomes**

- Able to differentiate in the vowels and consonants that can help the students to pronounce words better and be able to learn phonetics.
- Learn the correct pronunciation of the words helping in the reduction of Mother Tongue Influence.  
Able to communicate effectively and will have improved verbal communication.
- Learn to frame the sentences properly with the correct formation. This will improve the written skills of the students.
- Able to write paragraphs on different topics with the correct usage of vocabulary and will improve the written as well as verbal communication.
- Learn the correct usage of the punctuation marks, will draft formal & informal emails and will comprehend the articles.
- Effectively use established communication systems and protocols in the workplace.

<b>Unit</b>	<b>Topic</b>	<b>Key Learning</b>
I	<b>Communication</b>	<ul style="list-style-type: none"> <li>• Meaning of Communication,</li> <li>• Importance of Communication,</li> <li>• Types of Communication, Process of Communication,</li> <li>• Communication network in an organization,</li> <li>• Barriers to Communication,</li> <li>• Essentials of good Communication.</li> </ul>
II	<b>Grammar and Usage</b>	<ul style="list-style-type: none"> <li>• Subject and verb agreement,</li> <li>• Tenses: simple past (negatives/interrogatives) present perfect,</li> <li>• past perfect continuous,</li> <li>• past perfect,</li> <li>• expressing future time (will and going to),</li> <li>• Passive voice (perfect tenses and modals),</li> <li>• Modals (must, should ought to, would),</li> <li>• Linking words (to like because although, instead of, if, as, since, who, which that, when however, in spite of),</li> <li>• Reported speech, statements, questions (yes/no).</li> </ul>
III	<b>Reading Skills</b>	<ul style="list-style-type: none"> <li>• Prose texts: The Gift of the Magi by O. Henry</li> <li>• Poems: 1. Death the Leveller by James Shirely</li> </ul>

		<ul style="list-style-type: none"> <li>• 2. Mending wall – Robert Frost</li> <li>• Drama: Refund by Fritz Karinthy</li> </ul>
IV	<b>Listening Skills</b>	<ul style="list-style-type: none"> <li>• The process of listening,</li> <li>• Types of listening,</li> <li>• Benefits of effective listening,</li> <li>• Barriers to listening.</li> </ul>
V	<b>Writing Skills</b>	<ul style="list-style-type: none"> <li>• Paragraph Writing:(Describing objects,describing people,Narrating events,stories)</li> <li>• Letter Writing: Application for leave Application for jobs, asking for information from various agencies (e.g. Last date for getting prospects; price of items before placing orders) Note making</li> <li>• Ending (punctuation, spelling, appropriate vocabulary, structures)</li> </ul>

**Suggested Readings:**

- Sethi, J & et al. A Practice Course in English Pronunciation, Prentice Hall of India, New Delhi.
- Sen, Leena. Communication Skills, Prentice Hall of India, New Delhi.
- Prasad, P. Communication Skills, S.K. Kataria& Sons.
- Bansal, R.K. and J.B. Harrison. Spoken English, Orient Language.
- Roach Peter. English Phonetics and Phonology.
- A.S. Hornby&#39;s. Oxford Advanced Learners Dictionary of Current English, 7th Edition.
- Prasad, P. The Functional Aspects of Communication Skills, Delhi.
- McCarthy, Michael. English Vocabulary in Use, Cambridge University Press.
- Rajinder Pal and PremLata. English Grammar and Composition, Sultan Chand Publication.
- Idioms & Phrases (English-Hindi), Arihant Publication (India) Pvt. Ltd.
- One Word Substitution, Dr. Ashok Kumar Singh, Arihant Publications (India) Pvt,Ltd

**Subject: Language English Lab**

**Objectives:** Develop effective communication skills among the students for the business world

**Learning Outcomes**

- Able to differentiate in the vowels and consonants that can help the students to pronounce words better and be able to learn phonetics.
- Learn the correct pronunciation of the words helping in the reduction of Mother Tongue Influence.  
Able to communicate effectively and will have improved verbal communication.
- Learn to frame the sentences properly with the correct formation. This will improve the written skills of the students.
- Able to write paragraphs on different topics with the correct usage of vocabulary and will improve the written as well as verbal communication

**List of Practical's**

1. Greetings and starting a conversation.
2. Non Verbal Communication Techniques during conversation.
3. Verbal Communication Techniques during Conversation.
4. PPT presentation.
5. Debate.
6. Situational dialogues / Role play.
7. Telephonic skills.
8. Group Discussions

		30	70	100
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## Subject: Applied Mathematics -I

### Objectives

- Develop the knowledge in the area of algebraic functions to solve engineering problems.

### Learning Outcomes

- Learn the applications of Sets, Relations and Functions.
- Learn to solve special series and sequences
- Understand basic arithmetic and calculation methods.
- Learn co-ordinate Geometry.
- Learn to solve Statistics and Probability related problems.

Unit	Topic	Key Learning
I	<b>Sets, Relations and Functions</b>	<ul style="list-style-type: none"><li>• Theory of Sets,</li><li>• Relations,</li><li>• Functions,</li><li>• Polynomials and Graphical Representation</li></ul>
II	<b>Sequence and Series</b>	<ul style="list-style-type: none"><li>• Introduction to Sequence and Series,</li><li>• Arithmetic Progression (A.P.),</li><li>• Geometric Progression (G.P.),</li><li>• Harmonic Progression (H.P.)</li></ul>
III	<b>Algebra-I</b>	<ul style="list-style-type: none"><li>• Partial Fraction,</li><li>• Permutation,</li><li>• Combination,</li><li>• Binomial Theorem</li></ul>
IV	<b>Trigonometry</b>	<ul style="list-style-type: none"><li>• Trigonometric Ratio,</li><li>• Compound Angles,</li><li>• Multiple and sub multiple angles,</li><li>• Transformations of products into sums or differences and vice versa</li></ul>
V	<b>Straight Lines</b>	<ul style="list-style-type: none"><li>• Cartesian and Polar Coordinate,</li><li>• Different Forms of a Straight Line,</li><li>• General Equation of a Line,</li><li>• Distance of a Point from a Line</li></ul>

### Suggested Readings:

- Mathematics for class XI Part I and II NCERT.
- Mathematics for class XII Part I and II NCERT.

## Subject: Basics of Computer

### Objectives

- Build basic technical skills and develop any kind of computer application.

### Learning Outcomes

- State the applications of Computers and understand the basic components of computer.
- Identify & describe various parts of computers like CPU, keyboard, monitor, etc.
- View files, work with files and customize window.
- Able to Differentiate in various operating system.
- Apply the office Applications for the task assigned by the authorities.
- Outline the basics of Networking.
- Make use of Internet and its applications when required.

