Liverpool John Moores University

Title:	Design for Manufacture I
Status:	Definitive
Code:	**5001PDE** (120082)
Version Start Date:	01-08-2019
Owning School/Faculty:	Electronics and Electrical Engineering
Teaching School/Faculty:	Electronics and Electrical Engineering

Team	Leader
Paul French	Y

Academic Level:	FHEQ5	**Credit Value:**	20	**Total Delivered Hours:**	72
Total Learning Hours:	200	**Private Study:**	128		

Delivery Options
Course typically offered: Standard Year Long

Component	Contact Hours
Lecture	24
Practical	24
Tutorial	24

Grading Basis: 40 %

Assessment Details

Category	Short Description	Description	Weighting (%)	Exam Duration
Report	DFM Report	DFM Report	40	
Report	CAM Report	CAM Report	60	

Aims

Give students an understanding of the principles of design for computer-aided machining (CAM) systems and the related skills found in batch manufacturing and engineering companies.

Learning Outcomes

After completing the module the student should be able to:

1	Evaluate designs in terms the principles of design for machining for batch manufacturing
2	Determine the operational characteristics of CAM systems
3	Define safe and appropriate manufacturing parameters for different tooling and work piece materials
4	Produce and prove computer-assisted part programs
5	Define inspection and quality control in CAM systems

Learning Outcomes of Assessments

The assessment item list is assessed via the learning outcomes listed:

DFM Report	1	2	3
CAM Report	4	5	

Outline Syllabus

Module introduction
Module guide; aims; learning outcomes; assessment and marking schemes. Outline syllabus; module timetable and student feedback.

Machine tools:
Machine tools: a range of machine tools and their applications (e.g. centre lathes, vertical and horizontal milling machines, cylindrical and surface grinders, centreless grinders, lapping, honing, planing and shaping machines, internal and external broaching machines, sawing machines, presses, sheet and tube bending machines); types of drives (e.g. for lathes, milling machines and presses); relative motion between cutting tool and work piece.
Work holding techniques: the six degrees of freedom of a rigid body with respect to work
holding and jig and fixture design (eg the need for rigidity in design and build of machine
tools, three and four-jaw chucks, use of centres, machine vices, worktable clamps, magnetic
tables, etc)
Tool holding: tool posts; morse taper shanks; Jacobs chucks; milling machine arbors; mounting and dressing of grinding wheels.

Material cutting processes
Tooling: choice and effects of tool geometries; choice of tool material; permissible depth of cut; types and consequences of tool wear; calculation of expected tool life.
Forces: theory of metal cutting; mechanics of chip formation; calculation of forces exerted on cutting tool and work piece during operations; calculation of power required to perform specific operations; use of dynamometers.
Speeds and feeds: calculation of speeds and feeds for turning and milling operations on a variety of work piece features, sizes and materials (e.g. aluminium alloys, mild

steel, tool steels, cast metals and alloys); relationship between cutting speed and tool life – economics of metal removal.

Design for machining
Evaluate designs: in terms the design for machining. Design for economic production e.g. Component size, geometry, feature, material, dimensions, tolerancing and surface finish.

CAM
Hardware elements:
Computer e.g. mainframe, mini, micro; computer power and memory; printer; mouse; digitiser; digital and screen data displays; disc drives; axes of CNC machines; parametric settings e.g. zero datum setting and transfer, manual modes, program overrides.

Software elements:
Operating system; CAM software; CAM database management systems; program editing facilities; diagnostic testing techniques.
Inputs:
Geometry data; material specifications; CAD data.
Outputs:
Manufacturing data; tool data; cutter path; component profile; CAM file; Component location, work-piece clamping and tool holding: methods e.g. jigging devices, holding techniques, punch tooling, formers for bending.
Functions:
Generation of graphics e.g. use of third party software in design or draughting mode (EdgeCam); component profile definition e.g. simple 2D profile with internal circular and square pockets and holes on a pitch circle diameter suitable for fixed/canned cycle manipulation; geometry manipulation; tooling and machinery sequences; cutter path simulation; post-processing.
Databases:
CAD profile and attribute data; material files; tool data; cutter location files; report generators; Bill of Materials (BOM).
Macro routines:
Macro routines e.g. continuous operations, automatic tooling sequences, standard components.
Levels of inspection:
Inspection e.g. tooling verification, datum and location checks, in-process measurement, post-process inspection, qualitative data and attributes, statistical analysis, technical and management information.
Data capture:
Tactile sensing; non-tactile sensing; data transmission features.

Learning Activities

This module will be delivered through an integrated series of lectures, tutorials, practical sessions, guided design activities and case studies. The learning activities are to be student focused and develop the students design knowledge through

experiential learning.

Notes

This module is delivered using a variety methods including lectures, seminars, tutorials and practical sessions. The module will be delivered from a engineering and product design perspective.