LOK JAGRUTI UNIVERSITY (LJU)

INSTITUTE OF ENGINEERING AND TECHNOLOGY

Department of Mechanical Engineering (710)

Bachelor of Engineering (B.E.) – Semester - V

Course Code:	**017103503**
Course Name:	**Modern Manufacturing Processes and Systems**
Category of Course:	Professional Core Course (PCC)
Prerequisite Course:	Physics (017101192), Conventional Machining Processes (017103302), Manufacturing Technology (017103401)

Teaching Scheme				
Lecture (L)	**Tutorial (T)**	**Practical (P)**	**Credit**	**Total Hours**
3	1	2	**5**	40

Syllabus

Unit No.	Topic	Prerequisite Topic	Successive Topic	Teaching Hours
01	**Non-Conventional Machining Processes-I**			**5 (12%)**
	1.1 Definition, need of non-conventional machining processes	Conventional machining processes (017103302-Unit-all)	---	
	1.2 Classification based on energy involved	---	---	
	1.3 Water jet machining, abrasive water jet machining	---	---	
	1.4 Ultrasonic machining process	Ultrasonics (017101192-Unit-03)	---	
	1.5 Advanced fine finishing process: abrasive flow machining (AFM)	---	---	
02	**Non-Conventional Machining Processes-II**			**4 (10%)**
	2.1 Electro discharge machining (EDM), wire-cut EDM	---	---	
	2.2 LASER beam machining, LASER cutting	LASER beam welding (017103401-Unit-07)	---	
	2.3 Electron beam machining, ion beam machining	Electron beam welding (017103401-Unit-07)	---	
	2.4 Electro-chemical machining, electro-chemical grinding	---	---	
	2.5 Importance/ Advantages of NCM	Conventional machining processes (017103302-Unit-all)	---	
03	**Fundamentals of Computer Aided Manufacturing**			**3 (8%)**
	3.1 Computer aided manufacturing: definition, concepts, objectives and scope	---	---	
	3.2 Nature and type of manufacturing system, evolution	---	---	
	3.3 Advantages of CAM	CAM concepts (017103503-Unit-03)	---	
	3.4 Role of management in CAM, role of manufacturing engineers	CAM concepts (017103503-Unit-03)	---	
	3.5 Concepts of computer integrated manufacturing, impact of CIM on personnel, CIM wheel to understand basic functions	CAM concepts (017103503-Unit-03)	---	
04	**NC-CNC Machines**			**3 (8%)**
	4.1 Evolution of NC, CNC machines	---	---	
	4.2 NC and CNC technology: types, classification	Classification of manufacturing process and machine tools (017103302-Unit-01)	---	
	4.3 Construction details, controllers, sensors and actuators, CNC hardware: re circulating ball screw, anti-friction slides, step/servo motors.	Construction of lathe machine with its accessories and attachments (017103302-Unit-03)	---	
	4.4 Axis designation	---	---	
	4.5 NC, CNC and DNC	---	---	
05	**Part Programming**			**6 (14%)**
	5.1 Fundamentals of part programming	---	---	
	5.2 Types of format	---	---	
	5.3 Important G-code and M-code and their applications	Basic machining and tool motion (017103302-Unit-01)	---	
	5.4 Part programming of turning centre	Lathe operations (017103302-Unit-03)	---	
	5.5 Part programming of machining centre	Types of milling cutters and operations (017103302-Unit-06)	---	
	5.6 Introduction to advance concepts like subroutines, do loops, canned cycles, parametric sub routines	Fundamentals of part programming, (017103503-Unit-05)	---	
06	**Group Technology**			**3 (8%)**
	6.1 Current scenario in industries and need of group technology	---	---	
	6.2 Introduction: group technology philosophy	---	---	
	6.3 Part classification and coding systems	Machining processes (017103302-Unit-all)	---	
	6.4 PFA, FFA, cell design, rank order clustering(also	---	---	

	numerical) and Hollier Method (Also Numerical),composite part concepts			
	6.5 Advantages of group technology	---	---	
07	**Flexible Manufacturing System**			**4 (10%)**
	7.1 Introduction, definition of FMS	Group technology(017103503-Unit-06)	---	
	7.2 Components of FMS, need of FMS, FMS objectives		---	
	7.3 Flexibility and types of flexibility in FMS	Need of group technology(017103503-Unit-06)	---	
	7.4 Different FMS layouts, their applications and advantages, comparison of different FMS layouts	PFA, FFA, cell design(017103503-Unit-06)	---	
	7.5 Automated material handling systems	---	---	
	7.6 Automated storage and retrieval system	Automated material handling system(017103503-Unit-07)	---	
	7.7 Automated guided vehicles: basic structure, types and applications	---	---	
08	**Additive Manufacturing**			**3 (8%)**
	8.1 Introduction to additive manufacturing, need of additive manufacturing, advantages of additive manufacturing	Machining processes(017103302-Unit-all)	---	
	8.2 Additive manufacturing processes: types and principles	---	---	
	8.3 3D printing technology: manufacturing, materials and scope	---	---	
	8.4 Limitations of additive manufacturing	---	---	
	8.5 Application of additive manufacturing	---	---	
09	**Robot Technology**			**6 (14%)**
	9.1 Introduction, anatomy of robot, law of robot,	---	---	
	9.2 Robot coordinate systems	---	---	
	9.3 Actuators and sensors used in robots	Anatomy of robot(017103503-Unit-09)	---	
	9.4 Various gripers used in robots and their application	---	---	
	9.5 Robot programming, specification of robots	Anatomy, actuators, sensors, gripers of robots(017103503-Unit-09)	---	
	9.6 Applications of robots	---	---	
10	**Integrated Production Management System**			**3 (8%)**
	10.1 Introduction	CIM(017103503-Unit-03)	---	
	10.2 PPC fundamentals, problems with PPC	---	---	
	10.3 CAPP, concepts of expert system in manufacturing and management information system.	PPC(017103503-Unit-10)	---	

