UNIVERSITY OF CAMBRIDGE

Department of Engineering

Institute for Manufacturing

METIIA Course Handbook 2024-25

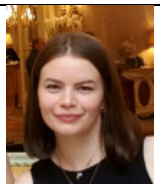
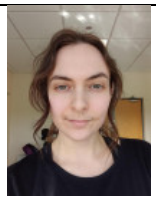
Disclaimer

We have endeavoured to ensure that the information contained in this handbook is as accurate as possible. However, it is likely that minor changes and updates may need to be made to some sections during the course of the year.

We will ensure that all updates are communicated to you by email and/or posted on the MET IIA Moodle site.

Contents

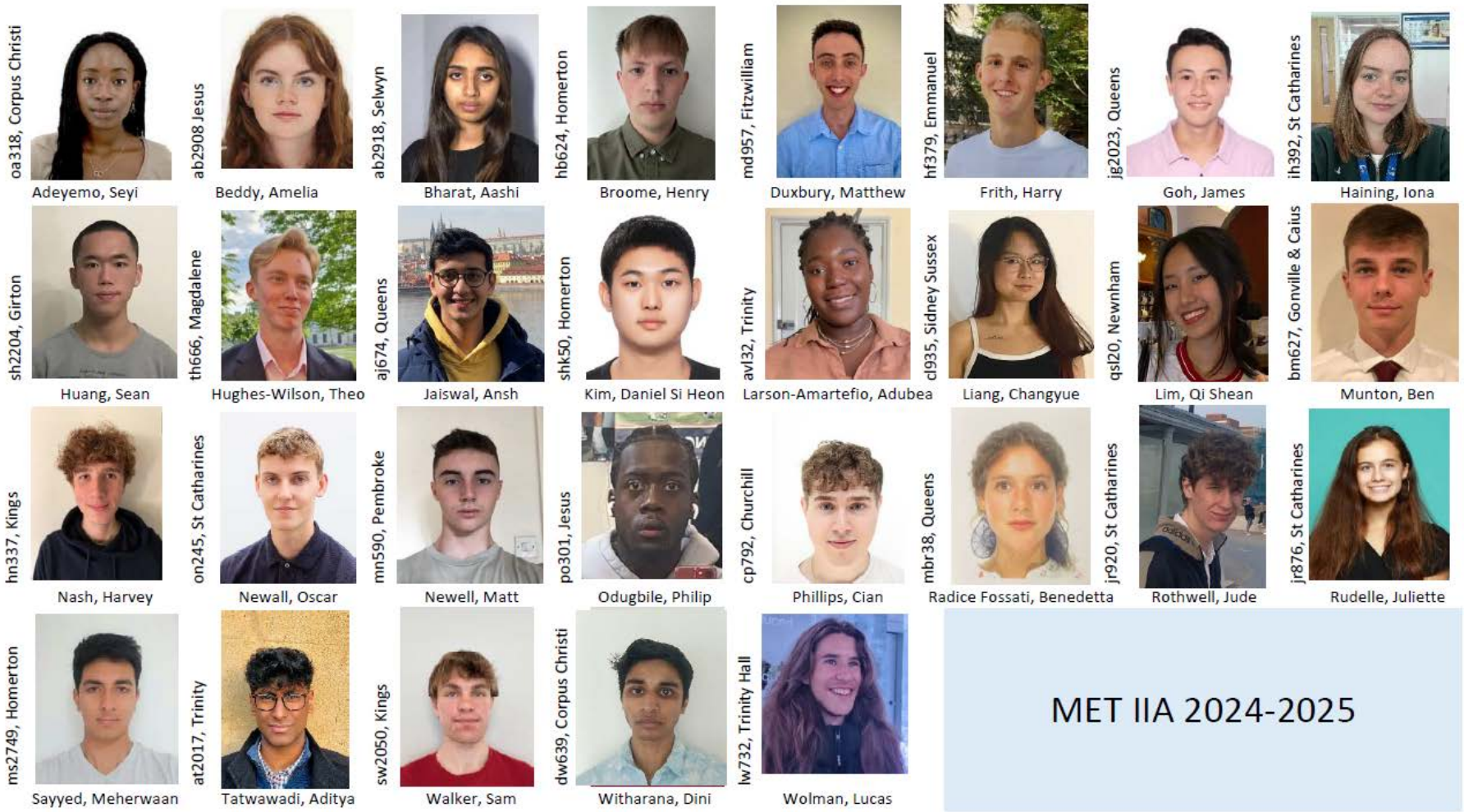
MET IIa People

Course Directors	 Prof Aexandra Brintrup (IIa)	 Dr Letizia Mortara (IIb)	
Teaching office	 Shane Strawson (MET Admin)	 Hannah Smith (ISMM Admin)	 Bet Brooke
3P1 Materials into Products (Mich)	 Dr Angkur Shaikeea (module leader)	 Dr Claire Barlow	 Dr Matteo Seita
3P2 Operation and Control of Production Machines and Systems (Mich)	 Prof Bill O'Neill (module leader)	 Dr Karel Kruger	
3P3 Product Design (Mich)	 Prof James Moultrie (module leader)	 Prof Michael De Volder	 Dr Sebastian Pattinson
3P4 Operations Management (Lent)	 Prof Alexandra Brintrup (module leader)	 Prof Jane Davies	
3P5 Industrial Engineering (Lent)	 Prof Ajith Parlikad (module leader)		

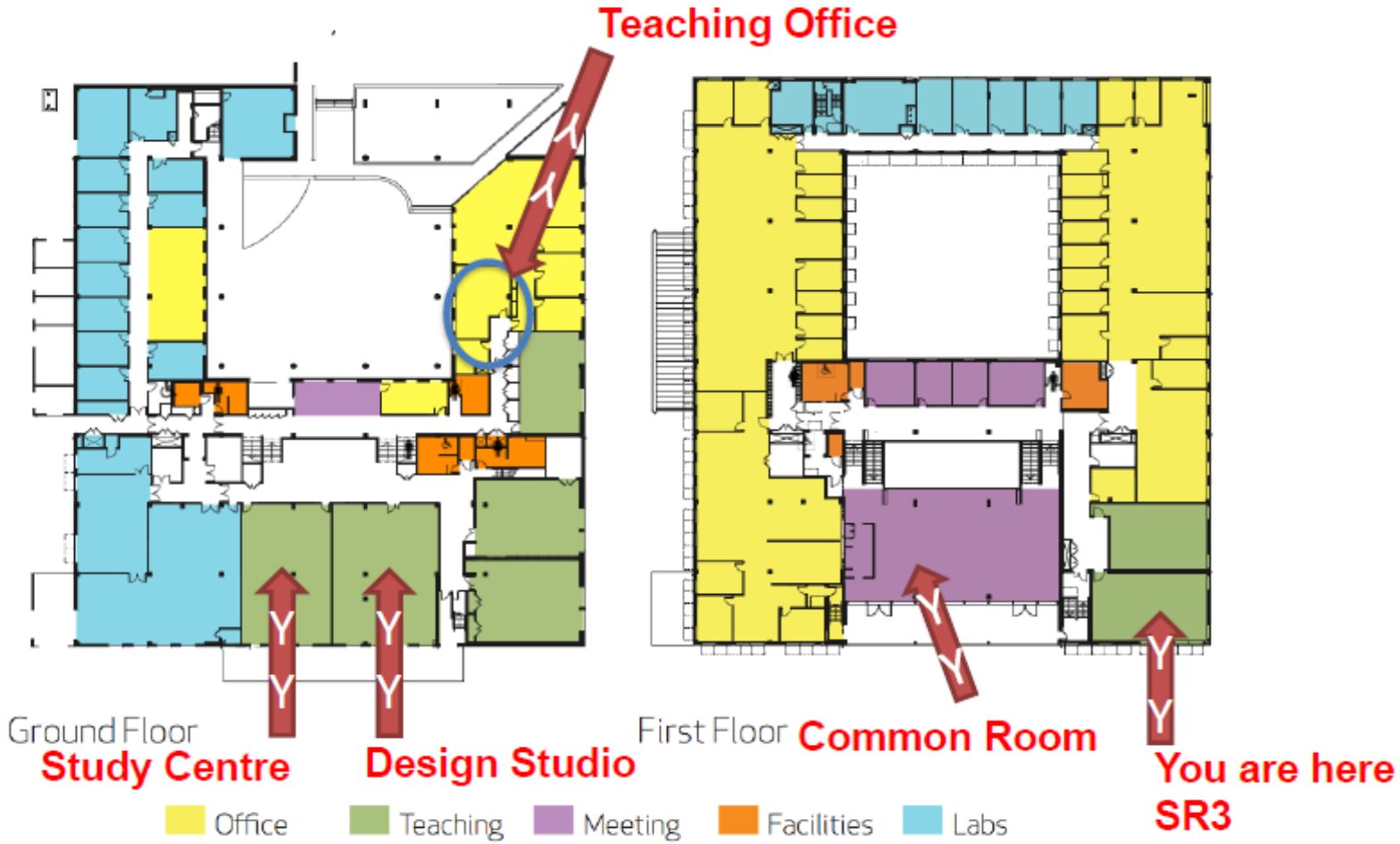
3P6 Organisational Behaviour (Mich)	 Dr Mukesh Kumar (module leader)			
3P7 Managing Business and People (Lent)	 Prof Tim Minshall (module leader)			
3P8 Financial and Management Accounting (Mich)	 Prof Chander Velu (module leader)			
3P9 Industrial Economics, Strategy and Governance (Lent)	 Prof Chander Velu (module leader)			
3P10 Contemporary Issues in Manufacturing (Mich)	 Dr Nathanial Cooper (module leader)	 Dr Dushanth Seevaratnam		
Major Project	 Prof James Moutlrie	 Prof Michaël De Volder	 Dr Sebastian Pattinson	 Prof Chander Velu
Industrial Visits and Workshops	 Dr Angkur Shaikeea			

IT Support	 Lewis Grantham (Heads the IT team)	 Giles Hainsworth (Senior Computing Technician)	
Workshop / Technical support	 Alan Thorne (Technical officer)	 Chris Jennings (Workshop technician, mechanical)	 Simon Sennitt (Workshop technician, electrical)
Others who you should know	 Maggie Harriss IfM Divisional Administrator	 Bridget Dore (Catering Supervisor)	

2024-25 Year Group



IfM Floor Plan



Course overview and timetables

Summary of Taught Modules

Module number	Module Title	Module Scope	Assessment	Term
3P1	Materials into Products	From microstructure to mechanical property: manufacturing process optimisation for all classes of solids	100% Examination	Michaelmas
3P2	Production Machines and Systems	The specification, operation and management of production machines and systems	100% Examination	Michaelmas
3P3	Design	Integrating engineering and industrial design in the creation of new products	100% Coursework	Michaelmas
3P4	Operations Management	The management of material and information flow in the factory and in the supply chain	100% Examination	Lent
3P5	Industrial Engineering	The design of production flows and operations in manufacturing	100% Examination	Lent
3P6	Organisational Behaviour	An introduction to the theory of organisational behaviour	100% Examination	Michaelmas
3P7	Managing Business and People	An introduction to the processes involved in starting and running a business	100% Examination	Lent
3P8	Financial and Management Accounting	An introduction to the principles and practice of financial and management accounting	100% Examination	Michaelmas
3P9	Industrial Economics, Strategy and Governance	An introduction to the principles and practice of industrial economics, strategy and corporate governance	100% Examination	Lent
3P10	Contemporary Issues in Manufacturing	(a) Integrative industrial visits to study modern manufacturing practice (b) Lectures to introduce current topics	100% Examination	Michaelmas

Examinations and Coursework Structure

Name	Descriptor	Contents	Marks
Paper 1	Single module paper: 90 minutes Common with 3C1	Module 3P1, Materials into Products	60
Paper 2	Single module paper: 90 minutes	Module 3P2, Production Machines and Systems	60
Paper 3	Double module paper: 3 hours	Module 3P4, Operations Management Module 3P5, Industrial Engineering	120
Paper 4	Double module paper: 3 hours	Module 3P6, Organisational Behaviour Module 3P7, Managing Business and People	120
Paper 5	Double module paper: 3 hours	Module 3P8, Financial and Management Accounting Module 3P9, Industrial Economics, Strategy and Governance	120
Paper 6	Single module paper: 90 minutes	Module 3P10, Contemporary Issues in Manufacturing	60
3P3 Product Design	Single module assessed coursework		60
Major Project	Coursework		140
CAD/CAM exercise	Coursework		30
Production Game	Coursework		30
Visits	Coursework		40
		TOTAL	**840**

Michaelmas Timetable: ***Note, these timetables are provisional and are subject to change***

Michaelmas Term 2024

Term begins on Tuesday 8 October and ends on Friday 6 December 2024

Paper numbers are shown in bold text, weeks in square brackets if not weeks 1-8 and room numbers in italics.

