Lok Jagruti Kendra University
University with a Difference

Diploma in Automation & Robotics

LJ Polytechnic

Course Code: 025120403

Machine Tools & Techniques

Programme / Branch Name			Diploma in Automation and Robotics			
Course Name	Machine Tools & Techniques				**Course Code**	025120403
Course Type	HSSC	BSC	ESC	PCC	OEC	PEC

Legends: HSSC: Humanities and Social Sciences Courses BSC: Basic Science Courses
ESC: Engineering Science Courses PCC: Program Core Courses
OEC: Open Elective Courses PEC: Program Elective Courses

1. Teaching and Evaluation Scheme

Teaching Hours / Week				**Evaluation Scheme**			
L	**T**	**P**	**Total Credit**	**CCE**	**SEE (Th)**	**SEE (Pr)**	**TOTAL**
3	0	2	4	50	50	50	150

Legends:
L: Lectures T: Tutorial P: Practical
CCE: Continuous & Comprehensive Evaluation
SEE (Th): Semester End Evaluation (Theory)
SEE (Pr): Semester End Evaluation (Practical)

2. Prerequisites

- ✓ Material Science
- ✓ Manufacturing Processes

3. Rationale

A large number of industrial parts have to undergo various machining operations for conversion into finished products. Appropriate selection and usage of machine tools, work holding devices, cutting tools, and process parameters play a very crucial role in obtaining a good quality product at optimum cost. This course will make the student familiar with fundamentals of cutting mechanics, kinematics, constructional features, and selection criterion for various basic machine tools and automates with some basic exposure to conventional work holding devices and cutting tools and tool holders used on the same machines.

4. Objectives

- ✓ To understand terminology and geometry of tools and various operations on the lathe
- ✓ To introduce students to the scientific principles underlying material behavior during manufacturing processes to enable them to undertake calculations of forces, tool stresses, and material removal rates.
- ✓ To understand various machine tools such as lathe, drilling machine, reciprocating machines, etc., and their operations.
- ✓ To impart knowledge of appropriate parameters to be used for various machining operations.
- ✓ Understand the use of various machine tools and their fields of application.

5. Contents

Unit No.	Unit Name	Topics	Learning Outcome	% Weightage	Hours
1.	**Introduction to Machine Tool and Metal Cutting**	1.1. Need of attitude, knowledge & skill required for shop floor supervisor in machine tools-based industries 1.2. Define and classify basic machine tools 1.3. Theory of metal cutting 1.3.1. Chip formation, types of chips 1.3.2. Mechanics of cutting action, orthogonal and oblique cutting 1.4. Cutting tool 1.4.1. Classification of cutting tools-single point cutting tool geometry 1.4.2. Cutting tool materials, tool wear, tool life 1.5. Concept and definition of cutting speed, feed, and depth of cut 1.6. Cutting fluid basic need, types, properties, and their applications	• Understand the concept and basic mechanics of metal cutting • Discuss the effect of varying cutting parameters. • Select cutting tool material for given workpiece material and machining operation. • Understand the factors affecting tool life.	19	8
2.	**Lathe and Lathe Operations**	2.1. Lathe machine 2.1.1. Types 2.1.2. Working principle (using block diagram) 2.1.3. Parts, feed mechanisms 2.1.4. Specifications of lathe 2.1.5. Lathe operations 2.2. Accessories and attachments 2.3. Machining cost estimation	• Understand classification, working principles, construction, and operation of the lathe • To learn about mechanism & motion transmission in the lathe • To understand about work holding devices for lathe	24	10
3.	**Reciprocating Machine Tools**	3.1. Shaping machine 3.1.1 Types	• To learn about different types, working principles, construction and	24	10

		3.1.2. Working principle (using block diagram) 3.1.3. Constructional features and detailed specifications 3.1.4. Quick return mechanisms- kinematic sketch, working, and advantages 3.1.5. Operations performed 3.1.6. Work holding devices- constructional sketch, working, and applications 3.2. Planning machine 3.2.1. Types 3.2.2. Working principle (using block diagram) 3.2.3. Constructional features and detailed specifications of double column planner 3.2.4. Operations performed 3.2.5. Work holding devices- constructional sketch, working, and applications 3.3. Machining cost estimation	operations of shaping, planning machine • Describe mechanisms & motion transmission in shaping and planning machines. • Cost estimation in shaper, planner machine shop		
4	**Drilling Machine**	4.1. Drilling machine 4.1.1. Types 4.1.2. Working principle (using block diagram) 4.1.3. Twist drill geometry 4.1.4. Radial drill machine 4.1.5. Constructional features	• Understand classification, working principles, construction, and operation of drilling machine • To learn about mechanism & motion transmission in drilling machine	14	6

		4.1.6. Detailed specifications 4.1.7. Accessories-types,constructional sketch, working, and applications 4.1.8. Tool holding and setting methods 4.2. Machining cost estimation	• To understand about work holding devices for drilling machine		
5	**Milling Machine**	5.1. Milling machine 5.1.1. Types 5.1.2. Working principle (using block diagram) 5.1.3. Constructional features 5.1.4. Detailed specifications 5.1.5. Operations performed 5.2. Milling cutters 5.2.1. Types 5.2.2. Applications 5.3. Up milling and down milling 5.3.1. Concept, advantages, disadvantages, and application 5.4. Indexing 5.4.1. Types 5.4.2. Constructional sketch, working, and use 5.4.3. Simple, differential, and compound indexing methods 5.5. Machining cost estimation	• Explain classification, working principles, construction, and operation of milling machine. • Describe mechanism & motion transmission in a milling machine. • Select appropriate milling cutter for required milling operation • Calculate the number of revolutions of the indexing head for given requirements using the appropriate indexing method.	19	8
				Total Hours	**42**

6. List of Practicals / Exercises

The practical/exercises should be properly designed and implemented in an attempt to develop different types of skills so that students can acquire the competencies/Programme outcomes. Following is the list of practical exercises for guidance.