Unit	Topic	Key Learning
I	<b>Introduction to Computer system</b>	<ul style="list-style-type: none"><li>• Basic Applications of Computer;</li><li>• Block Diagram of Computer System, Input / Output Devices,</li><li>• Computer Memory,</li><li>• Concepts of Hardware and Software;</li><li>• Computer Virus: Definition,</li><li>• Types of viruses, Characteristics of viruses, Anti-virus software.</li></ul>
II	<b>Operating System</b>	<ul style="list-style-type: none"><li>• Overview of operating system:</li><li>• Definition,</li><li>• Functions of operating system,</li><li>• Need and its services,</li><li>• Types of operating system,</li><li>• Batch Processing,</li><li>• Spooling, Multiprocessing, Multiprogramming, Time-Sharing,</li><li>• Comparison between DOS and windows,</li><li>• Comparison between Unix and Windows.</li></ul>
III	<b>Office Applications</b>	<ul style="list-style-type: none"><li>• Introduction to MS Word, Introduction to MS Excel,</li><li>• Introduction to MS PowerPoint,</li><li>• Menus,</li><li>• Shortcuts,</li><li>• Document types,</li><li>• Formatting documents,</li><li>• spread sheet and presentations,</li><li>• Working with Spreadsheets,</li><li>• Different templates.</li></ul>

IV	<b>Networking</b>	<ul style="list-style-type: none"> <li>• Network Technologies,</li> <li>• Introduction to Internet: Network connecting devices,</li> <li>• Topologies,</li> <li>• HTTP,</li> <li>• HTTPS DNS,</li> <li>• Hub,</li> <li>• Switches,</li> <li>• Router,</li> <li>• Repeater, Firewalls</li> </ul>
V	<b>World Wide Web</b>	<ul style="list-style-type: none"> <li>• WWW and Web Browsers Introduction,</li> <li>• Objectives,</li> <li>• Concept of internet,</li> <li>• Overview of search engines,</li> <li>• Popular search engines in use,</li> <li>• Surfing the web and websites.</li> </ul>

**Suggested Readings:**

- Computers and Beginners by Jain, V.K.;
- Computer Fundamentals by Anita Goel, Pearson.

**Subject:Basics of Computer lab**

**Objectives:** Build basic technical skills and develop any kind of computer application.

**Learning Outcomes**

- State the applications of Computers and understand the basic components of computer.
- Identify & describe various parts of computers like CPU, keyboard, monitor, etc.
- View files, work with files and customize window.
- Able to Differentiate in various operating system.
- Apply the office Applications for the task assigned by the authorities.
- Outline the basics of Networking.
- Make use of Internet and its applications when required.

**List of Practical's**

1. Troubleshooting
2. Practical based on to be exposed/shown various components and supposed how to switch on a computer.
3. Handling Boot Setup, Installation of Operating System
4. WordPad, Notepad, Sticky Note, Snipping tool, Paint
5. Ms Word
6. MS-Excel- Creating charts, Creating tables
7. MS-PowerPoint
8. Case study on Operating systems (Windows/ Ubuntu/ Android/iOS)

9. Networking
10. Sending E-mails

**Suggested Readings:**

1. Introduction to Information Technology, Leon Tech World by Leon and Leon
2. Foundations of Computing, BPB Publication by Sinha, Kr. Pradeep and Preeti Sinha;
3. Word Processing and Typing by Sharon Spencer, Heinemann.
4. MS Office by S.S. Srivastava, Firewall Media.
5. Microsoft Office 2010 by Bittu Kumar, V & S Publications
6. Data Communication and Networking by Behrouz.A. Forouzan, McGraw Hill

## **Subject Name: Fundamental of Industrial Management**

### **Course Objectives:**

- Understanding the knowledge of Quality Control, inspection and quality assurance management used in the organization.
- Develop the skill for using tool and techniques for quality in Industry
- Apply elementary knowledge of quality concepts for quality assurance.

### **Learning Outcome:**

- Students will be able to understand the daily management system related to Quality in the shop floor.
- Student will able to solve different type of problems in their manufacturing processes.
- Ensure implementation of 5S activities at the shop floor/ office area.
- Students will able to apply 5S and safety in their work place.

### **Unit-1**

#### **Concept of Quality:**

- 1.1 Quality: Definition, History, Importance
- 1.2 Introduction to Quality Control.

### **Unit-II**

#### **Organizational Aspects of Quality Assurance:**

- 2.1 Quality Assurance (QA): Introduction, Definition, QA in different stages, Quality Planning.
- 2.2 ISO: Introduction, Benefits of ISO.
- 2.3 ISO 9001, Benefits of ISO 9001.

### **Unit-III**

#### **Problem solving tools and techniques:**

- 3.1 Definition of a problem
- 3.2 Type of problems, classification of problems
- 3.3 Problem solving tools: Introduction to Cause and effect diagram, Histogram, Pareto charts,

### **Unit-IV**

#### **Total Quality Management:**

- 4.1 Basic concept of TQM, features of TQM
- 4.2 principles of TQM
- 4.3 Concept of TPM
- 4.4 Quality allied concept: KAIZEN, Poke yoke

### **Unit-V**

#### **5 S and Safety:**

- 5.1 Detailed concept of 5S and safety used in Industries
- 5.2 Integrated Management system

**Suggested Readings:**

1. Total quality Management by L.Sganthi & Anand A. Samuel, PHI Publication.
2. Total quality Management by Poornima M Charantimath, Pearson Publication.

**Subject: Fundamentals of Industrial Management lab****List of Experiments**

1. Draw and Demonstrate the process flow diagram
2. Draw and demonstrate Pareto diagram
3. Draw and Demonstrate cause and effect diagram

## **Subject: Inspection & Quality Control**

### **Unit-1: Inspection**

Introduction, units of measurement, standards for measurements and interchangeability, types of inspection, remedial, preventive and operative inspection, incoming, in-process and final inspection.

### **Unit-2: Measurement**

Basics principles used in measurement and gauging, study of various measurement instruments-calipers, micrometers, dial indicators, surface plate, try square, protectors, sine bar, slip gauges, profile projector.

### **Unit-3: Gauging**

Introduction, limit gauges-plug, ring, snap, taper, thread, height, depth, feeler, wire gauge and their applications for linear, angular, surface, thread and gear measurement.

### **Unit-4: Statistical Quality Control**

Basics statistical concepts, empirical distribution and histograms, frequency, mean, mode, standard deviation, normal distribution, introduction to control charts-X, R, P and C charts and their applications.

### **Unit-5: Sampling**

Introduction, sampling plans, collection of sample size, methods of taking samples, frequency of samples, inspection plan format and test reports.

#### **Recommended Books**

1. Statistical Quality Control by M. Mahajan; Dhanpat Rai and Sons, Delhi
2. Engineering Metrology by R. K. Jain
3. Engineering Metrology by R.K. Rajput, SK Kataria and Sons

## **Subject: Inspection & Quality Control lab**

### **List of Experiments**

1. Use of dial indicator for measurement taper
2. Use of combination set, bevel protector and sine bar for measuring taper
3. With the help of given data, plot X, R, P and C Charts
4. Use of slip gauge in measurement of centre distance between two pins.

