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MODULE SPECIFICATION FORM*

Module Title:	**Manufacturing Systems Economics**	Level:	**6**	Credit Value:	**10**

Module code: (if known)	**ENG637**	Cost Centre:	**GAME**	JACS2 code:	H410

Semester(s) in which to be offered:	**2**	With effect from:	**July 2015**

Office use only: To be completed by AQSU:	Date approved: Date revised: Version No:	**July 2015** 1

Existing/New:	**Existing**	Title of module being replaced (if any):

Originating Academic area:	**Engineering and Applied Physics**	Module Leader:	**N Vidmer**

Module duration (total hours)	100	**Status:** core/option/elective (identify programme where appropriate):	**Free-standing 10-credit component comprising half of ENG630 (Manufacturing Systems Economics and CIM).**
Scheduled learning and teaching hours	36		
Independent study hours	64		
Placement hours	0		

Percentage taught by Subjects other than originating Subject (please name other Subjects):	**0%**

Programme(s) in which to be offered: **Enginering European Programme** (Non Award Bearing)	Pre-requisites per programme (between levels):	**None**

Module Aims:

To develop an understanding of the budgeting and costing process and the influence of the economy on company business leading to the ability to complete a project finance appraisal.

Expected Learning Outcomes

Knowledge and Understanding:
At the completion of this module, the student should be able to:

1. Explain and apply the relevant concepts of manufacturing economics;
2. Apply the principles of budgeting and costing; *(KS 10)*
3. Explain and apply relevant methods of capital project appraisal;

Key skills for employability

1. Written, oral and media communication skills,
2. Leadership, team working and networking skills
3. Opportunity, creativity and problem solving skills
4. Information technology skills and digital literacy
5. Information management skills
6. Research skills
7. Intercultural and sustainability skills
8. Career management skills
9. Learning to learn (managing personal and professional development, self management)
10. Numeracy

Assessment: *Please indicate the type(s) of assessment (eg examination, oral, coursework, project) and the weighting of each (%).*

Assessment is by means of an examination covering all outcomes. It is an unseen time-constrained exam. (This corresponds to one-half (part A) of the examination of ENG630.)

Assessment number (use as appropriate)	Learning Outcomes met	Type of assessment	Weighting	Duration (if exam)	Word count (if coursework)
Assessment One:	1, 2, 3	Examination	100%	2 hr	

Learning and Teaching Strategies:

Learning will be facilitated by means of lectures and tutorials, demonstrations, industrial visits, and use of appropriate computer software packages. Assignment work is designed to broaden the range of students' reading and may be partially based on information obtained from industrial manufacturing companies.

Syllabus outline:

Company economics: Concept of resource allocation, mechanisms for determining resource allocation. Market versus command economy. Examination of demand behaviour. Interaction of supply and demand. Concept of shifts in demand and supply.

Budgeting and costing: Appreciation of the need for overall cost control. Budgeting control and budgeting, standard costing and variance analysis. The elements of job costing.

Project appraisal: Concept of cash flow across a company boundary. Sources of funds, time value of money. Rate of return or investment. Present and future worth calculations. Evaluation and comparison of projects.

Bibliography:

Essential reading:

Couper, J. (2003) *Process Engineering Economics*, CRC Press

Recommended reading:

Brockington, R.B. (1984); *Financial Management*; DP Publications

Wu, B. (1991) *Manufacturing Systems Design and Analysis*; Kluwer Academic Publishers

Ranky, P.G. (1990) *Flexible Manufacturing Cells and Systems in CIM*; (CIMware Ltd.)

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MODULE SPECIFICATION FORM*

Module Title:	**Developing Aircraft Technologies**	Level:	**6**	Credit Value:	**10**

Module code: (if known)	**ENG665**	Cost Centre:	**GAAE**	JACS2 code:	H410

Semester(s) in which to be offered:	**1**	With effect from:	**September 2014**

Office use only: To be completed by AQSU:	Date approved: Date revised: Version No:	1

Existing/New:	**Existing**	Title of module being replaced (if any):

Originating Academic area:	**Engineering and Applied Physics**	Module Leader:	**R Bolam**

Module duration (total hours)	100	**Status:** core/option/elective (identify programme where appropriate):	**Free-standing 10-credit component comprising half of ENG621 (Modern Aircraft Materials and Technologies).**
Scheduled learning and teaching hours	36		
Independent study hours	64		
Placement hours	0		

Percentage taught by Subjects other than originating Subject (please name other Subjects):	**0%**

Programme(s) in which to be offered: **Enginering European Programme** (Non Award Bearing)	Pre-requisites per programme (between levels):	**None**

Module Aims:

To develop an understanding of current aircraft technology and forward-looking experimental developments within the world-wide aircraft industry and to anticipate the adoption of particular technologies in the future.
To apply comprehensive analytical methods to materials and technology, including eco-auditing, from industrial perspective.

Expected Learning Outcomes

<u>Knowledge and Understanding:</u>
At the completion of this module, the student should be able to:

1. Demonstrate knowledge of a range innovative, experimental and prototype aircraft;
2. Critically analyse the present and future legislation and green effects for airframe, propulsion and control innovations for novel aircraft and compare with more established conventions;
3. Predict the success of design innovations (including eco-designs) and consider possible improvements. *(KS 6, 7)*

<u>Key skills for employability</u>

1. Written, oral and media communication skills,
2. Leadership, team working and networking skills
3. Opportunity, creativity and problem solving skills
4. Information technology skills and digital literacy
5. Information management skills
6. Research skills
7. Intercultural and sustainability skills
8. Career management skills
9. Learning to learn (managing personal and professional development, self management)
10. Numeracy

Assessment: *Please indicate the type(s) of assessment (eg examination, oral, coursework, project) and the weighting of each (%).*

Assessment is by means of an formal report covering all outcomes. Students are required to investigate an individual topic, chosen in agreement with the lecturer, which involves an in-depth probe into the 'forefront of the subject' of aeronautical, or aerospace, engineering. suitable topics would be the use of novel materials such as composite, or the trends in the use of unmanned aircraft and drones.
(This corresponds to Assessment 2 of ENG621.)

Assessment number (use as appropriate)	Learning Outcomes met	Type of assessment	Weighting	Duration (if exam)	Word count (if coursework)
Assessment One:	1, 2, 3	Report	100%		2000 words

Learning and Teaching Strategies:

The module should be largely investigative in nature but with some direction though guidance notes within the written assignment exercise. Work should be guided by keynote lectures (limited in number) and supported by occasional small group tutorials. The material should be guided in the light of current/recent developments but with an onus put on each student to develop a deeper knowledge via individual or small group work. The student would be expected to use resources and library, statistical projections, practical testing or other methods to verify the effects of developments.