	weeks		9-10	10-11	11-12	12-1	1-2	2-3	3-4	4-5	5-6
0	07-Oct	Monday		Induction [0], BRINTRUP, SR3			Lunch	Induction [0], BRINTRUP, SR3			
1	14-Oct		3P10: Contemp issues in manuf. [1-4], COOPER, SR3		3P6: Organisational Behaviour [1-8], KUMAR SR3			*Rapid Prototype Workshop 2 (group of 10 students)*			
2	21-Oct							*1.30 - 5.30 Workshop (2) - (Group of 4 students)*			
3	28-Oct							*1.30pm - 5.30pm Workshop (6) - (Group of 4 students)*			
4	04-Nov							*1.30pm - 5.30pm Workshop (8) - (Group of 3 students)*			
5	11-Nov			3P10: Contemp issues in manuf. [5-8] COOPER SR3							
6	18-Nov										
7	25-Nov										
8	02-Dec										
0	08-Oct	Tuesday	Induction [0], BRINTRUP, SR3					Induction [0], BRINTRUP, SR3			
1	15-Oct		Industrial Visit: scheduled all day but may finish earlier depending upon location								
2	22-Oct		Visit Debrief SR3		Skills workshop SR3			*1.30pm - 5.30pm Workshop (3) - (Group of 4 students)*			
3	29-Oct		Industrial Visit: scheduled all day but may finish earlier depending upon location								
4	05-Nov		Visit Debrief SR3		Skills workshop SR3						
5	12-Nov		Industrial Visit: scheduled all day but may finish earlier depending upon location								
6	19-Nov		Visit Debrief SR3		Skills workshop SR3						
7	26-Nov		Industrial Visit: scheduled all day but may finish earlier depending upon location								
8	03-Dec		Visit Debrief SR3		Skills workshop SR3						
0	09-Oct	Wednesday	Induction [0], BRINTRUP, *IfM*, SR3								
1	16-Oct		3P1: Materials into products [1-8], SEITA / SHAIKEEA, LR6		3P8: Financial & management accounting, [1-8], VELU SR3		Lunch	*Rapid Prototype Workshop 3 (group of 10 students)*			
2	23-Oct							*1.30pm - 5.30pm Workshop (4) - (Group of 4 students)*			
3	30-Oct							*1.30pm - 5.30pm Workshop (7) - (Group of 4 students)*			
4	06-Nov										
5	13-Nov										
6	20-Nov										
7	27-Nov										
8	04-Dec										
1	10-Oct	Thursday	L1: Process & prototyping (JM)		L2: Machine systems design (MFLD)	Coursework and Design task briefing	Lunch	Sketching Workshop			
2	17-Oct		Design challenge competition and debrief		L3 Tolerances (JM)	L4 Actuators (MFLD)		Introduction to Solidworks, *THORNE*			
3	24-Oct		L5 Bearings (MFLD)		L6 Mechanisms (MFLD)	Coursework Q&A (JM)		SOLID CAM: Milling, Briefing of CAD/CAM coursework, THORNE			
4	31-Oct		L7 Design for Assembly (JM)	DfA Exercise		DfA Debrief		SOLID CAM: Turning, THORNE			
5	07-Nov		L8 Design for Manufacture (MFLD)	L9 Design for Injection Moulding (MFLD)	L10 Design for AM (JM)	Portfolio Workshop		Coursework			
6	14-Nov		L11 Design History JM		L12 Product Form (JM)	L13: Ergonomics (JM)		Coursework			
7	21-Nov		Major Project Briefing	Major Project Group Work (Team Partnership agreement)				Group Work / Coursework			
8	28-Nov		Group Work / Coursework					Group Work / Coursework			
9	05-Dec		Group Work / Coursework					3P3 Submission via Moodle			
1	11-Oct	Friday	3P1: Materials into products [1-8], SEITA / SHAIKEEA, LR6		3P2: Production machines & systems [1-4], O'NEILL, [5-8], KRUGER SR3		Lunch	*Rapid Prototype Workshop 1 (group of 10 students)*			
2	18-Oct							*1.30pm - 5.30pm Workshop (1) - (Group of 4 students)*			
3	25-Oct							*1.30pm - 5.30pm Workshop (5) - (Group of 4 students)*			
4	01-Nov										
5	08-Nov										
6	15-Nov										
7	22-Nov										
8	29-Nov										
9	06-Dec										

Lent timetable: ***Note, these timetables are provisional and are subject to change***

Lent Term 2025

Term begins on Tuesday 21 January and ends on Friday 21 March 2025

Paper numbers are shown in bold text, weeks in square brackets if not weeks 1-8 and room numbers in italics.

weeks			9-10	10-11	11-12	12-1	1-2	2-3	3-4	4-5	5-6
0	20-Jan	Monday					*Lunch*				
1	27-Jan				**3P5: Industrial Engineering** [1-8], PARLIKAD SR3						
2	03-Feb										
3	10-Feb										
4	17-Feb										
5	24-Feb										
6	03-Mar										
7	10-Mar										
8	17-Mar										
0	21-Jan	Tuesday									
1	28-Jan		**Industrial Visit: scheduled all day but may finish earlier depending upon location**								
2	04-Feb		**Visit Debrief** SR3		**Skills workshop** SR3						
3	11-Feb		**Industrial Visit: scheduled all day but may finish earlier depending upon location**								
4	18-Feb		**Visit Debrief** SR3		**Skills workshop** SR3						
5	25-Feb		**Industrial Visit: scheduled all day but may finish earlier depending upon location**								
6	04-Mar		**Visit Debrief** SR3		**Skills workshop** SR3						
7	11-Mar		**Visit Final Presentations** - *all day*								
8	18-Mar										
0	22-Jan	Wednesday					*Lunch*				
1	29-Jan		**3P9: Industrial Economics** [1-8], VELU SR3		**3P4: Operations Management**, [1-8] BRINTRUP/DAVIES SR3						
2	05-Feb										
3	12-Feb										
4	19-Feb										
5	26-Feb										
6	05-Mar										
7	12-Mar										
8	19-Mar										
1	23-Jan	Thursday	**Major Project:** Project proposal presentation				*Lunch*	**Major Project:** Group Work			
2	30-Jan		**Major Project:** Project group consultations					**Major Project:** Group Work			
3	06-Feb		**Major Project:** Project group consultations					**Major Project:** Group Work			
4	13-Feb		**Major Project:** Design review 1					**Major Project:** Group Work			
5	20-Feb		**Major Project:** Project group consultations					**Major Project:** Group Work			
6	27-Feb		**Major Project:** Project group consultations					**Major Project:** Group Work			
7	06-Mar		**Major Project:** Design review 2					**Major Project:** Group Work			
8	13-Mar										
9	20-Mar										
1	24-Jan	Friday					*Lunch*				
2	31-Jan			**3P7: Managing Business and People** [1-8], KUMAR, SR3							
3	07-Feb										
4	14-Feb										
5	21-Feb										
6	28-Feb										
7	07-Mar										
8	14-Mar						**Production Game** [8] (commencing at 1pm)				
9	21-Mar										

Easter timetable: ***Note, these timetables areprovisional and are subject to change***

Easter Term 2025

Term begins on Tuesday 29 April and ends on Friday 20 June 2025

weeks			9-10	10-11	11-12	12-1	1-2	2-3	3-4	4-5	5-6
0	28-Apr	Monday	*Exam period*								
1	05-May		*Exam period*								
2	12-May		*Major Project Period*								
3	19-May										
4	26-May										
5	02-Jun										
6	09-Jun		**Major Project: Hand in porfolio, Business plan**								
7	16-Jun										
8	23-Jun										
0	29-Apr	Tuesday	*Exam period*								
1	06-May		*Exam period*								
2	13-May		*Major Project period*								
3	20-May										
4	27-May										
5	03-Jun										
6	10-Jun		*Set up for Presentations and Design Show*								
7	17-Jun										
8	24-Jun										
0	30-Apr	Wednesday	*Exam period*								
1	07-May		*Exam period*								
2	14-May		*Major Project period*								
3	21-May										
4	28-May										
5	04-Jun										
6	11-Jun		**MAJOR PROJECT FINAL PRESENTATIONS (Poster Display and evening Design Show)**								
7	18-Jun										
8	25-Jun										
1	01-May	Thursday	*Exam period*								
2	08-May		*Exam period*								
3	15-May		*Major Project Supervisions*								
4	22-May		*Project Team Consultations*								
5	29-May		*Project Team Consultations*								
6	05-Jun		*Project Team Consultations*								
7	12-Jun		Take down Design Show and clear up Design Studio								
8	19-Jun										
1	02-May	Friday	*Exam period*								
2	09-May		*Exam period*								
3	16-May		*Major Project Period*								
4	23-May										
5	30-May										
6	06-Jun										
7	13-Jun										
8	20-Jun										

Induction

Aims

- ***To provide information about the course*** including: the content and structure of the taught modules; the opportunity presented by the course work to demonstrate an integrative approach; the process and administration of the Company Visits; tablet based teaching; the methods of examination; timetable and locations.
- ***To ensure operating procedures and administration are understood***: including the different ethos from Part 1 of Engineering; the role of the IfM teaching office; the use of Moodle for providing information and taught content; access to admin and teaching staff; layout of the Alan Reece Building and the use of its facilities.
- ***To start the skills development programme.*** The induction programme includes sessions on communications, including presentation skills which are required early in the course. The remainder of the skills development programme takes place on alternate Tuesdays during Michaelmas and Lent terms.
- ***To facilitate group bonding*** which is essential for the successful operation of the course. Students will meet academic and teaching staff, and the style of the course will be interactive with taught inputs interspersed with small group activities.
- ***To provide a brief introduction to Manufacturing*** to emphasise the integrated nature of Manufacturing and to explain the importance of retaining this perspective even though the subject is deconstructed into modules for the purposes of teaching.

Teaching style

To meet these aims the induction programme will necessarily contain some taught input but will include substantial periods of interactive learning through group work and exercises.

Location

The induction programme is based in the Alan Reece Building, Seminar Room 3. Some components, highlighted in the timetable will be delivered remotely and additional resources will be available online.

Induction programme

Mon 7 October		
10:00 – 10:30	Welcome and overview of induction programme Discussion: your hopes from MET	Ajith Parlikad Alexandra Brintrup
10:45 – 11:15	Course overview and administration	Alexandra Brintrup
11:15 – 11:30	*Break*	
11:30 – 12:30	Manufacturing awareness	Sebastian Pattinson / Angkur Shaikeea
12:30 – 14:00	**Buffet lunch with MET and Staff**	**ALL**
14:00 – 14:45	Company visits: aims, visits process, themes and topics, assessment, safety	Angkur Shaikeea
15:00-16:00	Facilities tours	Alan Thorne / Simon Sennitt / Chris Jennings
Tues 8 October		
09:30 – 10:00	Introduction Library Facilities	Emily Bamber
10:00 – 10:30	Retail shop exercise: Briefing	Alexandra Brintrup
11:00 – 14:00	Retail shop exercise: Store Observation and Presentation Preparation Lunch: Own arrangements	Alexandra Brintrup
14:00-16:00	Retail shop exercise: Group Presentation and Feedback	Alexandra Brintrup
Wed 9 October		
10:00 – 10:15	IfM Health & Safety	Sebastian Pattinson
10:15 – 10:45	Introduction to workshop training	Alan Thorne
11:00 – 11:45	Workshop Health & Safety lecture	Alan Thorne /Simon Sennitt / Chris Jennings

Industrial Visits and Skills Workshops

Programme Leader: Dr Angkur Shaikeea

Programme

The Module consists of Industrial Visits and Skills Development workshops. These are delivered during the Michaelmas and Lent terms to allow maximum opportunity for observing real manufacturing environment and for testing and practicing a variety of managerial and practical skills as the MET IIA course progresses.

Industrial visits occur on Tuesdays, and typically are organised every other week (see programme)[1]. In the intervening week, on the Tuesdays the programme comprises debriefing sessions and skills workshops. The workshops start during the Induction programme and thereafter during all Michealmas and Lent terms.

All the elements of this module require attendance.

The coursework is expected to be delivered by teams and it is of the utmost importance that students will work collegially to produce the required outputs.

Industrial visits and Debriefing

Visits

It is important that the students' calendar remains completely free on Tuesdays for the whole day, to facilitate our organisation of visits.

Punctuality is expected. Companies will be informed of those attending. The coaches will be leaving on time and will not wait for any late student. Any absence from visit or presentation needs to be communicated by emailing the IfM Teaching office (met-admin@eng.cam.ac.uk) so your case can be considered.

If you will be out of Cambridge over lunchtime, then either the company will provide lunch, or you will have to bring your own lunch. Unless otherwise informed on the Visit Brief, the students are expected to bring their own lunch.

Dress Code

When visiting companies you are representing Cambridge University and the Institute for Manufacturing, and you are expected to maintain the high standards for which we are known. You should always behave in a responsible and professional manner, and you should be smartly turned-out and appropriately dressed. This means in compliance with the requests of the companies (which will be listed on the briefing provided ahead of each visit). You should always wear sensible shoes and **not** trainers on factory visits (no high heels or sandals). Safety footwear will be required on most visits. Other requirements, including the use of photography, may be specified by the company and must be adhered to. All rules visit by visit will be advised on the Visit Brief (which will be stored on Moodle).

[1] The programme might be changed during the year – for the most up-todate version lookup the industrial Visits Moodle folder

The visit rota will follow a schematic, (see example below).

Company visits schematic (example)

☺ De-briefing presenting responsibility * Responsibility for taking notes during industrial visits and contributing to de-briefing team		De-briefing presentations					Final presentation
Group 1	**Group 2**	*Sector 1 Primary Processes*	*Sector 2 Electro-mechanical*	*Sector 3 Food*	*Sector 4 Vehicles*	*Sector 5 Goods and information distribution*	*Review of practices Across sectors*
Team 1A	*Team 2A*	*Materials Prod process	*Ops Mgt	*Industrial Eng	☺ *Design Mgt	*HR +CSR	**Industrial Eng**
Team 1B	*Team 2B*	*Ops Mgt	*Industrial Eng	☺ *Design Mgt	*HR+CSR	*Materials Prod process	**Design Mgt**
Team 1C	*Team 2C*	*Industrial Eng	☺ *Design Mgt	*HR+CSR	*Materials Prod process	*Ops Mgt	**HR +CSR**
Team 1D	*Team 2D*	☺ *Design Mgt	*HR+CSR	*Materials Prod process	*Ops Mgt	*Industrial Eng	**Materials Prod process**
Team 1E	*Team 2E*	*HR+ CSR	*Materials Prod process	*Ops mgt	*Industrial Eng	☺ *Design Mgt	**Ops mgt**

Each visit group is divided into Groups (1 and 2), each group will attend a different visit in parallel.

Within each group, people will be assigned to teams (E.g., 1D). Each team will focus on a different generic theme during the visit (e.g. Materials and Production processes). The themes will be rotated between the teams so that each team focuses on a different theme for each visit (see example of table above). For every visit, one team (the Design management team highlighted by a smiley icon) will be responsible for collating the input from all the teams in their group and to prepare a debriefing presentation for the following Tuesday. This responsibility is rotated between the teams as assigned on the visit rota.

