MODULE DESCRIPTOR

TITLE: ENGINEERING DYNAMICS AND THERMOFLUIDS
CODE: EAT339
CREDITS: 20
LEVEL: 6 (Stage 3)
FACULTY: FAS
MODULE BOARD: Engineering
PRE-REQUISITES: EAT203, EAT223
CO-REQUISITES: None
LEARNING HOURS: 200

LEARNING OUTCOMES

Upon successful completion of this module, students will have demonstrated

Knowledge

1. Advanced knowledge of the principles underlying a range of engineering applications of engineering dynamics and thermofluids systems.
2. Critical knowledge of the significance of different parameters in the performance of engineering dynamics and thermofluids systems.

Skills

The ability to:

3. Independently and objectively analyse thermofluids systems in order to assess their performance.
4. Design from first principles a range of psychrometric and heat transfer systems.
5. Predict failure load and stresses in components due to a range of failure criteria including buckling.
6. Evaluate the dynamic characteristics of rotating systems and predict instability.
7. Model and analyse various dynamic systems and predict their response to numerous forms of disturbance.

CONTENT SYNOPSIS

Amplified Content

Thermofluids:

- First Law analysis of reacting systems: Molar enthalpies; isothermal combustion; enthalpy-temperature plots; enthalpy of formation; enthalpy of reaction; adiabatic flame temperature.
- Heat exchangers: heat transfer by convection and conduction; the LMTD design method; shell and tube heat exchanger design and analysis; derivation of shell side heat transfer coefficient.
- Psychrometry: composition of dry and moist air, humidity and the psychrometric chart; heating and cooling of moist air; the quality and quantity of supplied air; heating and ventilation loads; cooling towers, principles of performance and analysis.
- Transient conduction: finite difference methods; general conduction equation; the Biot number; the Schmidt-Binder method; the Saul'yev method; convective boundary conditions.

Engineering Dynamics and Analysis of Materials

- Forced vibrations with and without damping.
- Mathematical model and analyse of various dynamic systems and prediction of their response to numerous forms of external loading; non-constant excitation force; vibration transmission and isolation; base excitation (seismic vibration); vibration measurement.

- Two-degrees-of-freedom systems; definite and semi-definite systems; response to forced excitation; dynamic vibration absorber; transverse vibration of beams.
- Vibration of continuous systems using the energy and Dunkerley's methods; higher order natural frequencies; whirling and rotating shafts; dynamics of rotating shafts; critical speed and whirling characteristics.
- Strain energy techniques in stress analysis; axi-symmetrical stress systems; thick cylinders, compound cylinders, rotating cylinders and discs; failure of components through excessive deflection; buckling of struts.

The following mathematical techniques are used and developed at various times throughout the module: differentiation and integration; solution of simultaneous equations; ordinary differential equations; partial differential equations; Taylor series; numeric methods; solutions of second order differential equations and double integration techniques.

TRANSFERABLE SKILLS

- Understanding of scientific and mathematical principles and methodologies underpinning an engineering degree and the ability to integrate these to achieve the solution to real problems.
- Understanding of engineering principles and the ability to apply them to analyse key engineering processes.

TEACHING AND LEARNING METHODS:

Scheduled activities		**Independent study**		**Placement**		**Total hours**
Hours	Detail	Hours	Detail	Hours	Detail	
60	Lectures and tutorials	100	Private study (library and on line), directed reading, revision.			160
10	Formative Assessment	10	Private study activities working towards completion of formative assessment work			20
10	Summative Assessment	10	Private study (library and on line), revision for summative assessment exam			20
					Total	200

The learning on this module will be through the use of lectures and tutorials. Additional tutorial support will be mostly provided by the VLE.

ASSESSMENT METHODS

						Required For KIS return to HESA							
Seq.	Element *(1)*	% of module assessment weighting *(2)*	Summary *(3)*	Pass Mark	LO	Written exam – central timetable (% of the element)		Written exam – local timetable (% of the element)		Coursework (% of the element)		Practical (% of the element)	
						% *(4)*	Type	% *(5)*	Type	% *(6)*	Type	% *(7)*	Type
001	Exam	100	Exam	40	1,2,3,4,5,6,7	100	Exam	0		0	–	0	–

Assessment 001 Examination, contributing 100% to the overall module mark and assessing ALL learning outcomes.

INDICATIVE READING LIST

1. Rogers, G.F.C. and Mayhew, Y.R. (1992) Engineering Thermodynamics, Work and Heat Transfer 6th Edition, Longman Scientific, ISBN-10: 0582045665; ISBN-13: 978-0582045668
2. Rogers, G.F.C. and Mayhew, Y.R. (1994) Thermodynamics and Transport Properties of Fluids; 5th Wiley-Blackwell, ISBN-10: 0631197036; ISBN-13: 978-0631197034
3. Cengel, Y.A. & Boles, M.A. (2010) Thermodynamics: An Engineering Approach, 7th Edition, McGraw HillISBN-10: 0071311114; ISBN-13: 978-0071311113
4. Holman, J. (2009) Heat Transfer, 10th Edition, McGraw Hill. ISBN-10: 0071267697; ISBN-13: 978-0071267694
5. Fenner, R.T. (1989) Mechanics of Solids, 1st Ed. Blackwell Blackwell Scientific, ISBN: 0632020180.
6. Fawcett, J.N. and Burdess, J S. (2011) Basic Mechanics with Engineering Applications, 5th Ed. Buttermouth-Heinemann, ISBN: 9780415503174.
7. Gere, J. and Goodno, B. (2009) Mechanics of Materials, 8th Ed. Global Engineering, ISBN: 9781111577735
8. Den Hartog, J. (2008) Mechanical Vibrations, 3RD Ed. Crastre Press, ISBN: 9781443725361.
9. Rees, D. W. (1990) Mechanics of Solids and Structures, London- McGraw Hill, ISBN 9780077072223.
10. Case, J., Chilver, L., and Ross, C. (1999) Strength of Materials and Structures, 4th Ed. Buttermouth Heinemann, ISBN: 0340719206.
11. Meirovitch, L. (2000) Fundamentals of Vibrations, McGraw-Hill International Edition: Mechanical Engineering Series, ISBN: 9780071181747.

PROGRAMMES USING THIS MODULE AS CORE/OPTION:
B.Eng.(Hons) Mechanical Engineering (core)

The programme is delivered On Campus and Off Campus

College(s):
University of Sunderland
SEGi University College Kota Damansara, Malaysia
SEGi College Subang Jaya, Malaysia
TEG International College Singapore
International College of Business and Technology Sri Lanka

Penang Skills Development Centre (PSDC)

Work based learning: No

Professional Accreditation: No
This replaces two previously accredited modules with little or no content change. Formal accreditation of the module will be sought in 2015/6
The Institution of Engineering and Technology - The IET
No specific conditions for this module. Refer to Programme Specific Regulations.

MODULE LEADER

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LEAD DELIVERERS

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JACS Code: H300 (Mechanical Engineering)