Syllabus outline:

Current technologies: Survey of the range of current issues regarding aircraft technological development and an in-depth knowledge of one, or a few, specific topic(s). The topics and issues considered herein are only indicative:

Aircraft Developments: Comprehensive investigation of developments; for example, Airbus A350 and Boeing Dreamliner 787, unmanned combat and transport aircrafts etc.

Technological developments: materials used, airfoil and fuselage shapes and configurations (canard/delta/conventional), drag reduction measures, engines, other propulsion, eco-designs, fuel efficiency measures (e.g. the incorporation of sharklets).

Environmental legislation: Investigation of current EU legislation and "green" methods in aircraft evaluation, viability of the developments investigated, extrapolate trends to predict future aircraft design features from environmental perspective.

Bibliography:

Essential reading:

Strong, B. (2008) *Fundamentals of Composites Manufacturing: Materials, Methods and Applications*, 2nd Edn., Dearbon, Michigan: Society of Manufacturing Engineers.

The Aeronautical Journal: Royal Aeronautical Society (www.aerosociety.com), London.

Recommended reading:

Sholte, J. (2005) *Nanotechnology industry trends and applications*, Oxford: John Wiley and Sons.

Reports

Aeronautics and air transport: beyond vision 2020; towards 2050 (2010) Belgium: ACARE.

Aerospace and defence technology report (2003) DTI publication on Aerospace in 2020. London: DTI, HMSO.

European Aeronautics: A vision for 2020 (2001) Luxembourg: European Communities.

Periodicals

Flight International: Reed Business international. London.

Journal of Aerospace Engineering (part G): Institution of Mechanical Engineers (www.imeche.org), London.

Publications by the American Institute of Aeronautics and Astronautics (www.aiaa.org).

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MODULE SPECIFICATION FORM

Module Title:	**Complex Structures**	Level:	**6**	Credit Value:	**10**

Module code: (if known)	**ENG670**	Cost Centre:	**GAME**	JACS2 code:	H143

Semester(s) in which to be offered:	**1**	With effect from:	**September 2014**

Office use only: To be completed by AQSU:	Date approved: Date revised: Version No:	1

Existing/New:	**Existing**	Title of module being replaced (if any):

Originating Academic area:	**Engineering and Applied Physics**	Module Leader:	**Z Chen**

Module duration (total hours)	100	**Status:** core/option/elective (identify programme where appropriate):	**Free-standing 10-credit component comprising half of ENG620 (Vibration Analysis and Complex Structures).**
Scheduled learning and teaching hours	36		
Independent study hours	64		
Placement hours	0		

Percentage taught by Subjects other than originating Subject (please name other Subjects):	**0%**

Programme(s) in which to be offered: **Enginering European Programme** (Non Award Bearing)	Pre-requisites per programme (between levels):	**None**

Module Aims:

To develop an understanding of: methods of structural idealisation; assumptions made in torsional the analyses of thin walled tubes; the behaviour of multi-cell structures when subject to torsional and flexural loads; methods of analysing struts, bars, panels and stiffened panels when considering buckling; the behaviour of thin shells when subject to load.

Expected Learning Outcomes

Knowledge and Understanding:

At the completion of this module, the student should be able to:

1. Analyse an idealised structure and derive, making suitable assumptions, the equations for torsion applied to single celled tubes and for analysis of thin shells;
2. Solve problems involving multi-cell structures subject to torsion and bending loads and, in thin shells, solve for moments, slope and deflection for given boundary conditions and loading scenarios; (KS 3)
3. Derive equations for the analysis of membranes subject to various loading and boundary conditions;
4. Analyse the nature of structural weaknesses, such as panel buckling, and the effects they may have on the integrity of a structure, including the concepts of stress concentration. (KS 5)

Key skills for employability

1. Written, oral and media communication skills,
2. Leadership, team working and networking skills
3. Opportunity, creativity and problem solving skills
4. Information technology skills and digital literacy
5. Information management skills
6. Research skills
7. Intercultural and sustainability skills
8. Career management skills
9. Learning to learn (managing personal and professional development, self management)
10. Numeracy

Assessment: *Please indicate the type(s) of assessment (eg examination, oral, coursework, project) and the weighting of each (%).*

Assessment is by means of an examination covering all outcomes. It is an unseen time-constrained exam. (This corresponds to one-half (part B) of the examination of ENG620.)

Assessment number (use as appropriate)	Learning Outcomes met	Type of assessment	Weighting	Duration (if exam)	Word count (if coursework)
Assessment One:	1, 2, 3, 4	Examination	100%	2 hr	

Learning and Teaching Strategies:

The module will be presented to students through a series of lectures, tutorials and case studies utilising laboratory equipment where appropriate. Use of computer packages, including specially developed computer aided packages from within the department, will be used to aid learning.

Syllabus outline:

Structural idealisation: The concept of representing a panel in terms as booms and webs for ease of analysis.

Torsion of Multi-Celled Structure: The derivation of equations of torsion, Bredt-Batho and their application to single and multi-celled structures. Combined torsion and bending. Calculating shear stress distributions and stress flow around structure.

Plates and Shells: Definitions and limitations of theory, use in engineering, assumptions in plate theory, boundary conditions and supports are considered with various loading scenarios loading. The bending of thin shells (deflections, slopes) and calculation of membrane and local stresses.

Buckling Analysis: Panel buckling and Euler strut. Boundary conditions: free, fixed and partial clamping. Formulation and application of buckling charts to panels, reinforced panels and composite forms. Local and overall buckling, also crippling. Buckling modes: dimples.

Bibliography:

Essential reading:

Gere, J.M. (2008); *Mechanics of Materials*, 7th Edn., Nelson Engineering.

Recommended reading:

Megson, T.H.G. (2007) *Aircraft Structures for Engineering Students*; 4th Edn., Elsevier.

Benham, P.P. et al. (1996) *Mechanics of Engineering Materials*, 2nd Edn., Longman.

Timoshenko, S.P. and Woinowsky-Krieger, S. (1964) *Plates and Shells*; McGraw-Hill.

Durka, F. Et al. (2010) *Structural Mechanics: Loads, Analysis, Materials and Design of Structural Elements*; 7th Edn., Prentice-Hall.

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MODULE SPECIFICATION FORM*

Module Title:	**Further Analogue Electronics**	Level:	**6**	Credit Value:	**10**

Module code: (if known)	**ENG671**	Cost Centre:	**GAEE**	JACS2 code:	H600

Semester(s) in which to be offered:	**1**	With effect from:	**September 2014**

Office use only: To be completed by AQSU:	Date approved: Date revised: Version No:	1

Existing/New:	**Existing**	Title of module being replaced (if any):

Originating Academic area:	**Engineering and Applied Physics**	Module Leader:	**B. Klaveness**

Module duration (total hours)	100	**Status:** core/option/elective (identify programme where appropriate):	**Free-standing 10-credit component comprising half of ENG636 (Electronics, Design and Testing).**
Scheduled learning and teaching hours	36		
Independent study hours	64		
Placement hours	0		

Percentage taught by Subjects other than originating Subject (please name other Subjects):	**0%**

Programme(s) in which to be offered: **Enginering European Programme** (Non Award Bearing)	Pre-requisites per programme (between levels):	**None**

Module Aims:

To build upon analytical skills and knowledge gained in previous modules to further develop students' problem-solving abilities relating to the design, performance prediction, analysis and evaluation of advanced electronic systems.