Major Components/ Equipment

Sr. No.	Component/Equipment
1	CNC Lathe Machine
2	CNC Milling Machine
3	Laser Cutting Machine
4	FDM 3D Printing Machine

Sr No.	Practical Title	Link to Theory Syllabus
1	Laser Cutting	Unit-2
2	Construction and Working of NC/CNC Machine Tools	Unit-4
3	Configuration of CNC Machines	Unit-4
4	Manual Part Programming for CNC Milling & Lathe	Unit-5
5	Study of tool paths for Milling and Turning cycles	Unit-5
6	Group Technology	Unit-6
7	FMS – Introduction & System Elements	Unit-7
8	Rapid Prototyping	Unit-8

Proposed Theory + Practical Evaluation Scheme by Academicians (% Weightage Category Wise and it's Marks Distribution)					
L :	**3**	**T:**	**1**	**P:**	**2**
Note : In Theory Group, Total 4 Test (T1+T2+T3+T4) will be conducted for each subject. Each Test will be of 25 Marks. Each Test Syllabus Weightage: Range should be 20% - 30%					
Group (Theory or Practical)	**Group (Theory or Practical) Credit**	**Total Subject Credit**	**Category**	**% Weightage**	**Marks Weightage**
Theory	**4**	**5**	MCQ	45%	56
Theory			Theory Descriptive	33%	41
Theory			Formulas and Derivation	0%	0
Theory			Numerical	2%	3
Expected Theory %	**80%**		**Calculated Theory %**	**80%**	**100**
Practical	**1**		Individual Project	0%	0
Practical			Group Project	0%	0
Practical			Internal Practical Evaluation (IPE)	0%	0
Practical			Viva	7%	35
Practical			Seminar	13%	65
Expected Practical %	**20%**		**Calculated Practical %**	**20%**	**100**
Overall %	**100%**			**100%**	**200**

Course Outcome	
	Upon completion of the course Students will be able to
1	Formulate Non-Conventional Machining Processes, encompassing the definition and necessity, its classification based on various energy and recognize the importance and advantages.
2	Review Computer-Aided Manufacturing fundamentals and CIM concepts, as well as build expertise in NC-CNC Machines, demonstrate skill in Part Programming, involving format types, G-code, M-code, and advanced concepts for turning and machining centers.
3	Build proficiency in Group Technology, encompassing the understanding of industry needs, group technology philosophy, part classification, PFA, FFA, cell design, and clustering methods, as well as formulate Flexible Manufacturing Systems, covering FMS components, objectives, flexibility types, layouts, and automated material handling systems, storage, retrieval systems, and guided vehicles along with Additive Manufacturing, covering its introduction, necessity, advantages, process types, 3D printing technology, limitations, and applications.
4	Develop and review robot anatomy, coordinate systems, actuators, sensors, grippers, programming, and applications, as well as exhibit competence in Integrated Production Management System, encompassing PPC fundamentals, CAPP, expert system concepts, and management information systems in manufacturing.
Suggested Reference Books	
1	Manufacturing Science by A. Ghosh, and A. K. Mallik, Affiliated East-West Press Pvt. Ltd. New Delhi
2	Nontraditional Manufacturing Processes by G.F. Benedict, Marcel Dekker, Inc. New York
3	Advanced Machining Processes by V. K. Jain, Allied Publishers Pvt. Ltd.
4	Automation, Production Systems and Computer Integrated Manufacturing by Mikell P Groover, Pearson Education
5	Flexible Manufacturing Cells and System by William. W. Luggen Hall, England Cliffs, Newjersy
6	Robotics Technology and Flexible Automation by S R Deb, S Deb, McGraw Hill Education Private Limited.
7	Computer Numerical Control by P. Radhakrishnan, New Central Book Agency
8	Materials and Processes in Manufacturing by E. P. DeGarmo, J. T Black, R. A. Kohser, Prentice Hall of India, New Delhi
9	Manufacturing Processes for Engineering Materials by Serope Kalpakjion and Steven R. Schmid, Pearson Education
10	Rapid Prototyping: Principles and Applications in Manufacturing by Chua C K, Leong K F, Chu S L, World Scientific
11	Rapid Prototyping: Principles and Applications in Manufacturing by Noorani R, John Wiley and Sons.
12	Rapid Prototyping: Theory and practice by Kamrani A K, Nasr E A, Springer

List of Open Source Software/Learning website	
1	http://nptel.ac.in/
2	http://www.ocw.mit.edu
3	http://www.factoryoffactories.com
4	https://academy.autodesk.com
5	CNCSimulator (CNC Simulation Software)
6	Ultimaker Cura (3D Printing Software)