PREFACE

Alhamdulillah, praise thanks to Allah SWT because of the publishment of this Syllabus of Curriculum Electrical Engineering Department which is meant to fulfill information needed about Electrical Engineering Department of Undip.

This Syllabus renew every five year but the contents always matched with the updating technology at the present day. Its also published every year before new school year so that student, administration staff and lecturer and also another people outside Electrical Engineering Department of UNDIP would be able to made it as a guidance to get to know better about the activity of teaching and learning, facilities and basic facilities and also all the achievement which have been succeeded to be reached.

That's all about the Syllabus of Electrical Engineering Department, we hope this would be able to be used for all of the Civitas Academic and all of the stake holder as an information media to be the first step to the future development of Electrical Engineering Department.

Semarang, August 2008

The Head of Electrical Engineering Department

Ir. Sujadi, M.T
NIP. 131 558 567
SYLLABUS OF ELECTRICAL ENGINEERING DEPARTMENT OF DIPONEGORO UNIVERSITY

COMPULSORY SUBJECT

1. RELIGION (UNG105) 3 Credit
   According to the MPK of UNDIP.

2. CALCULUS I (TKE151) 3 Credit
   Objective : Students would be able to master mathematics method and principles so that they would be able to analyze physical phenomenon and also to form and to solve all the problems appears in engineering field.
   Material : numbering system ( real and imaginary number ); Function and Graphics; Differential and its Application; Integral and its Application; Transcendent Function; Polar Coordinate; Ranks and Progression; Calculus function with two or more variables.
               2. Leithold, The Calculus with Analytic Geometry.
               3. Purcell, Kalkulus dan Geometri Analitis jilid I & II. (translated by: Rawuh and Bana Karta Sasmata)
               5. Wilfred Kaplan, Donald Y. Lewis, Calculus and Linear Algebra Volume 1 dan 2.

3. BASIC OF PHYSIC I (TKE152) 2 Credit
   Objective : Students would be able to recognize and understand natural laws and its logic as basic to solve problems related to mechanics, light and sound wave and also optical introduction.
   Material : particle kinematics; particle dynamics; harmonic motion; work and energy; linear momentum; angular momentum and rigid body; fluid statics; fluid dynamics; gas kinetics theory; law of thermodynamics I & II; sound wave, ultrasonic wave and light wave; preface of optic.
   Literature : 1. David Halliday dan Robert Resnick, Physic I.
               2. Marcelo Alonso & Edward I. Finn, Fundamental University Physic I.

4. BASIC OF ELECTRICAL ENGINEERING (TKE153) 2 Credit
   Objective : Students would be able to recognize and understand the rule and the fundament aspect in electrical engineering science development.
   Material : General introduction of some concentrations in Electrical Engineering Department. Introducing the role of basic electrical engineering sciences to understand the other subjects at the higher level. Advanced introduction of electrical power engineering concentration, control engineering concentration, telecommunications and electronics concentration, informatics and computer system concentration. Giving an understanding of technological concept, the application and working area of electrical engineering in agriculture, fishery, husbandry, industry and health.

5. BASIC OF COMPUTER AND PROGRAMMING (TKE154) 2 Credit
   BASIC OF COMPUTER AND PROGRAMMING LAB. WORK (TKE154P) 1 Credit
   Objective : Students would be able to understand the basic of computer system and its language, students also have a capability to apply it in engineering field.
   Material : Concept of system, computer architecture; the basic of operating system; evaluation of high level language and software; the basic of programming (matlab, pascal, C); memory management; PC DOS and UNIX; the basic of database, introduction to the internet.
               5. Matlab user guide, Mathwork
               6. Jogiyanto, Pascal, Andi Offset

6. SPORT (TKE183) 0 Credit
   According to the MPK of UNDIP.

7. ENGLISH (TKE150) 2 Credit
   Objective : Students would be able to understand the good sentence stucture in English and also training “4 – skills” (reading, writing, listening, speaking).
   Material : 4 skills concerning with electrotechnical, basic structural pattern, vocabulary, and english for academic purposes (TOEFL like) and engineering.
   Literature : 1. English for Engineers Book 1 and 2.
8. BASIC OF ENERGY CONVERSION (TKE161) 2 Credit
BASIC OF ENERGY CONVERSION LAB. WORK (TKE161P) 1 Credit
Objective: Introducing basic principles of energy conversion.
Material: The basic of mechanic to electric energy conversion; heat to electric, chemical to electric, and electric to electric. Introduction to DC machines, AC machine, and transformer; the basic system of generating, distributing and electrical power loading.
2. B.I. Theraja, Electrical Technology.

9. SCIENCE OF BASIC SOCIAL AND CULTURE (TKE182) 2 Credit
According to the MPK of UNDIP.

10. BASIC PHYSIC II (TKE158) 2 Credit
BASIC PHYSIC LAB. WORK (TKE158P) 1 Credit
Objective: Students would be able to know and understand the laws of nature and its logic as the basic to solve problems related to magnet and electrics.
Material: magnet and electricity: electrical force field; electrical potential; direct electricity; magnetic field; motion force of glimpse electrics; acquired electrics; Maxwell equation; wave, characteristic of wave, general character of magnetic wave, interference and diffraction, polarization of electric and magnetic wave.
Literature: 1. David Halliday dan Robert Resnick, Physics I.
2. Marcelo Alonso & Edward I. Finn, Fundamental University Physics I.
Prerequisite: Basic of Physic I

11. CIVIC EDUCATION (UNG360) 2 Credit
According to the MPK of UNDIP.

12. ELECTRICAL MATERIAL (TKE184) 2 Credit
Objective: Students would be able to know and understand about materials used in Power Engineering field.
Material: Application of quantum mechanics at solid substance, characteristics of insulation materials, solid, liquid and gas, conductance, superconductance, and magnetics.
2. Lawrence H. Van Vlack, Element of Material Science.

13. CALCULUS II (TKE157) 3 Credit
Objective: Students would be able to master mathematics method and principles so that they would be able to analyze physical phenomenon and also to form and to solve all the problems appears in engineering field.
Material: Vector at R1, R2, and R3; algebra of vector; linear equation system; matrix; determinant and algebra of matrix; matrix inversion; linear transform; eigen value and eigen vector; Green’s, Gauss, and Stokes theorem; vector differential and integral; scalar field theorems
Prerequisite: Calculus I

14. INFORMATION TECHNOLOGY (TKE185) 2 Credit
Objective: Students would be able to know the element concept of information and its technology
Material: Definition of information; the necessity of technology and system; information technology used for industrial purpose; educational; military, medical, and outer space.
Literature: 1. Nicholas G. Carr, Does IT matter?
2. e-Book, Book on information Technology

15. ELECTRICAL DRAWING (TKE175) 1 Credit
Objective: Giving an understanding of electrical drawing, and also give an ability to read the picture.
Material: Paper size, various kind of line, electrical and electronic symbols, drawing electronic diagram and electrical installation.
3. Protel / Orcad

16. PROBABILITY, STATISTIC, AND STOCHASTIC (TKE166) 2 Credit
Objective: Students would be able to master mathematics method and principles so that they would be able to analyze physical phenomenon and also to form and to solve all the problems appears in engineering field.
Material: Theory of association, probability principle, distribution functions, average and variance values, first, second, and third moment, standard deviation, estimation, expectation, regression, random process, and density function.

Literature:

17. ENGINEERING MATHEMATICS I (TKE164) 3 Credit
Objective: Students would be able to master mathematics method and principles so that they would be able to analyze physical phenomenon and also to form and to solve all the problems appears in engineering field.

Material: Ordinary differential function order 1 and 2 with static coefficient, homogeneous and non homogeneous with an initial condition; solving problems with laplace transform; numeral progression method, Bessel and Fourier function, Fourier Integration, and Legendre Function.

Literature:

Prerequisite: Calculus I

18. DIGITAL SYSTEM (TKE165) 3 Credit
DIGITAL SYSTEM LAB. WORK (TKE165P) 1 Credit
Objective: Students would be able to subtract and analyze the application of digital circuit.

Material: Numbering System, Boolean Algebra; Logic gate; minimize combinational circuit; sequential circuit; digital arithmetic; counter and register; IC family; ADC/DAC; coding and conversion; detecting and correcting error; memory; digital system application.