The programme is assessed and so attendance is expected at all events. Any absence from any industrial visits needs to be approved by the Module Leader and the IfM Teaching Office by emailing met-admin@eng.cam.ac.uk

The following approach is suggested:

i. Teams (e.g. 1A, 1B, 1C etc) collect information on their theme during the visit. It is important that the “design management team” instructs the other teams on how to feed information (e.g. ‘please remember to ask this question, please remember

to look for XXXX'). A good time to do this is during the travels to reach the companies.

ii. Teams structure their information and feed it to the presenter team. This should be started on the return coach trip while the details are still fresh. Additionally, summary power point slides should be given to the presenter team by the Thursday following the visit.

iii. The presenter team prepares a 25 minutes power point presentation incorporating information from all the teams. The presentation should be structured and edited to ensure an integrated overview of the company and the analysis.

iv. The formal debrief normally takes place on the Tuesday following the visit. All members of the team whose debrief is due need to attend and present. At these de-briefing sessions, students from both visit groups come together, with their visit supervisors and the visits programme Module Leader.

v. The debriefing presentations are evaluated by the Module Leader and the accompanying supervisiors (15/40 marks). The debriefing presentations are evaluated as a group (all students presenting will receive the same mark).

vi. Debriefing process: The first visit group make their presentation, followed by discussion and questions, principally from the other group. All members of the first group will be encouraged to participate in the discussion. The process is repeated for the second visit group. There is a round up discussion about each of the themes in turn, drawing out comparisons and differences between the companies.

vii. The presenters' team annotates their power point slides with comments and update them as a result of the discussion. The annotated slides need to be sent to the teaching office after the presentations and are made available to all students on Moodle for reference and revision in preparation of the final presentation.

viii. At the end of the year, a final presentation, will consititute the rest of the module marks (25/40). The process is as follows:

   a. Students (e.g. D teams, together), will present on one theme (e.g., Material production processes)
   b. Within each team, discussions to review material from all visits will take place to identify learnings across all the companies visited during the previous months. A final presentation will be prepared with annotated slides
   c. On the final presentation day, each team will have 15 minutes (exactly) to present (each member of each team will need to contribute and present). The group will receive questions from the module leader and the assessors as well as from the rest of the class for 10 minutes The overall final presentation day will last approximately 4 hours.
   d. After the presentation, presenters update their slides to record the discussion and send their work to the Teaching office.

Visit themes

Theme	Details
Industry level context	• *History* - how has the industry developed: what technical and structural changes have occurred. • *Markets* - where are the major markets – how is this forecast to change; what are the current market conditions; what are the major trends affecting the industry. • *Competition* - who are the major players; what market shares.
Company level context	• *History* – what is the history of the company; has the ownership structure changed; is there a specific culture, ethos, or set of values. • *Scale* - key metrics for this site – turnover, employees, products • *Structure* – how is the company structured; how does it fit into the whole organisation. • *Market* - where does the company position itself in the market; who is the competition; who are the customers; where are they. • *Products* - what is the range of products - to what extent are products customised • *Strategy* - what is the business model – how does the company make money; how does the company compete – price, quality delivery, responsiveness, others; what is the impact of low cost economies.
Materials, production processes and technology	• *Materials* - what range of materials is used – why; where are they sourced. • *Production processes* - what production processes are employed; are there any areas of special expertise; which processes are outsourced – why and where to; what level of automation is in evidence – are there further opportunities; is the operation labour intensive or capital intensive. • *Technology* - how does the company stay abreast of technical developments; how is new equipment selected and justified.
Operations Mgt - organisation and control	• How many product variants are there – how does uncertainty affect the business and manufacturing operations • What are the key challenges in matching supply and demand • What is the typical time from order to delivery. • How is production configured - cell, line, functional etc – why. • What cost reduction techniques are used. • How are lean processes applied. • What are the systems for controlling production flow e.g. MRP, JIT, Kanban etc
Industrial engineering and quality	• *Industrial engineering* - how are work study methods applied; how is work place layout determined; how are task times determined; what performance measures are used. • *Quality* - what quality control systems are in place; are statistical approaches in evidence; what continuous improvement techniques are used e.g. quality circles, kaizan projects, suggestion schemes

Design management	• How is the brand positioned inthe market? • What is the customer journey: what are the range of 'touch points' (e.g. web, brochures, people, stores, telephone calls etc.) that define the customers interface with the company. How are these designed and who is responsible for ensuring consistency? • What is the company's design strategy? • How are industrial and engineering design linked?
Human Resources + Corporate social responsibility, H&S, environment and sustainability	• *Recruitment and training* - how are employees recruited and trained; what are the critical skills; how are they developed; how are they forecast to change. • *Remuneration* - what pay systems are in place – e.g. piece work, salary, bonus; what non pay reward systems are in place. • *Employee relations* - are any unions recognised; what structures are in place to work with them; how are communications with employees handled.
	• *H&S* – what is the company's safety record; how is safety managed. • *Environment* - why is the operation based in this locality – what advantages, disadvantages; what is the impact of the operation on the local environment and community; what measures are in place to reduce any negative impact; in what ways does the company engage with the community. • *Sustainability* - what regulations impinge on the business – are they getting tougher; are alternative technologies being developed to reduce the environmental impact – are there cost implications; how are sustainability issues affecting the business – markets, products, operations.

Skills workshops[2]

The skills workshops are designed to develop some of the personal skills critical for success in industry and related employment. The skills are introduced in the workshop series and are practiced and developed during the two years of the MET programme.

The skills considered in the workshop series are[2]:

- ***Process improvement skills***: bringing improvements to manufacturing processes form a fundamental part of the skillset that any manufacturing engineer must possess. These sessions focus on using structured approaches to understand a manufacturing process and to improve its performance.
- ***Working in Teams***: this session focuses on understanding and identifying the different skills, personalities and motivations which individuals bring to a team, and the ways in which they can be harnessed to optimum effect.
- ***Writing skills***: these are essential both in exams and detailed reports that require you to present a broad set of ideas in a coherent, evidence-based structure. A workshop and discussion will develop the skills, which will be of use throughout your career.
- ***Artefacts workshop****:* exploring how different components are manufactured.
- ***Examination skills:*** giving guidance on examinations and examination preparation skills.

[2] The skills workshops list will be updated at the start of the year. Please refer to Moodle more up to date timetable.

NOTE: Please check email and MOODLE for updated schedule. All debriefing and workshop sessions will be held at the IfM, Alan Reece Building, SR3

Example timetable (this is indicative, the visits and de-briefing days can change. See Moodle for up to date schedule)

Michaelmas	***Morning***	***Afternoon***
15 October	Visits	
22 October	Debriefing and Skills workshop	
29 October	Visits	
5 November	Debriefing and Skills workshop	
12 November	Visits	
19 November	Debriefing and Skills workshop	
26 November	Possible Visits – leave free	
3 December	Skills workshop (possible debrief	
Lent		
28 January	Visits	
4 February	Debriefing and Skills workshop	
11 February	Visits	
18 February	Debriefing and Skills workshop	
25 February	Visits	
4 March	Debriefing and Skills workshop	
11 March	Final Presentations	

Marking scheme

The programme is assessed and a total of 40 marks are available (15 marks for the debriefing presentations and 25 for the final presentation). Presentations are evaluated as a group (all students in the team will receive the same marks).

Attendance is expected at all events. Any absence from any assessed part (i.e. de-briefing presentations and final year presentation), and from the visits, should be discussed with the Module Leader and the IfM Teaching Office by emailing met-admin@eng.cam.ac.uk Please note that the debriefing presentations and final year presentations cannot be rearranged (see the Extension Policy in Appendix 2).

The assessment will consider:

- **Structure**: is the presentation structured in a logical way? Are all the necessary parts covered?

- **Content**: Has the presentation given an exhaustive account of the visit and demonstrates further research into the themes?
- **Analysis**: Have the team reflected on the issues and identified key take aways from the visit? Has this been done across all the themes?
- **Clarity**: is the presentation clearly delivered (professional language, clear slides, well referenced content, good time keeping) etc?

Reading list:

Goodson, R. E., "Read a Plant -Fast", Harvard Business Review, May, 2002

Upton, M.U., Macadam, S.E., "Why (and How) to Take a Plant Tour", Harvard Business Review, May-June, 1997.

Module Specifications

3P1: Materials into products

Module summary	From microstructure to final properties: manufacturing process optimisation for all classes of materials.
Taught by	Dr A Shaikeea (module leader) Dr C Barlow, Dr M Seita
Supporting activities	Artefacts workshops - TBA
Assessment	100% by examination. Paper 1, single module paper common with Engineering Part IIA 3C1
Supervision	4 supervisions (1 per examples paper, plus revision class), using a combination of groups of 4-5 and larger classes
Links to other elements of the course	Complementary materials know-how for aspects of 3P2 (processes), 3P3 (design) and Major Projects. Directly relevant to visits to industrial materials processing operations.

Module Learning Outcomes

By the end of the course, students should:

- Have a broad appreciation of the different materials processing methods used for metals, ceramics and polymers.
- Understand the main interactions between process and material in design and process selection, for each of the main classes of material.
- Understand the factors which control the microstructure of shaped castings, and their consequences for final properties and design of castings.
- Know the main deformation processes for wrought alloys, and be able to conduct simple upper bound analysis of plastic deformation.
- Know the microstructural characteristics of wrought alloys, and the reasons for alloying and heat treatment, with examples from Al alloys and steels.
- Understand hardenability of steels, using CCT diagrams to select steels and heat treatments for a given component specification.
- Know the main classes of polymers and composites, and understand the processing and design considerations in selecting these for a given component.
- Understand the processes and issues in the manufacture of powder metallurgy and ceramic products, and in additive manufacturing.
- Understand the importance of surface treatments and joining technologies, and know the main factors to consider in process selection.
- Be able to apply their knowledge of materials processing, microstructure evolution, and the mechanisms of material degradation to analyse and predict failures and to improve product design.

Syllabus

Lecture	Syllabus	On completion students should be able to….
1 Introduction and Process Selection	Classification of manufacturing processes. Coupled problems in design and manufacturing: the interaction between material, process and design parameters.	Take a structured approach to choosing and interpreting viable material-process combinations for making components.
2 Heat Treatment of Steels	Revision of phase transformations and TTT diagrams. CCT diagrams and hardenability for steels.	Predict microstructure and mechanical properties in steel components following a given heat treatment.
3 – 4 Casting of Metals	Ingot and shaped casting. Revision of phase diagrams and transformations applied to solidification: segregation, constitutional supercooling, casting alloys and microstructures. Casting defects and design of shaped castings. *Examples paper 1*	Describe the factors involved in optimising casting processes, alloys and design to achieve required quality and mechanical properties for a component.
5 – 8 Deformation Processing of Wrought Alloys, Heat treatment.	Wrought alloy processing and microstructure evolution. Simple modelling of plastic forming processes (upper bound method). Application to rolling, forging, extrusion, machining of metals. *Examples paper 2*	Describe the factors involved in optimising wrought processes, alloys and design to achieve required physical and mechanical properties for a component. Estimate load, power, and temperature rise for shaping processes involving plastic deformation of metals.
9 – 10 Processing of Polymers and Composites	Polymer and composite processing technology. Design, material and process selection for polymers and composites.	Select polymer and process to achieve required shape and properties for a component. Select manufacturing process to achieve required shape and mechanical properties in fibre-reinforced polymer composites.
11 – 13 Powder Processing, Welding and Joining, Surface Engineering	Sintering, HIPing and other powder methods for metals and ceramics. Additive manufacturing. Welding technologies and other joining processes, and design considerations. Surface engineering processes and their applications.	Describe the factors that govern the choice of powder and additive manufacturing routes instead of conventional processes. Make recommendations for suitability of joining technologies for different materials and applications. Select surface treatments to achieve required physical and mechanical properties.

14 - 16 Design against Failure.	Processing as the origin of defects and failures (microstructure, damage, residual stress). Environmental factors in failure of materials. Analysis and case studies of failures. *Examples paper 3*	Identify likely sources of failure for components made from all classes of materials. Propose ways in which such failures can be avoided.

Reading List

*ASHBY, M.F.	MATERIALS SELECTION IN MECHANICAL DESIGN Butterworth-Heinemann 4th edition 2010, 3rd edition available as an ebook at: http://www.myilibrary.com?id=75447	JA.208
*ASHBY, M.F. & JONES, D.R.H.	ENGINEERING MATERIALS 2 Butterworth-Heinemann 3rd edition 2006 (mainly revision) Available as an ebook at: http://www.myilibrary.com?id=75451	JA 191
ASHBY, M., SHERCLIFF, H. & CEBON, D.	MATERIALS: ENGINEERING, SCIENCE, PROCESSING AND DESIGN Butterworth-Heinemann 4th edition 2019, 3rd edition 2014, 2nd edition 2010 2nd edition available as an ebook at: https://www.dawsonera.com/guard/protected/dawson.jsp?name=https://shib.raven.cam.ac.uk/shibboleth&dest=http://www.dawsonera.com/depp/reader/protected/external/AbstractView/S9780080961552	JA.209
CALLADINE, C.R.	PLASTICITY FOR ENGINEERS Ellis Horwood 1985	FA 127
*CAMPBELL, J.	CASTINGS Butterworth-Heinemann 1991 = Author's Castings principles, 2nd ed available as an ebook at: https://www.dawsonera.com/guard/protected/dawson.jsp?name=https:// shib.raven.cam.ac.uk/shibboleth&dest=http://www.dawsonera.com/depp/reader/protected/external/AbstractView/S9780080488448	JO 41
*EDWARDS, L. & ENDEAN, M.	MANUFACTURING WITH MATERIALS Open University 1990	JA 146
JONES, D.R.H.	ENGINEERING MATERIALS III Pergamon 1993	JJ 308
*KALPAKJIAN, S. & SCHMID, S.R.	MANUFACTURING PROCESSES FOR ENGINEERING MATERIALS Pearson/Prentice Hall 5th edition SI units 2008	JN 67
LLEWELLYN, D.T. & HUDD, R.C.	STEELS: METALLURGY & APPLICATIONS Butterworth-Heinemann 3rd edition 1998	JD 64

MILLS, N.J.	PLASTICS Butterworth Heinemann 3rd edition 2005 Available as e-book at http://www.myilibrary.com/?id=101358	JG 216
*POLMEAR, I.	LIGHT ALLOYS Butterworth-Heinemann 4th edition 2006 Available as an ebook at: https://www.dawsonera.com/guard/protected/dawson.jsp?name=https:// shib.raven.cam.ac.uk/shibboleth&dest=http://www.dawsonera.com/depp/reader/protected/external/AbstractView/S9780080496108	JB 73
ROWE, G.W.	ELEMENTS OF METAL WORKING THEORY Arnold 1979	JN 39
STRONG, A.B.	PLASTICS – MATERIALS AND PROCESSING Pearson Prentice Hall 3rd edition 2006	JG 219
TEMPELMAN, E., SHERCLIFF H.R. & NINABER VAN EYBEN, B.	MANUFACTURING AND DESIGN Butterworth-Heinemann 1st edition 2014	AP343
WATERS, T.F.	FUNDAMENTALS OF MANUFACTURING FOR ENGINEERS UCL Press 1996	BN 204

3P2: Operation and Control of Production Machines and Systems

Module summary	The specification, operation and management of production machines and systems
Course leader	Prof Bill O'Neill (module leader), Dr Karel Kruger
Courses	a. Operation of production machines, 4 x 2hr lectures, Michaelmas Term (Prof B O'Neill) b. Control of production machines and systems, 4 x 2hr lectures, Michaelmas Term (Dr Karel Kruger)
Supporting activities	Integrated coursework – CAD/CAM exercise
Assessment	100% by examination. Paper 2 - single module paper.
Supervision	The course will be supported by two examples papers, for each of which one supervision will be arranged.
Timetable	Lectures are given in 2 hour blocks on Fridays in Michaelmas term
Links to other elements of the course	Links to 3P1, 3P4, 3P5, and industrial visits.

