OUTLINES COURSES OF PHYSICS DEPARTMENT 2007-2012

OUTLINES OF LEARNING PROGRAM

Course : Computational Physics (Lab)

Course Code, credit : PAF 213P, 3 / V

Description : This practical corresponds to material in the computational physics lecture course. It provides the opportunity to develop programming skill. There are six modules, each taking 100 minutes, as follow: Derivative of a function, Definite integral, Solution of first and second order Differential Equation, Special function, and eigen value of a matrix

General Objectives: : At the end of practical you should be able to make the programs for solving important physical problems with Pascal language

Prerequisite Course : PAF 213 (Fisika Komputasi)*

No.	Special Objectives	Topics	Sub Topics	Time (minutes)	Learning experience / methode	References
1	2	3	4	5	6	7
1.	At the end of practical you should be able to make the programs for calculating derivative of a function	The Derivative of a function	1. First Derivative. 2. Second Derivative	100		
2.	At the end of practical you should be able to make the programs for solving definite integral of a function	Definite Integral	1. Trapezium Rule 2. The 1/3 Simpson Rule 3. The 3/8 Simpson Rule 4. Bode Rule	100		

No.	Special Objectives	Topics	Sub Topics	Time (minutes)	Learning experience / methode	References
1	2	3	4	5	6	7
3.	At the end of practical you should be able to make the programs for solving first order Differential Equation	Solution of Differential Equation of first order	1. Euler Method 2. Adam Boshford Method 3. Adam Moulton Method 4. Runge Kutta	100		
	At the end of practical you should be able to make the programs for solving second order Differential Equation	Solution of Differential Equation of second order	1. Euler Method 2. Adam Boshford Method 3. Adam Moulton Method 4. Runge Kutta	100		
	At the end of practical you should be able to make the programs for solving special function	Special Functions	1. Hermite Function 2. Bessel Function 3. Lagendre Function 4. Laguare Function	100		
1	At the end of practical you should be able to make the programs for calculating eigen value of a matrix	Eigen value of a matrix	1. Method of the Approximation for Matrix of 2-order 2. Method of the Approximation for matrix of n- order	100		

Reference:

Chapra, S.C. dan Canale, R.P., 1988, *Numerical Methods For Engineers*, 2nd Edition, McGraw-hill, Inc, England

OUTLINES OF LEARNING PROGRAM

Course : Thermodynamics

Course Code, credit : PAF 222, 3 sks/IV

Description : This course covers basic concepts and definitions, properties of pure substances, fisrt and second law thermodynamics for opened and closed systems, entropy and avaibility

General Objectives: : After completing this course the students will understand the underlying principles of thermodynamics:
- properties of simple compressible fluids (use of tables included),
- first and second law of thermodynamics for opened and closed systems,
- Concepts of entropy and availability.

Prerequisite Course : Fisika dasar I, Matematika Dasar I

No.	Special Objectives	Topics	Sub Topics	Time (minutes)	Learning experience / methode	References
1	2	3	4	5	6	7
- 1	At the end of course you should be able • Differentiate the Macroscopic and microscopic description • Describe the basic concepts and definitions	basic concepts and definitions	1. Macroscopic and microscopic description 2. System state, and properties of system 3. Concept of pressure and volume 4. Concept of equilibrium 5. Concept of process 6. Concept of temperature and Zeroth law thermodynamics 7. Equation of state of ideal gas	250	Lecture, discussion, home works	

No.	Special Objectives	Topics	Sub Topics	Time (minutes)	Learning experience / methode	References
2	At the end of course you should be able to • state the First Law and to define heat, work, and the difference between various forms of energy • Describe the heat capacity • Analyze the thermodynamics problems using first law • Analyze the processes for an ideal gas using first law	Heat and the first law thermodynamics	1. p-V Work 2. Heat 3. First law thermodynamics 4. Internal energy 5. Heat capacity 6. Entalphi 7. Internal energy of gas 8. Processes for an Ideal gas 9. Quasistatic adiabatic processes for an ideal gas	200	Lecture, discussion, home works	
	Exercises			100		
3	Quiz I			100		
4	At the end of course you should be able • Define the pure substances • Describe the equilibrium phase • Mention equation of state for pure substances • Draw the surface of p-V-T of pure substances • Read the tables of thermodynamic properties of pure substances and be able to use for solving simple thermodynamics problems.	Properties of pure substance	1. Pure substances 2. Phase Change 3. Internal energy of gas 4. P-V-T Surface 5. Thermodynamics Tables 6. Processes for gas in closed system	150	Lecture, discussion, home works	
5	At the end of course you should be able apply the steady-flow energy equation or the First Law of Thermodynamics to a system of thermodynamic components (turbine, nozzle, etc)	Analysis of first law of thermodynamics for control volume	1. Principle of mass conservation for control volume 2. Principle of energy conservation for control volume 3. steady-flow energy equation, 4. Some Applications 5. unsteady flow process	150	Lecture, discussion, home works	
	Exercises			100		

No.	Special Objectives	Topics	Sub Topics	Time (minutes)	Learning experience / methode	References
6	Quiz II			100		
7	At the end of course you should be able to • apply ideal cycle analysis to simple heat engine cycles • estimate thermal efficiency and work • Explain the physical content and implications of the second law in non-mathematical terms • Define entropy • Calculate entropy change for various processes	Second law of thermodynamics and Entropy	1. Heat engine and refrigerator 2. statements of the second law of thermodynamics 3. Reversible and irreversible processes 4. Carnot cycle 5. Efficiency of reversible engine 6. Thermodynamics temperature scale and absolute zero 7. Entropy 8. T-s and h-s Diagram 9. Entropy change in reversible processes 10. two important relations 11. Entropy change for an ideal gas 12. isentropic process for an ideal gas 13. Entropy change in incompressible substance	300	Lecture, discussion, home works	
8	At the end of course you should be able toUse entropy calculations as a tool for evaluating irreversibility (lost work) in engineering	Ireversibility and exergy	1. Entropy change in irreversible process 2. Principle of Entropy increase 3. production of entropy in closed system 4. Second law of thermodynamics for control volume	300	Lecture, discussion, home works	

No.	Special Objectives	Topics	Sub Topics	Time (minutes)	Learning experience / methode	References
			5. processes of steady flow, steady state and processes of homogenous state 6. Isentropic efficiency 7. Helmhotz and Gibb free energy 8. Exergy 9. Exergy balance for control volume 10. Efficiency and effectivity of second law			
	Exercises			100		
	Final Exam			100		

Referensi

1. .Holman, J.P, 1988. *Thermodynamics*, McGraw-Hill International Edition, 4th ed. Singapore, pp 780.
2. J. Van Wylen, G and Sonntag, R.E, 1985. *Fundamental of Clasiccal Thermodynamics. 3rd ed*, John Wiley & Son, Canada, pp 722
3. Lee, J.F and Sears, F.W. 1963. *Thermodynamics*, 2nd, Addison-Wesley Publishing Company, Inc, Massachusetts, USA
4. Khuriati, A, 2004, Dasar-dasar Termodinamika, buku pegangan kuliah
5. Zemansky, M.W and Dittman, R.H,1982 Kalor dan Termodinamika. Edisi ke-2 Terjemahan oleh The How Liong 1986, Institut Teknologi Bandung, Bandung. 613 hal.

OUTLINES OF LEARNING PROGRAM

Course : Statistical Physics

Course Code, credit : **PAF 313, 2 SKS**

Description : The course include Statistical Physics approach, canonical ensemble, , grand canonical ensemble, Quantum gases, Fermi-Dirac Statistics , Bose-Einstein Statistics.

General Objectives: : At the end of course you should the basics or great foundation to develop the modern science and/or to apply to modern technologie

Prerequisite Course : PAF 222 (Thermodynamics)

No.	Special Objectives	Topics	Sub Topics	Time (minutes)	Learning experience / methode	References
1	2	3	4	5	6	7
1	At the end of course you should be able • Describe the definition and difference of macroscopic state microscopic • Understand the formulation of statistical burden of microstate • Describe the requirements of maximum entropy of equilibrium state • Define the opened systems and closed • Describe the microscopic Ensemble Definition and Partition function • Describe the definition of heat reservoir and how an equilibrium system in reservoir • Describe the formulation of canonical Ensemble which differentiate from micro canonic Ensemble • describe the distribution of Maxwell-Boltzmann	Statistical Physics approach	1. Macroscopic & microscopic state 2. Statistical burden of microstate 3. Principal of maximum entropy 4. Equilibrium at opened system and closed 5. Microscopic ensemble 6. Partition function 7. Equilibrium System in thermostat (reservoir) 8. Canonical ensemble 9. Distribution of Maxwell-Boltzmann	4 x 150		[1]:18-52 [2]: 25-26 128 – 139.
2	At the end of course you should be able to understand and describe:	Canonical ensemble	1. Paramagnetic Nature of solid	4 x 150		[1]:54-177