Literature:

19. LINEAR SYSTEM (TKE168) 3 Credit
Objective: Students would be able to transform methods and signal manipulation.

Material: Introduction to linear system; solving linear system using transform methods; steady state method..

Literature:

20. ELECTRICAL CIRCUIT I (TKE156) 3 Credit
Objective: Giving an ability to interpret electrical circuit with discret and linear component in so many configuration and also develop the understanding of circuit behavior.

Material: Characteristic of power supply; Ohm’s Law; Kirchoff Law I and II; circuit topology; Thevenin-Northon, Superposition, Mesh Current, Node Voltage, and Reciprocity theorem; complex number and phasor; serial and parallel circuit; complex, active, and reactive energy; magnetic chain circuit; transformer.

Literature:

21. BASIC OF TELECOMMUNICATION (TKE170) 2 Credit
BASIC OF TELECOMMUNICATION LAB. WORK (TKE170P) 1 Credit
Objective: Students would be able to know the basic of Telecommunication Engineering.

Material: Component of basic of telecommunication; communication way; introducing signal in telecommunication system; signal representation in domain frequency; modulation technique; communication media; telephone system; basic multiplexing technique; introduction of data communication.

Literature:
1. Suhana, Teknik Telekommunikasi.
2. Roddy & Coolen, Elektronika Komunikasi I.

Prerequisite: Linear System; Engineering Mathematics I

22. BASIC OF ELECTRONICS (TKE167) 2 Credit
BASIC OF ELECTRONICS LAB. WORK (TKE167P) 1 Credit
Objective: Recognizing and giving an understanding about characteristic and special parameters of electronics components, ration technique and method, network analysis with active component.
23. NUMERIC METHOD (TKE169) 2 Credit
Objective  : Students would be able to master mathematics method and principles so that they would be able to analyze physical phenomenon and also to form and to solve all the problems appears in engineering field.
Material : Basic knowledges of numeric method; definition of iteration algorithm, structure algebra, linear and non-linear equation solution; numeric integration and differentiation ; convergency and error in computing.
Literature :
Prerequisite : Calculus I

24. ELECTRICAL CIRCUIT II (TKE173) 2 Credit
ELECTRICAL CIRCUIT LAB. WORK (TKE173P) 1 Credit
Objective  : Introducing the principal elements of electrical machines and energy system component.
Material : Multiple phase system; four pole; Application of Laplace at : RLC circuit; transient circuit, step response and impulse response circuit; frequency response; using Fourier in application circuit.
Literature :
Prerequisite : Electrical Circuit I, Engineering Mathematics I

25. ENGINEERING MATHEMATICS II (TKE172) 3 Credit
Objective  : Students would be able to master mathematics method and principles so that they would be able to analyze physical indication and also to form and to solve all the problems appears in engineering field.
Material : complex number; functions with complex coefficient; radius of convergendtion; differentiation of complex function; singular dots; integration of complex field; integral contour; theory of residue; conformal mapping.
Literature :
5. Ahlfors, L. V., Complex Analysis
Prerequisite : Calculus II

26. ELECTROMAGNETIC FIELD (TKE171) 3 Credit
Objective : giving an understanding about laws of nature and physical behavior of electric field, students would be able to translate it into mathematics model and would be able to give interpretation and also assessment to its use in engineering field.
Material : Electro-Static law ( application of state and vector equation ), electrostatic field analysis and calculation; Maxwell equation for flat wave in free space; dielectric; vector pointing; energy, transmission, polarizition and reflection of wave; parameter and function transmission channel; electromagnetic wave shield; Maxwell equation application.
Literature :

27. BASIC OF CONTROL SYSTEM (TKE174) 2 Credit
BASIC OF CONTROL SYSTEM LAB. WORK (TKE174P) 1 Credit
Objective  : Students would be able to create model system, find the characteristics and analyze arrangement system pursuant to specification of time response, and mechanism of PID controller.
Material : Basic definition of control system; Open Loop and Close Loop Control System; Components of control system ( Censor and of Transducer, Signal Conditioning, P controller, PD controller, PI controller, PID controller, Actuator); Dynamic System Model ( PD representation, TF, block diagram, signal flow graph and state space); Characteristic of System ( Order 1, Order 2 and High Order); Analytic of PID controller.
Literature :

Prerequisite: Linear System, Electrical Circuit I

### 28. ELECTRICAL MEASUREMENT (TKE159) 2 Credit

**Objective:** Introducing and giving an understanding about electrical measuring instruments and also its usage, students would be able to know and master the technical procedure and the arrangement system and also the correctness boundary of measurement.

**Material:** Electrical measuring instruments; measuring method of electrical scale; analyze measurement and measuring error.

**Literature:**

### 29. INDOONESIAN LANGUAGE (TKE186) 2 Credit

According to the MPK of UNDIP.

### 30. ENTREPRENEURSHIP AND BUSINESS ETHICS (TKE163) 1 Credit

**Objective:** Students would be able to understand the concept, the character and the soul of business.

**Material:** Definition of entrepreneurship, entrepreneur culture, character of entrepreneur, development programme of entrepreneurship culture (mapang kewirausahaan), participation in community development project, student alternative creation, business consultancy and work assignment, incubator of new entrepreneur, ethics and behavior of business.

**Literature:**

### 31. MICROPROCESSOR (TKE103) 3 Credit

**Objective:** Giving basic knowledge, students would be able to analyze and design digital system based on microprocessor and microcontroller.

**Material:** An introduction; definition and philosophy; application; data bus and address bus concept; control system; memory map; microprocessor and microcontroller technology; basic hardware; technique and concept of address decoding; interface technique; basic hardware planning; Assembly software; assembler; data communication between hardwares; application planning using microprocessor and microcontroller.

**Literature:**
2. Ricard H Barnet, PhD, Purdue university, *The 8051 Family of Microcontroller*, Prentice Hall.

**Prerequisite:** Digital System, Basic of Computer and Programming

### 32. FIELD TRAINING (TKE175) 2 Credit

Field training done by the students in working environment, is it in industry, research institute or etc will be good in giving picture about working environment they have to face, beside to give job experience and extend their horizon.

(Enabled for student which have obtained the class till 6 semester)

### 33. RESEARCH METHOD (TKE176) 2 Credit

**Objective:** Students would be able to make research proposal for final project and self-supporting research according to research methodologies method for engineer.

**Material:** Definition of research method; research types, the step of arranging research proposal, the step of arranging final project and research proposal, orders in arranging and writing final project and research proposal, order in writing of final duty report and result of research, using statistic and mathematics in research and also computer usage in research; presentation technique of research result, making final duty proposal, making individual research report and proposal, presentation of proposal final project according to the concentration, presentation of research result.

**Literature:**
1. *Technik Penulisan Laporan Ilmiah, ITB*.
2. *Metodologi Penelitian untuk Insinyur, Prof. DR. Ir. Faraz Umar*.
34. MANAGEMENT OF INDUSTRY & PROJECT (TKE162) 2 Credit

Objective: Students would be able to know and understand economic and industrial management concepts.

Material: Factory and industry concept; setting factory location; factory arrangement and evacuation of materials; studying movement and time to increase work productivity; planning of factory; industrial; economical technique, network planning, evaluating project.