Expected Learning Outcomes

Knowledge and Understanding:
At the completion of this module, the student should be able to:

1. Originate analogue electronic designs for a given specification;
2. To design and develop cascade circuits, cascode circuits, passive and active n^{th} order filters; *(KS 3, 10)*
3. Use analysis techniques, including computer modelling techniques and practical experiments to verify and assess theoretical predictions and evaluate the performance of a given design. *(KS 4)*

Key skills for employability

1. Written, oral and media communication skills,
2. Leadership, team working and networking skills
3. Opportunity, creativity and problem solving skills
4. Information technology skills and digital literacy
5. Information management skills
6. Research skills
7. Intercultural and sustainability skills
8. Career management skills
9. Learning to learn (managing personal and professional development, self management)
10. Numeracy

Assessment: *Please indicate the type(s) of assessment (eg examination, oral, coursework, project) and the weighting of each (%).*

Assessment is by means of an examination covering all outcomes. It is an unseen time-constrained exam. (This corresponds to assessment 2 – examination - of ENG636.)

Assessment number (use as appropriate)	Learning Outcomes met	Type of assessment	Weighting	Duration (if exam)	Word count (if coursework)
Assessment One:		Examination	100%	2 hr	

Learning and Teaching Strategies:

The module will be delivered mainly through lectures and student-driven development work. Detailed lecture notes provided for the student will allow the optimisation of lecture time, with good opportunity for self-study, and supported by regular tutorials.

Extensive use will be made of VLE (Moodle) to supplement learning materials and provide on-line quizzes for additional learning opportunities.

Syllabus outline:

Operational amplifiers: Electrical characteristics of operational amplifiers; internal structure, differential amplifier, current mirrors, dynamic loads, level shifting and complementary class B output stages.
The ideal operational amplifier; summing, differentiating logarithmic function; antilog, integrator and differentiator. Selection criteria for op-amps and practical limitations. Methods of eliminating output voltage offsets and suitable noise models.
Signal generation: Position fullwave and halfwave active rectifier circuits. Waveform generators and Schmitt trigger circuits.
Transistor/FET modelling at high and low frequencies (CE-CS, CB-CG, CC-CS).
The nature of filters; S plane transfer characteristics and models for low/high pass systems and high/low pass transformations.
Active filters: Sallen-key and multiple feedback**,** analysis of Butterworth/Bessel and Chebyshev with high/low and bandpass transformations.

Bibliography:

Essential reading:
Crecraft, D.I and Gorham, D.A. (2003) *Electronics*, 2nd Edn., Nelson Thornes Ltd.

Recommended reading:
Tomlinson, G.H. (1994) *Electrical Networks and Filters Theory and Design*, Prentice-Hall.
Clayton (2005) *Operational Amplifier Circuits*, Butterworth-Heinemann.
Various (2007-) *Electronics Weekly* http://www.electronicsweekly.com London Reed Business Information 24
Various (2007-) *IET Electronic systems and software ,* London IET.
Various (2007-) *Components in Electronics* http://www.cieonline.co.uk, London Newsquest Specialist Media

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MODULE SPECIFICATION FORM*

Module Title:	**Discrete Time Signal Processing**	Level:	**6**	Credit Value:	**10**

Module code: (if known)	**ENG672**	Cost Centre:	**GAEE**	JACS2 code:	H651

Semester(s) in which to be offered:	**1**	With effect from:	**September 2014**

Office use only: To be completed by AQSU:	Date approved: Date revised: Version No:	 1

Existing/New:	**Existing**	Title of module being replaced (if any):

Originating Academic area:	**Engineering and Applied Physics**	Module Leader:	**B Klaveness**

Module duration (total hours)	100	**Status:** core/option/elective (identify programme where appropriate):	**Free-standing 10-credit component comprising half of ENG639 (Signal Processing and digital Control).**
Scheduled learning and teaching hours	36		
Independent study hours	64		
Placement hours	0		

Percentage taught by Subjects other than originating Subject (please name other Subjects):	**0%**

Programme(s) in which to be offered: **Enginering European Programme** (Non Award Bearing)	Pre-requisites per programme (between levels):	**None**

Module Aims:

To provide the student with fundamentals of discrete-time signal theory, digital filtering, digital spectrum estimation, with examples and applications arising from various disciplines, so as to prepare the student to solve practical problems. This includes common DSP techniques and an appreciation of the limitation of various implementations of DSP algorithms thus to apply DSP techniques on hardware platforms.

Expected Learning Outcomes

Knowledge and Understanding:
At the completion of this module, the student should be able to:

1. Evaluate various discrete transform of signals;
2. Select a suitable design for FIR (Finite Impulse Response) and IIR (Infinite Impulse Response) digital filters; *(KS 3)*
3. Understand the theoretical principles, limitations and methodologies associated with DSP-based system design;

Key skills for employability

1. Written, oral and media communication skills,
2. Leadership, team working and networking skills
3. Opportunity, creativity and problem solving skills
4. Information technology skills and digital literacy
5. Information management skills
6. Research skills
7. Intercultural and sustainability skills
8. Career management skills
9. Learning to learn (managing personal and professional development, self management)
10. Numeracy

Assessment: *Please indicate the type(s) of assessment (eg examination, oral, coursework, project) and the weighting of each (%).*

Assessment is by means of an unseen time-constrained examination covering all outcomes. (This corresponds to one-half (part A) of the examination of ENG639 but will be sat as a separate exam at the end of trimester 1.)

Assessment number (use as appropriate)	Learning Outcomes met	Type of assessment	Weighting	Duration (if exam)	Word count (if coursework)
Assessment One:	1, 2, 3	Examination	100%	2 hr	

Learning and Teaching Strategies:

The module will be delivered through lectures, tutorials and student-driven investigative work. A significant amount of the content is to be achieved through individual study. Approximately one third of the timetabled time will be devoted to formal lectures. The remainder of the time will be allocated to tutorials and to individual study. The application part of the module is done via laboratory work which consists of the implementation of digital filter on a DSK (Texas Instruments, Inc. TMS320), software simulation of digital filter using MATLAB/Simulink. The students will be encouraged to further investigate the topics as directed learning.

Syllabus outline:

Digital signal processing fundamentals: Revision of discrete-time signals. Digital processing of analogue signals. A/D and D/A converters. Sampling theorem and anti-aliasing. The discrete-time Fourier transform (DTFT). The discrete Fourier transform (DFT). The fast Fourier transform (FFT). The z-transform, transfer functions and difference equations.

