COURSE OUTLINE

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APPLIED THERMODYNAMICS (SKMM 2423)	Revision : F Date of issue : 1 March 2015 Last Amendment : 1 March 2015 Edition : 3

PRE-REQUISITE	:	**SKMM 2413 (Thermodynamics)**
EQUIVALENCE	:	**-**
LECTURE HOURS	:	**3 Hours Lectures** **1 Hour Tutorial**

Lecturers	E-Mail	Room No.	Phone No.
1. En. Mohsin Mohd Sies	mohsin@fkm.utm.my	C24-313	34578
2. PM. Dr. Nazri Kamsah	nazrikh@fkm.utm.my	C25-413	34749
3. Dr. Mohd Faizal Hasan	mfaizal@mail.fkm.utm.my	C24-212	34852
4. Dr Zulkarnain Abdul Latiff	zkarnain@mail.fkm.utm.my	C25-411	34758
5. Dr. Aminuddin Saat	amins@fkm.utm.my	C23-216	34657
6 Pn. Natrah Kamaruzaman	natrah@mail.fkm.utm.my	C23-215	34663

SYNOPSIS

The aim of this course is to teach second-year mechanical engineering students on the application of thermodynamics principles to evaluate the performance criteria of various thermal systems. These includes the reciprocating air-compressor, internal combustion engines, vapor power plants, gas turbine plants, refrigeration and heat pump systems. Also, principles of conservation of mass and energy are applied to various air-conditioning processes to assess the energy transfer during the processes.

PREPARED BY :	**CERTIFIED BY :**
Name : Dr. Haslinda Mohamed Kamar	**Name** : Head of Thermodynamics Panel
Date : 1 March 2015	**Signature** : **Date** : 1 March 2015

COURSE OUTLINE

COURSE LEARNING OUTCOMES

By the end of the course, students should be able to :

No.	Course Learning Outcomes	Programme Outcome(s) Assessed	Bloom Taxonomy	Assessment Methods
1.	**Describe** the working principles of thermodynamics systems (steam & gas power plants; reciprocating compressors; internal combustion engines; refrigerators and heat pumps) and the important psychrometric properties of the atmospheric air.	PO1	C2	T, E
2.	**Analyze** the performance of thermodynamics systems (steam & gas power plants; reciprocating compressors; internal combustion engines; refrigerators and heat pumps).	PO1, PO2	C4	HW, T, E
3.	**Apply** the principles of the conservation of mass and energy to various air-conditioning processes.	PO1, PO2	C4	HW, E
4.	**Examine** ways for further improvement of thermodynamics systems thermal performance.	PO2	C4	PR

Note: (T – Test ; PR – Project ; HW – Homework ; Pr – Presentation; E – Final Exam)

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STUDENT LEARNING TIME

No.	Teaching and Learning Activities	Student Learning Time (hours)
1.	Lectures SCL	36 6
2.	Tutorials	14
3.	Independent Study / Assignment / Project	58
4.	Tests	3
5.	Final Exam	3
Total		**120 (120/40 = 3.00)**

TEACHING METHODOLOGY

1. Explain to students the fundamental theory and formulations related to each chapter.
2. Demonstrate solution to problem examples related to the various subtopics contained in each chapter.
3. Do class exercises where students are asked to solve problems from subtopics in each chapter. Students are encouraged to discuss with their peers during this session.
4. Conduct tutorial classes during which explanation on the fundamental theory and difficult formulations are further explained. Extra exercises are also given to students.