## **Subject: Engineering Graphics & Drawing lab**

### **OBJECTIVES**

1. Understand and appreciate the importance of Engineering Graphics in Engineering
2. Understand the basic principles of Technical/Engineering Drawing
3. Understand the different steps in producing drawings according to BIS conventions

### **OUTCOMES**

1. The student will become familiar with fundamentals of various science and technology subjects and thus acquire the capability to applying them
2. The graduates will become familiar with fundamentals of engineering design. Understanding the concept generation, design optimization and evaluation.
3. Students will be able to effectively design various engineering components and make process plan for the production.

### **SKILL SET**

1. Projection of various components according to BIS specifications.
2. Assembly of data and information of various components in visualized way
3. Interpretation of technical graphics assemblies

### **CONTENTS**

#### **1. Introduction to drawing, lines and lettering:**

- 1.1. Definition and classification of drawing
- 1.2. Drawing instruments such as; drawing board, drawing sheets, drafter.
- 1.3. Types of pencils, sheets, eraseretc.
- 1.4. Different types of lines( Straight line, inclined line and curved lines)
- 1.5. Practice engineering style for letters and numbers as BIS: SP:46-2003

#### **Hands on training:**

- Prepare drawing sheet by using different types of lines
- Prepare drawing sheet by Bisection of line, angle, arc.

#### **2. Dimensioning and scale:**

- 2.1. Importance of dimensioning



- 2.2. Types (i.e. chain, parallel and progressive etc.) and methods of placing dimensioning (i.e. aligned and unidirectional)
- 2.3. Principles of dimensioning and practice dimensioning technique as BIS: SP: 46-2003.
- 2.4. Free hand sketching of straight lines, circle, square, Polygons

**Hands on training:**

- To divide line of length 120mm into 9equal parts
- Divide a circle into 12 equal parts by using engineering compass

**3. Introduction to Projection:**

- 3.1. Introduction to first and third angle projection
- 3.2. Introduction to projection of point, line and plane

**Hands on training:**

- Practice for projection of point
- Practice for projection of line
- Practice for projection plane

**4. Isometric projection**

- 1.1 Isometric drawing of simple geometric solids

**Hands on training:**

- Prepare drawing sheet of isometric projection.

**5. Orthographic projection**

- 1.1 Orthographic projection of simple geometric solids.

**Hands on training:**

- Prepare drawing sheet of orthographic projection

**Hands on training:**

- Prepare drawing sheet of orthographic projection
- Prepare drawing sheet of isometric projection.

**Text Book**

1. Engineering Drawing Plane and Solid Geometry : N.D. Bhatt and V.M. Panchal, Forty-
2. Fourth Edition 2002, Charotar Publishing House.

3. Engineering Graphics and Drafting : P.S. Gill, Milenium Edition, S.K. Kataria and Sons.

## **Subject: Workshop Technology**

### **Unit-1: Metal Cutting**

Introduction and definition, various types of single point cutting tools and their uses, Single point cutting tool geometry, Tool signature and its effect, Heat produced during cutting and its effect, cutting speed, feed and depth of cut and their effect.

### **Unit-2: Lathe, drilling and boring operations**

Introduction, function of various parts of a lathe, classification and specifications of various types of lathe, Lathe operations- plain and step turning, facing, parting off, taper turning, drilling, reaming, threading and knurling. Lathe accessories-centres, dogs, types of chucks, face plate, angle plate, mandrel, steady rest. Work holding devices.

Working principle of drilling, its classification, various operations performed on drilling machine- drilling, spot facing, reaming, boring, counter boring, counter sinking, tapping, nomenclature of a drill, types of drills

Working principle of boring, classification of boring machines, boring tools, boring bars and boring heads.

### **Unit-3: Milling and Grinding operations**

Introduction, working principle of milling machine, classification, brief description and applications of milling machine, Main parts of column and Knee type milling machine, Milling methods-up milling and down milling, Milling operation-face milling, angular milling, form milling and gangle milling, working holding devices.

Purpose of grinding, various elements of grinding wheel-Abrasive, Grade, Structure, Bond. Common wheel shapes and types of wheels- built up wheels, mounted wheels and diamond wheels, specification of grinding wheels as per BIS, Truing, dressing, balancing and mounting of wheel, Grinding methods-Surface grinding, cylindrical grinding and centreless grinding, Grinding machine-Cylindrical grinder, surface grinder, internal grinder

### **Unit-4: Welding**

Principle of welding, classification of welding processes, Advantages and limitations of welding, Industrial applications of welding, welding positions and techniques, symbols, Gas welding- Principle of operation, types of gas welding flames and their applications, Gas welding equipment, Gas welding torch. Arc. Welding-Principle of operation, Arc welding machines and equipment, A.C. and D.C. arc welding, effect of polarity, current and voltage regulations. Welding defects- types of welding defects, their causes and remedies

### **Unit-5: Cutting Tool Materials**

Introduction, properties of cutting tool materials, study of cutting tool materials- High speed steel, Tungsten Carbide, Cobalt steel cemented carbides, stellite, ceramics and diamond.

### **Recommended Books**

1. Manufacturing Technology by Rao: Tata McGraw Hill Publications, New Delhi
2. A Text Book of Production Engineering by P.C. Sharma: S. Chand and Company Ltd., New Delhi.

### **Subject: Workshop Technology lab**

#### **List of experiments**

1. To prepare a job on lathe machine including turning, taper turning, facing, threading and knurling operations.
2. To prepare lap joint using electric arc welding
3. To prepare a joint using gas welding

### **Subject: Workshop Practice lab**

#### **List of experiments**

1. To find the least count of Vernier caliper, micrometer and dial indicator
2. To study height gauge and surface plate
3. To prepare a job on milling machine
4. To prepare a job in fitting shop
5. To prepare butt joint using electric arc welding

## Semester: Second

### Subject: Entrepreneurship Management

UNIT	KEY LEARNING
<b>UNIT I Entrepreneurship</b>	Meaning, Nature and Scope Characteristics and Qualities of a Successful Entrepreneur Relationship between Entrepreneurship Development and Economic Development
<b>UNIT-II Entrepreneurship and Society</b>	Entrepreneurship and Society New Venture Development- Meaning and Stages Sources of Financing Entrepreneurship Managerial Vs Entrepreneurial Approach.
<b>UNIT-III EDP Programs</b>	EDP Programs Concept of Economic Freedom Financial Markets and Entrepreneurship Venture Capital; Angel Capital
<b>UNIT-IV Entrepreneurial Strategies and Business Plan:</b>	Entrepreneurial Strategies and Business Plan Presenting Business Plans to the Investors Future of Entrepreneurship in India
<b>UNIT-V Women Entrepreneurship</b>	Concept Factors governing women entrepreneurship Schemes for women entrepreneurship Rural Entrepreneurship, Concept, advantage and challenges.