Filter Design: Finite Impulse Response (FIR) digital filters and Infinite Impulse Response (IIR) digital filters.

FIR Filters: Linear phase. Symmetric and anti-symmetric impulse response. Frequency sampling method. Use of window functions. Quantisation and finite word-length effects.

IIR Filters: Approximation techniques based on differences. Impulse invariance and bilinear z-transformation. Design by pole placement method.

Applications: Implement filter design in CAE software such as MATLAB/Simulink and hardware platform such as TI DSK. An overview of the DSP hardware architecture with specific focus on task related issues. An overview of the DSP software environment.

Bibliography:

Essential reading:

Oppenheim, A. V. et al. (2010), *Discrete-Time Signal Processing*, 3rd Edn., Upper Saddle River, USA, Pearson Edn, Inc.
Mitra, S. K. (2011) *Digital Signal Processing: A Computer-Based Approach*, 4th Edn., McGraw-Hill Higher Education.

Recommended reading:

Hayes, M. (2011) *Digital Signal Processing*, 2nd Edn., Mc Graw-Hill Schaum's Outlines.
Proakis, J. G. and Manolakis, D. K. (2007) *Digital Signal Processing Principles, Algorithms and Applications*, 4th Edn., Upper Saddle River, USA, Pearson Education, Inc.
Kuo, S. M. and Woon-Seng Gan, W. S. (2005) *Digital signal processors: architectures, implementations, and applications*. Upper Saddle River, USA, Pearson Education, Inc.
Ifeachor, E. and Jervis, B. (2002) *Digital Signal Processing: A Practical Approach*, 2nd Edn., USA, Pearson Education, Inc.
Smith, S. W. (1997) *The Scientist and Engineer's Guide to Digital Signal Processing,* California Technical Publishing, USA.

Additional Reading:

http://www.mathworks.com/ (Guides for MATLAB software)
http://www.gnu.org/software/octave/ (Guides for Octave software)
http://www.theiet.org/ (Online resources from the IET)
http://www.ieee.org/index.html (Online resources from the IEEE)

EURASIP journal on applied signal processing, Akron, Ohio: Hindawi Pub. Corp.
IEEE Signal Processing e-Library (Electronic resource): 1950-2005 / IEEE Signal Processing Society. San Diego, USA, IEEE Pub.
IEEE Xplore Digital Library (http://ieeexplore.ieee.org/Xplore/guesthome.jsp) including:
IEEE Transactions on Signal Processing, IEEE Transactions on Control Systems Technology, IEEE Journals and Magazines, IET Transactions on Signal Processing, IET Journals and Magazines.

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MODULE SPECIFICATION FORM

Module Title:	**Thermo-Fluid Mechanics B**	Level:	**6**	Credit Value:	**10**

Module code: (if known)	**ENG676**	Cost Centre:	**GAME**	JACS2 code:	**H141/H311**

Semester(s) in which to be offered:	**2**	With effect from:	**September 2014**

Office use only: To be completed by AQSU:	Date approved: Date revised: Version No:	1

Existing/New:	**Existing**	Title of module being replaced (if any):	N/A

Originating Academic area:	**Engineering and Applied Physics**	Module Leader:	**C Abeykoon**

Module duration (total hours)	100	**Status:** core/option/elective (identify programme where appropriate):	**Free-standing 10-credit component comprising half of ENG616 (Advanced Thermo-Fluids and Turbomachinery).**
Scheduled learning and teaching hours	36		
Independent study hours	64		
Placement hours	0		

Percentage taught by Subjects other than originating Subject (please name other Subjects):	**0%**

Programme(s) in which to be offered: **Enginering European Programme** (Non Award Bearing)	Pre-requisites per programme (between levels):	**None**

Module Aims:

To further develop the concepts and applications introduced in the Level 5 Thermo-fluid and Propulsion module. The module focuses on the application of dimensional analysis in similarity and model testing, the thorough application of the second law of thermodynamics to more advanced thermodynamic power cycles and the investigation of compressible fluid flow.

Expected Learning Outcomes

Knowledge and Understanding:
At the completion of this module, the student should be able to:

1. Analyse thermodynamically irreversible processes and apply the analysis of more advanced thermodynamic cycles; (KS 3)
2. Analyse compressible fluid flow and develop an understanding of the formation of compression and expansion waves in supersonic streams; (KS 4, 10)

Key skills for employability
1. Written, oral and media communication skills,
2. Leadership, team working and networking skills
3. Opportunity, creativity and problem solving skills
4. Information technology skills and digital literacy
5. Information management skills
6. Research skills
7. Intercultural and sustainability skills
8. Career management skills
9. Learning to learn (managing personal and professional development, self management)
10. Numeracy

Assessment: *Please indicate the type(s) of assessment (eg examination, oral, coursework, project) and the weighting of each (%).*

Assessment is by means of an examination covering all outcomes. It is an unseen time-constrained exam. (This corresponds to one-half (part A) of the examination of ENG616.)

Assessment number (use as appropriate)	Learning Outcomes met	Type of assessment	Weighting	Duration (if exam)	Word count (if coursework)
Assessment One:	1, 2, 3	Examination	100%	2 hr	

Learning and Teaching Strategies:

This module will be presented to students through a series of lecture materials including videos, demonstrations, investigations and structured technical visits to large energy users.

Syllabus outline:

The Second Law and Isentropic Efficiency: Reversible and irreversible processes, the property entropy as a consequence of the second law. Further property diagrams, entropy changes in various processes. T-s and h-s diagrams for gases and vapours. Compressors, turbines, nozzles and diffusers. Isentropic irreversible processes on T-s and h-s diagrams. Entropy changes in various processes where the fluid is a gas or vapour. Use of isentropic efficiency to estimate work transfer to and from the devices listed.

Modified thermodynamic cycles: Criteria for maximum thermal efficiency in various cycles. Modifications necessary to achieve improvements in efficiency and work ratio. Expressions giving the work output and thermal efficiency of various cycles. Use of intercooling, reheat, regeneration, heat exchangers in gas and steam turbine cycles. Actual and ideal cycles.

Gas-vapour mixtures and applications: Dalton's law, the Gibb's-Dalton law and Avogadro's law. Relationships between properties and evaporation of water in a closed space. Terms used in psychrometry and methods of measuring relative humidity. Characteristics and analysis of air conditioning systems and cooling towers-forced and natural draught. Gas/vapour relationships, psychometric chart. Air-conditioning systems and evaporative cooling towers.

Flow of compressible fluids: Stagnation properties derivation of expressions from the S.F.E.E. Relationship between Bernoulli's equation and S.F.E.E. Movement of a pressure wave in a fluid, equation for the velocity of sound. Mach number, property relationships in terms of Mach number. Isentropic flow of gas through a duct of varying area. Converging and converging-diverging nozzles. Plane normal shock wave, equations for changes of gas properties across a normal shock in a convergent-divergent nozzle. Under and over expansion of a gas through converging-diverging nozzle, critical properties, choked flow.