	• The Definition of Ensemble density and the requirement referred as Canonical Ensemble • the relationship between canonical Ensemble to paramagnetic nature of solid • The Definition of internal energy in and Helmholtz free energy and their formulas • Definition and also formula of capacities of heat attributed to entropy and heat attributed to Helmholtz free energy • Definition of density of states and situation theory • Incompatibility of Einstein Heat Capacity Theory to experimental result which repaired with Debye. Heat capacity theory		2. Internal Energy 3. Helmholtz free energy 4. Heat Capacity and entropy 5. Density of states 6. Theory Situation 7. Einstein's Heat Capacity Theory 8. Debye Heat Capacity Theory.			[2]: 75-85 139 – 150
3	At the end of course you should be able to understand and describe: • The Definition grand canonical Ensemble to the amount of particle a macroscopic system • The Formulation of grand Partition function (classic) • The System criterion can be assumed classical • The Definition of state equation and entropy of grand canonical Ensemble • The Definition of Gibbs Free energy as Gibbs thermodynamics potential or Gibbs chemical potential • The Definition of real gas and virial expansion of estranged gas pressure • The Definition of critical point of a liquid gas transition	Grand canonic ensemble	1. Partition function 2. classic System Criterion 3. Equation Of State 4. Entropy 5. Free energy of Gibbs 6. Potential chemistry and thermodynamics 7. Real gases 8. Expansion Virial 9. Critical points	3 x 150		[1]:179-240. [2]:86–105 151–169 [3]:314 - 323

4	At the end of course you should be able to understand and describe: • The Difference of real gas and quantum gas and their statistical distribution • The Definition of Partition Function for the quantum gas • The difference between two statistical distributions of quantum gas that is Fermi-Dirac distribution and Bose-Einstein, Fermion and Boson particle definition.	Quantum Gases	1. Partition Function 2. Fermi-Dirac Distribution 3. Bose-Einstein distribution	1 x 150		[2]:46–49. 60–62. [3]:577-585
5	At the end of course you obtain the knowledge about • The Difference of classic limit concepts with free electron model of fermi-Dirac statistics of supporting result of experiment • The application of Fermi-Dirac Statistics on electron specific heat susceptibility magnetic and white cretinous Star, neutron star and Black Hole	Fermi-Dirac statistics	1. Classic Limit 2. Free electron model 3. Electron Heat capacity 4. Magnet Susceptibility 5. White Cretinous Star, neutron star and Black Hole	2 x 150		[1]:241-277 [2]: 63 – 74. [3]:343-351
6	Student expected to obtain knowledge concerning Bose-Einstein distribution and its application on spectrum of black body radiation and crystal specific heat theory	Bose- Einstein Statistics	1. Bose Einstein Gases 2. Spectrum of black body radiation 3. crystal capacity theory	2 x 150		[1]:278-304 [2]: 49 – 59 [3]:328-342

References:

[1] Huang, Kerson, 1987, *Statistical Mechanics*, second edition, John Wiley & Sons.

[2] Pointon, A. J., 1967, *An Introduction to Statistical Physics for Students*, Longman Group LTD, London.

[3] Beiser, Arthur, 1987, *Konsep Fisika Modern*, terjemahan The Houw Liong, edisi keempat, Penerbit Erlangga, Jakarta.

OUTLINES OF LEARNING PROGRAM

Course : **Waves**

Course Code; credit : PAF 215/ 3 sks/III

Description : This corss contain elementary concepts of waves and oscillations, and mathematical elementary concepts of them, mechanic waves, mechanic waves in media, properties of waves mechanic, spherical waves and is cylindrical, waves in media of inhomogeneous , waves multidimensional, effect of Doppler, shock waves , electromagnetic waves, properties of electromagnetic waves, geometrical optics, Fourier analysis and of transforms Laplace, properties of natural of particles, and finally waves non-linear.

General Objectives: : At the end of course you should be to describe the concepts of wave physically, mathematical and its properties, especially for mechanic and electromagnetic. waves

Prerequisite Course : PAF 111 (Fisika Dasar I)

No.	Special Objectives	Topics	Sub Topics	Time (minutes s)	Learning experience / methode	References
1	2	3	4	5	6	7
1.	At the end of course you should be to describe the concepts of Mass – spring systems, Energy in mechanic oscillations, Other mechanic Oscillations systems, Electromagnetic Oscillations Damped oscillation, and Forced oscillations	Oscillations	1. Introduction 2. Mass – spring systems 3. Energy in mechanic oscillations 4. Other mechanic Oscillations systems 5. Electromagnetic Oscillations 6. Damped oscillation 7. Forced oscillations	3x 50 minutes	Lecture, discussion, home works	pages: 1-25

No.	Special Objectives	Topics	Sub Topics	Time (minutes s)	Learning experience / methode	References
1	2	3	4	5	6	7
2.	At the end of course you should be to describe the concepts of Waves on string, Sinusoidal Waves Differential equation and partial, differential of Waves, Non sinusoidal waves, Dispersion, phase and group velocity, Superposition of two waves, and beat	Waves Motion	1. Waves on string 2. Sinusoidal Waves 3. Differential equation and partial differential of Waves 4. Non sinusoidal waves 5. Dispersion, phase and group velocity 6. Superposition of two waves, beat	3x 50 minutes	Lecture, discussion, home works	pages: 26-49
3.	At the end of course you should be to describe the concepts of transmission lines of mass-spring, Derivative of waves equation, Energy transport by a traveling waves, Momentum transport by a traveling waves, and Transversal waves on string	Mechanic waves	1. transmission lines of mass-spring 2. Derivation of waves equation 3. Energy transport by a traveling waves 4. Momentum transport by a traveling waves 5. Transversal waves on string	3x 50 minutes	Lecture, discussion, home works	pages: 57-76
4.	At the end of course you should be to describe the concepts of sound waves in solid, liquid, and gas.	Sound waves propagation	1. Sound velocity in solid 2. Derivation of the sound velocity in solid 3. sound waves in fluid 4. Sound waves in gases 5. Sound waves intensity in gases	3x 50 minutes	Lecture, discussion, home works	pages: 77-94
6.	At the end of course you should be to describe the concepts of Reflection at the tied end and tied free, standing waves.	Reflection of waves and standing waves	1. Reflection at the tied end 2. Standing waves 3. Reflection at the free end 4. waves reflection theory 5. mechanic impedance	3x 50 minutes		pages: 95-111
7.	At the end of course you should be to describe the concepts of spherical	Spherical and cyllindrical waves silindris	1. Energy conservation 2. spherical waves	3 x 50 minutes	Lecture, discussion, home	pages: 112-123

No.	Special Objectives	Topics	Sub Topics	Time (minutes s)	Learning experience / methode	References
1	2	3	4	5	6	7
	films, Fraunhofer diffraction, Resolution of optical instruments, and Fresnel diffraction.		pattern 4. Optical interference in thin films 5. Fraunhofer diffraction 6. Resolution of optical instruments 7. Fresnel diffraction			
12.	At the end of course you should be to describe the concepts of Reflection, refraction, Aberration, lens and optical instruments, and The physical meaning of focusing	geometrical optics	1. Reflection and refraction 2. total Reflection 3. Reflection at a spherical mirror 4. Spheres Aberration at glass 5. Refraction at a spherical surface 6. Chromatic aberration 7. Lens and optical instruments 8. The physical meaning of focusing	2 x 3 x 50 minutes	Lecture, discussion, home works	pages: 240-273
13.	At the end of course you should be to describe the concepts of Photoelectric effect, Photon theory of Einstein, Hydrogen atom, and De Broglie waves	Praticle waves	1. Photoelectric effect 2. Photon theory of Einstein 3. Hydrogen atom 4. De Broglie waves	3 x 50 minutes	Lecture, discussion, home works	pages: 295-302
14.	At the end of course you should be to describe the concepts of Non-linear waves	Non-linear waves	Equation of Non-linear waves Characteristics of non-linear waves	3 x 50 minutes	Lecture, discussion, home works	pages: 303-326

references:

1. Hirose, A. dan K.E. Lonngren, 1985, *Introduction to Waves Phenomena*, John Wiley & Sons, Inc, New York

No.	Special Objectives	Topics	Sub Topics	Time (minutes s)	Learning experience / methode	References
1	2	3	4	5	6	7
	waves, Cylindrical waves, inhomogeneous waves medium, and multi-dimension waves		3. Cylindrical waves 4. inhomogeneous waves medium 5. multi-dimension waves		works	
8.	At the end of course you should be to describe the concepts of Doppler effect at sound and shock waves	Doppler Effect and Shock waves	1. The source is at rest and The observer is in motion 2. The Source is in motion and The observer is at rest 3. General statement of Doppler frequency displacement 4. Shock waves.	3 x 50 minutes	Lecture, discussion, home works	pages: 124-134
9.	At the end of course you should be to describe the concepts of Electromagnetic waves, Coaxial cables, poynting vectors, Electromagnetic plane waves in vacuum, Reflection of eiectromagnetic waves, and electromagnetic waves in matters	Electromagnetic waves	1. Electromagnetic waves 2. Coaxial cables 3. poynting vectors 4. Electromagnetic plane waves in vacuum 5. Reflection of electromagnetic waves 6. electromagnetic waves in matters	3 x 3 x 50 minutes	Lecture, discussion, home works	pages: 135-186
10.	At the end of course you should be to describe the concepts of Field at rest charge , Field due to a charge moving at steady velocity, Radiation field due to a accelerated (or decelerated) charge, and Radiation due to dipole oscillations	Electromagnetic waves radiation	1. Field at rest charge 2. Field due to a charge moving at steady velocity 3. Radiation field due to a accelerated (or decelerated) charge 4. Radiation due to dipole oscillations	3 x 50 minutes	Lecture, discussion, home works	pages: 187-202
11.	At the end of course you should be to describe the concepts of Young experiments, Multiple-slit interference pattern, Optical interference in thin	Interference dan Difraksi	1. Interference between two harmonic waves 2. Young experiments 3. Multiple-slit interference	3 x 50 minutes	Lecture, discussion, home works	pages: 203-239