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WEEKLY SCHEDULE

Week	Lectures	Topics/Contents
1	1 - 3	**CHAPTER 8: STEAM CYCLES* (Pg 234)** 8-1 The Rankine Cycle; 8-2 Rankine Cycle with Superheat; 8-3 The Ehtnalpy-Entropy Chart;
2	4 - 6	8-4 The Reheat Cycle; 8-5 The Regenerative Cycle.
3-4	7 - 12	**CHAPTER 9: GAS TURBINE CYCLES* (Pg 260)** 9-1 The Practical Gas Turbine Cycle; 9-2 Modifications to the Basic Cycle: Intercooling; Reheat;
5	13 - 15	9-2 Modifications to the Basic Cycle: Heat Exchanger; Effect of Pressure Loss.
6-7	16 - 21	**CHAPTER 12: POSITIVE DISPLACEMENT MACHINES* (Pg 381)** 12-1 Reciprocating Compressors; 12-2 Reciprocating Compressors Including Clearance;
8		**MID SEMESTER BREAK**
9	22 - 24	12-3 Multi-stage Compression, 12-4 Steady-flow Analysis.

Reference Book: Y.A. Cengel & M.A. Boles, "Thermodynamics: An Engineering Approach", 6th Edition, McGraw-Hill Inc., New York, 2007.

* Reference Book: Eastop & McConkey, "Applied Thermodynamics for Engineering Technologists", 5th Edition, Prentice Hall (Pearson Education), Essex, England, 1993.

Steam Table: Use the steam table provided in "Thermodynamics: An Engineering Approach", 6th Edition, McGraw-Hill Inc., New York, 2007.

COURSE OUTLINE

WEEKLY SCHEDULE

Week	Lectures	Topics/Contents
10	25 - 27	**CHAPTER 13: RECIPROCATING INTERNAL-COMBUSTION ENGINES* (Pg 419)** 13-1 Four-stroke Cycle; 13-2 Two-stroke Cycle; 13-4 Criteria of Performance: Indicated Power; Brake Power; Friction Power and Mechanical Efficiency;
11	28 - 30	13-4 Criteria of Performance:BMEP, Thermal Efficiency and Fuel Consumption; Volumetric Efficiency.
12	31 - 33	**CHAPTER 14: REFRIGERATION AND HEAT PUMPS* (Pg 485)** 14-1 Reversed Heat Engine Cycles; 14-2 Vapour-Compression Cycles; 14-3 Refrigerating Load; 14-4 The Pressure-Enthalpy Diagram;
13	34 - 36	14-5 Compressor Types; 14-6 The Use of the Flash Chamber; 14-7 Vapour-Absorption Cycles.
14	37 - 39	**CHAPTER 15: PSYCHROMETRY AND AIR-CONDITIONING#** 15-1 Psychrometric mixtures; 15-2 Specific humidity, relative humidity and percentage saturation; 15-3 Specific enthalpy, specific heat capacity and specific volume of moist air;
15	40 - 42	15-4 Air-conditioning systems.

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TEXTBOOK

T.D. Eastop and A. McConkey, Applied Thermodynamics for Engineering Technologist, 5th Ed., Pearson Education Limited, England,1993.

REFERENCES

1. Y.A. Cengel & M.A. Boles, Thermodynamics: An Engineering Approach, 7th Ed., McGraw-Hill Inc., New York, 2007.
2. M.J. Moran and H.N. Shapiro, Fundamentals of Engineering Thermodynamics, 5th Ed., John Wiley & Sons Inc., New York, 2008.
3. S.C. Gupta, Thermodynamics, Dorling Kindersley (India); 2005.
4. R.E. Sonntag, C. Borgnakke, and G.J. Van Wylen, Fundamentals of Thermodynamics, 6th Ed., John Wiley & Sons Inc., New York, 2003.

GRADING

No.	Assessment	Number	% each	% total	Dates
1.	Test 1	1	15	15	25/03/2015 9pm DK5/DK6 P19
2.	Test 2	1	15	15	29/04/2015 9pm DK5/DK6 P19
3.	Test 3	1	15	15	3/06/2015 9pm DK5/DK6 P19
4.	Homework	5	2	10	
5.	Project	1	5	5	Week #13
6.	Final Exam	1	40	40	
Overall Total				**100**	

ATTENDANCE

The student should adhere to the rules of attendance as stated in the University Academic Regulation :-

1. Students must attend not less than 80% of lectures.

2.	The students are prohibited from sitting in the tests and final examination upon their failure to comply with the above requirement.