

GUJARAT TECHNOLOGICAL UNIVERSITY

SUBJECT: CNC MACHINE AND METROLOGY

SUBJECT CODE: 2154103

B.E. 5th Semester

Type of course: Professional Core Course

Prerequisite: NA

Rationale:

- Understand evolution and principle of CNC machine tools
- Write simple programs for CNC turning and machining centres
- Generate CNC programs for popular CNC controllers
- Describe about linear and angular measurements in metrology
- Study about the advancement in metrology

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks						Total Marks
L	T	P		Theory Marks			Practical Marks			
			ESE (E)	PA (M)		PA (V)		PA (I)		
PA	ALA	ESE		OEP						
3	0	2	5	70	20	10	20	10	20	150

L- Lectures; T- Tutorial/Teacher Guided Student Activity; P- Practical; C- Credit; ESE- End Semester Examination; PA- Progressive Assessment

Content:

Sr. No.	Topics	Teaching Hrs.	Module Weightage
1	INTRODUCTION TO CNC MACHINE TOOLS:- Evolution of CNC Technology, principles, features, advantages, applications, CNC and DNC concept, classification of CNC Machines – turning centre, machining centre, grinding machine, EDM, types of control systems, CNC controllers, characteristics, interpolators– Computer Aided Inspection, CNC Machine building, structural details, configuration and design, guide ways – Friction, Anti friction and other types of guide ways	9	20%

2	DRIVES AND WORK HOLDING DEVICES: Spindle drives – DC shunt motor, 3 phase AC induction motor, feed drives –stepper motor, servo principle, DC and AC servomotors, Axis measuring system – synchro, synchro-resolver, gratings, moiré fringe gratings, encoders, inductosyn, laser interferometer, work holding devices for rotating and fixed work parts, economics of CNC, maintenance of CNC machines	9	20%
3	CNC PROGRAMMING: Coordinate system, structure of a part program, G & M Codes, tool length compensation, cutter radius and tool nose radius compensation, do loops, subroutines, canned cycles, mirror image, parametric programming, machining cycles, programming for machining centre and turning centre for well known controllers such as Fanuc, Heidenhain, Sinumerik etc., generation of CNC codes from CAM	9	20%
4	LINEAR AND ANGULAR MEASUREMENTS: Linear Measuring Instruments – Evolution – Types – Classification – Limit gauges – gauge design – terminology – procedure – concepts of interchange ability and selective assembly – Angular measuring instruments – Types – Bevel protractor clinometers angle gauges, spirit levels sine bar – Angle alignment telescope – Autocollimator – Applications.	9	20%
5	ADVANCES IN METROLOGY: Basic concept of lasers Advantages of lasers – laser Interferometers – types – DC and AC Lasers interferometer – Applications – Straightness – Alignment. Basic concept of CMM – Types of CMM – Constructional features – Probes – Accessories – Software – Applications – Basic concepts of Machine Vision System – Element – Applications	9	20%

Reference Books:

1. Mechatronics”, HMT, Tata McGraw-Hill Publishing Company Limited, New Delhi, 2005.
2. Warren S.Seamers, “Computer Numeric Control”, Fourth Edition, Thomson Delmar, 2002.
3. Jain R.K. “Engineering Metrology”, Khanna Publishers, 2005.
4. Gupta. I.C., “Engineering Metrology”, Dhanpatrai Publications, 2005.
5. Charles Reginald Shotbolt, “Metrology for Engineers”, 5th edition, Cengage Learning EMEA,1990.
6. Backwith, Marangoni, Lienhard, “Mechanical Measurements”, Pearson Education , 2006.
7. Peter Smid, “CNC Programming Hand book”, Industrial Press Inc., 2000
8. Berry Leathan – Jones, “Introduction to Computer Numerical Control”, Pitman, London, 1987.
9. Radhakrishnan P “Computer Numerical Control Machines”, New Central Book Agency, 2002.

Course Outcomes:

- Ability to know about the basic in CNC machineries
- Evolution and principle of CNC machine tools and different measurement technologies
- Able to write simple programs for CNC machinery
- To impart knowledge about linear and angular measurements in metrology
- Ability to know about the advancement in metrology

ACTIVE LEARNING ASSIGNMENTS: Preparation of power-point slides, which include videos, animations, pictures, graphics for better understanding theory and practical work – The faculty will allocate chapters/ parts of chapters to groups of students so that the entire syllabus to be covered. The power-point slides should be put up on the web-site of the College/ Institute, along with the names of the students of the group, the name of the faculty, Department and College on the first slide. The best three works should submit to GTU.