Compression and expansion waves in a supersonic stream: Mach waves, equation for the Mach angle. Oblique shock wave at a concave corner, velocity components of a gas flow through a shock wave; 'strong ', 'weak' shock for given conditions. Detached shock wave, limiting conditions for attached shock. 'Prandtl-Meyer' expansions, Prandtl-Meyer function. Deflection angle, incident Mach number, resultant shock wave and expansion wave inclination. Compression and expansion over 2-D bodies. Examination of normal, oblique and detached shock waves and the limiting conditions for each case. Normal and oblique shock tables applied to supersonic flow over various bodies. Shock charts to analyse flows.

Bibliography:

<u>Essential reading:</u>
Cengel, Y.A. and Boles, M. (2010) *Thermodynamics: An Engineering Approach,* McGraw-Hill.

<u>Recommended reading:</u>
Rogers and Mayhew (1995) *Thermodynamic and Transport Properties of Fluids*, Blackwell.
Joel, R. (1995) *Basic Engineering Thermodynamics*, Longman.
Massey (2000) *Mechanics of Fluids*, Van Nostrand Reinhold.
Douglas et al (1995) *Fluid Mechanics*, Longman.
Thomas (1993) *Heat Transfer*; Prentice-Hall.

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MODULE SPECIFICATION FORM*

Module Title:	**Advanced Materials**	Level:	**6**	Credit Value:	**10**

Module code: (if known)	**ENG677**	Cost Centre:	**GAME**	JACS2 code:	H410

Semester(s) in which to be offered:	**1**	With effect from:	**September 2014**

Office use only: To be completed by AQSU:	Date approved: Date revised: Version No:	 1

Existing/New:	**Existing**	Title of module being replaced (if any):

Originating Academic area:	**Engineering and Applied Physics**	Module Leader:	**R Bolam**

Module duration (total hours)	100	**Status:** core/option/elective (identify programme where appropriate):	**Free-standing 10-credit component comprising half of ENG621 (Modern Aircraft Materials and Technologies).**
Scheduled learning and teaching hours	36		
Independent study hours	64		
Placement hours	0		

Percentage taught by Subjects other than originating Subject (please name other Subjects):	**0%**

Programme(s) in which to be offered: **Enginering European Programme** (Non Award Bearing)	Pre-requisites per programme (between levels):	**None**

Module Aims:

- To extend previous knowledge of materials and components by analysing the latest developments in aerospace industry.
- To apply comprehensive analytical methods to materials and technology, including eco-auditing, from industrial perspective.

Expected Learning Outcomes

Knowledge and Understanding:

At the completion of this module, the student should be able to:

1. Review and critically evaluate present and emerging processes for producing composites and new materials, including "smart" materials;
2. Apply a range of analytical and characterisation methods and select the most appropriate one on the basis of application data and type of composite material;
3. Evaluate and select aeronautical materials from eco-auditing and apply this to industrial scenarios and critically appraise the results; *(KS 7)*

Key skills for employability

1. Written, oral and media communication skills,
2. Leadership, team working and networking skills
3. Opportunity, creativity and problem solving skills
4. Information technology skills and digital literacy
5. Information management skills
6. Research skills
7. Intercultural and sustainability skills
8. Career management skills
9. Learning to learn (managing personal and professional development, self management)
10. Numeracy

Assessment: *Please indicate the type(s) of assessment (eg examination, oral, coursework, project) and the weighting of each (%).*

Assessment is by means of an examination covering all outcomes. It is an unseen time-constrained exam. (This corresponds to Assessment 1 of ENG621.)

Assessment number (use as appropriate)	Learning Outcomes met	Type of assessment	Weighting	Duration (if exam)	Word count (if coursework)
Assessment One:	1, 2, 3	Examination	100%	2 hr	

Learning and Teaching Strategies:

The module will be presented to students through a series of lectures, tutorials, interactive web-based analytical software and case studies utilising laboratory equipment where appropriate. Problem based learning (PBL) approach will be employed and students will be presenting their detailed analysis as a part of their portfolio.

Syllabus outline:

Materials, manufacturing and properties: Strengthening in composite materials. Manufacturing techniques. Fibre reinforced polymers. Anisotropy in composites. Metal matrix (MMC) and ceramic matrix (CMC) composites. Cellular materials. High performance super alloys. Introduction to novel and smart materials for aeronautical applications. Degradation of materials and anti-degradation measures.

Analysis of Materials: Introduction to the major theories of composites (e.g. failure envelopes, Tsai-Hill criteria etc.) relating to stiffness and strain in continuous and short fibres. Analysis of 3D stress. Strengthening mechanism and failure mechanisms.

Eco-informed materials: Materials selection process (including economic aspects), Life cycle analysis (including end of life analysis), eco-audits, material efficiency, recycling of aeronautical materials, materials from renewable sources.

Bibliography:

Essential reading:

Ashby, M.F. et al. (2010) *Materials; engineering, science, processing and design*, 2nd Edn., London: Elsevier.

Strong, B. (2008) *Fundamentals of Composites Manufacturing: Materials, Methods and Applications*, 2nd Edn., Dearbon, Michigan: Society of Manufacturing Engineers.

Recommended reading:

Ashby, M.F. (2012) *Materials and the environment,* London: Elsevier.

Sholte, J. (2005) *Nanotechnology industry trends and applications*, Oxford: John Wiley and Sons.

Callister, W.F. (2005) *Fundamentals of materials science and engineering*, 4th Edn., Oxford: John Wiley and Sons.

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MODULE SPECIFICATION FORM*

Module Title:	**Electric Drives**	Level:	**6**	Credit Value:	**10**

Module code: (if known)	**ENG679**	Cost Centre:	**GAEE**	JACS2 code:	H650

Semester(s) in which to be offered:	**1**	With effect from:	**September 2014**

Office use only: To be completed by AQSU:	Date approved: Date revised: Version No:	 1

Existing/New:	**Existing**	Title of module being replaced (if any):

Originating Academic area:	**Engineering and Applied Physics**	Module Leader:	**Y. Vagapov**

Module duration (total hours)	100	**Status:** core/option/elective (identify programme where appropriate):	**Free-standing 10-credit component comprising half of ENG645 (Power Electronics and Electric Drives).**
Scheduled learning and teaching hours	36		
Independent study hours	64		
Placement hours	0		

Percentage taught by Subjects other than originating Subject (please name other Subjects):	**0%**

Programme(s) in which to be offered: **Enginering European Programme** (Non Award Bearing)	Pre-requisites per programme (between levels):	**None**

Module Aims:

To develop the students' abilities to analyse techniques and performance of ac and dc electric drives by an in-depth knowledge of the principles of operation in order to exercise the ability to select an appropriate system for a given task.