Module Learning Outcomes

On completion of the module students should be able to:

1. Know the operational aspects of the main categories of machining processes
2. Know the operational aspects of the main categories of metal based additive manufacturing processes
3. Understand the types of interaction between components and process tooling
4. Understand the factors that affect the accuracy and precision of machining, grinding operations, and additive manufacturing processes
5. Understand the various control strategies used to mitigate the sources of error in machining processes and the manner in such which machines are automated
6. Understand the systems, requirements and challenges in cell-level automation and
7. Be able to model cell operations using Petri Nets and Ladder Logic
8. Know the means by which machining cells are integrated into factory wide operations using modern communications and computing systems
9. Develop an appreciation for recent developments in industrial automation

Syllabus: Operation of Production Machines

Lecture	Syllabus	On completion students should be able to ...
1 Introduction to machine tools	History and development of machine tools, and metal based additive manufacturing systems. Concept and definition of machining and machine tools. Classification and specification of machine tools. Basic constructional features, advanced system designs.	Know the history of machine tool developments. Know elements of machine tool design and their configurations. Know their manufacturing and operational capabilities. Know the applications domain and range of materials processed by modern machine tools.
2 Basics of machining and chip formation	Tool geometry, mechanism of chip formation, mechanics of machining, cutting temperature: causes, effects, estimation, measurement and control. Operations of single and multi-point tooling. Classification of machining processes. Basic machining operations - turning, shaping, planing, drilling, milling processes	Understand the basic physics of cutting-tool/material interactions. Understand the influence that parametric variables have on cutting performance (tool tip condition, cutting fluid flow, temperature, force, feed etc). Know the range of cutting tool materials and cutting tip geometries. Know the range of machining methodologies employed in modern machining operations.
3 Cutting tools and machinability	Failure modes, wear mechanisms, and life of cutting tools. Cutting tool materials, influence of geometrical, process and cutting fluid parameters on machinability and surface roughness, economics of cutting tool operations	Know the conditions necessary to deliver accurate machining processes. Understand the causes of wear and process strategies to reduce it. Know the techniques applied to characterize machining performance. Understand roughness classifications and measurement techniques. Understand Taylor's tool life equation and be able to apply it to make informed decisions on tool choice for a range of materials. Determine cost and times of machining operations.
4 Metal Additive Manufacturing Processes (AM)	System architectures, processing configurations. AM materials, process performance and applications, economics of additive manufacturing operations.	Know the conditions necessary to deliver accurate AM processes. Understand the causes of process variation and process strategies to reduce it. Understand the benefits and limitations of current processes.

5-6 Process Variability	Factors affecting the accuracy and precision of processes, static and dynamic effects, sources of uncertainties: inputs, process interactions, process degradation. Response to uncertainties: design of production equipment and tooling, online inspection, corrective processes	Understand the factors that affect the accuracy and precision of machining and grinding operations. Know the sources of variation in machining. Understand the various strategies used to mitigate the sources of error in machining processes.
7 - 8 Quality Control	Testing and inspection points in machining operations. Statistical process control-control charts, process improvement techniques, causes of variation, control chart patterns, control chart applications.	Understand quality control techniques in machining operations. Know how to measure and minimize process variation using statistical process control (SPC). Understand the various SPC strategies used to implement quality control measures in machining operations.

Syllabus: Control of Production Machines and Systems

Lecture	Syllabus	On completion students should be able to ...
9 – 10 Machine automation and control	Issues in automation of machines, CNC control, Open loop and closed-loop control of m/c tools, adaptive control, sensing and actuation, robotic control	Discuss the benefits and downsides of automation Design a feedback control loop to compensate for machine tool deflection during operation Describe how sensing and actuation is achieved to implement control Describe how machine tools are automated Articulate challenges in robotic control
11 – 12 Cell Control Using PLC Programming	Issues in cell-level control, Programmable Logic Controllers, Ladder Logic Diagrams, modeling of cell operations using FSM	Understand requirements for cell automation Develop Ladder Logic code to automate the operations of a manufacturing cell Learn how to develop Finite State Machine process representations Use Finite State Machines to develop Ladder Logic Code
13 – 14 Petri Net Based Automation Modelling and Control	Introduction to Petri-Nets, modeling of cell operations using petri nets, conversion of Petri Nets to Ladder Logic	Know the rationale for selecting different discreteevent models for automated systems Understand how to develop Petri Net models Develop a cell management scheme using a Petri Net approach Convert Petri Nets to equivalent Ladder Logic code
15-16 Factory Automation & Comms	Automation options in factory wide operations. Communication systems. Future automation developments	Understand automation requirements across the factory. Learn different options for communications at different levels in the factory, Be aware of modern automation and communications developments and how they will impact on modern manufacturing

Reading List: Operation of Production Machines

*Kalpakjian, Serope & Schmid, Steven R	MANUFACTURING PROCESSES FOR ENGINEERING MATERIALS, PRENTICE HALL, Edition: 0005, August 2007 (ISBN10: 0132272717, ISBN13: 9780132272711)
*Winston A. Knight, Geoffrey Boothroyd	FUNDAMENTALS OF METAL MACHINING AND MACHINE TOOLS, Third Edition. 2005 by CRC Press (ISBN 9781574446593)
Helmi A Youssef, & Hassan El-Hofy	MACHINING TECHNOLOGY, Taylor & Francis Ltd CRC Press Inc, 2008 (ISBN10: 1420043390 , ISBN13: 9781420043396)
*Ian Gibson, David Rosen, Brent Stucker	Additive Manufacturing Technologies: 3D Printing, Rapid Prototyping, and Direct Digital Manufacturing, Edition 2, Springer, Nov 26 2014, (ISBN 9781493921133)

Reading List: Control of Production Machines and Systems

*BOUCHER, T.O.	COMPUTING AUTOMATION IN MANUFACTURING: AN INTRODUCTION Chapman & Hall 1996
*KALPAKJIAN, S. & SCHMID, S.R.	MANUFACTURING ENGINEERING AND TECHNOLOGY Prentice Hall 5th edition 2004
BOLTON, W.	INSTRUMENTATION AND CONTROL SYSTEMS Newnes 2004
BOLTON, W.	PROGRAMMABLE LOGIC CONTROLLERS, Newnes 4TH Edition 2006

Links to online copies of this Reading List can be found here - https://cam.alma.exlibrisgroup.com/leganto/public/44CAM_INST/lists/14624245830003606?auth=SAML

3P3: Product Design

Module summary	Integrating engineering and industrial design in the creation of new products
Taught by	Prof J Moultrie (Module Leader), Prof Michael De Volder
Assessment	Coursework
Supervision	A Q&A session for the coursework will be timetabled
Links to other elements of the course	3P1: Links to content on production processes, relevant to design for manufacture (L8-10), including design for injection moulding and additive manufacturing 3P2: Links to content on machining processes and accuracy/precision relevant to lecture on tolerancing (L3) and design for assembly & standardisation (L7). 3P4: Very loose link to operational complexity when considering assembly simplification in design for assembly. CAD/CAM Exercise: requires the application of conent from the lecture on Engineering Drawing and tolerancing (L3). IIA Major Project: Aims to put 3P3 lectures content (L1-13) into practice.

Module Learning Outcomes

On completion of the module students should be able to:

1. Undertand the iterative nature of the design process.
2. Understand and apply dimensional tolerances to engineering drawings.
3. Understand and apply the principles of machine design to the design of products.
4. Be able to select appropriate manufacturing processes for a new design and understand how production volume and cost influences the design.
5. Be able to assess and improve the design for assembly of an existing design. Be able to apply these ideas to a new design.
6. Understand why products are designed as they are and be able to explore a product's form.
7. Understand and be able to apply basic ergonomic principles.
8. Develop skills in sketching, conceptual design and detailed design.

Syllabus

Session	Syllabus	On completion students should be able to ...
1 The design process & Prototyping	**1a**: introduction to the module & overview of the design process. **1b**: Improving design competence.	Understand the difference between a theoretical and real design processes. Be aware of the differences in competence between novice and experienced designers.
	1c: Types and roles of prototypes, simulations and models in design. **1d**: A short case study of prototyping.	Understand the importance of prototyping in the design process and the role of different types of prototype.
2 Machine systems	**2a:** Machine frames and force loops. **2b:** Frame construction, joining techniques and design practices.	Application and understanding of kinematic design, force loops, flexure hinges, etc.
3 Engineering Drawing and Tolerancing	**3a**: Nasics of dimensioning and drawing conventions. **3b**: Limits and fits. **3c**: Worked examples.	Produce and read engineering drawings Apply engineering tolerances.
4 Actuators and bearings	Introduction to different types of linear and rotating actuation principles.	Understand that different types of actuators serve different needs.
5 Bearings	Introduction techniques to guide the generated motion using bearings.	Understand the need for bearings, and be able to select the appropriate type of bearings in a design.
6 Mechanisms	**6a:** Gears and gear boxes **6b:** Linkages, cams and other mechanisms.	Understanding of the opportunities and limitations of mechanisms and how to calculate or simulate their operation.
7 Design for Assembly	**7a**: A brief history of standardisation. **7b**: Optimising an assembly – some heuristics. **7c**: Optimising an assembly – structured methods.	Be able to apply principles of design for assembly in order to simplify and reduce the cost/complexity of an assembly.
8 Design for manufacture	**8a**: Unit costs. **8b**: Process selection.	Understand the importance of understanding costs and volumes in designing a new product and the impact this has on the selection of production methods and how this influences the design.
9 Design for injection moulding	Overview of principles of design for injection moulding	Be able to apply design rules for manufacture, with emphasis on maching, injection moulding and 3D printing.

10 Design for Additive Manufacturing	Overview of principles of design for AM	Be able to apply design rules for manufacture, with emphasis on maching, injection moulding and 3D printing.
11 Design history	**11a**: Industrial revolution - 1900. **11b**: 1900-1920. **11c**: Early modernism. **11d**: Post war. **11e**: Postmodernism and post-post modernism	Understand how industrial design developed and evolved since the start of the industrial revolution. Be aware of key design movements and their ascociated forms, materials, technologies and designers as well as the technological, social and economic context influencing this. Reflect on current trends and drivers in design.
12 Product form	**12a**: What a product's form communicates **12b**: Capturing design inspirations	Understand how designers create a product's form. Be able to apply some basic principles to create a product's form.
13 Physical & cognitive ergonomics	**13a**: Physical ergonomics **13b**: Cognitive ergonomics	Understand how to apply principles of design for use. Understand how we physically interact with products and how we relate to and understand products.

Workshop activities

To support the lecture course, there will be a number of supporting activities:

1. Sketching skills session: to develop sketching confidence.
2. Design and prototyping challenge: to experience a concept design, make and test cycle.
3. Design for assembly exercise: to put theory into practice.

Assessment

The coursework will take the form of a product redesign. All students will be given a product to use as a starting point. This will be theirs to take apart and analyse the product's strengths and weaknesses (e.g. design for manufacture and assembly). They will redesign the product to improve it's design for manufacture and assembly as well as changing the product form to make it suitable for a specific brand. Work will be submitted in the form of a design portfolio which in addition to documenting the design work will include an overall assembly drawing and a final presentation drawing. All work will be submitted and assessed anonymously. A detailed briefing for the coursework will be provided separately.

Reading List

*BAXTER, M.R.	PRODUCT DESIGN: A PRACTICAL GUIDE TO THE SYSTEMATIC METHODS OF NEW PRODUCTS DEVELOPMENT Nelson Thornes 1995 (2002 reprint)	AP 308
*ULRICH, K.T. & EPPINGER, S.D.	PRODUCT DESIGN AND DEVELOPMENT McGraw-Hill/Irwin 3rd edition 2004	BN 220

SLOCUM A H PRECISION MACHINE DESIGN, 1991 AP 323

Links to online copies of this Reading List can be found here -
https://cam.alma.exlibrisgroup.com/leganto/readinglist/lists/14624300620003606?institute=44CAM_INST&auth=SAML

3P4: Operations Management

Module summary	The management of material and information flow in factory systems and the supply chain
Taught by	Prof Alexandra Brintrup (Module Leader), Prof Jane Davies
Assessment	100% by examination. Paper 3, double paper with 3P5
Supervision	The course will be supported by three examples papers, for each of which one supervision will be arranged. Typically Lent week 2, 4 and 8.
Links to other elements of the course	Production Game to simulate the operations of a manufacturing company, where students trial elements of the 3P4 module in a live setting. 3P4 has links to the 3P5 module particularly when students learn Lean and Just-In-Time manufacturing principles. 3P2 links to 3P4 as motivator for manufacturing process scheduling.