### Subject: OJT

- Conventional machining on lathe, milling, drilling and grinding machines
- Electric and Gas Welding
- Safety and health awareness
- Material handling devices
- CNC machine operation
- Surface finishing methods

**Year: Second**

**Semester: Third**

**Subject: Basics of Electrical and Electronics Engineering**

**Objectives**

- Provide quality electrical engineering knowledge with extensive hands-on and laboratory experience.

**Learning Outcomes**

- Outline various electrical quantities and their units.
- Able to derive Ohm's Law and make use of its applications.
- Able to understand the concept of AC circuits
- Able to understand the basic concept of semiconductor materials.
- Outline the various concepts of SMPS, inverter & UPS.

<b>Unit</b>	<b>Topic</b>	<b>Key Learning</b>
I	<b>Basic Electrical Quantities</b>	<ul style="list-style-type: none"><li>• Basic concept of charge,</li><li>• current,</li><li>• voltage,</li><li>• resistance,</li><li>• power,</li><li>• energy and their units,</li><li>• Conversion of units of work,</li><li>• power and energy from one form to another</li></ul>
II	<b>DC Circuits</b>	<ul style="list-style-type: none"><li>• Ohm's Law, Series – parallel resistance circuits,</li><li>• calculation of equivalent resistance,</li><li>• Kirchhoff's Laws and their applications</li></ul>
III	<b>AC Circuits</b>	<ul style="list-style-type: none"><li>• Concept of AC Generation,</li><li>• Difference between AC and DC,</li><li>• Concept of alternating current and voltage,</li></ul>

		<ul style="list-style-type: none"> <li>• equation of instantaneous values,</li> <li>• average value, r.m.s value, form factor, power factor etc.,</li> <li>• A.C. Series Circuits with (i) resistance and inductance (ii) resistance and capacitance and (iii) resistance inductance and capacitance</li> <li>•</li> </ul>
IV	<b>Basics of Semiconductor</b>	<ul style="list-style-type: none"> <li>• Semiconductor materials,</li> <li>• Metals and Semiconductors and Photo-electric emission. N-type and P-type semiconductor,</li> <li>• PN junction diode,</li> <li>• Forward &amp; Reverse bias, Zener diode.</li> </ul>
V	<b>Power supply</b>	<ul style="list-style-type: none"> <li>• Introduction and Working of Switched Mode Power Supply (SMPS),</li> <li>• Voltage Regulator, Introduction to Inverters and UPS.</li> </ul>

**Suggested Readings:**

- Electrical Technology by BL Theraja, S Chand and Co, New Delhi.
- Basic Electrical and Electronics Engineering by SK Sahdev; Dhanpat Rai and Sons, New Delhi.
- Experiments in Basic Electrical Engineering by SK Bhattacharya, KM Rastogi; New Age International (P) Ltd.; Publishers New Delhi.

**Subject: Basics of Electrical and Electronics Engineering lab**

**Objectives:** Provide quality electrical engineering knowledge with extensive hands-on and laboratory experience.



## **Learning Outcomes**

- Outline various electrical quantities and their units.
- Able to derive Ohm's Law and make use of its applications.
- Make use of the capacitors and use them in series and parallel connection.
- Able to understand the electromagnetic effects and its laws.
- Outline the various concepts of AC Circuits and its connection with resistance, inductance and capacitance.

## **List of Practicals**

1. Verify that resistance of conductor is directly proportional to resistivity and length and inversely proportional to cross-sectional area of the conductor
2. Verification of Ohm's Law
3. Study of series resistive circuits
4. Study of parallel resistive circuits.
5. Verification of Kirchhoff's current and voltage laws applied to DC circuits
6. Study of current, voltage and resistance measurement using of Multi-meter
7. Verification of Faraday's Laws of electromagnetic induction.
8. Study of SMPS Circuit.
9. Study of V-I Characteristic of Diode

## **Suggested Readings:**

- Electrical Technology by BL Theraja, S Chand and Co, New Delhi.
- Basic Electrical and Electronics Engineering by SK Sahdev; Dhanpat Rai and Sons, New Delhi.
- Experiments in Basic Electrical Engineering by SK Bhattacharya, KM Rastogi; New Age International (P) Ltd.; Publishers New Delhi.

**Subject: Applied Physics**

**Learning Outcomes:**

- To impart fundamental knowledge in the areas of scalar and vector quantities, basic laws of science, magnetism and electrical concepts.
- To apply fundamental knowledge in the area of Magneto-static and electro-magnetism.
- At the end of the course the students are familiar with the basic principles and applications of physics in various fields

<b>Unit Number</b>	<b>Key Learning</b>
<b>Unit-I Physical quantities, Units and Dimensions, Vectors and scalars:</b>	Physical quantities, units, systems of units – CGS, MKS and SI, dimensions and dimensional formula, Principle of Homogeneity, Checking the correctness of physical equations, Vectors and scalars, representation of a vector, Resolution of vectors, Rectangular components of vectors, Dot Product and Cross Product of vectors, Simple numerical
<b>Unit-II</b> Newton's Laws of Motion,:	Motion along a Straight Line, Distance and displacement, Speed and velocity, average velocity, acceleration, Introduction of force
<b>Unit-III</b> Work, Energy and Power	Laws of motion, momentum, conservation of momentum, Work done by force, negative work and positive work, Energy, Power, Kinetic and potential energy, Laws of conservation of energy, Work energy theorem.
<b>Unit-IV</b> Gravitation	Keplar's laws of planetary motion.The universal law of gravitation, Acceleration due to gravity and its variation with altitude and depth.Gravitational potential energy and gravitational potential. Escape velocity. Orbital velocity of a satellite. Geo-stationary satellites.
<b>Unit-V</b> Thermodynamics	Thermal equilibrium and definition of temperature (zeroth law of thermodynamics).Heat, work and internal energy. First law of thermodynamics. Isothermal and adiabatic processes, Second law of thermodynamics: reversible and irreversible processes. Heat engine and refrigerator

## **Subject: Applied Physics Lab**

1. Measurement of volume of a solid/hollow cylinder by Vernier Caliper.
2. Measurement of cross-sectional area of a wire by Screw Gauge.
3. Measurement of radius of curvature of a spherical surface by a Spherometer.
4. Calibration of a meter scale by using travelling microscope.
5. Determination of co-efficient of Friction by inclined Plane Method.
6. Determination of  $g$  by simple pendulum.
7. Determination of Moment of Inertia using a fly wheel.
8. Tracing of Lines of force due to a bar magnet with N-pole pointing North & N-pole pointing South and locate the neutral points.
9. Verification the laws of resistance by connecting two given standard resistances in series & in parallel using Ohm's Law.

## **Subject: Estimating & Costing**

### **Unit-1: Introduction**

definition of estimation, importance, aims and functions of estimating- cost accounting, purposes of cost accounting, comparison of estimating and costing, estimating procedure, cost estimators and their qualifications, types of estimates, constituents of job estimates, cost of production, selling price, capital investment, rate of return (ROR) on investment.