Literature:
2. Skrotzky, Power Station Engineering and Economic.
3. Devitsitis, Operation Management.
5. S. Kadariah, Evaluasi Proyek, UI Press

Prerequisite: Calculus I

35. PARTICIPATION IN COMMUNITY DEVELOPMENT PROJECT (TKE177) 3 Credit

36. FIELD WORK (TKE180) 0 Credit

37. FINAL PROJECT (TKE181) 4 Credit
SYLLABUS OF ELECTRONICS ENGINEERING & TELECOMMUNICATIONS CONCENTRATION

1. DIGITAL SIGNAL PROCESSING (TKE108) 3 Credit
   Objective: Gives basic knowledge about digital signal and digital signal processing methods and its application.
   Material: Signal sampling concept, time-frequency analysis, Fourier transform, DFT and FFT, Z transform, digital filter scheme, application of digital signal processing of noise reduction.
   Literature: 1. Roman Kuc, Introduction to Digital Signal Processing
   Prerequisite: 2nd Engineering Mathematics, Digital Engineering

2. TELECOMMUNICATION NETWORK (TKE100) 3 Credit
   Objective: recognizes audio communication network, video and data, and gives basic understanding of telecommunication network components.
   Literature: 1. John Bellamy, Digital Telephony
               2. William Stalings, ISDN & B ISDN With STM & Framer Relay
               3. Roger L. Freeman, Telecommunication Transmission Handbook
               4. Talley, David, Basic Telephone Switching Systems
               5. John L. Fike, Ph.D, P.E., Understanding Telephone Electronics.
   Prerequisite: Basic Telecommunication System

3. TRANSMISSION CHANNEL (TKE101) 2 Credit
   Objective: Gives basic knowledge about transmission and signal filtering for communication purpose.
   Material: Transmission line, reflectance of transmission line, transmission line for radio signal, filter concept, low pass filter, high pass filter, band pass filter.
               2. Johnson, Transmission Line and Network
   Prerequisite: 1st Engineering Mathematics, 2nd Electric Circuit, Electromagnetic Field

4. TELECOMMUNICATION SYSTEM (TKE104) 3 Credit
   TELECOMMUNICATION SYSTEM LAB WORK (TKE104P) 1 Credit
   Objective: recognizes the basic of telecommunication engineering
   Material: component and basic Telecommunication system, communication mode, Signal Recognition of Telecommunication System, Signal Representation on frequency domain, modulation technique, communication media, telephony system, basic multiplexing system, introduction of data communication.
   Literature: 1. Suhana, Teknik Telekomunikasi
               2. Roddy & Coolean, Elektronika Komunikasi I
               3. John L. Fike, Handbook of Digital Electronics
   Prerequisite: Linear System, Sistem Linier, 1st Engineering Mathematics

5. DIGITAL SYSTEM DESIGN (TKE114) 2 Credit
   DIGITAL SYSTEM DESIGN & DSP LAB WORK (TKE114P) 1 Credit
   Objective: able to design digital system application
   Material: combinational circuit design, sequential circuit design, interface RAM design, interface ROM design
               2. Samuel C. Lee, Digital Circuit and Logic Design
               3. John D. Lenk, Handbook of Digital Electronics
   Prerequisite: Digital Engineering, Basic Electronics

6. ANALOG ELECTRONICS (TKE102) 3 Credit
   ANALOG ELECTRONICS LAB WORK (TKE102P) 1 Credit
   Objective: recognizes and gives basic knowledge about various amplifiers with various characteristics.
   Material: Cascade amplifier, feedback amplifier, oscillator, controlled power amplifier, narrow band amplifier and wide band amplifier, power amplifier class A, class AB, class B, and class C, Operational Amplifier
   Literature: 1. Millman – Holtz, Integrated Electronics
               2. Bernard Grab, Electronic Circuit and Applications
   Prerequisite: Basic Electronics

7. THEORY OF INFORMATION AND CODING (TKE105) 3 Credit
   Objective: gives basic knowledge about information measurement and its coding.
   Material: Information content concept, entropy function, basic coding, Huffman coding, arithmetic coding, coding element, information theory application.
               2. Fazlollah M. Reza, Introduction to Information Theory.
### 8. DIGITAL COMMUNICATION (TKE109) 3 Credit

**Objective:** comprehends and assesses digital communication which is including channel coding processing, modulation and demodulation, encryption and description, multiple and demultiple access.

**Material:** Digital Modulation and Demodulation which is including MPSK, MQAM, MFSK. Coding: Line Encoding, Block Code, convolution code, Interleaver, Introduction of voice, data, image and video compression, Spread Spectrum (Direct Sequence & Frequency Hopping), Encryption and description

**Literature:**
1. Terplan, Digital Communication
2. Simon Haykin, Digital Communication
3. Proakis, Digital Communication
4. Introduction to Spread Spectrum

**Prerequisite:** Telecommunication System

### 9. ANTENNA AND PROPAGATION (TKE110) 3 Credit

**Objective:** gives basic knowledge about antenna and its design.

**Material:** Definition and antenna’s parameter, radiation intensity, point source, point source array, linear antenna, dipole, loop antenna, helix, antenna with reflector, antenna measurement, introduction of radio propagation.

**Literature:**
2. Collins, Antennas and Radiowaves Propagation

**Prerequisite:** Electromagnetic Field

### 10. TRAFFIC ENGINEERING (TKE113) 3 Credit

**Objective:** comprehends basic traffic design of telecommunication system.

**Material:** Magnitude and traffic variation, condition diagram, distribution of probability: Poisson, Erlang, etc. congestion, ERM, link system (Jacobsen, graf) routing; networking dimension; NNGOS evaluation (Gaudreau), waiting system, prediction.

**Literature:**
1. Telecom Australia, A Course in Teletraffic Engineering
2. Siemens, Telephone Traffic Theory : Tables and Chart

**Prerequisite:** Probability, Statistic and Stochastic

### 11. TELECOMMUNICATION ELECTRONICS (TKE117) 3 Credit

**Objective:** comprehends electric circuit is relating to telecommunication.

**Material:** Designs basic radio techniques and television technique theoerically and practically as according to technology development. RF Amplifier, oscillator. Modulator and demodulator AM, FM and PM. Transmitting and receiving equipments. Black and white TV, colour TV.

**Literature:**
3. Tomasii, Modern Electronic Communication

**Prerequisite:** Telecommunication System, Analog Electronics

### 12. DIGITAL IMAGE PROCESSING (TKE115) 3 Credit

**Objective:** gives understanding about digital image processing concept, and digs processing algorithms and its applications.

**Material:** Imaging concept, 2-dimension basic mathematics, image processing, image analysis, segmentation and thresholding, image bundle system, image processing application.

**Literature:**

**Prerequisite:** Digital Signal Processing

### 13. TRANSMISSION ENGINEERING (TKE116) 3 Credit

**Objective:** gives basic understanding about design of transmission network communication system.

**Material:** Basic transmission network system design, telephony transmission, microwave link, satellite, HF transmission, and video transmission.

**Literature:** Roger L. Freeman, Telecommunication Transmission Engineering.

**Prerequisite:** Telecommunication System

### 14. ADVANCED DIGITAL SIGNAL PROCESSING (TKE127) 3 Credit

**Objective:** gives continuation knowledge about digital signal processing and digs signal processing method and its application.

**Material:** Bank filter, Wiener filter, adaptive filter and its application, introduction of spectral estimation, wavelet introduction, introduction of Kalman filter.

**Literature:**
2. Bernard & Widrow, Adaptive Signal Processing

**Prerequisite:** Probability and Statistic
- Digital Signal Processing

15. OPTICAL ELECTRONICS (TKE112) 2 Credit
Objective: Recognized and gives basic knowledge about optical electronics.
Material: Electromagnetic theory, bundle and signal propagation (in the fiber), light source (Laser, LED), Wave Guide Optic, light detector (photo dioda), optical fiber for optical communication, optical loss, loss of optical fiber, optical coupling of optical fiber, integrated optical application.
Literature: 1. Amnon Yariv, Optical Electronics
2. Francis A Jensins – Harvey E. White, Fundamentals of Optics
Prerequisite: Electromagnetic Field, Basic Electronics

16. MOBILE COMMUNICATION (TKE129) 3 Credit
Objective: Comperehends mobile communication system
Material: cell concept, cellular system design, radio wave propagation model, GSM technology, CDMA technology, wireless LAN (Wifi), multi carrier system, 3G, 4G, and wireless communication network

2. Rapaport, Wireless Communications, Prentice Hall
Prerequisite: Telecommunication System

17. TELECOMMUNICATION NETWORK PERFORMANCE (TKE131) 3 Credit
Compact syllabus:

Literature:
2. Mischa Schwartz, Telecommunication Networks Protocols, Modeling and Analysis, Addison Wesley

18. WIRELESS SENSOR NETWORK (TKE132) 2 Credit
Objective: Comperehends concept and distributed Sensor network application in wireless system.
Material: Sensor concept, array censor, signal processing, and wireless network.