Module Learning Outcomes

On completion of the module students should be able to:

1. Understand the ways in which manufacturing processes are managed in order to achieve the right quality of product, manufactured to meet the customer requirements and delivered on time, and making the most efficient use of the resources available.
2. Understand the role of inventory in manufacturing systems, and apply basic ordering, replenishment, and forecasting techniques
3. Describe the major influences on the efficient flow of work through a factory, apply MRP techniques to scheduling, describe the implications of different co-ordination structures on job design, describe how improvement processes relate to co-ordination strategies
4. Understand how manufacturing operations are integrated with other aspects of the business; how operations are managed across supply networks; and the role of different information systems in supporting operations across the supply chain

Syllabus and Lecture Learning Outcomes

Lecture	Syllabus	On completion students should be able to ...
1 - 2 Introduction	Course introduction, Operations management levers, Volume vs Variety, Process Principles, Operations Trade-offs	Discuss the key issues in manufacturing and service operations and the key levers available to managers to tackle them. Discuss the importance of the volume-variety choice in process design Understand the importance of process theory Identify the objectives involved in operations management, the costs, and the trade-offs
3 - 4 Capacity Management	Capacity planning, Queuing Systems	Discuss reasons why actual capacity will be lower than theoretical capacity and how changing demand and product mix influence capacity Assess capacity/demand trade-offs and understand different options for a manager to cope with variations in demand and capacity Understand how queues and capacity are related and analyse the components of a queuing system
5 - 6 Inventory management	Role of Inventory, Parts classification, Independent and Dependent demand, Forecasting	Discuss the role of inventory in a production system Understand the differences between independent and dependent demand for goods Appreciate the need for forecasting of independent demand Calculate independent demand forecasts using different forecasting methods (Moving Average & Exponential Smoothing)
7 - 8 Inventory Management II	EOQ and other inventory models Sustainability and Inventory Management	Derive the expression for and calculate the Economic Order Quantity (EOQ) Understand different order fulfilment strategies and and batch sizing decisions Articulate green inventory practices
9 - 10 Scheduling	Line balancing, EDD, SPT, FIFO scheduling rules	Balance a production line Implement different production scheduling rules
11 – 12 Procurement	Materials Requirements Planning, JIT	Generate MRP records for a product and its components, given market demand and other process parameters. Discuss the differences between “push” and “pull” manufacturing approaches
13 – 14 Logistics & transportation	Transportation model, warehousing and distribution	Solve simple transportation problems for allocating product flows between supply chain locations Determine the optimal factory/warehouse location for a given demand distribution

15 - 16 Enterprise & Supply Chain information systems	SC Dynamics, ERP/SCM systems, CPFR, VMI	Discuss the implications of dynamics in supply chains Discuss the role of the information systems in improving supply chain operations Discuss various mechanisms used by organizations to coordinate product and information flows within a supply chain

Reading List

Course Text:

Slack, N., Brandon-Jones, A. and Burgess N. (2022) Operations Management. 10th ed. Harlow, England: Pearson

- Printed book at: TS155.S52 2022

Or

Slack, N. and Brandon-Jones, A. (2019) Operations Management. 9th ed. Harlow, England: Pearson

- Printed book at: TS155.S52 2022
- E-Book available via: iDiscover Link here

Additional Reading:

Womack, J.P., Jones D.T. & Roos, D. , The Machine That Changed The World: The Triumph Of Lean Production Rawson Associates 1990

Goldratt, E.M. & Cox, J., The Goal: A Process Of Ongoing Improvement Gower 3rd Edition 2004

Holweg, M., Davies, J., De Meyer, A., Lawson, B. & Schmenner, R. (2018). Process Theory: The Principles of Operations Management, Oxford University Press.

- Printed book at: TS155.H64 2017
- E-book via iDiscover Link here

Links to online copies of this Reading List can be found here - https://cam.alma.exlibrisgroup.com/leganto/readinglist/lists/15407380710003606?institute=44CAM_INST&auth=SAML

3P5: Industrial Engineering

Module summary	The design of production flows and operations in manufacturing
Taught by	Prof A. Parlikad (Module leader)
Assessment	100% by examination, consisting of 2 questions. Students will attempt all questions. Paper 3 is a double paper with 3P4.
Supervision	The module is supported by 3 supervisions: EP 1 – Lectures 1-6; EP 2 – Lectures 7-10; EP 3 – Lectures 11-16.
Links to other elements of the course	Production Game to simulate the operations of a card-manufacturing company where students trial elements of 3P4 and 3P5. Particular links between 3P4 and 3P5 exist in the application of the Just-in-time manufacturing principles. Links to the industrial visits and the major project particularly on the JIT, 5S, work measuments tools and layout planing.

Syllabus and Lecture Learning Outcomes

Lecture	Syllabus	On completion students should be able to ...
1-2 Introduction and Method Study	Introduction to Industrial Engineering; objectives of Method Study. Method Study procedure: Select, Record, Examine, Develop, Define, Install, Maintain.	Understand and be able to apply the traditional techniques of method study.
3-4 Ergonomics	Ergonomics, principles of Motion Economy. Job Design, use of the Human Body. Arrangement of the Workplace. Design of Tools and Equipment	Understand the factors that affect the ergonomic design of jobs, tools and equipment, and the workplace.
5-6 Lean Production Techniques	Toyota Production System: JIT, 5S and Kaizen.	Understand the principles of Lean production, and be able to relate these to traditional work study.
7-8 Work Measurement 1	The Need for Time Standards. Establishing Time Standards: Activity Sampling, Time Study, Rating, Learning Curves, Allowances, Basic time, Work Content, Standard time.	Understand the roles of time standards in manufacturing. Know the different ways in which time standards can be determined and the advantages and disadvantages of each method. Understand the basic principles behind learning and be able to manipulate a simple learning model to predict the effect of learning on the cycle time of repetitive work.

9-10 Work Measurement 2	Predetermined Time Standards: MTM-1; Standard Data Systems; Activity Sampling.	Know the basic motion elements and how these are used in predetermined motion time systems. Know how standard data systems are developed. Understand work sampling is used for measuring proportion of time spent in different activities.
11-12 Process Organisation & Plant Layout	Project, jobbing, batch, line, continuous flow; cellular production; group technology Factory, Department and Workplace layout; Systematic Layout Planning.	Understand the different types of process layout and the advantages and disadvantages of each. Appreciate the factors that affect the layout of a factory. Group technology. Understand and be able to apply the techniques used in planning factory layouts
13-14 Reliability Engineering	Failure detection and prevention in factory equipment. Reliability modelling.	Discuss the basics of machine tool reliability, and explain the implications of the "bathtub curve". Understand how to calculate reliability of complex engineering systems.
15-16 Maintenance Management	Maintenance strategies Preventive maintenance planning.	Explain various maintenance strategies, their advantages and disadvantages. Understand how to develop an optimal maintenance schedule for equipment.

Reading List

*GROOVER, M.P.	WORK SYSTEMS: THE METHODS, MEASUREMENT, AND MANAGEMENT OF WORK Pearson 2014
*MUHLEMANN, A., OAKLAND, J. & LOCKYER, K	PRODUCTION AND OPERATIONS MANAGEMENT Pitman 6th edition 1992
*BICHENO J. & HOLWEG M.	THE LEAN TOOLBOX, 4th Edition, PICSIE Books,2009
*WOMACK JP, JONES DT, ROOS D.	THE MACHINE THAT CHANGED THE WORLD, Rawson Associates, 1990
*IMAI M	KAIZEN, Random House, 1986
HELANDER, M.	A GUIDE TO THE ERGONOMICS OF MANUFACTURING, Taylor and Francis,1995
CHASE R, AQUILANO N.& JACOBS	PRODUCTION AND OPERATIONS MANAGEMENT,8th Ed, McGraw Hill,1998
SLACK, N., CHAMBERS, S. & JOHNSTON. R.	OPERATIONS MANAGEMENT FT/Prentice Hall 5th edition 2007 4th edition (2004) available as e-book at: http://ul-newton.lib.cam.ac.uk/cgi-bin/Pwebrecon.cgi?BBID=4508815

Links to online copies of this Reading List can be found here -

https://cam.alma.exlibrisgroup.com/leganto/readinglist/lists/15419780400003606?institute=44CAM_INST&auth=SAML

Online resources

*GROOVER, M.P.	Book: WORK SYSTEMS: THE METHODS, MEASUREMENT, AND MANAGEMENT OF WORK Pearson 2014. ***Online book*** http://idiscover.lib.cam.ac.uk/permalink/f/1ii55o6/44CAM_ALMA51606969690003606
Ergonomics	Video: Five steps for ergonomic workstation. https://www.youtube.com/watch?v=dVFtAEDlnRA
Toyota production system	Sugimori Y., Kusunoki K., Cho F. and Uchikawa S. (1977) Toyota production system and Kanban system Materialization of just-in-time and respect-for-human system, International Journal of Production Research, 15:6, 553-564, DOI: 10.1080/00207547708943149 https://www.tandfonline.com/doi/pdf/10.1080/00207547708943149
	Spear S. and Bowen K. 1992. Decoding the DNA of the Toyota production system. Harvard Busienss Review. Sept-Oct. pp. 96-106 https://i9y8y5w2.stackpathcdn.com/wp-content/uploads/2015/12/Decoding-DNA-Spear-Bowen.pdf
	Video: 5S Methodology and tips https://www.youtube.com/watch?v=8gKJ3_Hm3dM
	Video: Lean 5S in MSICU - Implementaiton in practice the before and after https://www.youtube.com/watch?v=aMkXICM1-98
Time study in work measurement	Article: Preparing to measure process work with a time study https://www.isixsigma.com/methodology/business-process-management-bpm/preparing-measure-process-work-time-study/
Predetermed time standards	Research article: Heungjae Cho, Sungkun Lee & Jaeil Park (2014) Time estimation method for manual assembly using MODAPTS technique in the product design stage, International Journal of Production Research, 52:12, 3595-3613, DOI: 10.1080/00207543.2013.878480
	Research Article: Todd H.C., Chyatte S. G. and Decker R.S. 1979. Predetermed time standards: their application in workhshop settings. Archives of physical medicine and rehabilitation. 60(5): 222-226 https://europepmc.org/article/med/156528
Plant Layout	Video: Celullar manufacturing https://www.youtube.com/watch?v=Ynhp8Wi2qwM
	Video: Plant layout https://www.youtube.com/watch?v=6FYvNrI_JVw
Predictive maintenance	Video: predictive maintenance explained. https://www.reliableplant.com/Read/12495/preventive-predictive-maintenance
*GROOVER, M.P.	WORK SYSTEMS: THE METHODS, MEASUREMENT, AND MANAGEMENT OF WORK Pearson 2014 *** Online book***. http://idiscover.lib.cam.ac.uk/permalink/f/1ii55o6/44CAM_ALMA51606969690003606
	Also:***ONLINE CHAPTERS***
	Chapters 6, 9, 10, 11, 12, 13, 14, 15, 16, 18, 19, 21, 22, 23, and 24.
	Note: chapters available in the Engineering Department Library.

3P6: Organisational Behaviour

Module summary	An introduction to theories of organisational behaviour
Taught by	Dr M Kumar (Module leader)
Assessment	100% by examination. Paper 4, double module paper combined with 3P7
Supervision	There will be three supervisions on Organisational Behaviour in the Michaelmas term, typically week 4, 6 and 8.
Links to other elements of the course	This module complements the following modules and course activities: **MET IIA**: Industrial Visits (Corporate Social Responsibility and Sustainability); Skill Workshops (Change Management and Team Building); 3P7 (Nuturing Talent and Change Management); 3P10 (Industrial Sustainability) **MET IIB**: MET IIB-6 (Leadership and Managing people); MET-IIB-8 (Sustainable Manufacturing)

Syllabus and Learning Outcomes

Lecture	Syllabus	On completion students should be able to ...
1 Introduction	Introducing *Organisational Behaviour*	Understand some of the central issues in work organizations Define organisational behaviour
2 Corporate Social Responsibility, and Business Ethics	Free Market Business Ethics Sustainability and Corporate Social Responsibility	Explain ethical dilemma in the workplace Describe key principles of corporate social responsibility, business ethics and sustainability
3 Culture	Levels of Organizational Culture Cultural Typology Cultural Change	Understand advantages of managing people through culture Distinguish between Schein's three levels of organizational culture Explain how mangers try to change culture
4 Personality and Individual Differences	Nomothetic Approach Personality Testing Ideographic Approach Social-radical Approach	Understand key approaches to study personality Explain how personality is mesured in organisational settings
5 Communication	Organizational Communication Noise Information, Communication, and Technology	Describe theories and processes of comminucation in organisations Explain how technology mediates communication, producing a trade-off between efficiency and richness of communication
6	Hawthorne Studies Human Relations	Describe the power of the informal organisation

Social Organisation		Explain how the Hawthorne studies lead to the foundations of organisational behaviour
7 Motivation	Extrinsic Motivators Intrinsic Motivators Bahavioural, Content, Process and Social Theories	Understand what motivates people to work Use theories to identify motivational problems in organizations and recommend solutions
8 Groups and Teams	Definitions of Groups and Teams Types of teams and loafing Groupthink Social Identity Theory	Understand the differences between groups and teams Explain the link between teamwork and productivity Analyse the factors needed to produce an effective team Explain how groupthink can have negative implications on teams
9 Work Design	Rational Work design Rational Production Capitalist Working Relationship	Describe the principles behind Taylorist and fordist rational work design Analyse the effect that Taylorism and Fordism are said to have upon workers
10 Changing the Organisation	Force-field analysis Approaches to change Three-Step Model	Describe approaches to the managem,ent of chnage Explain how change can be messy, causing conflict and resistance
11 Organization Design and Bureaucracy	Bureaucracy Rational Organisation Design Iron Cage Bureaucracy	State the main characteristics of a bureaucratic organization structure as specified by Max Weber Explain how bureaucracy is a form of rational organisational design
12 Leadership	Behaviourism Contingency theory Post-heroic	Describe the key leadership theories Explain the diffences between leadership and management Analyse whether there is too much emphasis on the individual leader
13 Perception and Decision Making	Attribution Theory Drawback in judgments Link between perception and decision making Organizational Decision-making	Undertand perception and explain the factors that influence it Identify the shortcuts Individuals use in making judgement about others Decribe the common Decision Biases or errors
14 Power and Politics	Office politics Emancipation False Consciousness Empowerment	Describe the power as property view Explain why power and politics exist within organisations Analyse the different underlying assumptions
15 & 16 Review /Summary	Challenges of Organisations Changing Nature of OB Predicting Future trends	Explain the importance of connecting organisational behaviour theories Describe some of the changes that have occurred in organisations over the last forty years

Reading List

* HUCZYNSKI, A.A. & BUCHANAN, D.	ORGANIZATIONAL BEHAVIOUR, Pearson, 8th edition 2013. Several university departments and colleges have copies of this text. You can purchase it at a 20% discount via http://www.pearson-books.com/cam using the voucher code ZP031F. The sixth and seventh editions are also acceptable.
ROBBINS, STEPHEN P.	ORGANIZATIONAL BEHAVIOUR: CONCEPTS, CONTROVERSIES AND APPLICATIONS. Prentice Hall, 1991
KING, DANIEL, AND SCOTT LAWLEY	ORGANIZATIONAL BEHAVIOUR. Oxford University Press, 2016

