Lok Jagruti Kendra University
University with a Difference

Diploma in Automation & Robotics

Course Code: 025120505

Advance Manufacturing Processes

Programme / Branch Name			Diploma in Automation & Robotics			
Course Name	Advance Manufacturing Processes				**Course Code**	025150505
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
- ✓ Basic mathematics
- ✓ Manufacturing process
- ✓ Machine tools and techniques

3. Rationale

Mechanical technologists (diploma holders) have to work with men, machines and materials. With the advancements, newer difficult to machine materials and complex shapes with high surface finish is the demand of manufacturing sector. To machine these materials and also the complex geometries with high surface finish the student must have the knowledge of non-conventional machining processes like EDM, ECM, LBM, PAM, EBM etc. and also the conventional machining like gear manufacturing, thread manufacturing, CNC machine etc.

4. Objectives

- ✓ Maintain the non-conventional machining process to produce complex components of hard materials.
- ✓ This course provides student to fundamental knowledge and skill to understand basic and practical approach of non-conventional processes.
- ✓ Choose relevant machining process to produce gears.
- ✓ Choose relevant process to produce thread.
- ✓ Maintain CNC machine to produce components effectively.
- ✓ Prepare CNC part programs for simple components.

5. Contents

Unit No.	Unit Name	Topics	Learning Outcome	% Weightage	Hours
1.	**Non-Conventional Machining Processes**	1.1. Fundamentals of Non-Conventional Method 1.1.1. Needs and types of Non-Conventional methods 1.1.2. Importance of Non-Conventional methods 1.2. Working principle, set up, process parameters, advantages, limitations and applications of 1.2.1. Electro Discharge Machining (EDM) 1.2.2. Electro Chemical Machining (ECM) 1.2.3. Abrasive Jet Machining (AJM) 1.2.4. Ultrasonic Machining (USM) 1.2.5. Laser Beam Machining (LBM) 1.2.6. Electron Beam Machining (EBM) 1.2.7. Plasma Arc Machining (PAM)	• Describe with sketches the working principleof given non-conventional machining methods. • Describe advantages, limitations and applications of given non-conventional machining processes. • Recommend the non-conventional machining process for the given job.	24	10
2.	**Gear & Thread Manufacturing**	2.1. Introduction of Gear manufacturing 2.1.1. Function and Classification of gears 2.1.2. Classification of Gear manufacturing methods 2.2. Gear milling 2.3. Gear hobbing 2.4. Gear shaping 2.5. Gear finishing methods – need and finishing method 2.5.1. Gear shaving 2.5.2. Gear grinding 2.5.3. Gear lapping 2.5.4. Gear honing 2.6. Introduction of Thread	• Explain with sketches procedure of the given gear manufacturing process. • Explain with sketches the given gear hob, hobbing and gear shaping process. • Explain with sketches the given gear finishing process. • Explain with sketches procedure of the given thread manufacturing process.	14	6

		manufacturing 2.6.1. Function and types of threads 2.7. Thread chasing 2.8. Thread rolling			
3.	**Fundamentals of CNC machines**	3.1.Introduction of Numerical control 3.1.1. Comparison of Numerical control and Conventional machine tools 3.1.2. Principles, Advantages & limitations of Numerical control machine tools 3.2. Computer Numerical Control 3.2.1. Comparison of CNC over NC & Conventional machining 3.2.2. Types of CNC machine 3.2.3. Classification of CNC machine 3.2.4. Machine control unit 3.2.5. Working & Block diagram of CNC 3.2.6. Advantages & Disadvantages of CNC 3.3. Direct Numerical Control 3.3.1. Introduction of DNC 3.3.2. Working & Block diagram of DNC 3.3.3. Advantages & Disadvantages of DNC 3.3.4. Comparison of NC, CNC & DNC 3.4. Classification of CNC system 3.4.1. Point-to-Point system 3.4.2. Straight-Cut CNC system 3.4.3. The continuous-Path machine	• Explain NC machine with principle, advantages and limitations and comparison with conventional machine. • Explain CNC machine with functions, types, advantages and limitations and comparison with NC. • Explain DNC machine with functions and advantages. • Explain types of CNC system and axis nomenclature.	17	7

		system 3.4.4. Open loop control system 3.4.5. Close loop control system 3.4.6. Absolute system 3.4.7. Incremental system 3.5. Axis Nomenclature			
4.	**Constructional features of CNC machines**	4.1. Design considerations of CNC machine to improve machining accuracy 4.2. Machine Structures – Requirement and reasons 4.3. Elements of CNC machine 4.3.1. Slide ways 4.3.2. Re-circulating ball screw 4.3.3. Drive (Spindle drive, Feed drive) 4.3.4. Automatic tool changer (ATC) 4.3.5. Automatic pallet changer (APC) 4.3.6. Feedback devices 4.4. Tooling for CNC machines	• Explain design consideration of CNC machine. • Explain elements of CNC machine. • Explain tooling for CNC machine.	14	6
5.	**Part Programming for CNC machines**	5.1. Introduction to Part programming 5.2. Coding system 5.3. Types of code 5.3.1. Preparatory codes 5.3.2. Miscellaneous codes 5.3.3. Modal and non – modal codes 5.4. Zero points & reference points 5.5. Need & importance of various compensations 5.5.1. Tool length compensation 5.5.2. Tool & cutter radius compensation 5.5.3. Pitch error compensation 5.5.4. Tool offset	• To understand the construction of an air-cooled condenser, including the tubes, fins. • To learn about the air cooled and water cooled condensers. • To learn the function of cooling towers and spray ponds and the factors that affect their capacities. • To identify the basic types and construction of cooling towers and spray ponds. • To learn cooling-tower and spray-pond maintenance	31	13

		5.6. CNC part programming for turning 5.6.1. Straight turning 5.6.2. Taper turning 5.6.3. Circular interpolation 5.6.4. Thread cutting 5.7. CNC part programming for milling 5.7.1. Simple milling 5.7.2. Circular interpolation 5.8. Canned cycle for turning and milling operations 5.8.1. Canned cycle 5.8.2. Macro 5.8.3. Do loops 5.8.4. Subroutine / Sub program 5.9. CNC turning & milling part program using canned cycle, do loop and sub program	procedures.		
				Total Hours	**42**

6. List of Practicals / Exercises

The practicals/exercises have been 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 practicals/exercises.