Sr. No.	Practical / Exercises	Key Competency	Hours
1.	**Preparatory Activity:** a. For given workpiece and tool material; select, set, and observe cutting speed, feed, and depth of cut on lathe machine. Also, define these terms. b. Calculate metal removal rate (MRR) for the above case. c. Identify various cutting tools, their geometry, and material available at the workshop. Sketch them. d. Identify various carbide inserts and ISO codification. e. Calculate revolution per minute (RPM) for lathe, milling cutter, and drill spindle based on given data	Types of Cutting tools, Tool geometry, Tool material, Material removal rate	2
2.	**Turning Job:** Prepare a job on a center lathe as per the given drawing. (Including plain turning, taper turning, knurling, threading, grooving, etc). The student will also prepare a report including: a. Drawing of the job. b. Operation sequences including details of cutting parameters used. c. Sketch of cutting tools used. d. Specification of machines used. e. Machine settings for threading.	Lathe machine, Sketch up, Different operations on lathe machine	6
3.	**Milling Job:** Prepare a job using milling operations including the use of indexing head (Excluding gear tooth cutting). The student will also prepare a report including: a. Drawing of the job. b. Operation sequences including details of cutting parameters used. c. Sketch of cutting tools used. d. Specification of machines used. e. Machine settings for indexing.	Sketch-up, Specification, Indexing, Milling operation	8
4.	**Shaping and Drilling Job:** Prepare a job having plain and inclined surfaces on shaping machine with a minimum of two holes as per given drawing. The student will also prepare a report including: a. Drawing of the job. b. Operation sequences including details of cutting parameters used. c. Sketch of cutting tools used. d. Specification of machines used.	Sketch-up, Specification, Drilling operation	6

5.	**Tool Layout:** Prepare a tool lay-out of a given component for capstan and turret lathe.	Tool layout, Single point cutting tool	2
6.	**Industrial Visit:** Visit A Nearby Machine Shop And Prepare A Two Page Report Comprises Of a List Of Machine Tools Including Automates, Technical Specification, Machining Parameters For Various Operations Being Performed, Cutting Tools, And Work Holding Devices Used, Observation Of Skill And Safety Criteria.	Skill development, Real-life solution	2
7.	**Mini Project and Presentation:** For a given product (different for each student) prepare a complete report in the suggested format including the selection of raw material type & section, sequence of various manufacturing operations, selection of machine, machining parameters, work holding device, tool holder, etc. For each machining operation. Each student will also present the outcome.	Skill development, Activity	2
		Total Hours	**28**

7. Suggested Specification Table for Evaluation Scheme

Unit No.	Unit Name	Distribution of Topics According to Bloom's Taxonomy					
		R %	U %	Ap %	C %	E %	An %
1.	Introduction to Machine tool and Metal cutting	20	40	24	8	8	-
2.	Lathe Machine & Operations	12	35	29	-	12	12
3.	Reciprocating Machine Tools	18	30	27	10	7	8
4.	Drilling Machine	16	34	32	-	6	12
5.	Milling Machine	18	38	30	-	6	8

Legends: R: Remembering U: Understanding
App: Applying C: Creating
E: Evaluating An: Analyzing

8. Textbooks

1) Manufacturing Technology, Vol I & II, Rao, P.N, Tata Mcgraw Hill Publishing Co, New Delhi.
2) Manufacturing Engineering and Technology,Seropekalpakjian, Steven R Schmid, Pearson Education-Delhi

9. Reference Books

1) A Textbook Of Production Technology – Vol I And II, P Sharma, S. Chand & Company Ltd., New Delhi.
2) HMT – "Production Technology", Tata Mcgraw-Hill.

3) Workshop Technology I & II J. A. Schey McGraw-Hill.
4) Workshop Technology I & II Raghuwanshi Dhanpat Rai and Company (P) Limited
5) Workshop Technology I, II & III W. A. J. Chapman Viva books
6) Manufacturing Processes M. L. Begman John Wiley and Son
7) Production Technology R. K. Jain and S. C. Gupta Khanna Publishers
8) Elements of Workshop Technology Volume No. II Machine Tools Hajra Choudhary, Bose S. K., Roy Nirjhar Media promotors and publishers PVT. Limited
9) Manufacturing Processes S. E. Rusinoff Times of India Press

10. Open Sources (Website, Video, Movie)

1) http://nptel.iitm.ac.in/video.php?subjectId=112105126
2) http://www.youtube.com/watch?v=81Fdif5e85c
3) http://www.youtube.com/watch?v=THVgkBnjLq0
4) http://www.youtube.com/watch?v=6VpCBk7FahI
5) http://www.youtube.com/watch?v=7wC1u4WOV1o
6) http://www.youtube.com/watch?v=VDIoUZuTunI
7) http://www.youtube.com/watch?v=fGqc9mZS0YI
8) https://www.youtube.com/watch?v=r7PUWpsf1pI
9) https://www.youtube.com/watch?v=hheFVuUBpxo