### **Unit-2: Elements of costing**

Definitions, objectives, elements of cost, components of costs, overhead expenses- factory expenses, depreciation causes, methods of calculation of depreciation cost, selling and distributions overheads and methods of allocation of overhead charges, procedure for costing.

### **Unit-3: Fundamentals of estimating**

Objectives of cost estimating, functions of cost estimating, organization of estimating department, principal factors in estimating, miscellaneous allowances, estimating procedures, qualities of estimator.

### **Unit-4: Estimation of material cost**

Estimation of volumes, weights and cost of material for items like pulleys, spindle, lathe centre, fly wheel, crank shaft and similar items

### **Unit-5: Estimation of machine shop**

Set up time, operation time, handling time, machining time, tear down time, allowances, personal, fatigue, tool checking/sharpening /changing, unit operation time, operations for different tools materials and product materials, estimation of time for various operations machining operations-turning, drilling, boring, tapping, shaping, planing, milling and grinding.

## **List of suggested books**

1. Mechanical estimating and costing by TTTI madras, TMH
2. Mechanical estimating and costing by BP Sinha, TMH
3. Production and costing by GBS, Narang and V. Kumar, Khanna publishers, New Delhi

**Subject: EVS**

**Objectives:**

Create awareness between the students about our ecosystem, related problems and our role in that.

**Learning Outcomes:**

- Encourage to solve the environment related problems and Make other people aware about environment problems
- Comply with the safety policies of ecosystem and environment
- Identify and recommend the opportunity for improving the environment hazards to the organization and society
- Report the polices and procedure need to adapt for environmental safety
- Create awareness among the employees and the society regarding the hazards of environmental pollution.

<b>Unit</b>	<b>KEY LEARNING</b>
<b>Unit-I</b> <b>Understanding our Environment</b>	Definition, Scope and Importance, Natural Resources, Forest Resources, Water Resources, Mineral Resources, Energy Resources, Food Resources, Land Resources.
<b>Unit-II</b> <b>Living things in Ecosystem</b>	What is Ecosystem, Habitat and ecological niche, interaction of species with each other, adapting to environment, bio geographic zones of India, Energy flow in ecosystem, cycling of materials, Kinds of ecosystem.
<b>Unit-III</b> <b>Atmosphere and Climate</b>	The atmosphere, layers of the atmosphere, climate, greenhouse effect, theOzone layer, deforestation, soil erosion

<b>Unit-IV Urbanisation</b>	Causes of urbanisation, Manifestations of Urbanisation, social economic and environmental problems in urbanisation, Agriculture, unsustainable patterns of modern industrialised agriculture, green revolution.
<b>Unit-V Environmental Pollution</b>	Causes of Air pollution, major air pollutants, classification of air pollutants, thermal inversions, photochemical smog, acid preparation in air, impact of Air Pollution.

### Field work

- Visit to a local area to document environmental assets river/forest/grassland/hill/mountain
- Visit to a local polluted site-Urban/Rural/Industrial/Agricultural
- Study of common plants, insects, birds.
- Study of simple ecosystems-pond, river, hill slopes, etc.

### Recommended Books

#### Text Books

E- book:<https://ugc.ac.in/oldpdf/modelcurriculum/env.pdf>

#### Reference Books

1. Industrial Safety and Health management” Pearson Prentice Hall,2003 by C.RayAsfahl
2. National Safety Council, “Accident Prevention Manual for Industrial Operations”, N. S. C. Chicago, 1988.
3. Industrial Accident Prevention” McGraw-Hill Company, New York,1980 by Heinrich H.W.

## **Subject: Applied Mechanics**

### **Unit-1: Introduction**

Concept and definition of engineering mechanics, statics, dynamics, application of engineering mechanics in practical fields, different systems of units (FPS, MKS and SI) and their conversions from one form to another forms e.g. density, force, pressure, work, power, velocity, acceleration (simple numericals), fundamentals and derived units.

### **Unit-2: Laws of forces**

Definition and types of forces, point/concentrated force, uniform distributed force, effect of force, characteristics of force, different force systems, principle of transmissibility of forces, law of super-position

Composition and resolution of coplanar concurrent forces, resultant force, method of composition of forces, laws of forces, triangle law of forces, polygon law of forces, free body diagram, Equilibrium force and its determination, Lami's theorem.

### **Unit-3: Friction**

Definition and concept of friction, coefficient of friction, angle of friction, angle of repose, equilibrium of a body lying on a horizontal plane, equilibrium of a body lying on a rough inclined plane.

### **Unit-4: Simple Machines**

Definition of simple and compound machine, definition of load, effort, velocity ratio, mechanical advantage and efficiency of a machine and their relationship, laws of machines, Definition of ideal machine, reversible and self locking machine, determination of maximum mechanical advantage and maximum efficiency, system of pulleys (first, second, third system of pulleys), determination of velocity ratio, mechanical advantage and efficiency, working principle and application of wheel

and axle, simple screw jack and worm and worm wheel, expression for their velocity ratio and field of their application.

### **Unit-5: Moment**

Concept of moment, moment of force and units of moment, principle of moment and its applications (lever-simple and compound), parallel forces (like and unlike parallel forces), calculating their resultant, concept of couple, its properties and effects, general conditions of equilibrium of bodies under coplanar forces.

### **Subject: Applied Mechanics lab**

#### **List of experiments**

1. To verify the forces in different members of jib crane
2. To find the mechanical advantage, velocity ratio, and efficiency in case of an inclined plane.
3. To verify the reaction at the supports of a simple supported beam
4. To find the mechanical advantage, velocity ratio, and efficiency of a screw jack.
5. To determine the coefficient of friction between three pairs of given surface.



## **Subject: CAD lab**

1. Introduction to Computer Aided Drafting (2D) commands of any one software (Auto CAD, Solid works, Unigraphics etc.).
  - 1.1 Concept of Auto CAD, Tools bars in CAD software, coordinate system, snap, grid and ortho mode (Absolute, Relative and Polar), setting of units and layout.
  - 1.2 Drawing commands-point, line, arc, circle, ellipse
  - 1.3 Editing commands-scale, erase, copy, stretch, lengthen and explode
  - 1.4 Dimensioning and placing text in drawing area
  - 1.5 Sectioning and hatching
  - 1.6 Inquiry for different parameters of drawing entity
  - 1.7 Create layers within a drawing
  - 1.8 Specifying geometrical dimensioning & tolerancing (GD & T) parameters in drawing
2. Details and assembly drawing of the following using drafting software (2D)
  - 2.1 Stepped pulley, V-belt pulley
  - 2.2 Flanged coupling
  - 2.3 Machine tool holder
3. Isometric Drawing by using CAD using any part modelling software (3D)  
Drawing of the following on computer
  - (a) Cone
  - (b) Cylinder
  - (c) Cube
  - (d) Spring
  - (e) Isometric view of objects
4. Introduction to any part modelling software (Pro-E, Solid works, Auto CAD, Unigraphics, Catia etc.)