Sr. No.	Practical / Exercises	Key Competency	Hours
1.	Prepare a spur / helical gear using milling machine / Observe the same in an industry.	Sketch part with dimensions, set up milling machine, identify milling cutter for cutting, prepare and set raw material on machine, prepare part on milling machine.	4
2.	Prepare a thread using lathe machine / Observe the same in an industry.	Sketch part with dimensions, set up lathe machine, identify tools for cutting, prepare and set raw material on machine, prepare part on lathe machine.	4
3.	CNC turning part programming: Teacher will assign part drawings. Minimum five drawings having following details are to be assigned. This include parts- (i) Simple turning	Sketch each part with dimensions, prepare CNC part programme using G	4

	with steps, (ii) Turning with tapers, (iii) Turning with circular (concave / convex shape) interpolation.	and M codes with ISO format. Show various zeros and tool path on part sketch with color codes and dimensions. Simulate the prepared part programmes using available simulation softwares. Prepare the parts on CNC.	
4.	CNC turning part programming: Teacher will assign part drawings. Minimum five drawings having following details are to be assigned. This include parts- (i) Turning using canned cycle - with threading or drilling or other and (ii) Turning with use of subroutine or macro or do-loop.	Sketch each part with dimensions. Prepare CNC part programme using G and M codes with ISO format. Show various zeros and tool path on part sketch with color codes and dimensions. Simulate the prepared part programmes using available simulation softwares. Prepare the parts on CNC.	4
5.	CNC machining centre part programming: Teacher will assign part drawings. Minimum three drawings having following details are to be assigned. This include parts- (i) Simple contour milling (ii) Contour milling with (convex / concave) circular interpolation.	Sketch each part with dimensions. Prepare CNC part programme using G and M codes with ISO format. Show various zeros and tool path on part sketch with color codes and dimensions.Simulate the prepared part programmes using available simulation softwares. Prepare the parts on CNC.	4
6.	CNC machining centre part programming: Teacher will assign part drawings. Minimum three drawings having following details are to be assigned. This include parts- (i) contour milling with drilling / tapping.	Sketch each part with dimensions. Prepare CNC part programme using G and M codes with ISO format. Show various zeros and tool path on part sketch with color codes and dimensions.Simulate the prepared part programmes using available simulation softwares. Prepare the parts on CNC.	4
7.	Seminar presentation	Prepare the seminar and make presentation on power point.	4
		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.	Non-conventional machining processes	34	18	18	9	12	9
2.	Gear Manufacturing & Thread Manufacturing	22	27	20	5	13	13
3.	Fundamentals of CNC machines	24	30	24	-	5	17
4.	Constructional features of CNC machines	31	23	15	15	8	8
5.	Part Programming for CNC machines	22	25	25	6	9	13

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

8. Textbooks

1) Production Technology By O. P. Khanna (10th Reprint) (Volume – I) (Dhanpat Rai Publications)
2) Production Technology By R. K. Jain (17th Edition) (Khanna Publishers)
3) Computer Aided Manufacturing By C. Elanchezhain, T. Sunder Selwyn, G. Shanmuga Sunder (2nd Edition) (University Science Press- Imprint of Laxmi Publications PVT LTD)
4) CNC Fundamentals and Programming By P.M. Agrawal, V.J. Patel (Charotar Publishing House PVT LTD)

9. Reference Books

1) Unconventional manufacturing processes By Singh M.K (New Edge Publication, New Delhi, 2009)
2) Introduction to NC / CNC machines By Vishal S. (S. K. Kataria and sons, New Delhi, 2010)
3) Computer Numerical Control – Turning and Machining centers By Quesada Robert (Prentice Hall India, New Delhi, 2014)

10. Open Sources (Website, Video, Movie)

1) https://www.youtube.com/watch?v=Pae2qwJk_6s&list=PLtpgVX7NgMc9iRpyBiK5BP8fjgKArXgzY&index=4
2) https://www.youtube.com/watch?v=fFakbdT_4vQ&list=PLtpgVX7NgMc9iRpyBiK5BP8fjgKArXgzY&index=5
3) https://www.youtube.com/watch?v=WBdTFayowuA&list=PLtpgVX7NgMc9iRpyBiK5BP8fjgKArXgzY&index=14
4) https://www.youtube.com/watch?v=cfdZEFwDxtE&list=PLtpgVX7NgMc9iRpyBiK5BP8fjgKArXgzY&index=17
5) https://www.youtube.com/watch?v=OT05eBVS1Lc&list=PLtpgVX7NgMc9iRpyBiK5BP8fjgKArXgzY&index=20
6) https://www.youtube.com/watch?v=CHQjexQc1tI
7) https://www.youtube.com/watch?v=NCEHRvFQqMo
8) https://www.youtube.com/watch?v=l1KblYNr0EA
9) https://www.youtube.com/watch?v=qMI32HX0Ibo