Design for Manufacture

H7022

Design of a Petrol Lawnmower

Group Project

Year 3: Auto, ME, PDes

Design for Manufacture

H7022

1. Introduction

The Module

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- The module runs through Autumn term for 12 weeks
- Some history

- D&M used to be lectured - 20 lectures and one 3 hour exam (12 credits)

- Design and Manufacture + Design Studies - both group projects with lectures and workshops (12+12 credits) – Design of a transmission and a combined heat and power generator

- Design and Manufacture - 15 credit group project – design of an air compressor

The Module

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- Module supervisors:
  - William Wang, Mike King
  - Mechanical design – William Wang
  - 3D Modelling – Mike King

- Structure of the module reflects our interest to get closer to real life
  - The work is done as a group project
  - Material is available to support your work
  - You face stiff deadlines
  - Every member is in a team and has to make effort.

Project Groups

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- Each group will have 6 or 7 members
- ME, AUTO, ME4, AUTO4 - engineers
- PDES students - designers
- Groups are seeded with balanced MEng/BEng engineers and designers- facilitating grouping and saving time
- The teams are formed in Week 1, seeded with suitable numbers of engineers and designers
- Kick off project from Week 1
- Let us know if you really want to change a team

Roles in a Group

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- Take different roles
  - Mechanical design
  - Product design
  - Project management

- Teams should share expertise

Scenario

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You are a design team from a firm of consultants

- You are to be employed by a manufacturer to design a new petrol lawnmower used for medium to large gardens

Immediate Actions

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- Think carefully about organising the team
- Agree team ground-rules – even what to do when things start going wrong
- Appoint a project manager – if you wish, rotate to spread,
- Define and agree roles according to the team needs
- Agreed on communication means

Immediate Actions

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- Decide roles in your team
- Tasks breakdown among team members to make1+1=2
- Make a plan and stick to it – but change it if circumstances change
- Work as a team and have regular meetings
- Recall and acquire required knowledge from sources including previous curriculum
- Get familiar again with Pro/E
  - Need to present your design in the form of Pro/E
  - Pro/E tutorials are supervised by Mr. King

Regular Meetings

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- Brief each other at regular intervals
- Create a project plan, review the plan weekly and make corrections to keep it current
- Design review is widely practiced in industry

  - Manager moderates, guides the team through the key features, and ensures fair play; design decisions are presented by team members in turn; decisions must be justified and could be challenged; reference are needed to specification and standards
- Action points must be minuted in logbook and included in a revised project plan

Staying in touch

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- Many issues must addressed in the project – all members need to be cooperative and responsible
- Action in coordinated way
- Stay in touch with team members
- Use the discussion group to communicate or raise issues within your team, and to raise global questions – such as information that you need to continue the design task
- Weekly progress reports can be posted on the web site