Literature:
2. Sensor Array Processing

Prerequisite:
- Digital Signal Processing
- Telecommunication Network

19. MATLAB PROGRAMMING (TKE134) 2 Credit
Objective: Comperehends and able to applicate Matlab programming to make digital signal processing simulation and digital image processing.
Material: Basic commands on Matlab, functions, GUI, dan Simulink

Literature: Matlab Programming, dari Mathworks
Prerequisite:
- Mathematics
- Digital Signal Processing

20. DIGITAL SPEECH PROCESSING (TKE118) 2 Credit
Objective: Gives basic understanding about digital voice processing and digs processing methods and its application.
Material: Digital voice processing model, voice signal coding, frequency-time domain, homomorphic analysis for pitch determination, formant analysis, digital voice signal processing application.

Prerequisite: Digital Signal Processing

21. PATTERN RECOGNITION (TKE119) 2 Credit
Objective: Gives basic understanding about pattern recognition principles and digs recognition methods also applicate its algorithm.
Material: Pattern recognition concept, decision function, classification with decision function, classification with equality function, characteristic election, classification with nerve network.

Literature: 1. Principles of Pattern Recognition

22. DATA COMMUNICATION (TKE107) 3 Credit
Objective: Comperehends data communication processing at various data communication network infrastructures.

- Mathematics
Material: Architecture and protocol, data transmission, transmission media, coding data, data communication interface, datalink control, multiplexing, packet switching, ATM, Frame Relay, ISDN, B-ISDN

Literature:

23. INTERFACE AND PERIPHERAL (TKE106) 2 Credit
Objective: Comperehends basic interface principle in digital electronic system and computer.

Literature:

Prerequisite: Microprocessor

24. STANDARDISATION (TKE037) 3 Credit
Objective: After following this subject, student expected able to explain basic concept, modulation, work mechanism, and characteristic of radio and television communication. Then can determine certain characteristics in determining damage diagnosis at part of television receiver.

Material: radio communication concept (basic concept, modulation, multiplexing, radio receiver), hereinafter is aimed at television system (basic television, TV B & Wand colour, TV camera, TV transmission, and television set repairment).

Literature:

25. RADIO AND TV ENGINEERING (TKE128) 2 Credit
Objective: After following this subject, student expected able to explain basic concept, modulation, work mechanism, and characteristic of radio and television communication. Then can determine certain characteristics in determining damage diagnosis at part of television receiver.

Material: radio communication concept (basic concept, modulation, multiplexing, radio receiver), hereinafter is aimed at television system (basic television, TV B & Wand colour, TV camera, TV transmission, and television set repairment).

Literature:

SYLLABUS OF ELECTRICAL POWER TECHNIQUE CONSENTRATION

1. ELECTRICAL MACHINES I (TKE403) 2 credits
   PRACTICAL WORK OF ELECTRICAL MACHINES I (TKE403P) 1 credit
   Objective:
   Comprehending characteristic and process of an electrical direct-current machines, can chosen to operate and install direct-current machine, comprehending characteristic and process of transformer and tools and also the maintenance.
   Material:
   Analysis the way of armature winding excitement, armature reaction, computation, characteristic, process of generator and motor according to its excitement (separated, shunt, series, and compound excitement); operating, setting, and brake; efficiency, temperature rises, the time constant; kinds of special direct-current machines, stepper motor; principle and work-characteristic of a power transformer, voltage transformer, and current transformer; transformer process in a system, transformers in parallel work, losses and efficiency of transformer, loading of transformer, winding connection in transformer, clock numbering and vector of transformer, harmonization in transformer, maintenance of transformer.
   References:
   1. Siskend, Electrical Machine
   2. Fitsgeral, Electric Machinery
   3. Sulasno, Teknik Tenaga Listrik
   4. Zesteake, Electrical Machines Part I.

2. THERMODYNAMICS AND PRIME MOVER (TKE407) 2 credits
   Objective:
   Mastering thermodynamics theory to solve thermodynamics problem in electrical technique, mastering heat movement concept and law to calculate the heat movement.
   Material:
   Thermodynamics laws I, II, and III; entrophy; reversible and irreversible process; characteristic function; thermodynamics usage in problems; steam production and steam kettle; heat movement by convection, radiation, and conduction; heat exchanger; power cycle rankine type, brayton type, otto type, diesel type, mixture pressure type, carnart type, and refrigeration type; fluids characteristic in power station of turbine (water turbine, steam turbine).
   References:

3. ELECTRICAL MACHINES II (TKE404) 2 credits
   PRACTICAL WORK OF ELECTRICAL MACHINES II (TKE404P) 1 credit
   Objective:
   Comprehending and capable to analyze parameter and characteristic of asynchronous and synchronous machines, and also other alternating-current machines.
   Material:
   Work-principle of induction motor and generator, parameter, equivalent circuit and characteristic of single-phase and three-phase induction motors; Work-principle of synchronous generator and motor, parameters, equivalent circuit and characteristic of single-phase and three-phase synchronous motors; Influence of salient pole and cylindrical pole, work-parallel of synchronous machines, introduction of complex park transformation, interpolues axis and pole axis theory (d-q axis), synchronous generator and motor models and dynamics; work-principle, characteristic, and process of universal motor, fractional motor, and half-phase motor.
   References:
   3. SK. Sen, Rotating Electrical Machinery.
   4. B.L. Theraja, Electrical Technology.

4. ELECTRIC POWER TRANSMISSION (TKE403) 2 credits
   Objective:
   Comprehending elements and modeling of power system components, knowing and calculating characteristic of power system element and aspects in power distribution.
   Material:
   Basics of power system, power system components, series impedance of air-duct and underground-duct, capacitance of air-duct and underground-duct, current, voltage, active and reactive power relationship, kinds of duct, equivalent circuit and power equation representation, 'dua pintu' circuit, ABCD constant and series-parallel relation, unity system and component modeling, power distribution distribution (power circle), mechanics aspect of air passing (corona), active and reactive power compensation, introduction of power system grounding, planning of transmission line by considering parameter and its electric circuit.
   References:

5. ELECTRIC POWER DISTRIBUTION SYSTEM (TKE406)  
Objective: Comprehending and capable to analyze electric power distribution line system.
Material: Electric power distribution concept; architecture and equipment of distribution system; network structure and topology; introduction of load estimation; power flow of radial and loop distribution line; voltage regulation and active power compensation; analysis of disturbance and distribution line protection equipment.
References:

6. HIGH VOLTAGE GENERATION, MEASURING, & TESTING (TKE405)  
Objective: Comprehending high voltage technique equipments and way of its measuring and testing.
Material: Method and equipment, high voltage generation, testing, and high voltage measuring for high voltage equipment, power switching, high voltage insulation solid type, fluid type and gas, cables, coils, arrester and substation equipment, air insulator for EHV and UHV system.
References:
2. Razevig, High Voltage Engineering.

7. HIGH FIELD SYMPTOM (TKE402)  
Objective: Comprehending basics of high voltage technique consist of field basic theory, breakdown voltage theory and high voltage transient symptom, also traveling wave analysis.
Material: Basics of electric field and magnetic field; mechanism of magnetic field and electric field breakdown on insulation material; electromagnetic compatibility in power system and industry; thunder surge, traveling wave, corona mechanism, transient symptom in electrical machine.
References:

8. ELECTRIC POWER GENERATION (TKE413)  
Objective: Comprehending work mechanism and designing of kinds of prime mover for electric power station, understanding work-mechanism and designing electric power station for example steam power station (PLTU), nuclear power station (PLTN), gas power station (PLTG), diesel power station (PLTD), and OTEC.
Material: Installation, components, and operation of electric power station steam power type (PLTU), nuclear power type (PLTN), diesel power type (PLTD), gas power type (PLTG), water power type (PLTA), gas and steam power type (PLTGU).
References:
1. Arismunandar, Turbin Penggerak Awal.
5. Skrotzki, Power Station Engineering Economy.

9. ILLUMINATION AND ELECTRIC INSTALLATION (TKE412)  
Objective: Comprehending and capable to design illumination and electric installation according to electricity regulation.
Material: Basic interpretation of illumination, definition and relationship of multiberies of lamination, intensity, flux, brightness, reflection radiation, equal angle, coefficient factor, calculation method of illumination indoor and outdoor; Definition, term, component symbol in electric installation, conductor and its installation, planning
and describing of simple house, level house, building and wide buildings installation design, planning and choosing switches, size of conductor, connect tools, protection, meter, and human safety and tools of leaky current to ground disturbance.

