

GANPAT UNIVERSITY										
FACULTY OF ENGINEERING & TECHNOLOGY										
Programme		Diploma Engineering				Branch		Mechatronics Engineering		
Semester		VI				Version		1.0.0.0		
Effective from Academic Year			2020-21			Effective for the batch Admitted in			July 2018	
Subject code		1MC2603		Subject Name			CNC MACHINES			
Teaching scheme					Examination scheme (Marks)					
(Per week)	Lecture(DT)		Practical(Lab.)		Total		CE	SEE	Total	
	L	TU	P	TW						
Credit	3	0	1	0	5	Theory	40	60	100	
Hours	3	0	2	0	6	Practical	30	20	50	

Pre-requisites:
Students must have knowledge of concepts of various machining processes, computer knowledge, engineering drawing, basics of Computer aided design and software.

Course Learning Outcomes:
The course content should be taught and implemented with an aim to develop different skills leading to the achievement of the following competencies and course learning outcomes: CO1. Identify different axes, machine zero, home position, systems and controls CNC machines. CO2. Select, mount and set cutting tools and tool holders on CNC. CO3. Prepare part programmes for given simple components with and without use of CANNED CYCLE, MACRO and SUBROUTINE using ISO format. CO4. Interface software application for auto part programming. CO5. Apply maintenance practices for CNC machines.

Course Content				
Name of UNIT	Unit Content	Unit Learning Outcomes	Marks	Hrs
UNIT – 1 Fundamentals of CNC	1.1 CAM - concept and definition. 1.2 NC (Numerical Control), CNC (Computerized Numerical Control) and DNC (Direct Numerical Control) - concept, features and differences. 1.3 Advantages and limitations of CNC. 1.4 Selection criteria for CNC machines.	1a. Differentiate between NC, CNC and DNC. 1b. Identify parameters governing for selection of CNC machines.	5	3
UNIT – 2 Constructional Features of CNC machines	2.1 CNC machines: Types, classification, working and constructional features. 2.2 Spindle drives and axes drives on CNC machines. 2.3 Machine structure- Requirements and reasons. 2.4 Elements of CNC machines - Types, sketch, working and importance of: Slide ways. i. Re-circulating ball screw. ii. Feedback devices (transducers,	2a. Classify CNC machines. 2b. Identify role of main elements of CNC machines. 2c. Identify CNC axes. 2d. Preset tool on CNC machines. 2e. Use qualified tools and tool holders on CNC machines.	15	10

	<p>encoders).</p> <p>iii. Automatic tool changer (ATC).</p> <p>iv. Automatic pallet changer (APC).</p> <p>2.5 CNC axes and motion nomenclature.</p> <p>2.6 CNC tooling : Tool presetting-concept and importance. Qualified tools-definition need and advantages.</p> <p>2.7 iii. Tool holders- types and applications.</p>			
<p>UNIT – 3 CNC Turning & Machining Centers</p>	<p>3.1 CNC turning centres: i. Types. ii. Features. iii. Axes nomenclature. iv. Specification. v. Work holding devices -types, working and applications. vi. Tool holding and changing devices - types, working and applications.</p> <p>3.2 CNC machining centres: i. Types. ii. Features. iii. Axes nomenclature. iv. Specification. v. Work holding devices-types, working and applications. vi. Tool holding and changing device-types, working and applications.</p>	<p>3a. List features of specified CNC turning and machining centre.</p> <p>3b. Identify various work holding and tool holding devices.</p>	10	4
<p>UNIT – 4 CNC Part Programming</p>	<p>4.1 Axes Identification in CNC turning and Machining centres</p> <p>4.2 Definition and importance of various positions like machine zero, home position, work piece zero and programme zero.</p> <p>4.3 CNC part programming: programming format and structure of part programme.</p> <p>4.4 ISO G and M codes for turning and milling-meaning and applications of important codes.</p> <p>4.5 Need and importance of various compensations: i. Tool length compensation. ii. Pitch error compensation. iii. Tool radius compensation. iv. Tool offset.</p> <p>4.6 Simple part programming using various compensations.</p>	<p>4a. Identify axes of CNC turning and machining centres.</p> <p>4b. Interpret ISO format of CNC part programming with used codes.</p> <p>4c. Prepare part programme by using applicable codes like G& M etc.</p> <p>4d. Implement advanced part programming features like canned cycle, do loop, subroutine etc.,</p> <p>4e. Prepare part programme considering various compensations.</p> <p>4f. Describe procedure for setting various compensations on CNC.</p> <p>4g. Interface software</p>	20	18