Expected Learning Outcomes

Knowledge and Understanding:
At the completion of this module, the student should be able to:

1. Analyse the operating characteristics of the dc and ac electric drives with interaction to mechanical loads; *(KS 10)*
2. Evaluate the various types of electric drives used in industry and select the appropriate system for optimum performance. *(KS 5)*

Key skills for employability

1. Written, oral and media communication skills,
2. Leadership, team working and networking skills
3. Opportunity, creativity and problem solving skills
4. Information technology skills and digital literacy
5. Information management skills
6. Research skills
7. Intercultural and sustainability skills
8. Career management skills
9. Learning to learn (managing personal and professional development, self management)
10. Numeracy

Assessment: *Please indicate the type(s) of assessment (eg examination, oral, coursework, project) and the weighting of each (%).*

Assessment is by means of a written examination covering all outcomes. It is an unseen time-constrained exam.
(This corresponds to one-half (part B) of the examination of ENG645.)

Assessment number (use as appropriate)	Learning Outcomes met	Type of assessment	Weighting	Duration (if exam)	Word count (if coursework)
Assessment One:	1, 2	Examination	100%	2 hr	

Learning and Teaching Strategies:

The module will be delivered through lectures, tutorials and student-driven investigative work. A significant amount of the content is to be achieved through individual study. Approximately one third of the timetabled time will be devoted to formal lectures. The remainder of the time will be allocated to tutorials and to individual study but also with some programmed access to lab/computer facilities, for practical investigation and analysis activities.

Syllabus outline:

Introduction to Electric Drives: Mechanical system requirement for electric drives, Torque, speed and inertia in electric drive systems, Steady state and dynamic conditions, Coupling mechanisms, Rotary to linear motion, Gears, Optimum gear ratio, Types of load, Four quadrant operation.

Industrial Motor Control: Control devices, Induction motor control applications: Across-the-line starter, Reversing the direction of rotation, Primary resistance starting, Star-delta starting.

DC Electric Drives: Methods of speed control of dc motors, Speed control by controlled rectifiers, Dynamic model of dc motor, Block diagram and transfer function of dc motor, Dynamic behaviour of dc motor, Torque, speed and position sensors and feedbacks, Closed loop torque, speed and position control, Resistance starting, Dynamic braking.

AC Electric Drives: Methods of speed control of ac motors, Variable frequency converter and cycloconverter, Speed control of squirrel cage induction motor by static voltage regulator, Speed control of wound rotor induction motor with recovering slip power.

Motor Selection: Power range, Load requirements, Thermal consideration, duty cycle and rating, Enclosures and cooling, Dimension standards, Energy saving applications

Bibliography:

Essential reading:
Mohan, N. (2012) *Electric Machines and Drives: A First Course*, Hoboken: Wiley.

Recommended reading:
Wildi, T. (2005) *Electrical Machines, Drives and Power Systems*, 6th Edn., Englewood Cliffs: Prentice-Hall
Chapman, S. J. (2011) *Electric Machinery Fundamentals*, 5th Edn., New York: McGraw-Hill.
Hubert, C.I. (2002) *Electric Machines: Theory, Operating Applications and Control*, 2nd Edn., Englewood Cliffs: Prentice-Hall

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MODULE SPECIFICATION FORM

Module Title:	**Aerodynamics A**	Level:	**6**	Credit Value:	**10**

Module code: (if known) **ENG6xx**	Cost Centre: **GAAE**	JACS2 code: H440

Semester(s) in which to be offered: **1**	With effect from: **September 2014**

Office use only: To be completed by AQSU:	Date approved: Date revised: Version No:	1

Existing/New: **New**	Title of module being replaced (if any): N/A

Originating Academic area: **Engineering and Applied Physics**	Module Leader: **S Monir**

Module duration (total hours)	100	**Status:** core/option/elective (identify programme where appropriate):	**Free-standing 10-credit component comprising half of ENG619 (Aerodynamics and CFD).**
Scheduled learning and teaching hours	36		
Independent study hours	64		
Placement hours	0		

Percentage taught by Subjects other than originating Subject (please name other Subjects):	**0%**

Programme(s) in which to be offered: **Enginering European Programme** (Non Award Bearing)	Pre-requisites per programme (between levels):	**None**

Module Aims:

To analyse the properties of the atmosphere, the effect of forces on the aerodynamic characteristics of aircraft and vehicles, the mechanics of flight and aircraft performance, thus to evaluate design features which provide static and dynamic stability and the forces affecting aircraft stability.

Expected Learning Outcomes

Knowledge and Understanding:
At the completion of this module, the student should be able to:

1. Analyse the properties of air and the atmosphere; calculate the effect of forces on the aerodynamic characteristics of vehicles;
2. Apply the mechanics of airflows to aircraft/vehicle performance; (KS 5)
3. Define those design features which provide static and dynamic stability; solve problems involving forces affecting land vehicle and aircraft stability; (KS 3)

Key skills for employability

1. Written, oral and media communication skills,
2. Leadership, team working and networking skills
3. Opportunity, creativity and problem solving skills
4. Information technology skills and digital literacy
5. Information management skills
6. Research skills
7. Intercultural and sustainability skills
8. Career management skills
9. Learning to learn (managing personal and professional development, self management)
10. Numeracy

Assessment: *Please indicate the type(s) of assessment (eg examination, oral, coursework, project) and the weighting of each (%).*

Assessment is by means of an examination covering all outcomes. It is an unseen time-constrained exam. (This corresponds to the 'examination' element of ENG619.)

Assessment number (use as appropriate)	Learning Outcomes met	Type of assessment	Weighting	Duration (if exam)	Word count (if coursework)
Assessment One:	1, 2, 3	Examination	100%	2 hr	

Learning and Teaching Strategies:

The aerodynamics will be delivered by a set of structured lectures backed up by tutorials. Laboratory work and computer packages will be utilised where appropriate to aid learning.

Syllabus outline:

Properties of the atmosphere: Properties of atmosphere, Ideal gas law, S.I. units.

Effect of forces on the aerodynamic characteristics of aircraft and vehicles:

Forces of importance: thrust, lift and drag. Moments. Centre of Gravity, Centre of Pressure, and Aerodynamic centre. Relationship between these positions.

Aerodynamic characteristics: Reynolds number, coefficients, coefficients of lift, drag and moment.

Mechanics of flight and vehicle performance:

Flight: Forces involved in climbing flight, gliding flight. Rate of descent and endurance. Criteria for aircraft control in a horizontal turn. Maximum range/endurance conditions for engine types.

Land vehicles: this section can consider aerodynamic forces at different velocities, skids, turns, effects of aerofoils, efficiency, power. Maximum range/endurance conditions for engine types.