References:
1. PUIL 1987
2. PUIL 2000
5. Van Nostrand, Illumination.

10. POWER ELECTRONICS (TKE408)  2 credits
   POWER ELECTRONICS LAB WORK (TKE408P)  1 credit
Objective:
Comprehending and capable to analyze and design electronics circuit as AC-AC, DC-DC, DC-AC, and AC-DC power regulator.
Material:
Components in power electronics, power and controller circuit, rectifier circuit, DC chopper, inverter and cycloconverter, natural and compulsion commutation, AC-AC converter, harmonics analysis.
References:

11. HIGH VOLTAGE EQUIPMENT (TKE411)  2 credits
Objective:
Comprehending function, work principle and characteristic of high voltage equipment, and choosing high voltage equipment.
Material:
Kinds of high voltage equipment, such as bushing, arrester, insulation; work-principle and characteristic of high voltage equipment; choosing, coordination, and placement of high voltage equipment.
References:

12. ELECTRICAL MACHINE USAGE (TKE410)  2 credits
   ELECTRICAL MACHINE USAGE LAB WORK (TKE410P)  1 credit

13. ELECTRIC POWER SYSTEM ANALYSIS (TKE415)  2 credits
Objective:
Comprehending and capable to analyze constant, parameter, and operation relationship also function of electric power system component.
Material:
Construction of model and calculation of admittance and line impedance matrix, power flow calculation by Gauss, Gauss-Seidel, Newton-Raphson Method, symmetrical components, disturbance and symmetrical and non-symmetrical short circuit analysis, series short circuit disturbance.
References:

14. PROTECTION AND RELAY SYSTEM (TKE409)  3 credits
   PROTECTION AND RELAY SYSTEM LAB WORK (TKE409P)  1 credit
Objective:
Comprehending problems of over voltage disturbance and over current disturbance in electric power system and the way of its prevention by using protection tools.
Material:
Protection philosophy, kinds of disturbance in electric power system, concept of relay and protection system coordination in generator, transformer, and transmission line, busbar, electrical motors; propagation surge over voltage and its protection tools.
References:
15. **STABILITY AND RELIABILITY (TKE414)**  
**Objective**:  
Comprehending criteria of power system reliability and capable to calculate stability and reliability of electric power system.  
**Material**:  
Definition of stability of electric power system, linear model of power system component, excitation effect in stability, transient stability, steady state stability, voltage stability for single machine and compound machine; basic concept of probability and reliability, transmission and distribution line reliability, static reliability of generation capacity.  
**References**:  

16. **ELECTRIC POWER SYSTEM GROUNDING (TKE416)**  
**Objective**:  
Capable to comprehend and design appropriate grounding method in power system.  
**Material**:  
Type and factor of power system grounding, grounding method, grounding equipment of transmission, generator, power transformer, and middle and low voltage equipment; ground resistance, grounding system resistance, calculation of substation grounding, case simulation of common neutral multi grounded system, low resistance, high resistance, and Petersen.  
**References**:  
2. Green Book – Electrical Grounding, IEEE.  

17. **COMPUTER APPLICATION IN ELECTRIC POWER SYSTEM (TKE417)**  
**Objective**:  
Comprehending usage of computer program for solving problems in electric power system.  
**Material**:  
Programming and usage computer software in review of operation matrix and spare matrix in power system, optimization and linear program, complex Park equal transformation, differential equal solution and handling non-linear problem, interaction of machine model, line and control device, power flow analysis by restriction (loop and radial system), security problem, short-circuit, stability, reliability, and contingency.  
**References**:  

18. **PLANNING ELECTRIC POWER STATION (TKE418)**  
**Objective**:  
Comprehending work mechanism and planning kinds of prime mover for electric power station, comprehending work mechanism and planning electric power station for example steam power station (PLTU), nuclear power station (PLTN), gas power station (PLTG), diesel power station (PLTD).  
**Material**:  
Inside burn motor; fuel and oil of burn motor; gas turbine, steam turbine; way of process, speed controlling, combination cycle of gas and steam; steam kettle, steam production, water turbine, way of process and speed controlling; installation and electric power station components : steam power station (PLTU), nuclear power station (PLTN), diesel power station (PLTD), gas power station (PLTG).  
**References**:  
1. Arismunandar, Turbin Penggerak Awal.  
4. Carr, Electric Power Station, Vol I & II.  
5. Skrotz, Power Station Engineering Economy.  

19. **POWER ELECTRONICS CONTROL CIRCUIT (TKE430)**  
**Objective**:  
Capable to design and analyze control system which is used in power electronics circuit, using analog electronics circuit even digital electronics circuit.  
**Material**:  
Basic circuit of Op-Amp, usage of analog circuit in control system : AC-DC, DC-DC, DC-AC, and AC-AC converter; Digital control basic in power electronics, application of microcontroller, principle of PWM modulation.  
**References**:  
20. **IT APPLICATION IN ELECTRIC POWER SYSTEM (TKE431)**

**Objective:**
1. Comprehending how important IT application in power system field.
2. Design IT application in power system.
3. Make IT application in power system.

**Material:**
1. Use of Information Technology in electric power system.
2. Geographical Information System (GIS)
   a. Component in GIS
   b. Data Saving
   c. Data Model
3. Architect of GIS Application
   a. Hardware
   b. Network
   c. Application
   d. Database

**References:**
2. Esri, Getting Started with MapObjects Version 2.2 in Delphi 5.0, Environmental Systems Research Institute, Inc. 2003.

21. **ELECTRIC ENERGY CONSERVATION (TKE428)**

**Objective:**
Students will comprehend, explain and evaluate building plant in order to energy conservation.

**Material:**
Background and development energy conservation, regulation and policy of energy, electric base for energy conservation, measuring instrument of energy conservation, energy consumer equipment, energy audit procedure, primary and secondary data, analysis and probability of energy thrift, recommendation, report of energy audit.

**References:**
14. NN, Power Cable, Nuova Fulgorcavi.
17. Katalog Product.

22. **Planning Electric Power Line and Substation (TKE418)**

**Objective:**
Knowing and comprehending problems which need to be paid attention for planning power system line and substation.
Material:
Optimization of transmission development route, construction of tower and network of transmission/distribution line air-duct and underground-duct, calculation of steady and shift stability characteristics, power flow and short-circuit of radial and loop transmission line, placement of air-duct and underground-duct high voltage equipment, mapping, location arrangement of substation, choosing and placement of substation equipment.

References:
5. PUIL 2000.
6. Bahan Penataran untuk Kontraktor Golongan D Saluran Udara dan Gardu Induk, AKLI.
7. Standard.

23. ELECTRIC POWER QUALITY (TKE419)  2 credits

Objective:
Capable to analyze electric power quality and the way of increase quality of electronic power.

Material:
Perspective of electric power quality, problems in electric power quality: Surge, Voltage Sag & Swell, Over voltage, Under voltage, Outage, Voltage Imbalance, Phase Angle Imbalance, Voltage Modulation, Electric Noise, Harmonic, Frequency Deviation, Electric Power Monitoring, Standard Wave Testing, Minimum Outage Solution, voltage regulation, harmonic filter, power conditioner, UPS, emergency and reserve electrical power, disturbance minimization in consumer side, electric power quality standard, SCADA.

References:

24. TRACTION AND ELECTRIC TRANSPORTATION SYSTEM (TKE420)  2 credits

Objective:
Comprehending kinds of traction motor system, behavior and its usage in transportation system.

Material:
Curve of speed to time, energy consumption of direct-current traction motor, single phase traction motor, three-phase traction motor, traction motor testing, traction motor control.

References:
1. Dover, Electric Traction.

25. DIRECT-CURRENT POWER TRANSMISSION (TKE421)  2 credits

Objective:
Comprehending aspect of direct-current high voltage, and its circuit in electric power transmission.

Material:
Economic aspect of direct-current power transmission, rectifier bridge, harmonics and filters, converter and inverter, transmission integration of direct-current and alternating-current power transmission; direct-current high voltage substation.

References:
2. EPRI, Methodology Integration of HDVC Link in Large AC.