Links to online copies of this Reading List can be found here –
https://cam.alma.exlibrisgroup.com/leganto/public/44CAM_INST/lists/14624311000003606?auth=SAML

3P7: Managing Business and People

Module summary	An introduction to the processes involved in starting and running a business.
Taught by	Dr Mukesh Kumar (Module leader)
Assessment	100% by examination. Double module paper combined with 3P6 Organisational Behaviour. Students will be required to answer one question from Managing Business and one from Managing People.
Supervision	There will be two hours of supervisions. Typically Lent week 5 and 8.
Links to other elements of the course	This module complements the following modules and course activities: **MET IIA**: Industrial Visits (Company Level Context, Human Resources); 3P7 (Group, Team, Motivation); 3P9 (Firm Boundaries, Competitive Analysis, Resouces and Capabilities, Strategic Marketing, Business Models) **MET IIB**: MET-IIB-2 (Performance Mesurement, Business Strategy, Strategic Marketing); MET-IIB-6 (Leadership and Managing people)

Module Learning Outcomes

On completion of the module students should be able to:

5. Explain the core processes involved in starting and running a business
6. Demonstrate the importance of integrating management and business practices with the firm's strategic objectives
7. Evaluate HR practices and the importance of making the best use of people

Syllabus

Lecture	Syllabus	On completion students should be able to ...
1 Introduction	The key integrating frameworks for understanding a manufacturing business Module overview Key areas of activity of a manufacturing business External factors that influence a manufacturing business Frameworks to show linkages between internal and external activities of a manufacturing business	Describe and apply a framework for management of a manufacturing business and the context within which it operates

2 Entrepreneurship	Starting and growing a business The role of entrepreneurship in an economy Defining entrepreneurship: Resource-based versus opportunity based activities How a firm grows: Typical growth trajectories and common management challenges	Describe entrepreneurial activity and its place in the economy, and to outline the most significant challenges faced by those managing a young firm
3 Staying competitive	Guiding and managing an established business Managing steady state c.f. managing change Tools for planning Managing Innovation (product, process, business model, organisational, etc)	Explain the challenges faced in managing an established business, and some of the tools available to assist in planning and implementing change
4 Marketing	Identifying future business opportunities The business planning cycle Identifying customer needs and opportunity areas Designing business models to address new needs	Outline the marketing function and its contribution to the business
5 Sales	Accessing customers (PBH) The links between business models and routes to market The key tools and techniques for sales Integrating sales with other business activities	Describe the sales process, its role in the business, and a selection of key tools and techniques
6 Case study	Integrating example	Discuss how the principles covered in lectures 1 to 5 might be applied practice
7 Introduction to HRM	Managing people to deliver business objectives People as a resource The principles of HRM (and contrasts with earlier models) The application of HRM (Hard & Soft; integrated, devolved, outsourced) Strategic HRM	Describe the core principles of HRM and discuss its practical application
8 Recruitment and Selection	Establishing the need for recruitment; establishing processes to attract good employees to the organisation; and identifying the best mechanism for selection.	Understand the supply-side factors that influence recruitment and describe the main components of the employee recruitment process.

9 Performance management	Goals of performance measurement Performance appraisals Potential biases in appraisals Stack ranking 360 degree appraisals Appropriate employee compensation and different means of achieving it	Describe how employee performance is measured and managed.
10 Nurturing talent	Models of learning Training/learning methods Segmenting talent Employee retention	Discuss the process of employee learning and different methods of training employees Describe how employee talent should be recognised and managed effectively to deliver value to the organisation
11 Change Management	Types of change in organisations Resistance to change and overcoming resistance Satir Model of change Kotter's 8 steps for successful change management	Discuss why change is an issue for organisations Describe the implications of change for the management of people
12 Legislation and regulation	Managing within the legal framework Employment law (hiring, firing, equal opportunities etc) Workplace legislation Employee participation and consultation	Describe the main features of the regulatory and legal framework for employment
13 Dispute Resolution and Governance	Managing people within a framework Dispute resolution Governance and ethics in HRM (inc objective-subjective perspectives)	Outline the main features of the frameworks within which employees are managed, and explain modern approaches to dispute resolution.
14 International practices/Globalisation	Addressing diversity - Cultural and regulatory variations; Pan-national influences Universalist and contextualist paradigms Convergence and divergence Cultural and institutional explanations Variations in practice	Explain, with examples, how cultural and national norms influence the nature and practice of HRM
15 Current trends	including globalisation, new technology, demographics, flexible working, outsourcing (People management) Technology in HRM Dynamic organisations	Demonstrate awareness of current trends and developments in HRM and in the management of people
16 Review/Summary	Integrating people, management practices, and business strategy	Explain and illustrate how strategic, operations and human resource management practices interact in the process of starting and running a business

Reading List

*MOORE, G	CROSSING THE CHASM, New York: Harper Business 1991	
*MULLINS, J. W	THE NEW BUSINESS ROAD TEST: WHAT ENTREPRENEURS AND EXECUTIVES SHOULD DO BEFORE WRITING A BUSINESS PLAN. London, FT Prentice Hall. 2003	
*STOREY, J. (ed)	HUMAN RESOURCE MANAGEMENT: A CRITICAL TEXT Thomson Learning 3rd edition 2007	1844806154
*TIMMONS, J. A. & SPINELLI, S	NEW VENTURE CREATION: ENTREPRENEURSHIP FOR THE 21ST CENTURY McGraw-Hill 8th edition, 2008	0071276327
*BEARDWELL, J., & CLAYDON, T.	HUMAN RESOURCE MANAGEMENT: A CONTEMPORARY APPROACH Financial Times/Prentice Hall 5th edition 2007	0273707639
*LEGGE, K	HUMAN RESOURCE MANAGEMENT: RHETORICS AND REALITIES, Palgrave Macmillan, 2005	1403936005

Links to online copies of this Reading List can be found here -
https://cam.alma.exlibrisgroup.com/leganto/public/44CAM_INST/lists/15467921380003606?auth=SAML

3P8: Financial and Management Accounting

Module summary	An introduction to the principles and practice of financial & management accounting and finance
Taught by	Prof Chander Velu (Module leader)
Supporting activities	The module content is used in the production of business plans for the major project
Assessment	100% by examination, Paper 5 combined with 3P9 Economics of Industry and Strategy
Supervision	Four supervisions will be offered in support of this module, typically weeks 3, 5, 7 and 8.
Links to other elements of the course	There are some links to 3P4, Operations Management, in particular inventory management. There are also links to 3P9, Industrial Economics, Strategy and Governance. This work also supports capabilities needed within the Major Project.

Aims

The course is designed to situate management and shareholders' decision making in their financial context. The course aims to develop students' understanding of the financial processes affecting corporate life - in particular, their understanding of the factors impinging upon corporate decisions and of the financial aspects of organisations.

Syllabus: Financial Accounting

Lecture	Syllabus	On completion students should be able to ...
1-2	Overall framework of financial reporting	Understand the importance of financial accounting. Understand the principles, conventions and regulatory framework of financial accounting.
3-4	The mechanics of accounting Balance Sheet, Profit and Loss Account/Income	Understand the principles of double entry bookkeeping. Understanding the principles of preparing of company financial statements such as the Profit and Loss Accounts and the Balance Sheet
5-6	Asset valuation methods, cash flow statements	Understand different methods of asset valuation and the purpose and creation of cash flow statements
7-8	Performance ratios Analysing and interpreting financial statements Creative accounting	Understand and be able to use firm performance ratios. Be familiar with company reports and their analysis, be able to compare performance of firms. Awareness of creative accounting and possible management of earnings.

Syllabus: Management Accounting and Finance

Lecture	Syllabus	On completion students should be able to ...
9-10	Cost concepts and cost behaviour Product costing systems and activity based costing	Understand the classification of different costs Understand and be able to apply different costing methods and to apply different methods for dealing with overhead costs
11-12	Building a budget Budgeting and variance analysis/cash flow management	Understand budgeting methods and processes. Understand and be able to apply variance analysis, and manage the cash in a business.
13-16	Investment Appraisal Financing decisions	Understanding the approaches to compare the financial viability of different projects - payback calculations - capital budgeting decisions (opportunity cost of capital, investment rules such as net present value and real options) - time value of money and risk versus return; - financing decisions (debt versus equity). Understand financing decisions (debt versus equity) and the capital markets.

Reading List

ATRILL, P. & McLANEY, E.J.	ACCOUNTING AND FINANCE FOR NON-SPECIALISTS Pearson 11th edition 2018
ATRILL, P. & McLANEY, E.J.	FINANCIAL ACCOUNTING FOR DECISION MAKERS Pearson 9th edition 2019
ATRILL, P. & McLANEY, E.J.	MANAGEMENT ACCOUNTING FOR DECISION MAKERS Pearson 9th edition 2019
BARKER, R.	SHORT INTRODUCTION TO ACCOUTING, Cambridge University Press, 2011
ATKINSON, A.A., *et al.*	MANAGEMENT ACCOUNTING: INFORMATION FOR DECISION MAKERS AND STRATEGY EXECUTION Pearson 6th edition 2011
ROSS, S.A., WESTERFIELD, R.W. & JORDAN, B.D.	FUNDAMENTALS OF CORPORATE FINANCE. McGraw-Hill Irwin. 13th ed. 2022.

Links to online copies of this Reading List can be found here -

https://cam.alma.exlibrisgroup.com/leganto/public/44CAM_INST/lists/14624323120003606?auth=SAML

3P9: Industrial Economics, Strategy and Governance

Module summary	An introduction to the principles and practice of economics in order to understand the structure of industries and corporate strategy
Taught by	Prof Chander Velu (Module leader)
Assessment	100% by examination, Paper 5, combined with 3P8 Financial and Management Accounting
Supervision	Four supervisions will be offered in support of this course
Links to other elements of the course	There are links to 3P8, Financial and Management Accounting. This work also supports capabilities needed within the Major Project.

Aims

The course is designed to situate firm practices and decisions in their wider economic context. The course aims to develop student understanding of the global economy and the evolving structure of industries and firms. It explores the key aspects of strategy formulation and the management of firms that shape the development of business.

Syllabus: Industrial Economics

Lecture	Syllabus	On completion students should be able to ...
1-2	The Global Economy, markets and industries The importance of manufacturing The rise of the service economy The role of strategy and strategic planning	Understand the global economy and the changing structure of markets and industries. Understand the development of the manufacturing and service industries. Appreciate of different views of strategic planning
3-4	Firm boundaries	Understand the theory of the firm Understand the horizontal and vertical boundaries of the firm
5-6	Competitive analysis	Appreciate the analytical framework of standard microeconomics. Understand the principles of models of perfect competition, monopoly and oligopoly. Understand the economics of entry and exit Understanding dynamics of competing across time
7-8	Industry and strategic positioning	Appreciate the main issues affecting the macro environment Understand the benefits of coopetition Analyse how firms may respond strategically to its changing environment. Understand strategic positioning and competitive advantage

9-10	Resources and capabilities	Appreciation of positioning versus resource base view Sustaining competitive advantage
13-14	Strategic marketing	Understand the role of marketing in the execution of strategy Appreciation of marketing objectives and strategies Understand product and pricing Understand distribution and promotion
11-12	Business models and innovation	Understand the relationship between strategy, business models and tactics and its relationship to innovation
15-16	Strategy and governance	Appreciate departmentalisation, coordination and control Appreciate of organizational structures Understanding efficient information processing

Reading List

BESANKO, D., DRANOVE, D., SHANLEY, M. & SCHAEFER, S.	ECONOMICS OF STRATEGY, 6th edition, Wiley. 2013
KOTLER, P.,KELLER, K.L. & BRADY, M.	MARKETING MANAGEMENT. Prentice-Hall/Pearson Education Global edition 2015
GRANT, R.	CONTEMPORARY STRATEGY ANALYSIS: Text and Cases, 8TH edition, Wiley, 2013

Links to online copies of this Reading List can be found here -

https://cam.alma.exlibrisgroup.com/leganto/public/44CAM_INST/lists/15532598300003606?auth=SAML

3P10: Contemporary Issues in Manufacturing.

Module summary	a. Lectures to introduce a selection of current topics and challenges facing manufacturing industries b. Information to support the study and analysis of modern industrial practice during the industrial visits module.
Taught by	Dr Nathanial Cooper (module leader), Dr Dushanth Seevaratnam
Supporting activities	The module is linked with the industrial visits, which will enhance understanding of all lecture modules and provide examples of their application in modern manufacturing companies.
Assessment	100% by examination. There will be a 90 minute examination in which students will be required to answer one question from each of the three sections – (i) industrial sustainability, (ii) bio engineering and medical device manufacturing and (iii) scaling up to manufacturing
Supervision	a. Industrial Sustainability - One review and discussion class for the whole group (1.0h) b. Bioengineering & Medical Device Manufacturing - One examples paper and class for whole group (1.0h) c. Scaling up to Manufacturing – One examples paper and class for whole group (1.0h)
Links to other elements of the course	METIIA 3P1: We look at materials used specifically for medical technologies. METIIA 3P3: There are specific design for manufacturing challenges for medical technologies METIIA: Industrial Visits Programme METIIB-3 Technology and Innovation Management (New product innovation) METIIB -6 Production Technologies and Materials (Sustainable materials, materials analysis for QC) METIIB-7 Sustainability Manufacturing

Syllabus: Industrial sustainability

Lecture	Syllabus	On completion students should be able to ...
1 The big picture	The industry landscape: The eco-impact of industrial activity. Energy and resource usage and security. "Triple bottom line"	Assess the contribution of industry to carbon emissions Discuss major resource implications relevant to manufacturing industry
2 The detailed picture	Measurement and legislation How do we assess the eco-impact of industry? What can we measure and how can we compare different	Explain where the eco-impact of industry arises, including the role of supply chains and the implications of the product lifecycle Know what the legislation is

	environmental stressors? ISO, LCA., 'LCA Light'	Discuss the strengths and weaknesses of different metrics
3 Mitigation measures	How can eco-efficiency be improved? Design for sustainability Optimising materials and process selection The role and limitations of recycling Waste reduction measures Paradigm shifts: Product service systems; zero waste systems	Choose materials and processes to minimise eco-impact Discuss the role and limitations of recycling Identify sources of waste and suggest how waste may be reduced Be aware of radically different ways of meeting materials needs of society
4 Effecting industrial change	How and why do companies 'go green'? Case studies	Assess the eco-impact of a company and make reasoned proposals for how to reduce it.

