Gautam Buddha University, Greater Noida

School of Engineering (Mechanical Engineering)

Degree	Course Name	Course Code	Marks:100
M. Tech.	Micromachining and Nanofinishing	MEM 506	SM+MT+ET 25+25+50
Semester	**Credits**	**L-T-P**	**Exam.**
II	3	3-0-0	3 Hours

Unit – I

Introduction to Micromachining Processes: Introduction; Micromachining; Mechanical Advanced micro machining (Ultrasonic micromachining, Thermal advanced micromachining processes, Electro discharge micromachining, Electron beam machining, LASER beam micromachining, electrochemical micromachining); Advanced nano finishing processes – abrasive flow machining, chemical mechanical finishing, Elastic emission machining, Magnetic abrasive machining, Magneto-rheological finishing, Magneto-rheological abrasive flow finishing, Magnetic float finishing. **(08 Hours)**

Unit – II

Diamond Turn Machining: Introduction; Components of diamond turn machine (DTM); Material removal mechanism in diamond turn machining; Classification of finishing techniques; Tools for DTM; Requirements of DTM tools, Tool geometries for single crystal diamond tools, Tool setting; Applications and advances in DTM. **(08 Hours)**

Unit – III

Electro-chemical Spark Micromachining: Introduction; Mechanics of machining in electro-chemical micromachining (ECSMM); ECSMM equipment – sinking and drilling ECSMM, travelling wire ECSMM, milling ECSMM.

(06 Hours)

Unit – IV

Chemo Mechanical Polishing: Introduction; Chemo-mechanical polishing (CMP); Mechanism of material removal in silicon wafer; Parametric analysis; Global planarization; Removal rate; CMP slurry;

Slurry flow rate; Abrasives in CMP slurry; Particle surface coating and particle-less slurry; Agglomeration of CMP slurry; Rheological studies of slurry; Slurry solution, pH value and organic alkali; Low stress slurry and effect of surfactant; Polishing pads and effect of temperature on polishing pad; Non-uniformity of pad and physical and chemical changes in pad; Defects and contamination; Forces responsible for contaminant on wafer surface; Post CMP cleaning process; Applications; Advantages and disadvantages. **(08 Hours)**

Unit – V

Magnetorheological Nanofinishing Processes: Nanofinishing; Smart rheological fluids; Magnetorhelogical polishing (MRP) fluids; Magnetorhelogical characteristic of MRP- fluids; Magnetorheological finishing (MRF) process; Magneto-rheological abrasive flow finishing process; Performance analysis of MRAFF process; Magnetorheological jet finishing (MRJF) process. **(07 Hours)**

Unit – VI

Metrology of Micromachined Components: Introduction; Scanning electron microscopy (SEM); Optical microscopy; Scanning white light interferometry; Confocal LASER scanning microscopy; Fringe projection microscopy; Scanning probe microscopy; Computed tomography; Digital volumetric imaging; Molecular measuring machine; Micro coordinate measuring machine; Microfabricated scanning grating interferometry; Autofocusing probing; Scanning LSAER doppler vibrometry; Digital holographic microscope systems.

(08 Hours)

Recommended Books:

1. Introduction to Micromachining; V. K. Jain; 2010; Narosa Publishers.
2. Fundamentals of Microfabrication; M. Madou.
3. A New Direction in Manufacturing; Kluwer; Academic Publishers, London, 1997.
4. Advanced Methods of Machining; J. A. Mcgeough Chapman and Hall; London, 1988.