26. NON-CONVENTIONAL GENERATION (TKE432)  2 credits

Objective:
Comprehending alternative energy resources as basic knowledge in furthermore system analysis.

Material:
Comprehension via study and designing electric power station by fuel cells, MHD, solar cell; indirect generation from ebb wind energy and sea wave; heat energy of earth, OTEC.

References:

27. MECHATRONICS (TKE432)  2 credits

Brief Syllabus:
Common framework of mechatronics and control system; concept of sensor, transducer, measurement; process characteristic of mechatronics, sensor/transducer classification; mechanical sensor; Resistive, Inductive, and signal conditioner; digital sensor; data acquisition, actuator and power excitement; Actuator components: mechanics actuator, hydraulics actuator, pneumatic actuator, and electric actuator.; Modeling mechatronics system : diagram and mathematics from translation/rotation mechanics, fluids; heat; and common.; Dynamic response system and kinds of control : analog, digital, and logic control; Control components: Microprocessor, PLC, Microcontroller, interface input-output (I/O Device); Mechatronics design system.
References:
1. W. Bolton; MECHATRONICS (Electronic Control Systems in Mechanical Engineering);
2. Krause; Wasyczuk; ELECTROMECHANICAL (Motion Devices).

28. PLANNING ELECTRICAL MACHINES (TKE428) 2 credits
Objective: Comprehending common equals, direct-current although alternating-current machines analysis, and capable to design electrical machines.
Material: Basic common theory of electrical machines design, analysis method and magnetic and electric equivalent circuit model, switchover phenomenon analysis, design of single phase and three phase transformer, direct-current machine, induction motor, synchronous generator and motor.
References:
3. Sawhney, A Course in Electrical Machines Design.

29. ELECTROMAGNETIC COMPATIBILITY (TKE433) 2 credits
Objective: Capable to know, detect, and analyze phenomenon of electromagnetic wave interference in electricity system and electronics, and also the ways to overcome its phenomenon.
References:

30. OPTIMATION AND OPERATION OF ELECTRIC POWER (TKE422) 2 credits
Objective: Capable to apply requirement system with economics factor well-balancedly.
Material: Development generation system based on criteria of technique and economics stability, input/output characteristics thermal and hydro power station, operational principles to minimize system cost and transmission losses disregarded and which is reckoned.
References:

31. SMART SYSTEM IN ELECTRIC POWER (TKE424) 2 credits
Objective: Comprehending kinds of smart system usage to solve problems in electric power system.
Material: Interpretation of Artificial Intelligent (AI), Fuzzy Logic, Genetics Algorithm, Artificial Nerve Network.; Problem solving process and application with Artificial Intelligent, Fuzzy Logic, Genetics Algorithm, and also Artificial Nerve Network in electric power system.
References:

32. SAFETY AND SECURITY OF WORK AND LABORS LAWS (TKE425) 2 credits
Objective:
Comprehending and understanding the importance of application of safety and security of work in working of electric power installation and operation, and basic law of labors.

Material:
- Definition of “Safety and Security of Work”, regulation of electrical “Safety and Security of Work” in installation of high voltage line, distribution network, and household, and also electricity system maintenance operation;
- Regulation peripheral in labor problem, guarantee of healthy and work safety, and application of labor law regulation.

References:
1. K3 – Kelistrikan, Departemen Tenaga Kerja
2. K3 dalam Operasi dan Pemeliharaan Kelistrikan, PT. PLN.
3. KUHP – Hukum Perburuhan.
4. 

33. **ESTIMATION METHOD OF LOAD REQUIREMENT AND ELECTRIC COST (TKE426)** 2 credits

Objective:
- Capable to estimate electric load requirement and calculating selling price of electric energy.

Material:
- Introduction of electric estimation study methodologies, method of prediction and development of electric requirement, development of generation system based on criteria of technique and economics stability, stock/utilization model, flow adjustment model, determination of average cost and marginal cost, Houthaker method, Halvorsen method, Griffin method, Taylor method, Verliger and Blattenberger, model and structure of household electric requirement, industry/commercial sectors, application of marginal cost technique (long run marginal cost), electric pricing technique (Base Cost of Electric)-PLN (electric country company), Welfare loss by capacity and welfare loss by energy pricing.

References:

34. **ELECTRIC POWER CABLE TECHNOLOGY (TKE427)** 2 credits

Objective:
- Comprehending characteristic, making and choosing cable and electric power conductor.

Material:
- Characteristic of power cable and coil to air-conduction, cable construction, electric loading, laboring mechanics forces in cable or coil, and heat in insulation, electric breakdown mechanism, dielectric losses as function of voltage and current, power cable insulation, determining capability of current and high voltage conduction, insulation economical calculation, power losses calculation.

References:

35. **STANDARIZATION (TKE187)** 3 credits

According to Diponegoro University Curriculum (MKB).
SYLLABUS OF INFORMATICS AND COMPUTER SYSTEM CONCENTRATION

1. ALGORITHM AND DATA STRUCTURE (TKE300) 3 Credit
   Objective: Students would be able to know and understand the way of finishing problems using computer program.
   Material: Abstract data type; mathematics and heuristic solution; algorithm; hanoi tower; floyd; dijkstra; sorting; binary tree.
   Literature: 1. Insap Santosa, Algoritma dan Struktur Data.
   Prerequisite: Basic of Computer and Programming

2. COMPUTER ARCHITECTURE AND ORGANIZATION (TKE301) 3 Credit
   Objective: Students would be able to recognize computer structure / organization through the understanding of component function and also its use.
   Material: CPU/computer component; ALU and register; processor organization; arithmetic operation; fixed point, floating point; multiplication, division, addition, and reduction operation; interface; bus and I/O system; processor; memory types; memory technology; micro programme control unit; direct addressing technique; immediate; indirect index; relative instruction set for data transfer and arithmetic operation.
   Prerequisite: Digital System

3. OBJECT ORIENTED DESIGN AND ANALYSIS (TKE322) 2 Credit
   OBJECT ORIENTED DESIGN AND ANALYSIS LAB. WORK(TKE322P) 1 Credit
   Objective: giving basic knowledge and skills in analysis and create a model of object oriented software.
   Material: Analysis role and function; system analysis; specification analysis; analysis technique and method; method and process of designing software; designing user interface; guarantee the quality of software.

4. OPERATING SYSTEM (TKE302) 2 Credit
   Objective: Learning and giving understanding about the basic concept of operating system.
   Material: Preface; process; interprocess synchronization. interprocess communication. memory, processor, and I/O arrangement; file system.
   Prerequisite: Basic of Computer and Programming

5. ASSEMBLY LANGUAGE PROGRAMMING (TKE304) 2 Credit
   Objective: Giving an understanding about theory of programming using assembly language and practice it.
   Material: Learning instruction functions; I/O; moving memory/ register; arithmetics and logic; programme sequence and control; register; addressing; emulator
   Literature: 
   Prerequisite: Algorithm and Data Structure

6. THEORY OF LANGUAGE & AUTOMATION (TKE323) 2 Credit

7. MULTIMEDIA (TKE317) 2 Credit
   MULTIMEDIA LAB WORK (TKE317P) 1 Credit
   Objective: Students would be able to understand and have the ability to design programme based on graphical and voice.
   Material: Preface; multimedia programming; interface with sound card and graphic card; designing animation programme; hyper text document; and another multimedia application above Windows.

8. OBJECT ORIENTED PROGRAMMING (TKE324) 2 Credit
   ADVANCED PROGRAMMING LAB WORK (TKE324P) 1 Credit
   Objective: Students would be able to understand the theory of C++ programming and practice it.
   Material: Part of C programme; constant and variables; expression and statement; function; basic class, programme flowchart; reference; advanced function; array; inheritance; polymorphism; stream; object oriented analysis and design.
   Prerequisite: Algorithm and Data Structure; Software Engineering

9. DIGITAL SIGNAL PROCESSING (TKE108) 3 Credit
Objective: Giving basic knowledge about signal digital and digging methods of signal processing and its application.

Material: Signal sampling concept, time-frequency analysis, Fourier transform, DFT and FFT, Z transform, digital filter scheme, application of digital signal processing of noise reduction.

