Indonesia University of Education
Faculty of Mathematics and Science Education

Syllabus

Course	**Thermodynamics**			Code		**FIS 509**	
Lecturer Name	***Drs. Saeful Karim,M.Si***						
Semester	4	Credit	3	Day of Week	2	Hour	5
Student to attend	80			Classroom			2
Pre-requisites	Have attend Physical Mathematics I and II						
Compulsory/elective/others				Compulsory			
Common/Fundamental/Special/Others				Special			
Course Objectives	Student comprehend basic concept of caloric interaction, work interaction and its application in closed and open systems for hidrostatic and chemical system, paramagnetic system, dielectric system and other thermodynamics system and also comprehend thermodynamics system laws as empirical knowledge and able to explain their applications						
Course description	The content covers Basic concepts of thermodynamics, thermodynamics coordinate, mathematics for thermodynamics, properties of pure substance, temperature and zeroth law of thermodynamics, system and state equation, external work, heat and the first law of thermodynamics either for close system or open system (Control Volumes), the second law of thermodynamics, Carnot cycle and reversibility, entropy, thermodynamic potential and thermodynamic property relations.						
Compulsory textbook	1) Yunus A.Cengel and Michael Boles.1994. ***Thermodynamics An Engineering Approach***, Second Edition, McGraw-Hill,Inc. 2) Mark W.Zemansky and Richard H.Dittman. 1982. ***Heat and Thermodynamics***, Sixth Edition, McGraw-Hill,Inc. Translated in Indonesian Language by The Houw Liong.1986. ***Kalor dan termodinamika***, terbitan ke enam, Bandung, Institut Teknologi Bandung (ITB). 3) Saeful Karim. 2001. ***Matematika untuk Termodinamika*** (Diktat), Jurusan Pendidikan Fisika FPMIPA UPI.						
Reference books	4) Paul A Tipler.1991. ***Physics for Scientits and Engineers***, Third Edition, Worth Publisher,inc. Translated in Indonesian Language by Lea Prasetio and Rahmad W Adi.1998. ***Fisika untuk Sains dan Teknik***, Edisi ketiga, Jilid I, Erlangga. 5) Darmawan.1980. ***Termodinamika***, FMIPA ITB. 6) Dimiski Hadi.1993. ***Termodinamika***. Depertemen Pendidikan dan Kebudayaan Direktorat Jenderal Pendidikan Tinggi						

Teaching Materials/Teaching Aids	• OHT • Physics Demonstration Apparatus
Evaluation Method	Evaluation done through individual assignment, testing, middle semester examination, and last semester examination
Request to Student	Special task in each topic.

Week	Schedule	Activities	References
1st and 2nd	***Introduction of Thermodynamics (Basic Concepts of Thermodynamics)*** : thermodynamics coordinate, mathematics for thermodynamics (A little math-partial derivatives and associated relations, mathematical theorems, exact and un-exact differentials, volume expansively, isothermal compressibility, intensive and extensive quantity, thermodynamics and energy, a note on dimensions and units, closed and open systems, form of energy, properties of a system, state and equilibrium, processes and cycles, and pressure.	Lecture, discussion, demonstration, exercise, practical and seminar	Ref 1:p.1-35 Ref 2:p.39-41 Ref 3:p.1-32 Ref 6:p.87-111
3rd	***Properties of Pure Substances*** : pure substance, phases of pure substance, phase change processes of pure substance, property diagrams for phase change processes, the P-V-T surface, property tables.	Lecture, discussion, exercise, practical and seminar	Ref 1:p.47-89 Ref 2:p.27-37 Ref 4:p.583-586 Ref 5:p.112-116 Ref 6:p.51-61
4th	***Temperature and The Zero Laws of Thermodynamics*** : macroscopic point of view, thermal equilibrium, temperature concept, measurement of temperature, thermometric property, comparison of thermometer, ideal gas temperature, temperature scale, thermocopule, and internal temperature scale	Lecture, discussion, demonstration, exercise, practical and seminar	Ref 1:p.21-27 Ref 2:p.3-26 Ref 4:p.560-591 Ref 5:p.18-25 Ref 6:p.1-21
5th	***System and Equation of State***: Thermodynamics equilibrium (mechanical equilibrium, chemical equilibrium, thermal equilibrium, phase equilibrium), pure substance, phase of pure substance, phase change processes of pure substance, the ideal gas equation of state, other equation of state.	Lecture, discussion, demonstration, exercise, practical and seminar	Ref 1:p.12-17 Ref 2:p.27-51 Ref 5:p.26-36 Ref 6:p.51-86
6th	***External Work*** : External work, internal work, quasistatic process, work in changing the volume a chemical system, P-V diagram, work depens on the path, calculation of work for quasistatic processes, work in changing the length	Lecture, discussion, demonstration, exercise, practical and seminar	Ref 1:p.100-115 Ref 2:p.52-73 Ref 4:p.622-626 Ref 5:p.37-44 Ref 6:p.112-123

