MODULE DESCRIPTOR

Module Title

Engineering Analysis A

Reference	EN3110	Version	5
Created	February 2024	SCQF Level	SCQF 9
Approved	December 2020	SCQF Points	30
Amended	April 2024	ECTS Points	15

Aims of Module

To provide the student with the ability to apply thermo-fluid science to engineering problems, as well as to critically analyse the dynamic structural behaviour of engineering system components.

Learning Outcomes for Module

On completion of this module, students are expected to be able to:

1	Interpret the principles of thermodynamics to problems involving power processes.
2	Interpret the principles of fluid mechanics to problems involving flow systems.
3	Explain vibrational analysis of simple systems, and their application to the design and analysis of engineering systems.
4	Determine the natural frequencies and mode shapes of linear and rotational vibrational systems having two, three and more degrees of freedom (of vibration isolators and absorbers, rotational machinery, gear shaft systems and shafts).
5	Assess dynamic theory and the use of numerical calculations for problems related to vibration of complex systems.

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Indicative Module Content

1st and 2nd Law of Thermodynamics, Reversible and Irreversible processes, Entropy. Heat Engine: Carnot cycle, Rankine cycle, Air Standard cycle, IC engines, Otto cycle, Diesel cycle. Heat transfer modes (conduction and convection). Hydrodynamics, pressure distribution in fluids; Bernoulli's equation and flow through orifices, jets, Venturis, etc. Flow measuring devices. The momentum equation for flowing fluids; application to jet reaction, forces on bends, fixed and moving vanes; fluid machinery. Flow in pipe, Reynolds' experiments, laminar and turbulent flow, pipe wall friction, friction factor, pipe wall roughness, flow in pipe systems, pipe design. Free vibration of undamped 1-DOF systems. Dynamic equivalence of engineering systems. Free and forced vibration of damped 1-DOF systems. Transient response to simple inputs. Steady-state sinusoidal response. Vibration isolation and forces transmitted to supports. Impulse force, impact and momentum. Kinetic and potential energy. Balancing of rigid rotors. Single plane and two-plane balancing Dynamics of engineering systems of two and more degrees of freedom; vibrational analysis of engineering components; basic numerical methods for dynamic analysis; Rayleigh's energy method. Derivation of equation of motion and 'eyeballing' methods of determining the matrix characteristics equations. Forced vibration response of 2 degree of freedom problems and analysis of the role of tuners and absorbers Vibration analysis of multi degree-of-freedom and continuous systems to periodic and transient loading. Systems modelling, transfer functions, transient and steady state response methods, frequency response methods, stability analysis.

Module Delivery

The module is delivered in Blended Learning mode using structured online learning materials/activities and directed study, facilitated by regular online tutor support. Workplace Mentor support and work-based learning activities will allow students to contextualise this learning to their own workplace. Face-to-face engagement occurs through annual induction sessions, employer work-site visits, and modular on-campus workshops.

Indicative Student Workload	Full Time	Part Time
Contact Hours	30	N/A
Non-Contact Hours	30	N/A
Placement/Work-Based Learning Experience [Notional] Hours	240	N/A
TOTAL	300	N/A
Actual Placement hours for professional, statutory or regulatory body	240	

ASSESSMENT PLAN

If a major/minor model is used and box is ticked, % weightings below are indicative only.

Component 1

Type:	Coursework	Weighting:	30%	Outcomes Assessed:	1, 2
Description:	Online test.				

Component 2

Type:	Coursework	Weighting:	70%	Outcomes Assessed:	3, 4, 5
Description:	Coursework covering vibration.				

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MODULE PERFORMANCE DESCRIPTOR

Explanatory Text

The module has 2 components and to gain an overall pass a minimum D grade must be achieved in each component. The component weighting is as follows: C1 (x-axis) is worth 30% and C2 (y-axis) is worth 70%.

		Coursework:						
		A	**B**	**C**	**D**	**E**	**F**	**NS**
Coursework:	**A**	A	A	B	B	E	E	
	B	B	B	B	C	E	E	
	C	B	C	C	C	E	E	
	D	C	C	D	D	E	E	
	E	E	E	E	E	E	F	
	F	F	F	F	F	F	F	
	NS	Non-submission of work by published deadline or non-attendance for examination						

Module Requirements

Prerequisites for Module	Completion of EN2108, EN2101, EN2102, EN2103 or equivalent.
Corequisites for module	None.
Precluded Modules	None.

INDICATIVE BIBLIOGRAPHY

1	KELLY S.G., 2012. Mechanical Vibrations: Theory and Applications (SI edition), Cengage Learning.
2	RAO, S.S., 2011, Mechanical Vibrations (5th ed in SI units). Pearson Prentice Hall.
3	CENGEL, Y. A. and ROBERT, H., 2012. Fundamental of Thermal-Fluid Sciences. Turner. MERIAM
4	MUNSON, B.R., OKIISHI, T.H., HUEBSCH, W.W. and ROTHMAYER, A.P., 2017. Fluid Mechanics. 7th ed. Wiley
5	MATLAB Getting Started Guide, Mathworks