WM9F7-15 Managing Design and Manufacturing Technology

24/25

Department
WMG
Level
Taught Postgraduate Level
Module leader
Helen Ascroft
Credit value
15
Module duration
4 weeks
Assessment
100% coursework
Study location
University of Warwick main campus, Coventry

Description

Introductory description

Design is vital to any engineering business’s aim of creating successful products. Design can also be viewed as a systematic and disciplined process. The design process is a framework that engineers utilise to design products. Manufacturing involves the conversion of raw materials into usable products and can be summarised as:- the design and manufacture of products; and using various manufacturing processes, operations and techniques, following an organised plan. Design and manufacturing is interrelated and should not be viewed as separate disciplines. Designed products should meet the design requirements AND be able to be manufactured relatively easily and economically. Effective implementation of design for manufacture requires engineers to have fundamental understanding of materials, manufacturing processes and related operations. In addition, they must be able to assess the impact of designs on; manufacturing process selection, assembly, automation, quality control, tools and dies, cost and sustainability. Management of design and manufacture is complex and as such Computer aided design (CAD), computer aided manufacture (CAM), computer aided process planning (CAPP), computer aided engineering (CAE) computer integrated manufacture (CIM) and product data management (PDM) have become indispensable in management and optimisation of the design and manufacturing process.

Module aims

This course module aims to provide an introduction to the fundamental aspects of product design and manufacture including, the design process, selecting materials, selecting processes, assembly, computers in manufacturing, automation, sustainability. Participants will learn a framework approach to the design and manufacture of products emphasising current trends in Industry 4.0 and sustainability. Participants will learn to differentiate between important methods, technologies, current trends, tools and techniques and how they may be effectively utilised, equipping them with the skills for a career in modern, sustainable engineering environments. The course module is augmented by laboratory demos, practical hands-on sessions and a case study.

Outline syllabus

This is an indicative module outline only to give an indication of the sort of topics that may be covered. Actual sessions held may differ.

Design process framework: Product design specification, Conceptual design, Design for manufacture, Design management, Computers aids to design, Appreciation of the scope and usage of further methods to aid design (Quality function deployment, Failure mode and effect analysis, Functional cost analysis, Life cycle analysis, Matrix analysis, Taguchi methods). Manufacturing technologies, processes & materials, comprising: Engineering materials properties & selection (Metals, Polymers, Ceramics and Composites), Manufacturing process knowledge and selection (Casting, Forming, Machining, Joining and Finishing), Assembly methods, Sustainability. Advanced understanding of the scope and impact of automation and computing in design and manufacturing: Machine control systems (CNC), Computer Aided Design and Manufacture (CADCAM), Finite Element Analysis (FEA), Industry 4.0, Automation fundamentals, Robotics technology and Robotic demonstrations.

Learning outcomes

By the end of the module, students should be able to:

- Demonstrate an advanced understanding of the fundamentals of product design and development processes, including important methods, technologies, latest trends, tools and techniques, outcome and functional/resource interdependence, and interpreting their relationships from concept to customer.
- Critically evaluate and make recommendations on approaches to the management of product design and development processes.
- Critically evaluate and contrast materials and manufacturing processes that are most commonly used in manufacturing industry
- Critically evaluate the use of computers and automation in successful design & manufacture.
- Critically evaluate manufacture-design, demonstrating detailed knowledge of fundamental aspects of manufacturing and materials processes and technologies in the context of a circular /sustainable economy.

Indicative reading list

Bhargava, Vikram (2017) Robust plastic product design: a holistic approach, Hanser Publications ISBN 9781569905814
Boothroyd, G., Dewhurst, P. and Knight, W. A. (2011) Product design for manufacture and