Introduction to Sketcher, Sketch entities, sketch tools, blocks, dimensioning

4.1 part modelling tools:

4.1.1 Creating loft features

4.1.2 Creating extrude features creating revolve creating swept

4.1.3 Creating reference- points, axis, coordinates

4.1.4 Creating curves

4.1.5 Creating fillet features

4.1.6 Inserting Hole types

4.1.7 Creating Chamfer

4.1.8 Creating Shell

4.1.9 Creating Rib

4.1.10 Environment & utilities- Working with views and manipulating views

4.1.11 Create parts e.g. Piston, pin, bolts and nuts, fixture, jig parts, washer, rings, gaskets etc.

List of books

1. Auto CAD 2000 by Ajit Singh, TMH, New Delhi
2. Engineering drawing with AutoCAD by T.Jeyapooran; Vikas publishing house, Delhi

## **Subject: CNC machines & Automation**

### **Unit-1: Introduction**

Introduction to NC, basic components of NC, MCU, input devices, advantages/disadvantages of NC machine over conventional machines, CNC & DNC, their types, their advantages, disadvantages and applications, selection of parts to be machined on CNC machines, problems with conventional NC.

### **Unit-2: System Devices**

Control system, feedback control classification (open & close loop), Actuators, transducers and sensors, characteristics of sensors, tachometer, LVDT, opto-interrupters, potentiometers for linear and angular position, encoder and decoder, axis drive, other classification of CNC machines-feedback, motion, positioning.

### **Unit-3: Problems in CNC machines**

Common problems in mechanical, electrical, pneumatic, electronic and PC components of CNC machines, diagnostic study of common problems and remedies, use of on-line fault finding diagnosis tools in CNC machines, methods of using discussion forums, environmental problems.

### **Unit-4: Automation and NC system**

Automation, suitability of production system to automation, types, emerging trends in automation, automatic assembly, manufacture of printed circuit boards, manufacture of integrated circuits, overview of FMS, AGV, ASRS, group Technology, CAD/CAM and CIM, Automated identification system, concept of AI, Robotics, nomenclature of joints, motion.

### **Unit-5: Part programming**

Part programming and basic procedure of part programming, NC blocks, part programming formats, simple programming for rational components (point to point, straight line, curved surface), tool offset, cutter radius compensation and wear compensation.

## **Subject: CNC machines & Automation lab**

### **List of practical**

1. Develop a part programme for following lathe operations and make the job on CNC lathe and CNC turning center (for finish pass only)  
Calculate coordinate points for a cylindrical job by considering sign convention for lathe
  - Plain turning and facing operations
  - Taper turning operations
  - Operations along contour using circular interpolation
2. Develop a part programme for the following milling operations and make the job on CNC milling (for finish pass only)
  - Plain milling
  - Slot milling
  - Contouring
  - Pocket millingCalculate coordinate points for a zig-zag job by considering sign convention for milling.
3. Develop a part program by using canned cycle on CNC lathe for turning, facing.
4. Preparation of work instruction for machine operator
5. Preparation of preventive maintenance schedule for CNC machine
6. Use of software for turning operations on CNC turning centre
7. Use of software for milling operations on machine centres

### **List of books**

1. CNC Machines-Programming and applications by M.Adithan and B.S. Pabla, New Age International (P) Ltd, Delhi

2. CNC machine and Automation by J.S. Narang, Dhanpat Rai & Co., New Delhi
3. Computer Aided manufacturing by Rao, Kundra and Tiwari, Tata McGraw Hill, New Delhi

**Subject: CNC Programming lab**

1. Write the NC program for component (dia. - 35mm) to be machined on lathe with step turning to 16mm taking from 25 mm.
2. Write the NC program for component (dia. - 30mm) to be machined on lathe with taper turning to 20 mm followed by 20 mm turning.
3. Write the NC program for rectangular block to be machined on milling for a slot 100mm wide on the periphery of block.
4. Write the NC program for 4 holes to be drilled on 10mm thick plate in symmetry using CNC milling
5. Write NC program with subroutines, Do- loops for component to be machined.

**Semester: Fourth**  
**Subject: Industrial Ethics**

**OBJECTIVES**

1. To develop moral responsibility and mould them as best professionals..
2. To create an ethical vision and achieve harmony in life

**LEARNING OUTCOME**

1. By the end of the course student should be able to understand the importance of ethics and values in life and society.

<b>Unit-I Self Exploration</b>	Self Exploration–what is it? - its content and process Ethics and Business Ethics Concepts Values and Ethics Human Values-Classification of Values
<b>Unit-II Human Values</b>	Understanding Harmony in the Human Being Ethical Corporate Behaviour Its Development Ethical Leadership
<b>1. Unit-III Controlling of the Mind</b>	Control of the mind through Simplified physical exercise Yoga- Objectives Types, Asanas; Meditation- Objectives, Types Effect on Body Mind and Soul
<b>Unit-IV Social Responsibility of Business</b>	Ethical Decision-making Social Responsibility of Business and Corporate Governance Profession and Professionalism Professional Ethics
<b>Unit-V Social Issues and the Environment</b>	Sustainable Development, Urban Problems Related to Energy, Water Conservation, Rain Water Harvesting, Watershed Management, Resettlement and Rehabilitation of People, Its Problems and Concerns,

**Suggested Readings:**

1. Govindharajan, M., Natarajan, S. and Senthil Kumar, V.S., Engineering Ethics, Prentice Hall of India, (PHI) Delhi, 2004.
2. Subramainam, R., Professional Ethics, Oxford University Press, New Delhi, 2013.
3. Business Ethics & Corporate Governance, Utkal University
4. Charles D, Fleddermann, "Engineering Ethics", Pearson / PHI, New Jersey 2004

**Subject: OJT**

- Testing & inspection of raw materials
- CNC programming
- Pneumatic and Hydraulics circuits

**Semester: 5<sup>th</sup>**

**Subject: Materials and Metallurgy**

### **Unit-1: Introduction**

Overview of various engineering materials and applications, importance, classification of materials, difference between metals and non-metals, physical and mechanical properties of various materials, present and future needs of materials.

### **Unit-2: Crystallography**

Fundamentals, crystalline solid and amorphous solid, unit cell, space lattice, arrangement of atoms in SCC, BCC, FCC and HCP crystals, number of atoms per unit cell, atomic packing factor, coordination number.

Deformation- Overview of deformation behaviour and its mechanisms, elastic and plastic deformation, behaviour of materials under load and stress-strain curve, failure mechanism-Overview of failure modes, fracture, fatigue and creep

### **Unit-3: Metallurgy**

Introduction, cooling curves of pure metals, dendritic solidification of metals, effect of grain size on mechanical properties, binary alloys, thermal equilibrium diagrams, lever rule, solid solution alloys

### **Unit-4: Metals and Alloys**

Ferrous metals: Different iron ores, flow diagram for production of iron and steel, allotropic forms of iron, Alpha, Delta, Gamma, basic process of manufacturing of pig iron and steel making.