5. S. Kadariah, Evaluasi Poyek, UI Press

Prerequisite: Engineering Mathematics II, Digital System

10. INTERFACE DAN PERIPHERAL (TKE106) 2 Credit
INTERFACE DAN PERIPHERAL LAB WORK (TKE106P) 1 Credit

Objective: Students would be able to understand the element principle of interface and peripheral in digital electronic system and computer.


Prerequisite: Microprocessor

11. DATA COMMUNICATION (TKE107) 3 Credit

Objective: Students would be able to understand data communications process at various data communications network infrastructure.

Material: Architecture and protocol, data transmission, transmission media, coding data, data communication interface, datalink control, multiplexing, packet switching, ATM, Frame Relay, ISDN, B-ISDN.


12. COMPUTER NETWORK (TKE307) 2 Credit
COMPUTER NETWORK LAB WORK (TKE307P) 1 Credit

Objective: Students would be able to understand computer network structure and also its application.

Material: Basic architecture of protocol network; network surface interface; local area network internal protocols; Addressing, Routing; Flow control; high level protocol.


Prerequisite: Basic of Computer and Programming

13. DATA BASE SYSTEM (TKE305) 2 Credit
DATA BASE SYSTEM LAB WORK (TKE305P) 1 Credit

Objective: Learning and giving an understanding about database concept.

Material: Database architecture; hierarchy of database system; database system network; relational database system; relational query language; theory of recovery and concurrency relational database design; security and integrity; distributed database.

2. S. Antre, Database Management System, Techniques and Design.

Prerequisite: Algorithm and Data Structure

14. CRYPTOGRAPHY (TKE308) 2 Credit

Objective: Introducing and giving an understanding one of the data security concept at single host and computer network. Cryptography technology guarantee data sent to the computer network more safely.

Material: basic concept of cryptography; cryptography protocol; digital signature; checksum; symmetrical and asymmetrical key; algorithm of cryptography; some cryptography applications.


15. DISCRETE MATHEMATICS (TKE328) 2 Credit

Objective: After following this class, students would be able to use discrete mathematics concepts in problem analysis, designing system, trouble-shooting problems using algorithm, and or in problems related with number theory at higher level class.

Material: Logic (especially propositional logic) and authentication; theory of association; matrix; relation and function; mathematical induction; algorithm and integer; combinatoric and discrete possibility; Boolean algebra; graph and its application; tree and its application; and algorithm complexity.

16. SOFTWARE ENGINEERING (TKE306) 2 Credit
Objective: Learning technique and the way of developing software with high quality.
Material: Definition and Paradigm: software engineering and growth and also its prospect; software component and characteristic, cycle of life and prototyping software engineer. Planning and conditions of software, designing software, Coding and programming language, Test-Drive and maintenance of software, software management and configuration.
Literature:
3. Devitsitis, Operation Management.
5. S. Kadariah, Evaluasi Proyek, UI Press
Prerequisite: Algorithm and Data Structure

17. INFORMATION SYSTEM (TKE3329) 3 Credit
Objective: Giving an understanding of SIM meaning, organizational pattern of SIM, supplying information for decision making in so many area management of organization.
Material: Meaning and role of SIM. Management, system information and approach. Information for the decision making. Planning of SIM: detail and Macro Device. Applying SIM. Evaluate SIM.
Literature:

18. ANALOG ELECTRONICS (TKE102) 3 Credit
Objective: Introducing and giving basic knowledge about various amplifiers with various characteristic.
Material: Cascade amplifier, feedback amplifier, oscillator, controlled power amplifier, narrow band amplifier and wide band amplifier, power amplifier class A, class AB, class B, and class C, Operational Amplifier.
Literature:
5. S. Kadariah, Evaluasi Proyek, UI Press
Prerequisite: Basic of Electronic

19. PEMODELAN DAN SIMULASI SISTEM (TKE215) 2 Credit
Objective: Student would be able to compile simulation model to the problems of system, expressing simulation model in the form of computer program, doing an experiment to the system using simulation model, doing statistical analysis to the result of simulation, taking conclusion from the result of analysis, and also give interpretation to the result.
Material: Modelling Simulation; Steps of Simulation Analysis; Simulation Result Accuracy; Calculation of Sample Requirement; Mechanism of Stopping Simulation; Average and Variance Value Calculation Method (sample and time); Produce Random Variable; Static System Simulation and its application; Discrete System Simulation; Interpretation of Event, State, and Statistic; Mechanism of Progressing Time; Organization of Discrete System Simulation; Application of Discrete System Simulation; Usage of Simulation Program Package; Continu System Simulation; Application of Continu System Simulation.
Literature:
Prerequisite: Probability, Statistic, and Stochastic.

20. SYMBOLIC COMPUTATION (TKE321) 2 Credit
Objective: Students would be able to understand symbolic number computation and its operation.
Material: Symbolic system and its proceed. Symbolic proceduer architecture.
Literature: 1. Symbolic computer architecture.
Prerequisite: Numeric Computation

21. THEORY OF QUEUE AND RELIABILITY (TKE320) 2 Credit
Objective: Students would be able to understand theory of queue, its concept and its reability process.
Material: Discrete and continu. produang distribution, queue theory, single queue & single server, single queue & multiple server, reliability theory and process.
Literature:
Prerequisite: Algorithm and Data Structure

22. NETWORK PROGRAMMING (TKE311) 3 Credit

Objective: Students would be able to understand programming at computer network, especially at computer network of TCP / IP.

Material: TCP/IP protocol, network programming technique, socket elementer, multiplexing I/O, I/O non-blocking, socket routing, broadcasting, threading, XTI.


Prerequisite: Computer Network

23. PARALLEL PROCESS (TKE315) 2 Credit

Objective: Students would be able to understand the concept of parallel processing in computer.

Material: Uniprocessor-multiprocessor system, memory and I/O system, vector processing and pipeline principal, structure and algorithm of array processing.


Prerequisite: Basic of Computer and Programming, Computer Organization, Microprocessor

24. BIOINFORMATIC (TKE330) 2 Credit

25. SMART SYSTEM (TKE313) 3 Credit

Objective: Giving knowledge about smart system and its application

Material: Definition of AI, AI and internal interpretation, predicate calculus, indexing, alternative pointer and notation, LISP and PROLOG, vision, early processing, NLP, search algorithm, plan interpreter language comprehension.


Prerequisite: Basic of Computer and Programming

26. COMPUTER BASED DESIGN (TKE316) 2 Credit

Objective: Students would be able to understand system design that using computer as its supporting device.

Material: Preface, system design using computer, structure and environment, developing tools, simulation and checking, application in electronic design, design management.


Prerequisite: Software Engineering

27. MOBILE COMPUTATION (TKE326) 2 Credit

Objective: After following this class, students would be able to understand the basic problems in mobile computation.

Material: Nircable communication, bandwith management, location management and mobile tracking, mobile IP, mobile application, mobile agent.


Prerequisite: Software Engineering

28. DIGITAL IMAGE PROCESSING (TKE115) 3 Credit

Objective: Giving an understanding about the concept of digital image processing and searching more about processing algorithms also its application.

Material: Imaging concept, 2-dimension basic mathematics, image processing, image analysis, segmentation and thresholding, image bundle system, image processing application.


Prerequisite: Digital Signal Processing

29. THEORY OF INFORMATION (TKE325) 2 Credit

Objective: Giving basic knowledge about information measurement and its coding.

Material: Information content concept, entropy function, basic coding, Huffman coding, arithmetic coding, coding element, information theory application.

2. Fazlollah M. Reza, *Introduction to Information Theory*.

Prerequisite: Probability, Statistic, and Stochastic

30. COMPILATION ENGINEERING (TKE319) 2 Credit

Objective: Learning and giving an understanding about basic concept of compilation technique that is contains of its function, component, steps, and its working mechanism.

Material: Preface, basic concept, compilation step, lexical analysis (scanning), syntax directed translation, code generation, code optimization, information table, error recovery.

Prerequisite: Algorithm and Data Structure

31. COMPUTER AND HUMAN INTERACTION (TKE326) 2 Credit

Objective: Students would be able to understand and assessing digital communications which cover channel code processing, demodulation and modulation, encryption and decryption, multiple and demultiple access.