No.	Special Objectives	Topics	Sub Topics	Time (minutes)	Learning experience / methode	References
1	2	3	4	5	6	7
			7. Motion in straight line 8. rectilinear motion with constant acceleration 9. Motion in two dimension 10. Projectile Motion 11. Circular motion			
3	At the end of course you should be able to • Describe and define the Newton's law. • describe and define the Newton forces	Dynamics	1. Newton's first law, Newton's second law , Newton's third law, AND normal force. 2. Friction. 3. Acceleration of Motion 4. Pseudo forces	4x50	Lecture, discussion, homeworks	1,2,3,4
4	At the end of course you should be able to describe the work and energy	Work and energy	1. Kinetic Energy 2. Potential energy 3. Work done by spring 4. Mechanic Energy 5. The conservation of energy 6. Work 7. Work and energy 8. Power	4x50	Lecture, discussion, homeworks	1,2,3,4
5	At the end of course you should be able to describe the momentum and collision	Momentum and collision	1. Momentum 2. Impulse of constant force 3. Impulse of variable force 4. Collision 5. Types of collision	4x50	Lecture, discussion, homeworks	1,2,3,4
6	At the end of course you should be able to describe the kinematics and dynamic rotation	Rotation	1. Rotational kinematics 2. Dynamic rotation 3. Equation of rotational motion	4x50	Lecture, discussion, homeworks	1,2,3,4

OUTLINES OF LEARNING PROGRAM

Course : **Fundamental of Physics I**

Course Code, credit : PAF 111 , 4

Description : This course is the first in a two-semester. Topics covered will include measurement, physical quantities and units, vectors, kinematics, dynamics, work and energy, momentum and collision, rotational dynamics, equilibrium and , elasticity , static fluid, dynamic fluid, kalor, kinetic theory of gases, thermodynamics, wave and oscillations, and sound. torque, angular momentum, simple harmonic motion, and mechanical waves.

General Objectives: : At the end of course you should be able to
- identify and mesure physical quantities
- Use the phenomena physics for science and technologie development

Prerequisite Course : -

No.	Special Objectives	Topics	Sub Topics	Time (minutes)	Learning experience / methode	Referenc es
1	2	3	4	5	6	7
1	At the end of course you should be able to understand the great flexibility and generality of the laws of physics, their application, and the relation to the other sciences .	Introduction	1. Goal 2. Relevance 3. Explanation of Course Contract 4. Grading 5. physical quantities 6. Measurement 7. dimension and units 8. Vectors	4x50	Lecture, discussion, homeworks	1,2,3
2	At the end of course you should be able to describe the position, displacement, distance, acceleration and the velocity.	kinematics	1. Equation Of Motion 2. Position 3. Average velocity 4. instantaneous Speed 5. Average acceleration 6. instantaneous Acceleration	4x50	Lecture, discussion, home works	1,2,3,4

No.	Special Objectives	Topics	Sub Topics	Time (minutes)	Learning experience / methode	References
1	2	3	4	5	6	7
7	At the end of course you should be able to • describe circular dynamics with a constant velocity • Describe force of gravity	Gravitation	1. Keppler's law 2. Newton's law of gravitation 3. The Universal Gravitation constant 4. Gravitational potential 5. Acceleration of gravity 6. Gravitational field 7. Gravitational field of skin ball and solid ball	4x50	Lecture, discussion, homeworks	1,2,3,4
8	**Midterm**			2x50		
9	At the end of course you should be able to describe translate and rotational equilibrium	Rotational equilibrium	1. Kesetimbangan translation 2. Rotational equilibrium 3. center of mass 4. Motion of the center of mass	4x50	Lecture, discussion, homeworks	1,2,3,4
10	At the end of course you should be able to describe the elasticity	Elasticity	1. Stress 2. Pressure 3. Strain 4. Modulus Young 5. Modulus Bulk 6. Hooke's law	4x50	Lecture, discussion, homeworks	1,2,3,4
11	At the end of course you should be able to describe the fluid and surface tension	Fluid static	1. Fluids 2. Surface Tension 3. Hydrostatic Pressure 4. Hydrostatic Paradox 5. Pascal's Law 6. Archimedes's Law 7. Capillarity	4x50	Lecture, discussion, homeworks	1,2,3,4
12	At the end of course you should be able to describe dynamic fluid	Fluid Dynamics	1. Continuity equation 2. Bernoulli's law	4x50	Lecture, discussion,	1,2,3,4

No.	Special Objectives	Topics	Sub Topics	Time (minutes)	Learning experience / methode	References
1	2	3	4	5	6	7
			3. poeuseule's law 4. Stokes's law 5. Reynold's Number		homeworks	
13	At the end of course you should be able to describe the oscillations	Oscillations	1. Harmonic motion 2. Energy of simple harmonic motion 3. oscillations of spring 4. Pendulum 5. Damped oscillation 6. Combine oscillations 7. Resonance	4x50		1,2,3,4
14	At the end of course you should be able to describe the sound waves	Waves	1. Pulse of Waves 2. Wave velocity 3. Harmonic Wave 4. Wave stand up 5. quantities of wave 6. wave equation 7. resonance 8. Intensity sound level 9. Effect of Doppler	4x50	Lecture, discussion, homeworks	1,2,3,4
15	At the end of course you should be able to describe the gas kinetic theory	Gas kinetic theory	1. Temperature 2. Expansion of matter 3. Phase change 4. theory of Kinetic gas 5. Boyle law 6. Boyle Law -Gay Lussac 7. Equation of Van of der Waltz 8. Diagram of phase	4x50	Lecture, discussion, homeworks	1,2,3,4
16	At the end of course you should be able to describe heat and the thermodynamics	Thermodynamics	1. Heat Capacity 2. Specific Heat 3. Phase Change	4x50	Lecture, discussion, homeworks	1,2,3,4

No.	Special Objectives	Topics	Sub Topics	Time (minutes)	Learning experience / methode	References
1	2	3	4	5	6	7
			4. Energy Transfer 5. Heat 6. Thermodynamics Law 7. Work 8. Heat Machine 9. Entropy			

Reference

1. *Physics, for scientist and engineer,* , Paul A Tipler, 1991 Worth Publisher, (Fisika Untuk Sains dan Teknik Jilid 1 edisi terjemahan Erlangga, Jakarta)
2. *Physics*, Halliday D, Resnick, R, 2005
3. *Physics*, Giancoli, DC, 1998 Prentice Hall, Inc. (Fisika, Jilid 1, edisi Terjemahan Erlangga Jakarta)
4. *Fisika Untuk Insinyur*, Schaum Series, The Mc Graw Hill Companies,1999

OUTLINES OF LEARNING PROGRAM

Course : **Fundamental Mathematics I**

Course Code, credit : PAF 112, 3 / I

Description : This course include introduction to set theory, functions, limit and continuity, differential, application of differential, integral, and application of integral.

General Objectives: : At the end of course you should be able to apply the principles inductive think and deductive for proving the mathematics theorems in theory of limit, differentiation and integration, and drawing a graph in coordinate systems.

