Liverpool John Moores University

Title:	ENGINEERING PRINCIPLES
Status:	Definitive
Code:	**4110BEUG** (118098)
Version Start Date:	01-08-2014
Owning School/Faculty:	Built Environment
Teaching School/Faculty:	Built Environment

Team	Leader
Andy Shaw	Y
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Academic Level:	FHEQ4	**Credit Value:**	24.00	**Total Delivered Hours:**	75.00
Total Learning Hours:	240	**Private Study:**	165		

Delivery Options
Course typically offered: Standard Year Long

Component	Contact Hours
Lecture	24.000
Practical	24.000
Tutorial	24.000

Grading Basis: 40 %

Assessment Details

Category	Short Description	Description	Weighting (%)	Exam Duration
Portfolio	AS1		30.0	
Exam	AS2		70.0	3.00

Aims

This module introduces the fundamental concepts and principles of mechanical and electrical engineering, heat transfer, thermodynamics and fluid mechanics, and the application of these to engineering problems in the built environment.

Learning Outcomes

After completing the module the student should be able to:

1 Apply the basic principles of mechanical engineering to common problems in the built environment.
2 Apply the basic principles of human thermal comfort and heat transfer to common problems in the built environment.
3 Apply the basic principles of electrical engineering to common problems in the built environment.
4 Apply the basic principles of thermodynamics and fluid mechanics to common problems in the built environment.
5 Explain the principles of thermodynamic cycles and the application of these in the operation of refrigeration plant and heat pumps

Learning Outcomes of Assessments

The assessment item list is assessed via the learning outcomes listed:

Lab folio	4			
Examination	1	2	3	5

Outline Syllabus

Mechanical Engineering

Dynamics of solid bodies; Newton's laws of motion, application to linear and angular motion and connected systems.
Work, power and energy; conservation of energy, application to building systems.
Impulse and momentum; conservation of momentum, application to building systems.
Acoustics; measurement of sound levels, insulation, absorption, attenuation, acoustic characteristics of building materials and systems, noise control in buildings.
Vibration; simple harmonic motion, modes of vibration, characteristics of springs, static and dynamic modulus of materials and natural frequency, vibration isolation and control in buildings.

Heat Transfer

Thermal comfort in humans; factors affecting humans, thermal indices.
Heat transfer rates; principles of heat transfer by conduction, radiation and convection. Natural and forced convection.
Radiant heat transfer for black and grey body radiation.
Conduction through homogeneous and multi-layered structures.
Heat transfer through insulated surfaces, economic insulation thickness.
Temperature gradients and interstitial condensation risk in structures.

Electrical Engineering

Fundamental notations and relations of electrical properties; Ohm's Law, measurement of voltage, current and resistance.
Kirchhoff's Laws; series and parallel circuit equivalences.
Electromagnetism; induced emf's, transformers, power generation.
Semiconductors; diode action, capacitance, inductance.
Alternating current fundamentals; period, frequency, angular frequency; peak, rms and instantaneous values; complex representation of sinusoidal quantities, phasors.
Electrical networks; single phase AC circuits, quantities in series, parallel and combined RLC networks.
Resonant AC circuits; circuit resonance, circuit conditions at resonance for various arrangements of induction coil and capacitor, resonant frequency and dynamic frequency. Power factor; true, reactive and apparent power; power factor correction.

Thermodynamics & Fluid Mechanics

Thermodynamic definitions; physical properties of fluids and mixtures.
Hydrostatics; pressure and flow, forces on immersed surfaces and buoyancy.
Energy in flowing fluids; conservation of energy in a moving fluid, continuity, Bernoulli's equation and momentum equations with application to flow measuring devices.
Reynolds number: laminar and turbulent fluid flow, boundary separation and transition.
Energy losses in flowing fluids: principles and applications of frictional losses in pipe and duct networks and fittings.
Thermodynamic properties of fluids; application of the first law of thermodynamics to steady flow and non-flow processes for gases, vapours and liquids.
Basics of refrigeration cycles.
Dimensional analysis: units and dimensions in commonly used terms and parameters, Checking rational formulae. Identify dimensionless groups in rational and empirical formulae e.g. Reynolds Number, Grashof Number, Nusselt Number and Prandtl Number etc. Application of dimensional analysis to solve appropriate problems related to building services applications.
Thermodynamic cycles: Use of T-S and p-H diagrams to construct heating and cooling refrigeration cycles. Thermodynamic processes in refrigeration cycles, heat pumps and heat engines. Comparison between practical refrigeration/heat pump cycle and the Carnot Cycle. Performance analysis of refrigeration/heat pumps in cooling and heating modes. Mass flow rates, input power, capacity, efficiencies, temperature and COP for theoretical and actual cycle arrangements.

Learning Activities

The main concepts will be introduced by means of lectures and tutorials, and these will be applied using laboratory work.

References

Course Material	Book
Author	Rogers, G. & Mayhew, Y.

Publishing Year	1994
Title	Thermodynamic and Transport Properties of Fluids: S. I. Units
Subtitle	
Edition	5th
Publisher	Wiley-Blackwell
ISBN	9780631197034

Course Material	Book
Author	Sherwin, K. & Horsley, M.
Publishing Year	1996
Title	Thermofluids
Subtitle	
Edition	
Publisher	Chapman & Hall
ISBN	9780412598005

Course Material	Book
Author	Mayhew Y. & Rogers G
Publishing Year	1992
Title	Engineering Thermodynamics: Work and Heat Transfer
Subtitle	
Edition	4th
Publisher	Longman Scientific
ISBN	9780582045668

Course Material	Book
Author	Hannah J. & Hillier M
Publishing Year	1995
Title	Applied Mechanics
Subtitle	
Edition	
Publisher	Longman
ISBN	9780582256323

Course Material	Book
Author	Hambley A
Publishing Year	2014
Title	Electrical Engineering: Principles and Applications
Subtitle	
Edition	6th
Publisher	Pearson Education
ISBN	9780273793250

Notes

This module provides an education in the principle concepts of mechanical and electrical engineering to support studies in Building Services Engineering and similar engineering disciplines.