Cast Iron; properties, types of cast iron, manufacturing and their use.

Steels: plain carbon steels and alloy steel, classification of plain carbon steels, properties and application of different types of plain carbon steel, effect of various



alloying elements on properties of steel, uses of alloy steels (high speed steel, stainless steel, silicon steel, spring steel).

Non-ferrous materials; properties and uses of Copper, Aluminium and their alloys

### **Unit-5: Heat Treatment**

Definition and objectives of heat treatment, iron carbon equilibrium diagram, different microstructures of iron and steel, formation and decomposition of Austenite, Martensitic transformation. Various heat treatment processes-hardening, tempering, annealing, normalizing, surface hardening, carburising, nitriding, cyaniding, hardenability of steels, types of heat treatment furnaces (only basic idea), measurement of temperature of furnaces.

#### **List of suggested books**

1. Text book of material science by RK Rajput, Katsons pub., Kudhiana
2. Text book of materials science by VK manchanda and GBS Narang, z\Khanna publishers, New Delhi

#### **Subject: Materials and Metallurgy lab**

#### **List of experiments**

1. Classification of about 25 specimens of materials/machine parts in to
  - (i) Metals and non-metals
  - (ii) Metals and alloys
  - (iii) Ferrous and non-ferrous metals
  - (iv) Ferrous and non-ferrous alloys
2. Study of a metallurgical microscope and a specimen polishing machine
3. To anneal a given specimen and find out difference in hardness as a result of annealing.
4. To normalize a given specimen and to find out the difference in hardness as a result of normalizing.

5. To harden and temper a specimen and to find out the difference in hardness due to tempering.

## **Subject: Hydraulics & Pneumatics**

### **Unit-1: Introduction**

Introduction to hydraulics and pneumatics, fluid, types of fluid, properties of fluid- mass density, weight density (specific weight), specific volume, capillarity, specific gravity, viscosity, compressibility, surface tension, kinematic viscosity and dynamic viscosity and their units

### **Unit-2: Pressure and Measurement**

Concept of pressure, intensity of pressure, static pressure and pressure head, types of pressure (atm. Pressure, gauge pressure, absolute pressure)

Pressure measuring devices- Manometers and Mechanical Gauges, Manometers- Piezometers, simple U-tube manometer, Inverted U-tube manometers, construction, working and application, Mechanical Gauges- Bourdon tube pressure gauge, diaphragm pressure gauge, dead weight pressure gauge, construction, working and applications, statement of Pascal's law and its applications.

### **Unit-3: Flow of fluids**

Types of fluid flow- steady and unsteady, uniform and non-uniform, laminar and turbulent, rate of flow and its units, continuity equation of flow, hydraulic energy of a flowing fluid, total head, Bernoulli's theorem statement (without proof), and its applications, discharge measurement with the help of Venturimeter, Orifice meter, Pitot tube, limitations of Bernoulli's theorem

Pipe and pipe flow- loss of head due to friction- Chezy's equation and Darcy's equation of head loss (without proof), Reynold's number and its effect on pipe friction.

### **Unit-4: Hydraulic machines**

Description, operation and application of- hydraulic press, hydraulic jack, hydraulic brake, hydraulic door closer

### **Unit-5: Oil power hydraulic and pneumatic system**

Introduction to oil power hydraulic and pneumatic system, relative merits and demerits as oil power hydraulic and pneumatic system, industrial applications of oil power hydraulic and pneumatic system, basic components of hydraulic system, definition and functions of each component in a hydraulic circuit, hydraulic oils-classification and their properties, seals and packing-classification of seals, sealing materials, maintenance of hydraulic system-common faults in hydraulic system, simple visual checks of oil, causes of contamination, preventive measures

Basic components of pneumatic systems, definition and functions of each component in a pneumatic circuit necessity of filter, regulator and regulators (FLR)

Common problems in pneumatic systems, maintenance schedule of pneumatic systems.

#### **List of suggested books**

1. Fluid mechanics by K.L. Kumar, S. Chand and Co. Ltd., New Delhi
2. Hydraulics and Fluid Mechanics by R.S. Khurmi, S. Chand & Co. Ltd., New Delhi
3. Fluid Mechancs by Dr. A.K. Jain, Khanna Publisher

## **Subject: Hydraulics & Pneumatics lab**

### **List of practical**

1. Measurement of pressure head by using
  - (i) Piezometer tube
  - (ii) Simple U-tube manometer
2. Verification of Bernoulli's theorem
3. Measurement of flow by using venturimeter
4. To find the value of coefficient of discharge for a venturimeter
5. To find the value of coefficient of friction for a pipe
6. Study of hydraulic circuit of any available machine or working model
7. Study of pneumatic circuit of any available machine or working model

## **Subject: Fabrication processes**

### **Unit-1: Welding consumables**

Classification of electrodes, functions of electrodes coating, types of coating, classification and coding of heavy coated electrodes, welding fluxes, functions of fluxes, roles of flux in gradients, basicity index, classification of fluxes, characteristics of inert gases used in welding.

### **Unit-2: Weldability**

Definition of weldability, different aspects of welding, weldability tests, weldability of carbon steel, stainless steel and aluminium.

### **Unit-3: Welding inspection**

Visual inspection, tensile and bend test of a weldment as per standard practice, principle and procedure of dye penetrant, magnetic particle, ultrasonic and X-ray inspection.

### **Unit-4: Distortion and residual stresses**

Causes of the development of distortion and residual stresses, different methods to control distortion and residual stresses in the weldment.

### **Unit-5: Safety codes and practices related to welding**

Effect and protection from fumes and gases, chromium and Nickel in welding fumes, Radiation, noise shocks, safe storage, handling and use of gas cylinders, eye and face protection for welding and cutting operations.

#### **List of books**

1. Welding Engineering by Dr. RS parmar, Khanna Publisher, Delhi
2. Welding Technology by OP Khanna, Dhanpat Rai & Sons, Delhi

### **Subject: Fabrication Processes lab**

#### **List of Experiments**

1. To prepare a joint by using the spot welding machine
2. To analyse the effect of welding parameters (voltage, welding speed, current etc.) on the weld bead geometry (penetration, bead width etc.)
3. To prepare a weldment and perform the tensile and band tes of the same as per standard practice.
4. To inspect a given weld joint by using penetrant test.

## **Subject: Strength of Materials**

### **Unit-1: Stresses and Strains**

Concept of stress and strain, concept of load, stresses and strain, tensile, compressive and shear stresses and strains, concept of Elasticity, Elastic limit and limit of proportionality, Hook's law, Poisson ratio, longitudinal and circumferential stresses in seamless thin walled cylindrical shells (derivation not required)

### **Unit-2: Bending stresses**

Concept of bending stress, theory of simple bending, use of equation  $f/y = M/I = E/R$ , concept of moment of resistance, bending stress diagram, calculation of maximum bending stress in beams of rectangular, circular, and T-section.