Prerequisite Course : -

No.	Special Objectives	Topics	Sub Topics	Time (menits)	Learning experience / methode	References
1	2	3	4	5	6	7
1.	At the end of course you should be able: • recognize the numbers classification into set of numbers • Find the result of set operation of number set • recognize real number and integer and their properties • describe inequality • describe absolute value and its properties • Describe the complex number and its components • Determine the conjugate complex number • Add, subtract, multiplication, and division to complex numbers • Determine the rank of complex	Set and number,	1. set 2. Real Number 3. Inequality 4. Absolute Value 5. Distant Formula and Midpoint formula 6. Complex number	2 x 150	Lecture, discussion, homeworks	

No.	Special Objectives	Topics	Sub Topics	Time (menits)	Learning experience / methode	Referenc es
1	2	3	4	5	6	7
	number using Newton binomial • Determine the root of complex number.					
2.	At the end of course you should be able: • Describe the function • draw the function graph, determine the definition area of a function and recognize the types of function	Functions	1. Equation of line, circle, function 2. Inverse function 3. Special Types of functions	150	Lecture, discussion, homeworks	
3.	At the end of course you should be able: Define the derivative. Interpret the derivative. Describe some of the differentiation formulas derive of the trigonometric functions get the derivatives of the exponential and logarithm functions derive of inverse trig functions derive of hyperbolic functions .	Derivatives	1. The Definition of the Derivative 2. Differentiation Formulas. 3. Derivatives of Trigonometric Functions 4. Derivatives of Exponential and Logarithm Functions 5. Derivatives of Inverse Trig Functions. 6. Derivatives of Hyperbolic Functions. 7. Implicit Differentiation 8. Logarithmic Differentiation 9. Higher Order Derivatives 10. Applications of Derivatives	3 x 150	Lecture, discussion, homeworks	

No.	Special Objectives	Topics	Sub Topics	Time (menits)	Learning experience / methode	References
1	2	3	4	5	6	7
4	At the end of course you should be able: • Describe the definition and properties of indefinite integrals • Interpret the definite integrals. • define the definite integral and its properties • compute definite integrals • The substitution rule as it applies to definite integrals.	Integrals	1. Indefinite Integral 2. Area Problem 3. Definition of the Definite Integral. 4. Computing Definite Integrals 5. Substitution Rule for Definite Integrals	150	Lecture, discussion, homeworks	
5.	Mid Semester			100	Lecture, discussion, homeworks	
6.	At the end of course you should be able: • Use integrals to determine the average value of a function. • determine the area between two curves • find the volume of a solid of revolution • Determine the length of a curve in this section. • Determine the surface area of a solid of revolution. • determine the center of mass or centroid of a thin plate • Determine the amount of work required to move an object. • Determine the hydrostatic pressure and force on a vertical plate submerged in water.	Applications of Integrals	1. Average Function Value. 2. Area Between Two Curves 3. Volume 4. Arc Length 5. Surface Area 6. Center of Mass 7. Hydrostatic Pressure and Force	2 x 150	Lecture, discussion, homeworks	

No.	Special Objectives	Topics	Sub Topics	Time (menits)	Learning experience / methode	Referenc es
1	2	3	4	5	6	7
7..	At the end of course you should be able: • Integrate certain products and quotients of trig functions. • use partial fractions to allow us to do integrals involving some rational functions • Describe the substitution that can, on occasion, be used with integrals involving roots.. • Describe some integrals that involve quadratics	Techniques of integration	1. Integration by Parts 2. Integrals Involving Trig Functions 3. Trig Substitutions 4. Partial Fractions 5. Integrals Involving Roots 6. Integrals Involving Quadratics	2 x 150	Lecture, discussion, homeworks	1,2,3
8.	At the end of course you should be able: • Find tangent lines of polar curves. • Find the area enclosed by a polar curve. • Determine the length of a polar • determine the surface area of a solid obtained by rotating a polar curve	Polar Coordinates	1. Tangents with Polar Coordinates 2. Area with Polar Coordinates 3. Arc Length with Polar Coordinates Surface Area with Polar Coordinates	150	Lecture, discussion, homeworks	
9.	FINAL EXAM			100		

Reference:

Purcell, E.J. 1993, *Kalkulus dan Geometri Analitis Jilid 1* (terjemahan), Erlangga, Jakarta

OUTLINES OF LEARNING PROGRAM

Course : **Method Measurement of Physics**

Course Code, credit : PAF 114, 2/ I

Description : Method Measurement of Physics is science studying the ways of measurement for getting experiment datas accurately and correctly

General Objectives: : At the end of course you should be able to use the measurement instruments and be able to measure physical quantities accurately and correctly.

Prerequisite Course :

No.	Special Objectives	Topics	Sub Topics	Time (minutes)	Learning experience / methode	References
1	2	3	4	5	6	7
1	At the end of course you should be able to mention the unit of standard measurement and its derivative and be able to mention dimension of physical quantities	Unit of standard measurement	• Definition of quantities and unit-quantities of standard measurement • Relationship with the other unit	50 50	Lecture, discussion, homeworks	1
		dimension Analysis	• unit symbol and dimension • Application of dimension for cheking a formula	50 50	Lecture, discussion, homeworks	1
2	At the end of course you should be able to estimate the average values and be able to estimate the significant numbers	Estimate of significant average value.	Estimate of average value, modus, median, mean and significant number	50 50	Lecture, discussion, homeworks	1

No.	Special Objectives	Topics	Sub Topics	Time (minutes)	Learning experience / methode	References
1	2	3	4	5	6	7
3	At the end of course you should be able to calculate the random and systematic erratum	Random and Systematic erratum	• Random erratum • Systematic erratum	100 100		1 1
4	At the end of course you should be able to calculate the combination of random and systematic erratum	combination erratum	combination erratum	100	Lecture, discussion, homeworks	1
5	At the end of course you should be able to analyze the set of measurements data with statistics method	statistical analysis	• Normal Distribution • chi square Formula	100 100	Lecture, discussion, homeworks	1
		Straight-line equation	• linearity ; • point-in-pairs approach	100 100	Lecture, discussion, homeworks	1
6	At the end of course you should be able to make the final report correctly	Final report	• experiment planning • Final report	100 100	Lecture, discussion, homeworks	1

Reference

1*) Ralph J. Smith, "*Rangkaian Piranti dan Sistem" (terjemahan)*, Penerbit Erlangga, Jakarta, 1990.

OUTLINES COURSE of MATHEMATICAL PHYSICS

Lecture : Mathematical Physics I
Code / CSU : PAF 211 / 4
Brief Description : The lecture of Mathematical Physics is given in the 3rd semester. This course provides sequences and series, complex number, linear equations, vectors, matrixes, determinant, partial differential, multiple integral, vector analysis, Fourier series and ordinary differential equations.

General objectives : After learn this course; the students will be able: to solve mathematical problems in physical cases, in relation with sequences and series, complex number, linear equations, vectors, matrixes, determinant, partial differential, multiple integral, vector analysis, Fourier series and ordinary differential equations.

Prerequisites : PAF 122

Nu	Special objectives	Topics	Subtopics	Duration (minutes)	Methods	References
1	2	3	4	5	6	7
1.	After learn this part, the students will be able to understand the importance of mathematical Physics I and its relation with other sciences.	Introduction	Explanation the syllabuses, rules and procedures in the lecture, explanation of the assignments and exams, procedures of evaluations, the meaning of sequences, series, and types of series.	4 x 50	speaking, discussion, problems solving practice	1,2,3
2.	In this sessions, the students will be able: to explain the meaning of sequences and series, to determine convergence of a sequence	Sequences and Series	• Convergence test preliminary test • Ratio test • Integral test • Comparison test • Alternating series • Power series	4 x 50	speaking, discussion, problems solving practice	1,2,3,4

3	In this sessions, the students will be able: to explain the meaning of sequences and series, and its applications	Sequences and Series	• Taylor and Mac Lauren's series • Function series • Convergence and computational accuracy • Series applications	4 x 50	speaking, discussion, problems solving practice	1,2,3,4
4.	In this sessions, the students will be able: to explain the meaning of complex number and its basic applications	Complex number	• Topology of complex number • Complex planes • Complex algebra • Series of complex number • Complex functions	4 x 50	speaking, discussion, problems solving practice	1,2,3,4
5	In this sessions, the students will be able: to explain the meaning of complex number and its basic applications	Complex number	• Euler's Formula • Power and root of complex number • Exponential functions and trigonometry • Hyperbolical functions • Logarithmic • Inverse of trigonometric and hyperbolical functions • applications	4 x 50	speaking, discussion, problems solving practice	1,2,3,4
6	In this session, the students will be able: to calculate and analyze matrices, their determinant and also their applications in physics.	Matrices and Determinant	• matrices algebra • Determinant and Inverse of Matrices • System of Linear equations • Eigen values and eigen vectors	2 x 4 x 50	speaking, discussion, problems solving practice	1,2,3,4
7	In this session, the students will be able: to understand and to analyze vectors and their applications in physics	Vector and Vector Analysis	• Vector Algebra • Vector calculus • Integral of paths and surfaces	2 x 4 x 50	speaking, discussion, problems solving practice	1,2,3,4

			• Theorems in vectors			
8	In this session, the students will be able: to master various concepts of partial differential	Partial differential	• Notations of partial differential • Series in two variables • Total differential • Approximated calculation using differential • Chains rules • implicit differentiation • applications of partial differential • Lagrange's multiples • Changes of variable • Leibniz's rule	6 x 50	speaking, discussion, problems solving practice	**[1]**, p. 83 – 103 **[2]**, p. 11- 12
9	In this session, the students will be able: to master various concepts of multiple integral.	Multiple integral	• Separation of variable • First order linear equation • 2nd order linear equation • 2nd order linear equation with zero constant • 2nd order linear equation with non zero constant • others 2nd order linear equation	6 x 50	speaking, discussion, problems solving practice	**[1]**, p. 201 – 233 **[2]**, p. 122 - 130
10	In this session, the students will be able: to master various concepts of Fourier transformation.	Ordinary differential equations	• Separation of variable • First order linear equation • 2nd order linear equation • 2nd order linear equation with zero constant • 2nd order linear equation with non zero constant • others 2nd order linear equation	6 x 50	speaking, discussion, problems solving practice	1,2,3,4
11	In this session, the students will be able: to master various concepts of Fourier	Fourier Transformation	• harmonic motion • applications of Fourier	6 x 50	speaking, discussion,	1,2,3,4

	transformation.		series • average value of functions • Fourier coefficient • Dirichlet problems • Complex form of Fourier series • Even and odd functions • Application in sounds • Parseval's theorem		problems solving practice	