Syllabus: Bioengineering & Medical Device Manufacturing

Lecture	Syllabus	On completion students should be able to ...
1	Introduction to medical devices, materials, required properties and tissue engineering	Understand the breadth of the medical device industry and the classification of devices. Display familiarity with the range of synthetic and biomaterials used to form medical devices.
2	Selected key challenges in manufacturing of medical devices.	Explain the specific challenges faced in manufacturing of medical devices, e.g. sterilisation, biocompatibility.
3	The medical device industry Sector analysis in UK and international context Regulatory bodies and their influence on manufacturing Bioethics	Explain the essential features of the medical device industry. Show an understanding of the regulatory procedures that are followed. Understand the development of bioethics as a field and the key principles of bioethics
4	Future trends in medical devices and potential impact on manufacturing. E.g. Nanomanufacturing, personalised medicine	Show awareness of trends in the industry and identify the challenges they pose to manufacturing.

Syllabus: Scaling up to Manufacturing

Lecture	Syllabus	On completion students should be able to ...
1	Introduction to multiple dimensions of scale-up and links to other modules Case-studies of scale-up challenges	Understand the multidimensional nature of scale-up in manufacturing Systematically think through the scale-up challenges for an emerging technology Understand the use of frameworks to support scale-up
2	Introduce risks leading to the Valley of Death	Assess combination of risk factors when scaling up

	Techniques for risk management	Understand and describe a range of management tools for scale-up Understand the industrial innovation infrastructure needed to address risks
3	Challenges of scale-up can be addressed through contributions from science, engineering, industry and policy Innovation infrastructure for scale-up	Understand the importance of supporting generic and infra technologies Understand the international approaches to addressing scale-up risks

Reading list – Industrial Sustainability

ALLWOOD, J.M., CULLEN, J.	*Sustainable materials – with both eyes open* Available as download from the web http://www.uit.co.uk/B-SMWBEO/
ASHBY, M.F.	Materials and the environment, Butterworth-Heinemann 2009, ISBN 978-1-85617-608-8
VON WEISZACKER E, LOVINS A.B., LOVINS L.H.	Factor Four: doubling wealth, halving resource use. Earthscan publications, 1997,
MACKAY, DJC	Sustainable energy – without the hot air, www.withouthotair.com, 2008

Reading List – Bioengineering & Medical Device Manufacturing

RATNER, Buddy D.	Biomaterials science an introduction to materials in medicine, Elsevier Academic Press, 2004 (specific references to sections will be provided in class).
SINGER, P.A., VIENS, A.M.	Cambridge Textbook of Bioethics, Cambridge University Press, 2008 (specific references to sections will be provided in class).
WORLD HEALTH ORGANISATION	Medical Device Regulations- Global overview and guiding principles, Geneva, 2003, ISBN 92 4 154618 2. (specific references to sections will be provided in class).

Links to online copies of this Reading List can be found here -
https://cam.alma.exlibrisgroup.com/leganto/public/44CAM_INST/lists/14624337100003606?auth=SAML

Coursework

CAD/CAM Exercise

Coursework summary	Aims to develop and test the student's ability to produce engineering drawings using CAD, turn the CAD drawings into programmes for the production of the components, and operate the machine tool to produce the parts
Taught by	Alan Thorne, Prof James Moultrie
Assessment	Coursework
Links to other elements of the course	From -MET IIB - 3P2 (Tools, Feeds & Speeds - B. O'Neill) From -MET IIA – Workshop Practical (Machining – A. Thorne) From -MET IIA – Drawing / Tolerancing Lectures (J. Moultrie) To -MET IIB - MSE (Robot Lab - A. Thorne / D. McFarlane) To -MET IIA - 3P3 (Major Design Project - J. Moultrie / M. De Volder)

Overview

The CAD/CAM coursework aims to develop and test the student's ability to produce engineering drawings using CAD, turn the CAD drawings into programmes for the production of the components, and operate the machine tool to produce the parts. The coursework contributes 30 marks. The group will be split into half, with one half producing drawings and programmes for the machining of a milled component, the other half for a turned component.

The CAD exercise is to be completed using SolidWorks. The CAM work is to be produced using SolidCam. There will be classroom support early in Michaelmas term in the use of both software packages.

Students will work in pairs, and be assessed as a pair.

Deliverables

Students will be provided with a simple assembly of 3 parts, 2 of which will have an engineering drawing. Each pair will be required to:

- produce a complete engineering drawing of the 3rd component in the assembly. This must be approved before any programming can begin;
- produce a programme to be loaded onto the machine tool.

Electronic Submission (via Moodle)

The CAD drawings must be electronically submitted on or before **17:00 Friday 1st November**

Your drawing must include your candidate numbers. A pdf file of your engineering drawing is to be electronically submitted via Moodle submissions, using the following file name structure, where you replace the numbers with your own: **1234n_5678x_CAD_date.pdf**

The CAM programmes must be submitted electonically on or before **17:00 Thursday 5 December** via Moodle submissions. To hand in the CAM component of coursework, please create a zip file, named using the following convention: **1234n_5678x_CAM_date.zip**

Assessment

The coursework is worth 30 marks in total.

- CAD drawing: 50% marks, awarded for completeness, clarity, precision and presentation. Individual drawing will be 'marked-up' with suggested changes, much as would be done in industry by a senior engineer.
- CAM programme: 50% marks, awarded for elegance in programming

Production Game

Introduction

The Production Game is a simulation of a manufacturing operation. Small companies (teams) are required to manufacture simple paper-based products (greeting cards) based on orders from a market place. Products which meet the required standards of quality and delivery are purchased by the market. Unacceptable products are rejected.

The Production Game typically provides a rich array of first-hand experience with which to think about the issues involved in the organisation and control of manufacturing systems.

Students are required to electronically submit two reports, a pre-game report, and a final report.

Deliverable 1: pre-game report

Each team is required to submit a report before the game starts outlining the following:

- Resource allocation: How are your resources going to be allocated?
- Production Layout: Are you going to go for a functional or a product-based layout?
- Order selection: What type of orders would you pick?
- Coordination and control: What co-ordinating (integrating) and scheduling mechanisms are you going to use?
- It is important to not only describe the strategies, but to describe the manner in which the strategy was formulated. Prior preparation (e.g., time study, cost-benefit analysis) will pay dividends.

Deliverable 2: Final report

Final report (individual): Each student should produce a report of a maximum of 2000 words in length which analyses the performance and activities of their company during the Game. Where appropriate, draw on material from 3P3 and 3P4 in your report. The report should include treatment of at least some of the following issues:

- Did your strategy prove to be correct – if so, why, if not, why not?
- How did you design, organize and control your manufacturing system? How did this reflect your wider strategic decisions vis a vis the market? What methods did you use to control costs, quality, time etc?
- How was whole enterprise managed? For example, how did coordination between 'Marketing and Sales' and 'Manufacturing', and 'Manufacturing' and 'Purchasing' occur? What formal and informal information systems were designed (or evolved) during the game? How appropriate were these?
- The things that you feel you did right, and the major errors you made; how you would do it differently next time.
- Comparisons between the performance and processes of your company and those of the other firms. Were there any patterns in who did well and who did badly?

Evaluation

The coursework will be marked out of 30, with the following allocation of marks to different activities:

- Pre-game report 50%
- Final report 50%

Standard filenames for electronic submission through Moodle submission in the following format please:

Your coursework number followed by the coursework name and date

e.g. **1234n_ProdGame_date.pdf**

Major Project

Project summary	A major group design project seeking to apply learning from 3P3 and to integrate different elements of MET
Taught by	Prof Michael De Volder (Project Leader), Prof James Moultrie, Dr Sebastian Pattinson
Assessment	Coursework
Supervision	The staff meet with students during timetabled session on Thursday mornings to discuss progress and to steer the project. We also hold to 2 formal supervisions with each team to discuss team member contributions and provide feedback on progress; these are recorded in CamCors.

Overview

The Major Project runs from the end of Michaelmas term until the end of the academic year and aims to integrate the design, manufacturing and management elements of the course.

The main components of the project are the development of a viable design solution to a genuine problem or issue, in tandem with understanding the market and producing a comprehensive business plan. The business plan will also include some detailed analysis of the financial viability of the product.

A brief for the project will be circulated to students during Michaelmas term, before the project starts. In previous years, briefs have included: “develop a new Additive Manufacturing technology” and “develop a piece of production technology to help manufacturing a better future.”

Learning Outcomes

At the end of the project, students should have:

- Applied their engineering design skills to solve technical problems.
- Applied their industrial design skills to develop solutions which are fit for the intended users, appropriately styled and clearly explained visually.
- Applied their knowledge of materials and production engineering to develop solutions that could be produced in volume.
- Axplored issues relating to environmental, economic and social sustainability relating to their products.
- Gained experience in market and user research.
- Applied their skills in financial analysis to develop a robust business model for their proposed designs.
- Developed their skills in producing a compelling and believable business plan.

Assessment

Detailed assessment criteria will be outlined in the Major Project briefing during Michaelmas term. In total, the project contributes 140 marks.

General information

Extensions and Penalties for late hand in of coursework

There is a MET Extensions Policy and Penalty Policy (see Appendix 2).

Coursework extensions or re-arrangements can be requested prior to the submission date by emailing the IfM Teaching Office (met-admin@eng.cam.ac.uk) however, not all coursework can be rearranged or have an extension (see policy for details).

There are automatic penalties for late submission of any piece of coursework without an approved extension. The penalty is outlined in the policy.

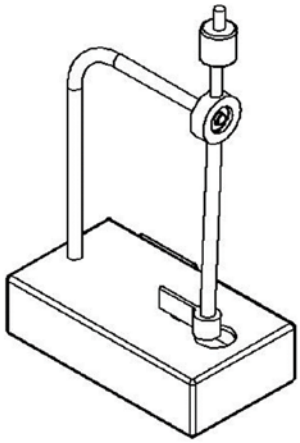
Workshop Practical

Workshop summary	The objective of this workshop practical is to provide MET IIA students with a basic understanding of fabrication skills
Taught by	Alan Thorne (Workshop Leader), Simon Sennitt, Chris Jennings
Assessment	**This activity is not marked** (Training for use of studio & workshop equipment)
Links to other elements of the course	To - MET IIB - MSE (Robot Lab - A. Thorne / D. McFarlane) To - MET IIA - 3P3 (Major Design Project - J. Moultrie / M. De Volder) To - MET IIA - 3P2 (Machine Configurations, Stiffness, Finishes - B. O'Neill) To - MET IIA – CAD / CAM (CNC / Mutli Axis Machining – A. Thorne)

Overview

The objective of this workshop practical is to provide MET IIA students with a basic understanding of fabrication skills required to:

a) Produce prototyped components using 3D printing, laser cutting and vacuum forming processes.
b) Produce actual components using more traditional production processes such as turning, milling and electronic assembly techniques.



The workshop sessions have been designed to enable students to produce components required for the fabrication of a perpetual pendulum. The pendulum makes use of an electro-magnet to provide the pendulum with pulses of energy to overcome losses in the mechanical system.

The pendulum blister pack and transport jig will be made using Rapid Proto Type (RPT) technologies. The Pendulum body, arm and base containing the electromagnetic drive will be made using more traditional production processes.

Students will be asked to attend two workshop sessions. The first workshop session will focus on skills required to use the RPT equipment within the design studio. An option of three RPT sessions will scheduled, each accommodating up to a thrid of the class. The second workshop session will focus on skills required to operate hand tools, machine tools and electronic fabrication tools within the IfM workshop. A series of workshop sessions will be scheduled, each accommodating a maximum of four students. Students will be asked to sign up to workshop sessions on a first come first served basis.

At the end of the workshop sessions the students are expected to have a good understanding of the different production processes as well as the use of various equipment in a safe

manner. Successful completion of this activity will allow students to utilise the facilities within the IfM for other project activities such as the Design Project and CAD/CAM.

Information

- Students will complete a safety questionnaire before entering the workshop.
- Students should be appropriately dressed to work within a workshop environment. Closed toe shoes, no loose clothing or jewellery and hair tied back. (Lab coats and safety glasses will be provided.)

Technology Libraries Team

The Technology Libraries team provide specialist information and library services support for the departments of Engineering, Computer Science and Chemical Engineering and Biotechnology.

Based in the Engineering Library in the Baker Building on Trumpington Street and at the West Hub on JJ Thomson Avenue, the team is available in person and online to help with any questions you may have about resources, search strategies, managing references and more.

The team provide a range of teaching and training of topics ranging from finding the resources you need for your projects to poster design and presentation skills to time management. You can explore the range of open sessions that you are welcome to attend. We can also be contacted for 1-1 or small group support at anytime throughout your course.

Visit the website to discover the range of services and support available to you.

Contact the team techlib@lib.cam.ac.uk or come and say hello at one of our libraries.

Further Library Support

Other libraries at Cambridge that may have further resources to support your studies include:

The University Library

Home to huge research collections and a wide range of spaces to study.

Judge Business School Information & Library Services

Providing a specialist information and library service in the field of business and management studies, including a large range of specialist databases and electronic resources.

Visit the website to find out more and how to register for access.

Appendix 1: Referencing and Plagiarism

University of Cambridge General Board Statement on Plagiarism

The General Board, with the agreement of the Board of Examinations and the Board of Graduate Studies, has issued this guidance for the information of candidates, Examiners and Supervisors. It may be supplemented by course-specific guidance from Faculties and Departments.

Plagiarism is defined as submitting as one's own work that which derives in part or in its entirety from the work of others without due acknowledgement. It is both poor scholarship and a breach of academic integrity.

Examples of plagiarism include **copying** (using another person's language and/or ideas as if they are a candidate's own), by:

- *quoting verbatim* another person's work without due acknowledgement of the source;
- *paraphrasing* another person's work by changing some of the words, or the order of the words, without due acknowledgement of the source;
- *using ideas* taken from someone else without reference to the originator;
- *cutting and pasting* from the Internet to make a pastiche of online sources;
- **submitting** *someone else's work* as part of a candidate's own without identifying clearly who did the work. For example, buying or commissioning work via professional agencies such as 'essay banks' or 'paper mills', or not attributing research contributed by others to a joint project.