	of wire, work in varying the charge of reversible cell, work in changing the magnetization of a magnetic solid		
7th	***Heat and First Laws of Thermodynamics (Closed Systems)***: Introduction to the first law of thermodynamics, heat transfer, mechanical forms of work, Concept of heat, adiabatic work, internal energy function, the first law of thermodynamics, specific heat, and quasistatic flow of heat (heat reservoirs).	Lecture, discussion, demonstration, exercise, practical and seminar	Ref 1:p.91-175 Ref 2:p.74-85 Ref 4:p.597-621 Ref 5:p.45-53 Ref 6:p.112-125
8th	**EXAMINATION-1**		
9th	***Heat and First Laws of Thermodynamics (Control Volumes)***: Thermodynamics analysis of control volumes, the steady flow process, unsteady flow process	Lecture, discussion, demonstration, exercise, practical and seminar	Ref 1:p.177-237 Ref 6:p.135-187
10th	***Ideal Gases*** : Equation state of a gas, compressibility factor, internal energy of a gas, concept of an ideal gas, thermodynamics equations, experimental determination of heat capacities, quasistatic adiabatic process	Lecture, discussion, demonstration, exercise, practical and seminar	Ref 1:p.63-70 Ref 2:p.112-150 Ref 5:p.54-63 Ref 6:p.51-62
11th	***The Second Law of Thermodinamics*** : Introduction to the second law of thermodynamics, thermal energy reservoirs, heat engines, refrigerators and heat pumps, perpetual motion machines, the scond law efficiency, scond law analysis of closed systems, scond law aspects of daily life.	Lecture, discussion, demonstration, exercise, practical and seminar	Ref 1:p.239-293 Ref 2:p.151-176 Ref 4:p.650-666 Ref 5:p.64-75 Ref 6:p.189-205
12th	***The Carnot Cycle and Reversibility***: Reversible and irreversible processes, the Carnot cycle, the Carnot principles, the thermodynamics temperature scale, the Carnot heat engine, the Carnot refrigerator and heat pump, Otto cycle- The ideal cycle for spark ignition engines, Diesel cycle- The ideal cycle for compression ignition engines	Lecture, discussion, demonstration, exercise, practical and seminar	Ref 1:p.262-293 Ref 4:p.657-664 Ref 5:p.76-85 Ref 6:p.167-171
13th	***Entropy*** : The Clausius inequality, entropy, the increase of entropy principle, causes of entropy change, what is entropy ?, property diagrams	Lecture, discussion, demonstration, exercise,	Ref 1:p.296-340 Ref 2:p.201-239 Ref 4:p.666-675 Ref 5:p.86-111

	involving entropy, the T ds relations, the entropy change of pure substances, the entropy change of solids and liquids.	practical and seminar	Ref 6:p.193-218
14th	***Thermodynamic Property Relations*** : The Maxwell relations, general relations for dU, dS, dH, dG, dF, C_v, and C_p, the $\Delta H, \Delta S, \Delta U$ of real gases	Lecture, discussion, demonstration, exercise, practical and seminar	Ref 1:p.629-663 Ref 2:p.240-259 Ref 5:p.112-131 Ref 6:p.251-277
15th	**EXAMINATION 2**		