Referensi:

1. Boas, M, L, 1983. *Mathematical Methods in The Physical Sciences*, edisi 2, John Willey and Sons
2. Spiegel, M.R., 1987. *Mathematical Handbook of Formula and Tables*, McGraw-Hill, Inc., Seri Buku Schaum: *Penuntun Matematika* diterjemahkan oleh Tjia M.O, Penerbit Erlangga, Jakarta.
3. Ruwanto, B., 2003. *Matematika untuk Fisika dan Teknik*, , Adicita Karya Nusa, Yogyakarta.
4. Arfken, G., 1983. *Mathematical Methods for Physicists*

OUTLINES OF LEARNING PROGRAM

Course : **Electricity and Magnetism I**

Course Code, Credit : PAF 212, 2/ III

Description : This course covers topics in vector calculus, Charges and Coulomb's Law, Field Electrics and Gauss's law, Electrics Potential , Conductor in Electrostatic Field , electrics current, Ampere Law, magnet induction, vector potential, Faraday law, magnet energy, magnet multiple, and magnetization.

General Objectives : At the end of course you should be able to
- Describe the various mathematical concept of vector field
- Describe the interaction model between objects because electric charges
- Describe the concept of model interaction between moving charges in the magnetic force form,
- Describe the properties of magnetic field as vector field

Prerequiste Course : PAF121 (Fundamental Physics I), PAF 122 (Fundamental Mathematics II), PAF 211 (Mathematic Physics I) *

No.	Special Objectives	Topics	Sub Topics	Time (menits)	Learning experience / methode	References
1	2	3	4	5	6	7
1.	At the end of course you should be able to • Define the vector and describe about operation of vector • Describe the del operator / gradient • Describe and interpret the divergence • Describe and interpret the curl • Describe the Stoke's Theorem	Vector calculus	1. Vector 2. Gradient 3. divergence 4. curl 5. Stokes theorem	100	Lecture, discussion, homeworks	1
2.	At the end of course you should be able to • Describe the electric charges • Describe the Coulomb law force • Describe the principle of superposition	Charges and Coulomb's Law	1. charges 2. Columb's Law 3. The superposition principle: discrete charges 4. The superposition priciple : continuous charges 5. Energy stored in a system of charges	100	Lecture, discussion, homeworks	1
3.	At the end of course you should be able to • Describe the electric field • Visualize the electric field • Describe and calculate the electric field	Electric field and Gauss's Law	1. Electric field : concept and problem 2. Gauss's Law and its applications	100	Lecture, discussion, homeworks	1

No.	Special Objectives	Topics	Sub Topics	Time (menits)	Learning experience / methode	References
1	2	3	4	5	6	7
	generated by electric charges • Describe and apply the Gauss's law					
	At the end of course you should be able to • Describe the electric scalar potential • Describe and apply the Gauss's law in differential form	Electric Scalar Potential	1. Electric potential difference and electric potential. 2. Gauss's law in differential form and its applications 3. Energy associated with an electric field 4. More applications of vector calculus to electrostatics		Lecture, discussion, homeworks	
5.	At the end of course you should be able to • Differentiate the isolator and conductor • Analyze electrics field in conductor • Define capacitance • Mention the capacitor types • Determine the electrics field and capacitance of a capacitors • Describe and calculate the energy in conductor	Conductors in electrostatic field	1. Introduction to conductors 2. Electric Fields in Conductors 3. Uniqueness theorem and its applications 4. Method of images 5. capacitance and Capacitors 6. Dielectrics 7. Energy stored in a capacitor	100	Lecture, discussion, homeworks	1
	At the end of course you should be able to describe the electrical currents concepts	Electrical Currents	1. Concept and definition : current and current densities 2. Continuity Equation 3. Conduction Currents 4. Electrical Energy	2 x 50	Lecture, discussion, homeworks	2
7.	Exercise			100		
8.	**Mid semester**			100	Written exam	
9.						
10.	At the end of course you should be able to • describe the Ampere' Law in the differential form and integral • Describe the Magnetic induction	Ampere's Law and Magnetic induction	1. The force between two complete circuits and current elements 2. Magnetic induction 3. Ampere' Law in the differential form and integral 4. Vector potential	2 x 50		2
11.	At the end of course you should be able to describe Ffaraday's Law	Faraday's law	1. Faraday's law 2. Stationary Media	2 x 50		2

OUTLINES OF LEARNING PROGRAM

Course	:	**Method Measurement of Physics**
Course Code, credit	:	PAF 114, 2/ I
Description	:	Method Measurement of Physics is science studying the ways of measurement for getting experiment datas accurately and correctly
General Objectives:	:	At the end of course you should be able to use the measurement instruments and be able to measure physical quantities accurately and correctly.
Prerequisite Course	:	

No.	Special Objectives	Topics	Sub Topics	Time (minutes)	Learning experience / methode	References
1	2	3	4	5	6	7
1	At the end of course you should be able to mention the unit of standard measurement and its derivative and be able to mention dimension of physical quantities	Unit of standard measurement	• Definition of quantities and unit-quantities of standard measurement • Relationship with the other unit	50 50	Lecture, discussion, homeworks	1
		dimension Analysis	• unit symbol and dimension • Application of dimension for cheking a formula	50 50	Lecture, discussion, homeworks	1
2	At the end of course you should be able to estimate the average values and be able to estimate the significant numbers	Estimate of significant average value.	Estimate of average value, modus, median, mean and significant number	50 50	Lecture, discussion, homeworks	1

No.	Special Objectives	Topics	Sub Topics	Time (minutes)	Learning experience / methode	References
1	2	3	4	5	6	7
3	At the end of course you should be able to calculate the random and systematic erratum	Random and Systematic erratum	• Random erratum • Systematic erratum	100 100		1 1
4	At the end of course you should be able to calculate the combination of random and systematic erratum	combination erratum	combination erratum	100	Lecture, discussion, homeworks	1
5	At the end of course you should be able to analyze the set of measurements data with statistics method	statistical analysis	• Normal Distribution • chi square Formula	100 100	Lecture, discussion, homeworks	1
		Straight-line equation	• linearity ; • point-in-pairs approach	100 100	Lecture, discussion, homeworks	1
6	At the end of course you should be able to make the final report correctly	Final report	• experiment planning • Final report	100 100	Lecture, discussion, homeworks	1

Reference

1*) Ralph J. Smith, "*Rangkaian Piranti dan Sistem" (terjemahan*), Penerbit Erlangga, Jakarta, 1990.

OUTLINES OF LEARNING PROGRAM

Course : Fundamentals of Electronics

Course Code, credit : PAF 213, 4

Description : The course includes D.C. and a.c. circuit basic principles of semiconductor operation, transistors, analog and digital integrated circuits.

General Objectives: At the end of course you should be able to

- Understand various principles and concept which can be used to think for solving problems of electronics that is analyze and design a simple electronic circuit for DC, AC and diode
- Describe how the transistor and diode work
- Describe the basic principles of positive and negative feed back using a input (Opamp) and without input (Oscillator)

Prerequisite Course : Fundamentals of physics II

No.	Special Objectives	Topics	Sub Topics	Time (menits)	Learning experience / methode	Refer ences
1	2	3	4	5	6	7
1.	At the end of course you should be able to • Describe the current, voltage , and resistance • Describe Ohm law • Describe the elementary voltage source • Describe loading effect to the voltage source • Describe the elementary current source • Calculate equivalent resistance of resistors in series and parallel • Describe the Kirchoff I and II law • Analyze the complex circuits using Mesh Current Method, • branch current, and superposition • simplify any linear circuit using Thevenin theorem • Determine the power dissipations in a circuit. • Measure the voltage, current, and resistance	DC Circuit	1. Introductory concepts 2. Circuits analyzing 3. Equivalent Circuit 4. Power dissipation 5. Electrical measurements	250	Lecture, discussion, homeworks	