Time Line

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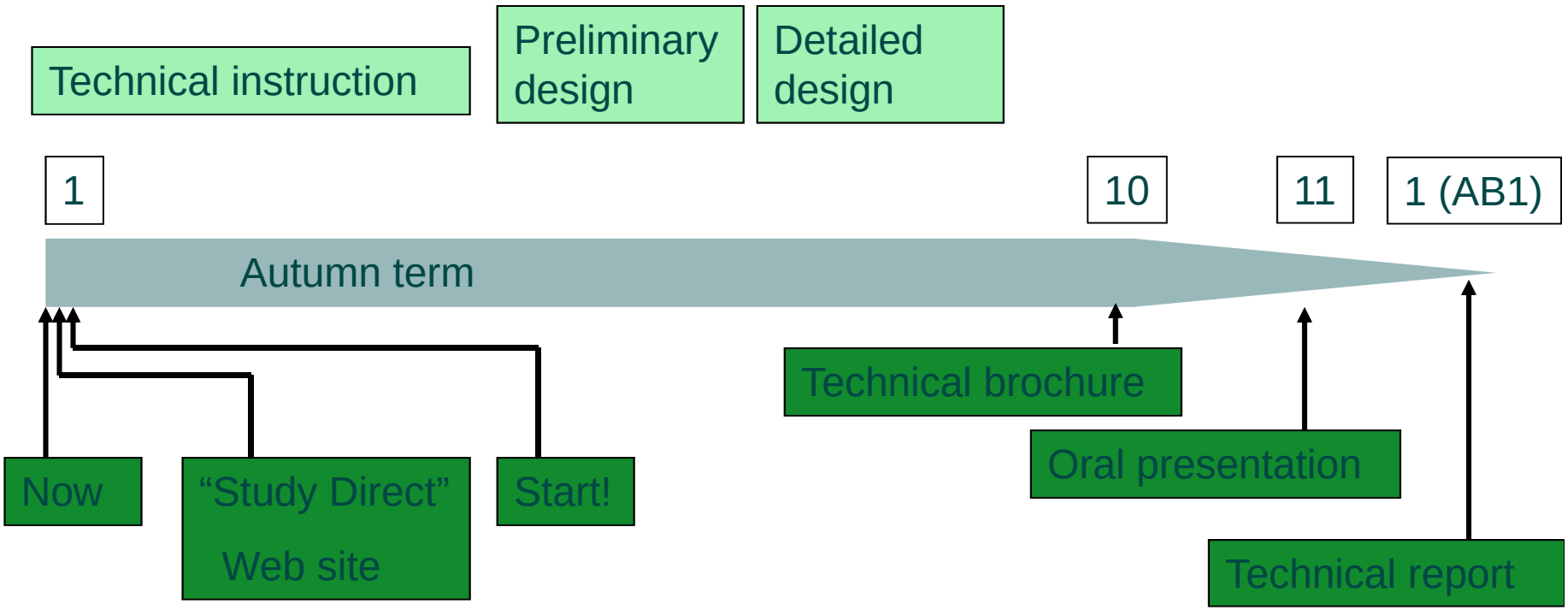

Project Management

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- Project is a combination of human and other resources pulled together in a temporary organisation to achieve a specified purpose.

- A project has
  - A definable purpose with established goals
  - Cost, time and performance requirements
  - Multiple resources across organisation lines
  - Assessment of risk

Project Management

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- Roles of project manager and members
- Objectives
- Receivables and deliverables
- Use of project management tools – e.g. Microsoft Project
- Make plan and keeping it up to date
- Reviews – how well are things going?

Product Examples

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Components

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Design Tasks for a New Petrol Lawnmower

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- Select an engine
- Engine thermal power and parts dimensions
- Identify peak torque from the design then select from a engine supplier's data sheet
- Choose from different component arrangements
- Detailed design of the power transmission from engine to blades and wheels
- Manufacturing cost is critical – "low cost" features
- Safety and environment issues
- Branding and styling

Specifications

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- 3-6 horsepower, 4 stroke petrol engine



- 350-700 mm cutting width





- 5-10 height adjustments



- 30-100-litre collection bag





Design and manufacture

New Design Encouraged

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- New styling and configuration
- Use of new materials
- Technical innovation
- Good maintenance recommendation
- Environment friendly
- More ‘Wow’ factors

Risk Analysis in Product

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Failure Mode and Effects Analysis (FMEA) is a risk assessment technique for systematically identifying potential failures in a system or a process. It is widely used in the manufacturing industries in various phases of the product life cycle

Planning

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Week 1-7 – Briefing, form teams, technical lectures, including revising key relevant thermal-dynamic concepts, power calculation, torque fluctuations, specifications.

Week 5,6 How to use design techniques

Week 7 industrial speaker on how to make a good sale presentation.

Weeks 3-9 - Design review, detailed design.

Week 10 – Technical Brochure

Weeks 11-12 Group Presentation and finalise design details

Week 1 (AB1, Spring term) Hand in Technical Report

Assessment

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- Measuring effort and effect in a teamwork assessment

  - Assessment of an engineering design where a team project mimicking industry practice

  - A grading system that captures and rewards effort and effect in assessment of group work

  - ‘authentic’ assessments that prepare students for employment.

- Professional institution requires team work elements in the degrees for playing team role and social skills

- Every member has to make effort, 15 credits =150 hours.

Assessment Components

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- Technical brochure 20%– group mark
- Technical report 60% – one group report with team member's contribution recognised 30:30% group:individual
- Final presentation 20% – group mark 10%, individual 10%

Assessment Summary

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Deliverables	Group/Individual based	Weighting %	Hand in/Take place
Technical brochure	Group	20%	Thursday Wk 10
Group presentation	Group and individual	20% (10 % Group and 10% Individual)	Wk 11
Technical report	Group report with individual contributions	60% (30% group 30% individual)	Thursday Wk 1 AB 1 Spring term

Measurement for individual performance

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Effort

- Each team maintains a weekly record of member's input efforts by numbers of hours for each week, signed by the team manager, and stamped by the tutor.

