Liverpool John Moores University

Title:	AUTOMOTIVE THERMAL SYSTEMS
Status:	Definitive
Code:	**6092ENG** (115907)
Version Start Date:	01-08-2016
Owning School/Faculty:	Maritime and Mechanical Engineering
Teaching School/Faculty:	Maritime and Mechanical Engineering

Team	Leader
David Allanson	Y

Academic Level:	FHEQ6	**Credit Value:**	10	**Total Delivered Hours:**	51
Total Learning Hours:	100	**Private Study:**	49		

Delivery Options
Course typically offered: Standard Year Long

Component	Contact Hours
Lecture	21
Practical	6
Tutorial	21

Grading Basis: 40 %

Assessment Details

Category	Short Description	Description	Weighting (%)	Exam Duration
Exam	AS1	Examination	70	3
Portfolio	AS2	P:ortfolio of Case Study Work	15	
Report	AS3	Laboratory assignment	15	

Aims

To study automotive thermal systems, their analysis and performance prediction.

Learning Outcomes

After completing the module the student should be able to:

1 Apply the basic gas laws and energy balance equations to the analysis internal combustion engine cycles.
2 Undertake engine tests using a test bed engine dynamometer and associated instrumentation and analyse the resulting test data.
3 Demonstrate familiarity with a range of pressure charging systems and undertake turbocharger matching calculations using analysis and charts.
4 Apply the general equations of energy and mass transfer, tables and psychrometric charts in the analysis of automotive air conditioning processes.
5 Undertake the analysis of automotive cooling systems and compact automotive heat exchangers by application of heat transfer equations, tables.
6 Synthesize the design of specific configuration of automotive air conditioning and cooling systems.

Learning Outcomes of Assessments

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

EXAM	1	2	3	4	5	6
Portfolio of Case Study Work	4	5	6			
Laboratory assignment	1	2				

Outline Syllabus

Air standard cycles, Otto, Diesel and dual cycles. Ideal and actual thermodynamic cycles.
Criteria for internal combustion engine performance - BMEP, IMEP, FMEP, SFC, volumetric and other efficiencies.

Pressure charging, effects on performance. Superchargers. turobcharging and thermodynamic performance. Compressor and turbine characteristic. Matching Engine and turbocharger. Intercooler and intercooling. Waste gates.

Review elements of vapour compression refrigeration. Review laws of gas/vapour mixtures.
Psycrometry: air/water vapour mixtures, relative humidity, absolute humidity, use of tables, psychrometric charts. Unit processes: dehumidification, adiabatic saturation and cooling.

Analysis of automotive air conditioning and ventilation systems. Air recirculation, blending, air conditioning and dehumidification in automotive climate control systems.

Review of heat transfer principles, conduction, convection. Extended surfaces, fins, secondary surfaces. Compact heat exchanger analysis, LMTD and NTU methods, use of tables and charts. Heat exchange prediction, fouling factors, pressure loss calculations, heat exchanger types.

Radiator and heater matrix design, choice and selection of materials.

Learning Activities

A combination of lectures, tutorials and laboratory work.

Notes

The module will allow students to study the performance of automotive thermal systems at an advanced level. The main thermal systems are studied with particular reference to the use of theory, design charts and tabulated data.