No.	Special Objectives	Topics	Sub Topics	Time (menits)	Learning experience / methode	Refer ences
1	2	3	4	5	6	7
2	At the end of course you should be able to • Identify sinusoidal waveform and its characteristic • Analyze inductive network and capacitive network • Analyze RLC in series and in • Describe the dc and ac transient current • Describe the complex waveforms	AC Circuits	1. AC Quantities 2. Capacitance 3. Inductance 4. Transient Currents 3. Complex Waveforms	200	Lecture, discussion, homeworks	
3.	At the end of course you should be able to • Describe the rectifier circuits and draw their characteristics • Calculate the average output voltage and the ripples frequency for various rectifiers. • Describe the capacitor filter characteristic • Describe how zener diode can act as regulator • Describe the clamp and the limiter	Diode Circuit	1. Rectifier circuits 2. Filters 3. Zener diode 4. Other diode circuits	200	Lecture, discussion, homeworks	
4.	Quiz I			100		
5.	At the end of course you should be able to • Describe theory of semiconductor • Describe how diode work • Describe how transistor work • Use the transistor as a switch • Describe the Field Effect Transistors	Semiconductor devices	1. Semiconductor 2. semiconductor diodes 3. Bipolar Transistors 4. Field Effect Transistors	2x150	Lecture, discussion, homeworks	
6.	At the end of course you should be able to • mention and describe the functions of logic elements, digital apparatus function • string up to finish a simple problem	Logic circuit and digital apparatus	1. Boolean algebra 2. Logic Gates 3. Combinational Digital Apparatus 4. Sequential Digital apparatus	2 x 150	Lecture, discussion, homeworks	

No.	Special Objectives	Topics	Sub Topics	Time (menits)	Learning experience / methode	Refer ences
1	2	3	4	5	6	7
7.	Quiz II			100		
8.	At the end of course you should be able to • Understand the basics of negative feed back and positive feed back • Understand influence of feed back to frequency response	Feedback	1. Negative feed back 2. Positive Feed back 3. Influence of feed back to frequency response	1x150	Lecture, discussion, homeworks	1,3
9.	At the end of course you should be able to • Design an inverting amplifier and a noninverting amplifier and analyse the nature of network • Design an integrator circuit and a differensiator using op-amp • Design a comparator using op-amp	Operational - Amplifier	1. Basic OP-AMP 2. Op-Amp as Integrator, Differentiator, and Filters 3. Op-Amp as Comparator	2 x1 50	Lecture, discussion, homeworks	1,2,3
10.	At the end of course you should be able to • Analyse the operation of various RC oscillator circuit, that is Wien bridge and of T-Twin • Analyse the operation of various LC oscillator circuit that is Colpitt, Hartley, and crystal • Analyse an relaxation Oscillator	Oscilator	1. RC Oscillator 2. LC Oscillator 3. Relaxation Oscillator	2 x 150	Lecture, discussion, homeworks	1,2,3

Reference:

1. Brophy J.J. 1990, *Basics Electronics For Scientists*, McGrawHill Newyork, Fifth Edition
2. Milman dan Halkias, 1992, *Integrated Electronics*, Mc GrawHill, Toronto
3. Sutrisno., 1986, *Dasar dasar Elektronika dan penerapannya*,ITB, Band

OUTLINES OF LEARNING PROGRAM

Course : Basic Electronics laboratory

Course Code, credit : PAF 213P, 3 / V

Description : These experiments demonstrate key aspects of physics covered in Fundamental of electronics lecture courses, and also provide you with the opportunity to develop key experimental skills. There are six experiments, as follow: AC Circuit, AC circuit, diode circuit, op-amp, and logic gate.

General Objectives: :
At the end of course you should be able to
- Use electronics tools for testing the behaviour of electronic circuit
- Calculate the time response of filter
- Analyze the diode circuit diode, transistor, dan op-amp
- Analyze logic gate

Prerequisite Course : PAF 121 (Fisika Dasar II), PAF 121P (Prak. Fisika Dasar II), PAF 213 (Elektronika Dasar)*

No.	Special Objectives	Topics	Sub Topics	Time (menits)	Learning experience / methode	References
1	2	3	4	5	6	7
1.	At the end of course you should be able to 1. Apply the Ohm's law 2. verify that a resistor obeys Ohm's law 3. Determine diode characteristics 4. Use the voltage divider and resistive voltage divider	DC Circuits	1. Ohm's law 2. Current limiter 3. Diode Characteristic 4. Voltage divider	120	Experiments	

No.	Special Objectives	Topics	Sub Topics	Time (menits)	Learning experience / methode	References
1	2	3	4	5	6	7
2.	Mahasiswa semester V Jurusan Fisika FMIPA UNDIP, setelah mengikuti praktikumn ini akan mampu: 1. Draw capasitor response to the voltage changement in a circuit 2. use the capasitor for making a Differentiator, an Integrator, a High and low pass filter	Capasitors (AC Circuits)	1. RC Circuit 2. Differentiator 3. Integrator 4. High Pass Filter 5. Low Pass Filter	120	Experiments	
3.	At the end of course you should be able to Use the diode as half and full wave rectifier, clamp, and limiter	Diode Circuit	1. half wave rectifier 2. full wave bridge rectifier 3. diode clamp 4. diode limiter	200	Experiments	
4.	At the end of course you should be able to 1. Determine transistor characteristics 2. Draw load line 3. Calculate α_{DC}, β_{DC} 4. Mesure the h_{FE} directly for several I_C values	Transistor	1. Transistor Characteristics 2. Emiter Follower 3. transistors current gain 4. current source	120	Experiments	

No.	Special Objectives	Topics	Sub Topics	Time (menits)	Learning experience / methode	References
1	2	3	4	5	6	7
5.	At the end of course you should be able to • construire the inverting and non-inverting amplifier, summing, integrator dan diferensiator with op-amp • Analyze cara kerja divais-divais tersebut	Op-Amp	1. inverting amplifier 2. non-inverting amplifier 3. summing amplifier 4. Integrator dan Diferentiator	200	Experiments	
6.	At the end of course you should be able to 1. Apply the Boole equatiion to AND, OR, dan Inverter gates 2. Display the alfanumerics with bar matrix methode.	Logical Gate	1. AND Gate 2. OR Gate 3. NAND gate 4. Biner Decoder 5. Minimalisation	120		

Referensi:

1. Khuriati, A, *Modul Praktikum Elektronika Dasar*, 2006, Lab Insel
2. Brophy J.J. 1990, *Basics Electronics For Scientists*, McGrawHill Newyork, Ffth Edition
3. Milman dan Halkias, 1992, *Integrated Electronics*, Mc GrawHill, Toronto
4. Sutrisno., 1986, *Dasar dasar Elektronika dan penerapannya*,ITB, Band

OUTLINES OF LEARNING PROGRAM

Course : **Modern Physics**

Course Code, credit : PAF 214, 3 / 3

Description : Modern Physics course represent a bridge between classic theory to modern theory. First, the special Theory of Relativity is a correction to classic theory for matters with very high speed (coming near c). Second, introductory of Quantum Theory or wave Mechanics theory is as a correction to classic theory for very small matters (micro order, nano, or angstrom). Those will used to explain the complex matter structure for simplest structure (from atomic nucleus to great universe). Both represent foundations of modern technology and science. Therefore, We will begin with Special Relativity Theory. Then we will study the atomic physics. We'll solve the problem of the hydrogen atom. We'll learn to include spin, and then use this to obtain a qualitative understanding of the periodic table. With quantum mechanics, these ideas really come into their own in surprising ways. Finally, we will study the molecules and solids.

Objectives: : At the end of course you should be able to
- use the relative motion concepts to explain phenomenon of relativistic in inertial frame and its implications
- use the wave particle duality concept to explain matter structure and its applications in microscopic system

Prerequisite Course : PAF 121 (Fundamental of physics II)

No.	Objectives	Topics	Sub Topics	Time (menits)	Learning experience / methode	References
1	2	3	4	5		6
1	At the end of course you should be able to • Difference between classical physics to modern physics. • Classical relativistic motion, the concept of. Inertial frames and non inertial frames, measurement of light relative velocity, ether concept. • invariant concept and its examples • Einstein's Postulates, measurement of light relative velocity • Einstein's postulates consequences	1. Special Relativity Theory	1. Introduction to Modern Physics 2. Classical relativistic motion 3. Einstein's postulates consequences 4. Relativistic dynamics	4X150	Lecture, discussion, homeworks	[1]:18-52 [2]:2-47 [3]:792-822 [4]:1099-1144

No.	Objectives	Topics	Sub Topics	Time (menits)	Learning experience / methode	References
1	2	3	4	5		6
	include time Dilatation, length contraction, twin Paradox, Momentum, mass, and relativistic energy. •					
2	At the end of course you should be able to describe the : • Particle Properties of Waves like black body rdiation, Photoelectric effect, Compton effect, absorption • Wave Properties of Particle, De Broglie Hyphothesis, Heisenberg reltionship, Electron microscope • Physical meaning of the Schroedinger equation, Physical meaning of wave function, , probabilities distribution to find particle • Time independent of Shroedinger equation in one dimension, free particles in one dimension • Applications of Shroedinger equation on harmonic oscillator	Introductory of Quantum Mechanics	1. Particle Properties of Waves 2. Wave Properties of Particle 3. Heisenberg's uncertainty 4. Schrödinger's equation.	5X150	Lecture, discussion, homeworks	[1]:54-177 [3]:823-858 [4]:1145-1171
3	At the end of course you should be able to • Describe and distingue the Thomson model atom, Rutherford, and Bohr • Describe the reasons of correction Thomson model to Rutherford model, Rutherford to Bohr, and Bohr model to quantum • Calculate the grand quantization of angular momentum , electron orbit radius, and quantization of electron energy of hydrogen	Atom Models according to quantum physics	1. Models of the Atom 2. the hydrogen atom 3. Applications (X – rays) 4. Comple:: atom and periodic tables	5X150	Lecture, discussion, homeworks	[1]:179-228 [3]:859-886