assembly. 3rd ed. Boca Raton, Fl: CRC Press. Available at: http://encore.lib.warwick.ac.uk/iii/encore/record/C__Rb2873743.
Chapman, Jonathan (ed) (2017) Routledge handbook of sustainable product design, Routledge ISBN 9781138910171
DeGarmo, E. P. (2003) Materials and processes in manufacturing. 9th ed. New York: Wiley.
Dieter, George E., Engineering design : a materials and processing approach, New York ; London : McGraw-Hill, 1991. 2nd ed.
Dieter, George E., Mechanical metallurgy, London : McGraw-Hill, 1988. SI metric ed.
Groover, M. P. (2017) Principles of modern manufacturing. 5th edition, SI version. Hoboken, New Jersey: Wiley.
Groover, M. P. and Jayaprakash, G. (2016) Automation, production systems, and computer-integrated manufacturing. Fourth edition. Harlow, Essex, England: Pearson.
Ind, Nicholas, Watt, Cameron, (2004) Inspiration: Capturing the creative potential of your organization ISBN 0230510884
Jahan, Ali, Edwards, Kevin L., Bahraminasab, Marjan (2016) Multi-criteria decision analysis for supporting the selection of engineering materials in product design Elsevier ISBN 9780081005415
Kalpakjian, S. and Schmid S.R. (2016) Manufacturing processes for engineering materials, Sixth edition. Boston : Pearson Education,ISBN 9780134290553
Kumar, K., Zindani, D. and Davim, J. P. (2018) Advanced machining and manufacturing processes. Cham: Springer. Available at: https://0-link-springer-com.pugwash.lib.warwick.ac.uk/10.1007/978-3-319-76075-9.
Mastro, Paul F. (2016) Plastics product design, Wiley ISBN 9781118842737
Mehta, B. R. and Reddy, Y. J. (2015) Industrial process automation systems: design and implementation. Amsterdam: Elsevier. Available at: http://0-www.sciencedirect.com.pugwash.lib.warwick.ac.uk/science/book/9780128009390.
Modrak, V. (ed.) (2017) Mass customized manufacturing: theoretical concepts and practical approaches. Boca Raton: CRC Press. Available at: https://0-www-taylorfrancis-com.pugwash.lib.warwick.ac.uk/books/9781315398976.
Nee, A. Y. C. (ed.) (2014) Handbook of manufacturing engineering and technology. London: SpringerReference. Available at: http://encore.lib.warwick.ac.uk/iii/encore/record/C__Rb2766742.
Pugh, Stuart (1990) Total design: integrated methods for successful product engineering. Wokingham : Addison-Wesley ISBN 0201416395
Pugh, Stuart; Clausing, Don; Andrade, Ron (1996) Creating innovative products using total design: the living legacy of Stuart Pugh ISBN 0201634856
Pidaparti, Ramana M. (2018) Design engineering journey, Morgan & Claypool ISBN 9781681732619
Szewczyk, R., Zieliński, C. and Kaliczyńska, M. (eds) (2018) Automation 2018: Advances in Automation, Robotics and Measurement Techniques. Cham: Springer International Publishing.
Ulrich, Karl T.; Eppinger, Steven D. (2012) Product design and development ISBN 9780073404776

Subject specific skills

The course is centred around developing a broad range of knowledge and skills in design and manufacturing. The course focusses on two major disciplines, design and manufacturing, and will develop knowledge, skills and core competencies in:

1. Fundamentals of the design process and a framework approach, independent of technology, to manage the design process.
2. Fundamentals of materials and process technology together with utilisation of appropriate selection tools to enable a more scientific approach to material and process selection decisions.
3. Recognise the scope and with utilisation of appropriate tools and techniques, critically evaluate and interpret the impact of automation and computing in design and manufacturing.

Transferable skills

1. Apply complex scientific selection processes to arrive at solutions.
2. Logically argue with rigour and reasoning to arrive at a given solution.
3. Problem solving.
4. Team-working.
5. Presentation skills.

Study

Study time

Type	Required
Lectures	15 sessions of 1 hour (10%)
Seminars	4 sessions of 1 hour (3%)
Demonstrations	1 session of 1 hour (1%)
Practical classes	10 sessions of 1 hour (7%)
Online learning (scheduled sessions)	2 sessions of (0%)
Online learning (independent)	30 sessions of 1 hour (20%)
Private study	30 hours (20%)
Assessment	60 hours (40%)
Total	150 hours

Private study description

Further research into applications of taught material.
Survey of the engineering manufacturing market is required, hence some time will be spent researching literature.

Costs

No further costs have been identified for this module.

Assessment

You do not need to pass all assessment components to pass the module.

Assessment group A1

	Weighting	Study time
Post Module Assessment: critical review of IMA proposal	60%	36 hours
Critical review of IMA covering both the viability of the proposal and the groups approach to the case study.		
In Module Assessment presentation and portfolio	30%	18 hours
20 minute group presentation, followed by a short Q&A session from the assessors. Portfolio of completed IMA tasks as set out in the assignment brief.		
In Module Assessment proposal outline	10%	6 hours
Executive summary		

Feedback on assessment

In-class debrief of performance on in-module presentation; written feedback will be provided in a report for all written assignments within 20 days using WMG’s standard feedback template.

Availability

Courses

This module is Core for:

- Year 1 of TWMS-H1S3 Postgraduate Taught Engineering Business Management (Full-time)