### **Unit-3: Columns**

Concept of column, modes of failure, types of columns, buckling load, crushing load, slenderness ratio, factors effecting strength of a column, end restraints, effective length, strength of column by Euler formula without derivation, simple numerical problems

### **Unit-4: Torsion**

Concept of torsion difference between torque and torsion, use of torque equation for circular shaft, comparison between solid and hollow shaft with regard to their strength and weight, power transmitted by shaft, simple numerical problems

### **Unit-5: Springs**

Closed coil helical springs subjected to axial load and impact load, stress deformation, stiffness and angle of twist and strain energy, proof resilience, laminated spring (semi elliptical type only), determination, simple numerical problems.

### **List of Books**

6. SOM by RS Khurmi, S. Chand & Co., New Delhi
7. SOM by Birinder Singh, katson publishing house, New Delhi

### **Subject: Strength of materials lab**

#### **List of Experiments**

1. Tensile test on bars of mild steel
4. Bending tests on a steel bar
5. Impact test on metals (a) Izod test (b) Charpy test
6. Torsion test on specimens of different metals for determining modulus of rigidity
7. To determine the stiffness of helical spring and to plot a graph between load and extension
8. Hardness test on different metals

## **Subject: Jigs Fixtures and Guage Design**

### **Unit-1: Jigs and Fixtures**

Concept of jigs and fixtures, need and advantages, concept of interchangeability, classification of jigs and fixtures

### **Unit-2: Location and Clamping devices**

Basic principles of location, 3-2-1 principle of location, location for various services, location methods and devices, concept of clamping and various clamping devices

### **Unit-3: Drilling jigs**

Definition of drilling jigs, Drilling jigs, Drilling bushes & their function, types of drilling jigs such as box type, channel jig, latch jig, indexing jig.

### **Unit-4: Fixtures**

Introduction to fixtures, types of fixtures such as milling fixtures ( single piece, gang milling), lathe and boring fixtures, grinding and welding fixtures, application of pneumatic in jigs and fixtures

### **Unit-5: Limit Gauges**

Introduction to plain limit gauges, classification of limit gauges such as plug, ring & snap gauges, brief description of thread gauges, material selection, Taylor`s principle of maximum and minimum material condition, Go and Not go ends of gauges and selection of gauges for inspection.

### **List of books**

1. Prakash H Joshi, Press tools design & construction, wheeler publisher
2. Fundamentals of tool design by Donaldson
3. Production Engineering & Design by Surender Kr & Umesh Chandra, Satya Parkashan, New Delhi



## **Subject: Jigs Fixtures and Guage Design lab**

### **List of Experiments**

1. Design and drawing of drilling jigs
2. Design and drawing of fixtures for milling
3. Design and drawing of limit gauges such as plug gauge, ring gauge and snap gauge (at least one)

## **Subject: CAD/ CAM lab**

### **1: Introduction**

Introduction to CAD/CAM, advantages of CAD, product cycle and CAD/CAM, reasons for implementation of CAD/CAM, steps involved in CAM process

### **2: Surface/ Solid Modelling**

Introduction to parametric and non-parametric surfaces, creation of simple surfaces using revolved surface, ruled surface and 3D surfaces commands, designing softwares used in creation of soild models, concept of solid models, solid primitives- box, cylinder, cone, sphere, wedge and torus, construction of solid using region, extrude and revolve features, creation of composite soild using Boolean function e.g. union, subtraction and intersection, sectioning of soilds and modification of solid edges and faces using solid editing commands, shell, separate commands, performing 3D operations like 3D array, mirror and rotate, creation of filters and chamfers, dimensioning of solids

### **3: Viewing objects in 3D space**

Viewing the objects in different views, concept of SW, SE, NE and isometric views, views ports, layout, changing from model to paer space layout, arranging the drawing showing different voews to get the hard copy, plotting the drawing

### **4: CNC operations involved in turning and milling**

Introduction to operations involved in turning machines-facing, OD and ID rough cut, finish cut, taper cut, taper turning, drilling, threading, grooving and cut-off (parting), introduction to operations involved in milling-contouring, pocketing, drilling, facing, circular tool paths, different terms like clearance, retract, feed plane, depth of cut, lead in, lead out, overlap, simple programs in milling and turning involving different operations.

## **5: Tool path generation and verifications**

Setting up the jobs, defining the operations, chaining the geometry, specifying the tools, machining parameters and type of machining, back plotting and verification of operations, post processing-converting the generated tool path in NC code depending on the system, transfer of drawing from any CAD software like AutoCAD, to CAM and vice-versa.

## **Subject: Plant maintenance and material handling**

### **Unit-1: Introduction**

Necessity and advantages of testing, repair and maintenance, common instruments required for testing, significance of B-T curve in the life span of machine tool, acceptance test for machine tools, economic aspects, manpower planning and materials management, Fits and Tolerances-common fits and tolerances used for various machine parts.

### **Unit-2: Testing of machines**

Testing equipment, dial gauge, mandrel, spirit level, straight edge, auto collimator, recalibration of measuring instruments like Vernier calliper, testing methods-geometrical/alignment test, performance test, testing under load, run test, vibrations, noise.

### **Unit-3: Repairing**

Common parts which are prone to failure, reasons of failure, repair schedule, parts that commonly need repair such as belts, couplings, nuts and bolts repairing the engines, compressors and boilers

#### **Unit-4: Lubrication system**

Lubrication methods and periodical lubrication chart for various machines (daily, weekly, monthly), handling and storage of lubricants, lubricants conditioning and disposal, lubricant and their grades needed for specific components such as gears, bearings and chains, purpose and procedures of changing oil periodically (like gear box oil)

#### **Unit-5: material handling systems**

Basic principles of material handling, basic types of material handling equipments and its characteristics, uses and limitations, forklift trucks, selection of material handling equipment, unit load-pallet sizing and loading, conveyor models, AGV systems, Automated storage & retrieval system(ASRS)

#### **List of books**

1. Industrial maintenance by HP Harg, S. Chand and company, Delhi
2. Installation, testing and maintenance by JS Narang, Dhanpat Rai & Sons, New Delhi
3. Plant maintenance Engineering by RK Jain, Khanna Publisher, Delhi

Semester: Six

#### **Subject: Major Project (Live)**

Some of the suggested project activities are given below;

1. Projects connected with repair and maintenance of machines

2. Estimating and costing of projects
3. Design of jigs/ fixtures
4. Projects related to quality control
5. Projects work related to increasing productivity
6. Projects related to installation, calibration and testing of machines
7. Projects related to wastage reduction
8. Projects related to fabrication
9. Energy efficiency related projects
10. Projects related to improving an existing system

Note: Each student has to take one project individually and one to be shared with a group of four-five students depending upon cost and time involved. There is no binding to take up the above projects as it is only a suggestive list of projects.

**Subject: OJT**

Measurements including CMM  
Profile projector  
Exposure to metallurgy and heat treatment