Design features which provide static and dynamic stability: Static and dynamic stability of aircrafts and vehicles. Functions of parts of the aircraft/vehicle that provide stability. Basic equations of equilibrium for aircraft/vehicles in selected types of motion. Forces and moments used in the analysis of the stability of aircraft/vehicles.

Forces affecting stability: Basic equations of equilibrium for an aircraft or land vehicle in selected types of motion. Forces and moments used in the analysis of stability.

Bibliography:

Essential reading:

Houghton, E.L., et al. (2012) *Aerodynamics for Engineering Students.* 6th Edn., Oxford: Butterworth-Heinemann.

Recommended reading:

Anderson, J.D. (2011) *Introduction to Flight*. 7th Edn., McGraw-Hill Higher Education

Dingle, L.and Tooley, M. (2012) *Aircraft Engineering Principles*, 2nd Edn., Oxford: Butterworth-Heinemann

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MODULE SPECIFICATION FORM*

Module Title:	**Communication Systems Engineering**	Level:	**6**	Credit Value:	**10**

Module code: **ENG6xx** (if known)	Cost Centre: **GAEE**	JACS2 code: H640

Semester(s) in which to be offered: **1**	With effect from: **September 2014**

Office use only: To be completed by AQSU:	Date approved: Date revised: Version No:	 1

Existing/New: **New**	Title of module being replaced (if any):

Originating Academic area: **Engineering and Applied Physics**	Module Leader: **B. Klaveness**

Module duration (total hours)	100	**Status:** core/option/elective (identify programme where appropriate):	**Free-standing 10-credit component comprising half of ENG638 (Communications Engineering).**
Scheduled learning and teaching hours	36		
Independent study hours	64		
Placement hours	0		

Percentage taught by Subjects other than originating Subject (please name other Subjects):	**0%**

Programme(s) in which to be offered: **Enginering European Programme** (Non Award Bearing)	Pre-requisites per programme (between levels):	**None**

Module Aims:

To review digital communication techniques based on satellite, optical, mobile and wired technologies and relate these to current communications systems – both discrete and integrated;

Expected Learning Outcomes

Knowledge and Understanding:

At the completion of this module, the student should be able to:

1. Analyse the operating principles and structures of different communication networks;
2. Evaluate the performance of digital communication systems, including satellite, optical, mobile and wired systems, using standard criteria and international standards; *(KS 5)*
3. Synthesise the range digital communications techniques in order to produce integrated system structures which will support the range of applications anticipated in the future. *(KS 9)*

Key skills for employability

1. Written, oral and media communication skills,
2. Leadership, team working and networking skills
3. Opportunity, creativity and problem solving skills
4. Information technology skills and digital literacy
5. Information management skills
6. Research skills
7. Intercultural and sustainability skills
8. Career management skills
9. Learning to learn (managing personal and professional development, self management)
10. Numeracy

Assessment: *Please indicate the type(s) of assessment (eg examination, oral, coursework, project) and the weighting of each (%).*

Assessment is by means of an examination covering all outcomes. It is an unseen time-constrained exam. (This corresponds to assessment 2 – examination - of ENG638.)

Assessment number (use as appropriate)	Learning Outcomes met	Type of assessment	Weighting	Duration (if exam)	Word count (if coursework)
Assessment One:	1, 2, 3	Examination	100%	2 hr	

Learning and Teaching Strategies:

The module will be presented to the learner through a series of lectures and tutorials. A case study will be used as part of an investigative exercise to support learning. Students will also be required to support these studies with further reading and Internet searches.

Syllabus outline:

Overview: Discrete and Integrated Applications Systems: Mobile, internet, broadcast, cable, terrestrial, satellite, point-to-point, public and local area networks.
Voice communication, audio and video transfer, industrial and commercial data transfer.
Trends and future developments.

Satellite communication: Earth station. Satellite orbit and systems. Design and analysis of up-link and down-link systems. DBS and basic satellite receiver design principles. Satellite TV, types of modulation systems, PAL, MAC, MPEG, JPEG. Compare different scrambling, compression, decoding, and error correction systems.

Optical Fibre Communication: System components. Modulation and demodulation of light. Operating frequency. Ray theory transmission (T.I.R., critical angle, acceptance angle, numerical aperture, skew rays). Material absorption (extrinsic, intrinsic). Scattering Losses (linear - Mie, Rayleigh; non-linear - Raman, Brilloun). Intramodal and intermodal dispersion. Types of optical fibre cable**,** R.I. profile, relative cost of Step index fibres (multimode, monomode), Graded index fibres. Optical sources and detectors, L.E.D. (types, principle of operation, limitations). Laser (basic concept, semiconductor injection laser, characteristics). Photodiode, APD, phototransistor (principle of operation, characteristics, advantages and disadvantages). Choice of fibre type and operating frequency, compatibility with source and detector for optimal performance. Alignment and joint loss. Coupling efficiency. Power budget calculations.

Bibliography:

Essential reading:

Roddy, D. (2006) *Satellite Communications,* **McGraw-Hill.**
Senior, J. (2008) *Optical Fiber Communications: Principles and Practice*, 3rd Edn., Prentice-Hall.

Recommended reading:

Othman, M. (2008) *Principles of mobile computing and communications,* **Boca Raton.**

MODULE SPECIFICATION FORM

Module Title:	**Computational Fluid Dynamics (CFD)**	Level:	**6**	Credit Value:	**10**

Module code: (if known)	**ENG6xx**	Cost Centre:	**GAME**	JACS2 code:	H440

Semester(s) in which to be offered:	**1**	With effect from:	**September 2014**

Office use only: To be completed by AQSU:	Date approved: Date revised: Version No:	 1

Existing/New:	**New**	Title of module being replaced (if any):	**Computer Analytical Tools B (ENG664)**

Originating Academic area:	**Engineering and Applied Physics**	Module Leader:	**S. Monir**

Module duration (total hours)	100	**Status:** core/option/elective (identify programme where appropriate):	**Free-standing 10-credit component comprising half of ENG619 (Aerodynamics and CFD).**
Scheduled learning and teaching hours	36		
Independent study hours	64		
Placement hours	0		

Percentage taught by Subjects other than originating Subject (please name other Subjects):	**0%**

Programme(s) in which to be offered: **Enginering European Programme** (Non Award Bearing)	Pre-requisites per programme (between levels):	**None**

Module Aims:

To develop an understanding of processes involved in the application of computer-based modelling and analysis software and practical experience at deriving solutions for engineering tasks.
This module aim to develop industry-standard software techniques to model and solve aeronautical, mechanical and automotive engineering problems.