	<p>4.7 Simple part programming for turning using ISO format having straight turning, taper turning (linear interpolation) and convex/concave turning (circular interpolation).</p> <p>4.8 Simple part programming for milling using ISO format.</p> <p>4.9 Importance, types, applications and format for:</p> <p>i. Canned cycles. ii. Macro. iii. Do loops. iv. Subroutine.</p> <p>4.10 CAD CAM integration: Concept Steps involved in CAD/CAM integration, CAM software.</p>	application for auto part programming.		
UNIT – 5 Recent trends in CAM	<p>5.1 Interfacing standards for CAD/CAM -Types and applications</p> <p>5.2 Adaptive control- definition, block diagram, sources of variability and applications.</p> <p>5.3 Flexible Manufacturing System (FMS) - concept, main elements and their functions, layout and its importance, applications.</p> <p>5.4 Computer Integrated Manufacturing (CIM) - Concept, areas covered, benefits.</p> <p>5.5 Robotics- definition, types, terminology, elements and applications.</p> <p>5.6 Rapid prototyping - Concept and application.</p>	<p>5a. Select suitable standard for CAD/CAM interfacing.</p> <p>5b. List source of variability for adaptive control.</p> <p>5c. Interpret different FMS layouts.</p> <p>5d. Correlate areas of CIM.</p> <p>5e. Identify types and elements of robots.</p> <p>5f. Describe concept of Rapid prototyping.</p>	10	10
		Total	60	45

List of Practical		
No.	Unit	Name of Practical
1	1	Demonstration of construction features of CNC Machines.
2	3	Demonstration of simulation software used for Part programming.
3	4	CNC machining center part programming. (Prepare CNC part programme using G and M codes with ISO format, Simulate the prepared part programmes in software and Prepare the parts on CNC)
4	4	CNC turning center part programming. (Prepare CNC part programme using G and M codes with ISO format, Simulate the prepared part programmes in software and Prepare the parts on CNC)
5	5	Demonstration of CAD/CAM integration using CAM software.
List of Instruments/Equipment/TrainerBoard		
1	CNC Turning Centre (Tutor or Productive)- Minimum diameter 25 mm, Length 120 mm with ATC. (Approximate)	
2	CNC Machining Centre (Tutor or Productive)-	

	X axis travel - 225 mm, Y axis travel - 150 mm, Z axis travel - 115 mm, With ATC. (Approximate)		
3	CNC Simulators like CNC Simulator Pro, SSCNC, FANUC CNC Simulator etc.		
4	CAM Softwares like MasterCAM, NX CAM, Fusion 360, Solid Edge, SolidWorks CAM etc.		
Link of Text Books			
No	Title of Books	Authors	Publication
1	CNC Machines	Pabla B.S., Adithan M.	New Age International, New Delhi, 2014 (reprint).
2	CAD/CAM	Sareen, Kuldeep	S.Chand, New Delhi, 2007
List of Reference Books			
No	Title of Reference Books	Authors	Publication
1	Computer Aided Manufacturing	Ragadia Sadiq Y.	Atul Prakashan, Ahmedabad
2	Computer Aided Manufacturing	Rao P N, Tiwari N K, Kundra T	Tata McGraw Hill 2014
3	CAD/CAM: computer aided design and manufacturing	Groover Mikell P, Zimmered W Emory	Prentice Hall 2011
4	Computer Numerical Control- turning and machining centers	Quesada, Robert	PHI Learning , New Delhi, 2004
Link of Learning Web Resource			
1	http://www.nptel.ac.in		
2	http://www.youtube.com/watch?v=M3eX2PKM1RI		
3	http://www.youtube.com/watch?v=EHQ4QIDqENI&list=PLBkqkLQO2nAt5MNLoeUhvKFS9M0p8y_1		
4	http://www.youtube.com/watch?v=hJFLcvtiNQI		
5	http://www.youtube.com/watch?v=BIM1AyxYkw		
6	http://www.swansoftcncsimulator.com		
7	http://www.mtabindia.com		