Plagiarism might also arise from *colluding* with another person, including another candidate, other than as permitted for joint project work (i.e. where collaboration is concealed or has been forbidden). A candidate should include a general acknowledgement where he or she has received substantial help, for example with the language and style of a piece of written work.

Plagiarism can occur in respect to all types of sources and media:

- ***text, illustrations, musical quotations, mathematical derivations, computer code, etc;***
- ***material downloaded from websites or drawn from manuscripts or other media;***
- ***published and unpublished material, including lecture handouts and other students' work.***

Acceptable means of acknowledging the work of others (by referencing, in footnotes, or otherwise) vary according to the subject matter and mode of assessment. Faculties or Departments should issue written guidance on the relevant scholarly conventions for submitted work, and also make it clear to candidates what level of acknowledgement might be expected in written examinations. Candidates are required to familiarize themselves with this guidance, to follow it in all work submitted for assessment, and may be required to sign a declaration to that effect. If a candidate has any outstanding queries, clarification should be sought from her or his Director of Studies, Course Director or Supervisor as appropriate.

Failure to conform to the expected standards of scholarship (e.g. by not referencing sources) in examinations may affect the mark given to the candidate's work. In addition, suspected cases of the use of unfair means (of which plagiarism is one form) will be investigated and

may be brought to one of the University's Courts. The Courts have wide powers to discipline those found guilty of using unfair means in an examination, including depriving such persons of membership of the University.

The University's plagiarism and good academic practice website (www.cam.ac.uk/plagiarism) provides more information and guidance.

Plagiarism and good academic practice: your responsibilities

If, after reading the guidance, you have any outstanding queries you should seek clarification at the earliest opportunity from your Director of Studies or supervisor.

Sources of further information and support

The University's plagiarism website:

www.cam.ac.uk/plagiarism

Department's plagiarism advice:

http://teaching.eng.cam.ac.uk/node/526

Appendix 2: MET Extension and Penalty Policy

Obtaining extensions or rearrangements for assessed work on the Manufacturing Engineering Tripos

Introduction

MET IIa and IIb consists of a range of assessed activities including examinations and coursework. Coursework has a variety of forms and may be completed both individually and in groups.

We expect students on MET IIa and MET IIb to attend all timetabled sessions and respect hand-in deadlines.

We understand that there may be valid reasons why this may not always be possible. This document sets out the conditions where extensions or rearrangements may be allowed for MET IIa and MET IIb as agreed by the Faculty board.

This policy is intended to reduce paperwork and complexity by removing the need for simple and straightforward issues to be submitted to the EAMC. It is not intended to deal with complex matters.

This policy has been updated as of the ***12th October 2023*** to align with the new University Policy on coursework extensions.

Policy principles for both MET IIa and MET IIb

All timetabled coursework activities are compulsory parts of the course.

In general, marks will not be awarded for activities that are not completed.

For the purposes of this document, extensions and rearrangements are defined as:

- ***Extensions****: a change to the anticipated submission time for a piece of assessed work.*

- ***Rearrangements****: arrangement to complete an activity which is assessed or leads to a piece of assessed work at a time different to the one timetabled.*

Extensions or rearrangements are feasible in specific circumstances. In general, the conditions where extensions or rearrangements can be made are:

- *Extensions are possible for individual pieces of assessed work where the submission date is not close to the end of term, when there is sufficient time for subsequent examination and when there is not a subsequent piece of work which would be adversely affected by a delay.*

- *Rearrangements are only possible for activities which are not group based, which do not depend on availability of external resources and for which the resources are available internally at multiple times in the term.*

Where ***extensions*** are feasible, students may obtain up to 7 additional days to submit the assessed work on a self-declaration basis. No tutorial support or medical evidence is required and no reason need be given. In such cases:

- The student must inform the IfM teaching office in advance, unless this is not possible and in any case within a week of the deadline.
- When the IfM teaching office is notified, students will be informed of their revised submission date.
- The student must inform their College Tutor of the request for an extension. All decisions will be copied to the student's tutor.
- Where extensions of more than 7 days are required, an application must be made to EAMC.

Where ***rearrangement*** is feasible, students must contact the IfM teaching office (MET-admin@eng.cam.ac.uk) who will then liaise with the relevant academic to identify an alternative time for the activity. If re-arrangement is not feasible and as a result the student is not awarded marks, then the student will need to consult with their tutor regarding the possibility of an application to the EAMC at a later date.

Students may not accrue more than **28** days of extensions over the academic year. Where the **28** day limit is exceeded:

- Further extension requests need to be made via EAMC.

Students may lose marks for work submitted late (without an agreed extension of rearrangement) or for non-attendance in accordance with the MET Penalty Policy at the end of this document. Students who wish to appeal these penalties must apply to the EAMC in respect of marks for missed sessions or penalties for late submission.

Decisions under this procedure will normally be made by the MET Course Director and Chair of Examiners acting on behalf of the department. On request decisions can be reviewed by the Deputy Head (Teaching) of the Department of Engineering. Students remain free to approach the EAMC if a deadline extension is not approved by the department.

Reasonable grounds for requesting rearrangements

Illness: Students may self-certify that they are ill as the reason for requesting a rearrangement (where this is feasible). A rearrangement will not be granted without self-certification. 'Illness' includes medical appointments.

Compassionate or religious grounds: Students may request rearrangement on compassionate or religious grounds. Examples of compassionate grounds includes attendance at a funeral of a close family member or a family or medical emergency. Attendance at a family event, such as a family holiday, wedding or graduation would not be considered compassionate grounds. Applications to rearrange timetabled activities for religious observance that usually occurs over a restricted period (e.g. Eid al-Fitr, Shavuot, Pesach, Shivaratri, Vaisakhi) will be considered. Where observance extends over a

significant period of time (e.g. Ramadan), and where it is normally expected that daily activities (including teaching) will continue as normal, applications would not be considered. Rearrangements for the purpose of holy visits, pilgrimages etc. cannot be approved.

Interviews: When applying for jobs, work placements or sponsorship, students may be invited for interview on days that conflict with coursework activities. Students should in the first instance seek to rearrange the interview rather than the coursework. If this proves impossible, then the student should try to rearrange the coursework. Such re-arrangements must be made in advance. Retrospective requests will not be accepted.

Sporting and social commitments: Coursework may not be rearranged to accommodate College sporting/social commitments or College or University training sessions. Students may be allowed to seek to rearrange coursework that conflicts with University sporting fixtures. Such re-arrangements must be made in advance. Retrospective requests will not be accepted.

MET IIA Project and Coursework

Activity	Description of each element	Maximum marks associated with the activity	Mode of assessment	Ability to reschedule (if appropriate)	Ability to extend the deadline (if appropriate)
Industrial visits	Debrief presentation	15 marks	Contribution to a group presentation	It is not possible to reschedule this group activity	NA
	Final presentation	25 marks	Contribution and engagement in a group presentation	It is not possible to reschedule this group activity	None
CAD/CAM	CAD work	15 marks maximum	Coursework submission completed in a small group (2-3 students)	NA	It is not possible to extend the deadline without impacting on subsequent work.
	CAM work	15 marks max	Coursework submission completed in a small group (2-3 students)	NA	It is not possible to extend the deadline as it is at the end of term.
Production game	Pre-game report	15 marks	Group report	NA	It is not possible to request an extension as the report must be submitted prior to the game itself
	Post-game reflective report	15 marks	Individual piece of written work	NA	It is possible to request an extension
3P3 Product Design	Portfolio submission	60 marks	Individual piece of design work	NA	It is possible to request an extension

Major design project	Design Review 1	5 marks	Group presentation	It is not possible to reschedule these group presentations	NA
	Design review 1	10 marks	Group presentation		
	Design review 2	15 marks	Group presentation		
	Final presentation	20 marks	A group presentation		
	Design completion	60 marks	A group submission (portfolio)	NA	It is not possible to request an extension
	Business plan	20 marks	A group submission (report)	NA	It is not possible to request an extension

MET IIB Coursework

Activity	Mode of Assessment	Ability to reschedule or extend deadline
Strategy & Marketing	Individual Assignment	7-day extension allowed
TIM	Individual Assignment	7-day extension allowed
DDS	Individual Assignment	7-day extension allowed
AOM	Individual Assignment	7-day extension allowed
PTM	Timed Assessment	No rearrangement allowed
	Group work	No rearrangement/extension allowed
Sustainable Manufacturing	Individual Assignment	7-day extension allowed
Leadership and Managing People	Individual Assignment	7-day extension allowed
2-Week Project	Group Presentation	No rearrangement allowed
	Group Report	7-day extension allowed
4-week Project	Group Presentation	No rearrangement allowed
	Group Report	No extension allowed
Long Project	Individual Presentation	No rearrangement allowed
	Individual Report	No extension allowed
Robot Lab	Lab work	No rearrangement allowed – attendance is compulsory
	Technical Report	No extension allowed
	Final Presentation	No extension/rearrangement allowed
	Final Integrated Solution & Demonstration	No extension/rearrangement allowed
	Individual Report	7-day extension allowed

MET Penalty Policy

Work submitted after an agreed deadline (either the original deadline or an agreed extension), will be assessed on submission as normal. It will be marked as if submitted on time. A penalty will subsequently be applied which will be a reduction of 20% of the assessed grade for each week (or part week) that the work is late as outlined below.

Original mark (%)	1 week late	2 weeks late	3 weeks late
80.0	64.0	38.4	15.4
75.0	60.0	36.0	14.4
70.0	56.0	33.6	13.4
65.0	52.0	31.2	12.5
60.0	48.0	28.8	11.5
55.0	44.0	26.4	10.6
50.0	40.0	24.0	9.6
45.0	36.0	21.6	8.6

Where an extension was not feasible, the piece of work will either not be assessed (if no work is submitted) or the student will be assessed on the work they have completed up to the submission date.

Where students miss activities which cannot be rescheduled, students will not gain the marks associated with those activities.

Students are able to submit an application to the EAMC where marks have been lost due to activities which cannot be rescheduled or where an extension is not available.

Your College Tutor can assist you in making an application to the EAMC. You should note that EAMC approves allowances in the case of illness or other "grave cause."

This should be done after marks have been released, normally at the end of Easter term. You should not make applications piecemeal throughout the year. You should also note that the EAMC typically only considers cases which would lead to change in your degree classification.

Any application to the EAMC will be reliant on the evidence submitted to support the application and therefore you should keep evidence, including any emails confirming that extensions or rearrangements were not possible and notes of any interactions that you had with your GP, Tutor or College Nurse at the time to confirm illness. You should also keep evidence of any positive COVID test etc.

Appendix 3: Progression from Manufacturing Engineering Tripos IIA (BA, 3rd year) to Manufacturing Engineering Tripos IIB (MEng, 4th year)

Proposal for Re-Examinations for Progression from Manufacturing Engineering Tripos IIA (BA, 3rd year) to Manufacturing Engineering Tripos IIB (MEng, 4th year)

For progression from MET IIa to MET IIb, the following rules on progression apply:

- **Rule 1**: Students must have taken Engineering or Chemical Engineering and Biotechnology in Part 1. Thus, students taking MET IIa having first completed other part 1 courses are not able to progress to MET IIb.
- **Rule 2**: Students must gain a 2:2 or higher in at least one of Engineering 1b and MET IIa. Students who gain a 3rd in both 1b and IIa are not able to progress to the MEng degree and will graduate with a BA.

To satisfy Professional Institution Accreditation purposes, the MEng degree can only be awarded to students who achieve a **pass** mark for **all** of the individual assessed elements of MET IIa. The pass mark for an element is as determined by the Examiners and is typically around **40%**. Thus, a third rule for progression is:

- **Rule 3:** students must NOT fail any individual element of MET IIa.

This rule applies to the 10 examined modules (3P1-3P10).

For the purposes of this policy, the coursework activities are treated as a single assessed item. It should be noted that it is not possible to re-sit or retake these elements, so failure to achieve a pass mark for the coursework activities would mean a student is unable to progress to MET IIb.

Should a student pass overall, but fail one of the examined modules and there are no valid mitigating circumstances, then they will not be permitted to progress to MET IIb and will therefore automatically be eligible to graduate with a BA degree.

Re-Examination

Should a student pass overall, but fail one (or more) of the examined modules and they believe there to be valid mitigating circumstances, then should they wish to, they may apply to the EAMC for these circumstances to be considered. Students may elect to graduate with a BA if they do not wish to apply for mitigation.

Applications should be made in the usual way and success will be dependent upon the evidence submitted to support the application. Students are advised to keep all evidence regarding these circumstances; including any emails, notes of any interactions with their GP, Tutor or College Nurse etc.

If the EAMC is content that there are valid mitigating circumstances, then they will recommend that the student be offered the appropriate re-examination(s). Note, this is only sensible if the student will satisfy Rule 2 above after successfully passing any re-examination(s).

Any re-examination would be an assessment of competence for progression and would therefore be marked as pass/fail.

Any other decisions made by the EAMC regarding a student's classification would be treated separately.

Format of the re-examinations for MET IIa

Where modules are grouped to form a single exam paper, it is the grade for the individual module which is of concern. Re-examination(s) would be at a module (rather than paper) level.

Should a student fail 3P3, they will be offered the opportunity to revise their coursework submission, which will be re-marked on completion. Marks for this resubmission will be capped using the same approach as for exam-based re-examination.

The typical format of a re-examination paper will be a short (1.5 hour) examination, comprising 2 compulsory questions. The paper examiner will produce the test paper at the request of the Chair of Examiners (usually following a successful EAMC appeal). Paper examiners will be asked to consider the likely questions for a test paper after the final examiners meeting in the event of one or more students failing their module exam.

The assessment will take place after the decision from EAMC, as early as possible in September. Resit papers will be marked quickly so that progression decisions can be made before the start of the following Michaelmas term. The chair of examiners will consult with other examiners as appropriate

Should a student fail the re-examination, they will not be offered the opportunity of a second attempt and will therefore automatically be eligible to graduate with a BA degree.

Students will be informed immediately following the final examiners meeting of any failed assessed elements. At that point, they may decide whether to pursue an application via the EAMC or to graduate with a BA degree.

Option for non-accredited IIb route

In some cases, and at the discretion of the Faculty Board, the student may have the option to transfer to the non-accredited route in IIb in Engineering.

Right to appeal

Any student informed that they will be limited to the non-accredited pathway in Part IIB because they were not offered a re-assessment will have the right to appeal via the Reviews of Decisions of University Bodies (RDUB) process.