No.	Objectives	Topics	Sub Topics	Time (menits)	Learning experience / methode	References
1	2	3	4	5		6
	• Describe how the X-ray produced, its characteristic and its interaction with matters, X-ray diffraction • Quantum Theory about particle / atom covering mass media. Schroe.in 3 dim., hydrogen atom, bil. Quantum numbers, Complex Atom, rules of Pauli, periodic table, Fluorescence, Phosphorescence, and Laser..					
4	At the end of course you should be able to describe • The energy levels and molecules spectrum • The solid energy levels and its applications.	Molecules and solids*	1. Molecules Binding and potential energy 2. Molecules Spectrum 3. Applications (fluorescence, fosforisenc, LASER) 4. Binding in solids 5. Energy Band in Solids 6. Applications (Semiconductor)	1X150	Lecture, discussion, homeworks	[3]:887-915

***) Optional dan tambahan**

References:

[1] Krane, K.S., 1983, *Modern Physics*, John Wiley & Sons
[2] Beiser, A., 1995, *Concepts of Modern Physics*, 5th Edition, McGraw-Hill, Inc., New York.
[3] Giancoli, D..C., 1998, *Physics*, 5th ed., Prentice Hall, New Jersey.
[4] Tipler. P.A., 1991, *Physics*, 3rd ed., Worth Publishers, New York.
[5] Frederick J. Bueche, 1995, *Physics For Scientists And Engineers,* McGraw-Hill

OUTLINES OF LEARNING PROGRAM

Course : **Waves**

Course Code, credit : PAF 215/ 3 sks/III

Description : This corss contain elementary concepts of waves and oscillations, and mathematical elementary concepts of them, mechanic waves, mechanic waves in media, properties of waves mechanic, spherical waves and is cylindrical, waves in media of inhomogeneous , waves multidimensional, effect of Doppler, shock waves , electromagnetic waves, properties of electromagnetic waves, geometrical optics, Fourier analysis and of transforms Laplace, properties of natural of particles, and finally waves non-linear.

General Objectives: : At the end of course you should be to describe the concepts of wave physically, mathematical and its properties, especially for mechanic and electromagnetic. Waves

Prerequisite Course : PAF 111 (Fisika Dasar I)

No.	Special Objectives	Topics	Sub Topics	Time (minutes s)	Learning experience / methode	References
1	2	3	4	5	6	7
1.	At the end of course you should be to describe the concepts of Mass – spring systems, Energy in mechanic oscillations, Other mechanic Oscillations systems, Electromagnetic Oscillations Damped oscillation, and Forced oscillations	Oscillations	1. Introduction 2. Mass – spring systems 3. Energy in mechanic oscillations 4. Other mechanic Oscillations systems 5. Electromagnetic Oscillations 6. Damped oscillation 7. Forced oscillations	3x 50 minutes	Lecture, discussion, home works	pages: 1-25

No.	Special Objectives	Topics	Sub Topics	Time (minutes s)	Learning experience / methode	References
1	2	3	4	5	6	7
2.	At the end of course you should be to describe the concepts of Waves on string, Sinusoidal Waves Differential equation and partial, differential of Waves, Non sinusoidal waves, Dispersion, phase and group velocity, Superposition of two waves, and beat	Waves Motion	1. Waves on string 2. Sinusoidal Waves 3. Differential equation and partial differential of Waves 4. Non sinusoidal waves 5. Dispersion, phase and group velocity 6. Superposition of two waves, beat	3x 50 minutes	Lecture, discussion, home works	pages: 26-49
3.	At the end of course you should be to describe the concepts of transmission lines of mass-spring, Derivative of waves equation, Energy transport by a traveling waves, Momentum transport by a traveling waves, and Transversal waves on string	Mechanic waves	1. transmission lines of mass-spring 2. Derivation of waves equation 3. Energy transport by a traveling waves 4. Momentum transport by a traveling waves 5. Transversal waves on string	3x 50 minutes	Lecture, discussion, home works	pages: 57-76
4.	At the end of course you should be to describe the concepts of sound waves in solid, liquid, and gas.	Sound waves propagation	1. Sound velocity in solid 2. Derivation of the sound velocity in solid 3. sound waves in fluid 4. Sound waves in gases 5. Sound waves intensity in gases	3x 50 minutes	Lecture, discussion, home works	pages: 77-94
6.	At the end of course you should be to describe the concepts of Reflection at the tied end and tied free, standing waves.	Reflection of waves and standing waves	1. Reflection at the tied end 2. Standing waves 3. Reflection at the free end 4. waves reflection theory 5. mechanic impedance	3x 50 minutes		pages: 95-111
7.	At the end of course you should be to describe the concepts of spherical	Spherical and cyllindrical waves silindris	1. Energy conservation 2. spherical waves	3 x 50 minutes	Lecture, discussion, home	pages: 112-123

No.	Special Objectives	Topics	Sub Topics	Time (minutes s)	Learning experience / methode	References
1	2	3	4	5	6	7
	waves, Cylindrical waves, inhomogeneous waves medium, and multi-dimension waves		3. Cylindrical waves 4. inhomogeneous waves medium 5. multi-dimension waves		works	
8.	At the end of course you should be to describe the concepts of Doppler effect at sound and shock waves	Doppler Effect and Shock waves	1. The source is at rest and The observer is in motion 2. The Source is in motion and The observer is at rest 3. General statement of Doppler frequency displacement 4. Shock waves.	3 x 50 minutes	Lecture, discussion, home works	pages: 124-134
9.	At the end of course you should be to describe the concepts of Electromagnetic waves, Coaxial cables, poynting vectors, Electromagnetic plane waves in vacuum, Reflection of electromagnetic waves, and electromagnetic waves in matters	Electromagnetic waves	1. Electromagnetic waves 2. Coaxial cables 3. poynting vectors 4. Electromagnetic plane waves in vacuum 5. Reflection of electromagnetic waves 6. electromagnetic waves in matters	3 x 3 x 50 minutes	Lecture, discussion, home works	pages: 135-186
10.	At the end of course you should be to describe the concepts of Field at rest charge , Field due to a charge moving at steady velocity, Radiation field due to a accelerated (or decelerated) charge, and Radiation due to dipole oscillations	Electromagnetic waves radiation	1. Field at rest charge 2. Field due to a charge moving at steady velocity 3. Radiation field due to a accelerated (or decelerated) charge 4. Radiation due to dipole oscillations	3 x 50 minutes	Lecture, discussion, home works	pages: 187-202
11.	At the end of course you should be to describe the concepts of Young experiments, Multiple-slit interference pattern, Optical interference in thin	Interference dan Difraksi	1. Interference between two harmonic waves 2. Young experiments 3. Multiple-slit interference	3 x 50 minutes	Lecture, discussion, home works	pages: 203-239

No.	Special Objectives	Topics	Sub Topics	Time (minutes s)	Learning experience / methode	References
1	2	3	4	5	6	7
	films, Fraunhofer diffraction, Resolution of optical instruments, and Fresnel diffraction.		pattern 4. Optical interference in thin films 5. Fraunhofer diffraction 6. Resolution of optical instruments 7. Fresnel diffraction			
12.	At the end of course you should be to describe the concepts of Reflection, refraction, Aberration, lens and optical instruments, and The physical meaning of focusing	geometrical optics	1. Reflection and refraction 2. total Reflection 3. Reflection at a spherical mirror 4. Spheres Aberration at glass 5. Refraction at a spherical surface 6. Chromatic aberration 7. Lens and optical instruments 8. The physical meaning of focusing	2 x 3 x 50 minutes	Lecture, discussion, home works	pages: 240-273
13.	At the end of course you should be to describe the concepts of Photoelectric effect, Photon theory of Einstein, Hydrogen atom, and De Broglie waves	Praticle waves	1. Photoelectric effect 2. Photon theory of Einstein 3. Hydrogen atom 4. De Broglie waves	3 x 50 minutes	Lecture, discussion, home works	pages: 295-302
14.	At the end of course you should be to describe the concepts of Non-linear waves	Non-linear waves	Equation of Non-linear waves Characteristics of non-linear waves	3 x 50 minutes	Lecture, discussion, home works	pages: 303-326

references:

1. Hirose, A. dan K.E. Lonngren, 1985, *Introduction to Waves Phenomena*, John Wiley & Sons, Inc, New York

OUTLINES OF LEARNING PROGRAM

Course : NUMERIC ANALYSIS DAN PROGAMMING

Course Code, credit : PAF 216, 2/ III

Description : This course covers the error analysis, methods for finding the roots of an equation, methods for solving linear algebra equation, method of curve. Pascal programming include looping, Selection of conditions, procedure, function, array, file and their application on numeric Analysis.