Academic office's definition: 1 credit =10 hours learning.

The credit volume reflects all student effort

Effect

- A percentage contribution breakdown to the report from each member, agreed at the end by the whole team, and signed by all team members.

Weighting

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$$\text{Final_score} = 20\% \times \text{technical_brochure} + 20\% \times \text{final_presentation} + 60\% \times \text{technical_report}$$

Effort and effect in technical report

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$$technical_report = 50\% \times individual_effort + 50\% \times individual_effect$$

Individual Effort

$$individual_effort = group_score \times \left(1 + \frac{indivatual_hours - team_average_hours}{team_average_hours}\right)$$

Individual Effect

$$individual_effect = group_score \times \left(1 + \frac{indivatual_contribution - average_contribution}{average_contribution}\right)$$

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1. Technical Brochure

- The technical brochure will describe the product and its merits as a sales document.
- The technical performance should be given the form that a sophisticated technical purchaser would require to make a purchasing decision.
- It should be well illustrated and capture the brand and values of the customer – designer takes lead.

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2. Group Presentation

The group oral presentation is a sale presentation which should

- describe the merits of your design and your qualities as a team
- Each team is given 18 minutes in average this year (2012-13). Therefore suggested 12-14 minutes for the presentation and 4 minutes for questions approximately with an industrial panel. Time will be varied slightly according to the size of group.
- Every member is expected to participate in the presentation.

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3. Technical Report

- Specifications with technical calculations support for main functions, including power, torque, energy source;
- Engine unit design with lubrication and control,
- Cutting blades, transmission to wheels,
- Casing with push handles, wheels with adjustable height levels, grass bag,
- Manufacture, packaging and environment issues,
- FMEA, critical evaluation of activities,
- Costs, market and branding,
- Others: Background introduction, conclusion, references, etc.

Member's Name: Team Number:

Week	Allocated Tasks	Estimated Hours	Actual Hours Spent	Manager's Signature
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
	Total Hours:	( )	( )	

Team Member Contribution Breakdown for Technical Report **Team Number:**

Name of Member	Work Undertaken for the report (e.g. Power calculation, transmission design)	Chapter /section Written for the report (e.g. Chapter 3, 5.1 & 5.2)	Contribution to the report (total 100%)	Member's Signature

Individual Contribution

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Example for calculating individual contributions

Name	Individual to tech report %	Group	Component of Individual contribution to tech report
Member 1	24	75	75x(1+(24 -16.7)/16.7)=107.9
Member 2	12	75	75x(1+(12-16.7)/16.7)=53.8
Member 3	16.5	75	75x(1+(16.5-16.7)/16.7)=74.2
Member 4	15.5	75	75x(1+(15.5-16.7)/16.7)=69.7
Member 5	16.5	75	75x(1+(16.5-16.7)/16.7)=74.2
Member 6	15.5	75	75x(1+(15.5-16.7)/16.7)= 69.7

Ceiling and floor marks will be set

There are 2 individual factors to measure: effort and effect

Sales Presentation

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Scheduled Teaching

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Week	Classroom teaching content	Speaker
1-4	Lectures on compressor technical calculations	W Wang
1-12	Design using Pro-Engineer 3D modelling	M King
5-6	Design Techniques	Design Staff
7	How to make good sale presentation	Industrial speaker

FAQ

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- Can you design something else?
- Is the task too big for a 15 credits course?
- Time sheet: if I spend hours but not recognised by the team?

  Who signs the time sheet for the manager?
- If someone is not contributing, what should be done?
- If a team member is 5 or 6 not 7, how will be the difference in assessment?
- Put Logbook/Minutes electronically on Sussex Wikisite?

Frequent Encountered Problems

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- Low attendance to project meetings
- Do not engage at all
- Lack of coordination
- Ineffective communication
- Work alone
- Do not maintain record (timesheet, logbook)
- Over spending of time

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Lecture notes:
www.sussex.ac.uk/Users/tafb8/dfm
Study Direct is linked