Expected Learning Outcomes

Knowledge and Understanding:
At the completion of this module, the student should be able to:

1. Identify and describe the main areas where computational analysis can be applied and the key stages associated with practical CFD analysis; *(KS 5)*
2. Define the key stages involved with utilising design variables in performing design sensitivity and optimisation studies; utilise CFD techniques to analyse practical design problems;
3. Define current industrial practice with respect to the application of analysis and simulation methods. *(KS 4)*

Key skills for employability

1. Written, oral and media communication skills,
2. Leadership, team working and networking skills
3. Opportunity, creativity and problem solving skills
4. Information technology skills and digital literacy
5. Information management skills
6. Research skills
7. Intercultural and sustainability skills
8. Career management skills
9. Learning to learn (managing personal and professional development, self management)
10. Numeracy

Assessment: *Please indicate the type(s) of assessment (eg examination, oral, coursework, project) and the weighting of each (%).*

Assessment: is by means of a coursework on CFD and is assessed via a series of developmental exercises modelling air flow around different objects, such as aerofoil, cooling fan and lorry, investigating the aerodynamic behaviours and comparing the simulation data with experimental results. Each stage would be evaluated on a week-by-week basis as the exercise develops. It covers all outcomes.
(This corresponds to the 'coursework' element of ENG619.)

Assessment number (use as appropriate)	**Learning Outcomes met**	**Type of assessment**	**Weighting**	**Duration (if exam)**	**Word count (if coursework)**
Assessment One:	1, 2, 3	Coursework	100%		2000

Learning and Teaching Strategies:

The CFD module will take the form of practical exercises, using specialist software, supported by introductory lectures and demonstrations.

Syllabus outline:

CFD Software: Introduction to Computational Fluid Dynamics (CFD) and its role as an enabling technology in a 'time to market strategy' using ANSYS Gambit and Fluent;

Model Definitions: definition of geometry and mesh set-up; selection of models; specifications of boundary conditions;

Case Study; interpretation of results;

CFD Analytical Activities: further development of theoretical concepts in fluid mechanics applicable to CFD; studies of fluid flows in cases of 2-D and 3-D modelling; boundary layer theory and turbulence modelling.

Bibliography:

Essential reading:
Houghton, E.L. and Carpenter, P.W. (2006) *Aerodynamics for Engineering Students*, Butterworth-Heinemann.

Recommended reading:
Versteeg, H. K. and Malalasekera, W. (2007) A*n introduction to computational fluid mechanics*. 2nd Edn., Oxford: Longman
Chung, T.J. (2011) *Computational Fluid Dynamics*. 2nd Edn., Cambridge: Cambridge University Press

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MODULE SPECIFICATION FORM*

Module Title:	**Power Electronics**	Level:	**6**	Credit Value:	**10**

Module code: (if known)	**ENG6xx**	Cost Centre:	**GAEE**	JACS2 code:	H650

Semester(s) in which to be offered:	**1**	With effect from:	**September 2014**

Office use only: To be completed by AQSU:	Date approved: Date revised: Version No:	 1

Existing/New:	**New**	Title of module being replaced (if any):

Originating Academic area:	**Engineering and Applied Physics**	Module Leader:	**Y. Vagapov**

Module duration (total hours)	100	**Status:** core/option/elective (identify programme where appropriate):	**Free-standing 10-credit component comprising half of ENG645 (Power Electronics and Electric Drives).**
Scheduled learning and teaching hours	36		
Independent study hours	64		
Placement hours	0		

Percentage taught by Subjects other than originating Subject (please name other Subjects):	**0%**

Programme(s) in which to be offered: **Enginering European Programme** (Non Award Bearing)	Pre-requisites per programme (between levels):	**None**

Module Aims:

To develop the understanding of power electronic devices into the control or provision of power supplies and in controlling electrical machinery and thus to design and prove electronics-based circuits for the control of electrical machines and power supplies.

Expected Learning Outcomes

Knowledge and Understanding:
At the completion of this module, the student should be able to:

1. Comprehensively understand the principles and operation of the electronic devices available for power applications;
2. Critically analyse and evaluate the effects of power electronics equipment on electrical supplies and loads;
3. Apply appropriate techniques in the design of different types of converters; *(KS 10)*

Key skills for employability

1. Written, oral and media communication skills,
2. Leadership, team working and networking skills
3. Opportunity, creativity and problem solving skills
4. Information technology skills and digital literacy
5. Information management skills
6. Research skills
7. Intercultural and sustainability skills
8. Career management skills
9. Learning to learn (managing personal and professional development, self management)
10. Numeracy

Assessment: *Please indicate the type(s) of assessment (eg examination, oral, coursework, project) and the weighting of each (%).*

Assessment is by means of a written examination covering all outcomes. It is an unseen time-constrained exam.
(This corresponds to one-half (part A) of the examination of ENG645.)

Assessment number (use as appropriate)	Learning Outcomes met	Type of assessment	Weighting	Duration (if exam)	Word count (if coursework)
Assessment One:	1, 2, 3	Examination	100%	2 hr	

Learning and Teaching Strategies:

The module will be delivered through lectures, tutorials and student-driven investigative work. A significant amount of the content is to be achieved through individual study. Approximately one third of the timetabled time will be devoted to formal lectures. The remainder of the time will be allocated to tutorials and to individual study but also with some programmed access to lab/computer facilities, for practical investigation and analysis activities.

Syllabus outline:

Power Semiconductor Devices: Operation, characteristics, ratings, applications of diodes, thyristors, MOSFETs, IGBTs. Darlington-pair configuration, transistor as a switch. Analysis and calculation of power losses in power semiconductors. Selection of devices for particular tasks.

Thermal Consideration: Cooling systems and heat sinks. Thermal resistances. Thermal equivalent circuits. Heat transfer coefficient. Analysis and calculation of heat sink parameters.

AC–DC Converters - Rectifiers: Principle of operation of controlled rectifiers. Thyristor firing methods. Phase control firing circuits. Natural and forced commutation circuits. Single-phase and three-phase bridge rectifiers operating under different load conditions. Harmonics and power factor improvement.

DC–DC Converters: Principle of operation and characteristics of step-down, step-up, inverting converters. Duty ratio and voltage control.

DC–AC Converters - Inverters: Principle of operation and characteristics of single-phase and three-phase inverters. Pulse width modulation. Voltage control and harmonics.

Power Electronic Applications: Switching mode power supplies, Uninterruptible power sources. Power factor correctors. Static voltage regulators.

Bibliography:

Essential reading:
Hart, D.W. (2011) *Power Electronics*, New York: McGraw-Hill.
Mohan, N. (2012) *Power Electronics: A First Course*, Hoboken: Wiley.

Recommended reading:
Wildi, T. (2005) *Electrical Machines, Drives and Power Systems*, 6th Edn., Englewood Cliffs: Prentice-Hall
Chapman, S. J. (2011) *Electric Machinery Fundamentals*, 5th Edn., New York: McGraw-Hill.
Hubert, C.I. (2002) *Electric Machines: Theory, Operating Applications and Control*, 2nd Edn., Englewood Cliffs: Prentice-Hall