General Objectives: :
At the end of course you should be able to
- Analyze the errors
- Find the roots of an equation
- Solve the equation of linear algebra and be able to solve adaptation of curve
- Make the programs application of the numeric analysis

Prerequisite Course : PAF 211 (Fisika Matematika I)

No.	Special Objectives	Topics	Sub Topics	Time (minutes)	Learning experience / methode	References
1	2	3	4	5	6	7
1.	At the end of course you should be able to describe the concepts related to error and types of error and be able to anaiyze them .	Error analysis	1. Significant Digits 2. Accuracy and precision 3. Rounding error 4. Chopping error 5. Error propagation 6. Total numeric error	100	Lecture, discussion, home works	
2.	At the end of course you should be able to describe various method of closed method for finding roots of an equation.	Closed methode	1. Graph method 2. Bisection Method 3. False-Position Method 4. Incremental finding and Determination of pre guess	100	Lecture, discussion, home works	
3.	At the end of course you should be able to describe various method of Opened Methods for finding roots of an equation..	Opened Methods	1. Fixed-point iteration 2. Newton - RaphSon method 3. Secant method	100	Lecture, discussion, home works	

No.	Special Objectives	Topics	Sub Topics	Time (minutes)	Learning experience / methode	References
1	2	3	4	5	6	7
4.	Evaluation I			100		
5.	At the end of course you should be able to describe the structure and the elements of Pascal program and be able to desribe data input/output statements	Structure and elements of Pascal Program	1. Program structures in Pascal 2. Declaration 3. Program elements in Pascal 4. Entering data 5. Displaying data	100	Lecture, discussion, home works	
6.	At the end of course you should be able to make a program with looping statement and selection of condition and be able to apply on the numeric cases.	Looping and Selection of Conditions	1. The FOR loop structure 2. While-Do loop structure 3. Repeat - Until Structure 4. IF Statement 5. Case Statement	100	Lecture, discussion, home works	
7.	At the end of course you should be able to make a program with procedure and function statement and be able to apply on numeric cases	Procedure and Function	1. Parameters in procedure 2. Nested Procedure 3. Standard Procedure 4. Parameters in function 5. Nested function 6. Standard Function	100	Lecture, discussion, home works	
8.	At the end of course you should be able to make a program with array and file statement and be able to apply on numeric cases	Array and File	1. Array 2. Untyped File 3. Typed File	100	Lecture, discussion, home works	
9.	Evaluation II			100		
10.	At the end of course you should be able to describe the Gauss elimination and Gauss-Saidel method on the linier equation systems	Gauss elimination and Gauss-Saidel method	1. Naive Gauss Ellimination 2 Method of Trap Gauss elimination 3. Improvement techniques of Gauss elimination method 4. Matrix Inversion 5. Gauss-Saidel Method	100	Lecture, discussion, home works	
11.	At the end of course you should be able to describe the LU Decomposition	LU Decomposition	1. Naïve LU Décomposition 2. Gauss Ellimination	100	Lecture, discussion,	

No.	Special Objectives	Topics	Sub Topics	Time (minutes)	Learning experience / methode	References
1	2	3	4	5	6	7
	method on the linier equation systems	method	3. LU Décomposition 4. Crout Decomposition		home works	
12.	At the end of course you should be able to describe the various least square method for the curve fitting	Least Square Method	1. Linear regresion 2. Polynomial regression 3. Double Linear Regression	100	Lecture, discussion, home works	
13.	At the end of course you should be able to describe the various interpolation methods for the curve fitting	Interpolating method	1. Interpolating Polynomial 2. Divided-difference of Newton 3. Lagrange Interpolating Polynomial 4. Coefficients of a interpolated polynomial	100	Lecture, discussion, home works	
14.	Evaluation III					

Reference

Chapra, S.C. and Canale, R.P., 1988, *Numerical Methods For Engineers*, 2nd Edition, McGraw-hill, Inc, England

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OUTLINES OF LEARNING PROGRAM

Course : **NUMERIC ANALYSIS DAN PROGAMMING LAB**

Course Code, credit : PAF 216P, 2/ III

Description : These laboratories practice course of the Numeric Analysis and programming. This Practical cover Method of find the roots of a polynomial (Method of fixed point Iteration, Newton–Raphson and Secant method), linear interpolating, operations of Matrix, and solution of linear algebra with Gauss-Seidel method

General Objectives: : At the end of course you should be able to make a program to solve problems of physical system (phenomenon of physics) related to Numeric Analysis using Pascal Language, as follow : to find the root of a polynomial, Linear Interpolation, Operation Matrix, and solution of Linear algebra

Prerequisite Course : PAF 216* (Analisis numerik dan pemrograman)*

No.	Special Objectives	Topics	Sub Topics	Time (minutes)	Learning experience / methode	References
1	2	3	4	5	6	7
1.	At the end of course you should be able to make a program for finding of a polynomial	Method for finding the roots of a polynomial	1. Fixed point Titik iteration 2. Newton_Raphson method 3. Secant method	200	Practicum	
2.	At the end of course you should be able to make a program for linear interpolating of a function	Linier Interpolation	1. First Order linier Interpolation 2. N Order Linier Interpolation	200	practicum	
3.	At the end of course you should be able to make a program for matrix operations.	Operation of Matrix	1. Transpose 2. Matrix multiplication 3. Adam Moulton Method	100	practicum	

No.	Special Objectives	Topics	Sub Topics	Time (minutes)	Learning experience / methode	References
1	2	3	4	5	6	7
			4. Runge Kutta Method			
4.	At the end of course you should be able to make a program for solution of linear algebra equations	Linier Algebra equation	1. Gauss-Seidel Method 2. Crammer Method	100	practicum	

OUTLINES OF LEARNING PROGRAM

Course : **Quantum Physics I**

Course Code, credit : PAF 312, 2 SKS/VI

Description : This course covers the quantization concept, function and operators, Hilbert's space, expectation values, Heissenberg uncertainty, Schrodinger equation, application of Schrodinger equation for free particle, particle in box, harmonic oscillator, hydrogen atom, complex atoms and angular momentum.

General Objectives: : At the end of course you should be able to describe about concepts, definitions dan apllication of quantum physics, correspondence quantum mechanics to classical mechanics

Prerequisite Course : PAF 214 (Modern Physics), PAF221(Mathematical Physics II)

No.	Special Objectives	Topics	Sub Topics	Time (minutes)	Learning experience / methode	References
1	2	3	4	5	6	7
	At the end of course you should be able to 1. Describe the concepts related to Approach and introductory of Physics Quantum 2. Describe the definition and operator function of hermitian, physical meaning of wave function, understanding of Schroedinger equation, applications of free particles in one dimension	Quantum physics approach and introduction	1. Blackbody Radiation 2. Photoelectric effects 3. Quantum Theory for atomic energy 4. De Broglie Hypothesis and Davison-Germer Experiment 5. Heisenberg Uncertainty 6. Born.wave probability 7. Postulate of Quantum Mechanics 8. Hermitian Operators 9. Wave functions 10. Schroedinger equation 11. Particle current density	2 x 100	Lecture, discussion, homeworks	1,2,3
	At the end of course you should be able to solve and interpret the	Applications of Schroedinger equation	1. The infinite well potential in one dimension : case $E<V_0$	5 x 100	Lecture, discussion,	1,2,3

No.	Special Objectives	Topics	Sub Topics	Time (minutes)	Learning experience / methode	Referenc es
1	2	3	4	5	6	7
	results related to the applications of One Dimension Schroedinger Problem Applications	problems in one dimension	2. The Potential Step 3. Finite Potential in one dimension case $E>V_0$ 4. The Potential Step 5. Application of Potential barrier, Alfa decay, NH_3 molecule, Diode Tunnel 6. Simple harmonic Oscilator 7. Solution of SHO and its interpretation 8. Application of SHO.		homeworks	
7.	At the end of course you should be able to describe Heissenberg uncertainty	Heissenberg uncertainty	1. Expectation Values Concept 2. Operator Concept in quantum mechanics 3. Formulation of Heissenberg uncertainty formula 4. Consequence of Heissenberg. uncertainty principle	2 x 50 minutes	Lecture, discussion, homeworks	4 pages: 18-24
8.	At the end of course you should be able to describe the Harmonic Oscillators in quantum mechanics	Harmonic Oscilator	1. Tingkat-tingkat energi oscillator harmonic. 2. Hamiltonian harmonic oscillator 3. Schrodinger equation for the harmonic oscillator and variable separation method 4. Hermite Special Function and its normalization 5. Expllicit form of harmonic oscillator wave function	2 x 50 minutes	Lecture, discussion, homeworks	4, pages: 29-34
9.	At the end of course you should be able to describe hydrogen atom concepts	**Hydrogen Atom**	1. Electron Hamiltonian 2. Schrodinger equation for the hydrogen atom system and variable separation method 3. Harmonic Function, Special Function of Legendre and	2 x 50 minutes	Lecture, discussion, homeworks	4, pages: 35-38