4. Introduction to Spread Spectrum.

Prerequisite: Telecommunication System

32. DIGITAL COMMUNICATION (TKE109) 3 Credit

Objective: Giving an understanding of application technique that use the screen monitor as a media.

Material: Recognize graphics system tools (joystick, control dials, flat bed plotter). Compare pascal graphic instruction with Autocad instruction and Basic instruction. Recognize interpolation graphic function, screen normalization, data graphic structure, approximation, animation, 3-dimension graphic, graphic transform.

2. Computer graphics, Schaum's series.

33. COMPUTER GRAPHIC (TKE327) 3 Credit

According to the MKB of UNDIP.

34. STANDARDIZATION (TKE187) 3 Credit

According to the MKB of UNDIP.

35. PATTERN RECOGNITION (TKE119) 2 Credit

Objective: Giving basic understanding about principles of pattern recognition and searching more about its method, also applying its algorithm.

Material: Pattern recognition concept, decision function, classification with decision function, classification with equality function, characteristic election, classification with nerve network.

SYLLABUS OF CONTROL CONCENTRATION

1. OPTIMATION (TKE204)  3 credit
Objective: The student will be able to comprehend the base of optimization technique, methods and its application.

Material:

Reference:
3. SS Rao, Optimization and Its Application.

2. ELECTRONICS INSTRUMENTATION SYSTEMS (TKE200)  3 credit
Objective: The student will have strong knowledge of measurement device and perception in electronic field.

Material:
- DC and AC bridge, Oscilloscope Voltage measurement, current, power, phase, electronic impedances, RLC, frequency and period, electronic phasor diagram, counter frequency, Jembatan dc and ac; oscilloscope; pengukur tegangan, arus, daya, fasa, tahanan elektronik, RLC, perioda dan frekuensi; diagram fasor elektronik; frekuensi counte, spectral analizer, distortion analyzer, electrical wave generator, data acquisition, data storage systems.

Reference:
1. Larry D. Jones dan A. Foster Chin, "Electronic Instruments and Measurements".

Prasyarat: Dasar Elektronika, Pengukuran Listrik, Rangkaian Listrik I dan II

3. MULTIVARIABLE CONTROL SYSTEMS (TKE202)  3 credit
Objective: The students will have strong basic math for modern control systems and basics of modern control. The student will be have knowledge of analytical method and multivariable system designing.

Material:
- concept of state; system representation with state, state space equation, homogenous and non homogenous, state transition matrix; impulse response matrix; controlability; observability; state feedback theory of observer. Representation of state system multivariable; reachability; decomposition; decentralization; parsial systems; frequency representation of systems representation dalam domain frekuensi; design of single loop, performance definition, pole and zero concept, Matrix Fraction Description (MFD).

Reference:

4. ANALOG CONTROL SYSTEMS (TKE203)  2 Credits

ANALOG CONTROL SYSTEMS LAB WORK (TKE203P)  1 Credit
Objective: The student will be could analyzing systems stabilization with various method and could design compensator in time and frequency domain.

Material:
- Specification of control system, Spesifikasi Disain Sistem Kontrol (stabilitas, sensitivitas, disturbance rejection); analyzing of Error; analyzing method: Root locus, Bode diagram, Nyquist diagram; design of compensator; Nonlinear system analyzing (describing function, phase plane), stability concept, Lyapunov

Reference:

Condition: Basic of Control Systems

5. MODELING AND SYSTEM IDENTIFICATION (TKE224)  3 Credits

MODELING AND SYSTEM IDENTIFICATION LAB WORK (TKE224P)  1 Credit
Objective: The student will be able to draw modeling and system identification using math approach.

Material:
- Introduction to system, System modelling, first and second order systems modeling, transient response, frequency response, Non parametric identification, (correlation analyzing,, transient, spectrum), offline and online (LS, RLS, SLS, ELS, LMS).


6. MANUFACTURING AND PROCESS CONTROL SYSTEMS (TKE225) 3 Credits
MANUFACTURING AND PROCESS CONTROL SYSTEMS, LAB WORK (TKE225P) 1 Credit

Objective: The student will have good knowledge of control systems for industrial process and Manufacturing.

Material: Introduction to manufacturing and process concept, Manufacturing Process Control, Sensor and transducer, pneumatic and hydraulic, Electronic Controller, PLC, CNC, introduction to DCS, Centralize control system systems


7. OPTIMAL CONTROL SYSTEMS (TKE207) 3 Credits

Tujuan: The students will be able to design optimal based control system

Material: Pontraygin maximum principal; Hamiltonian calculus variation; principle; Linear Quadratic Regulator (LQR) dan LQ tracking; sub-optimal; discrete systems LQR; dinamik programming; output feedback; separation theory I: constrained-input problem.


Condition: Optimization, Multivariable controlled systems

8. ADAPTIVE CONTROL (TKE226) 3 Credits

Objective: The student will be able to design algorithm and adaptive control system control strategy and can implement using software.

Material: Definition of adaptive control, parametric model, parameter estimation (nonrecursif, recursive), system validation, Model reference adaptive system, self tuning regulator (Direct, Indirect, Linear Quadratic); Stochastic adaptive control systems, adaptive control stability.


9. SMART CONTROL SYSTEMS (TKE219) 3 Credits

Objective: The student will have good understanding of artificial intelligence for Control purpose

Material: Definition of Smart control systems and basic concept, knowledge base, inferencial machine, chaining, rule based control system, artificial neural networks, fuzzy control, genetic algorithm and application in smart systems.


10. DIGITAL CONTROL SYSTEMS (TKE227) 2 Credits

DIGITAL CONTROL SYSTEMS, LAB. WORK (TKE227P) 1 Credit

Objective: The student will be able to design computer and digital machine based control systems.

Material: Digital control system basic concept; discreet signal, Z transformation, sampling theorem, digital control system analysis, (stability, sensitivity, robustness, controlability, observability); pole placement design (state-space and polynomial approach); digital controller implementation.


Condition: Multivariable Control Systems

Condition: Basic of Control Systems, Digital system design and microcontroller

12. MODEL BASED CONTROL SYSTEMS (TKE230)  3 Credit
Objective: The student will be able to design control for plant and process based know model
Material: Internal Model Control, Feedforward Control, Cascade Control, Inferential Control, Model Predictive Control

13. LARGE SCALE SYSTEMS (TKE231)  2 Credit
Objective: The student will be able to consider several aspect in large scale systems, evaluate systems, and plan several model
Material: Introduction to large scale systems, general Aggregation, modal aggregation, equal Aggregation, optimum design, distributed control, hierarchy control, control application.
Condition: Estimasi dan Identifikasi Sistem

14. EMBEDDED CONTROL SYSTEMS (TKE232)  2 Credit
Objective: The student will be able to design control system embedded in microcontroller or digital machine for any purpose
Material: Embedded C, Microcontroller, FPGA, StateFlow, Finite State Machine, introduction to VHDL

15. THE FUTURE TREND OF CONTROL FIELD (TKE233)  2 Credit
Objective: The student will be good knowledge of control systems field development
Material: Special topic of control field development, automatic control, stability, adaptive control, optimal control, smart control and system simulation.
Condition: the student is taking final project

16. ROBUST CONTROL SYSTEMS (TKE234)  2 Credit
Objective: The student will be have good knowledge about robust control and can implement it in industrial process.
Material: Introduction to Robust Control; Multivariable Frequency Response Analysis; The H2 Control Problem; The Full Information Control Problem; Minimax Estimation and H-inf Filtering; The Solution of the H-inf Generalized Regulator Problem; Model Reduction by Truncation; Optimal Model Reduction; Design Case Studies in Industrial Processes.

17. MECHATRONICS (TKE432)  2 Credit
Objective: The students can explain operation principle of various mechatronic systems
Material: This subject contain basic concept, examples and operation principle of mechatronic system
Reference: 1. W.Bolton; MECHATRONICS (Electronik Control Systems in Mechanical Engineering);
2. Krause; Wasynczuk; ELECTROMECHANICAL (Motion Devices).

18. DIGITAL IMAGE PROCESSING (TKE115)  3 Credit
Objective: The student will be have good understanding of digital image processing, algorithm and implementation.
Material: Imaging concept, Two dimension basic math, image processing, image analyzing, segmentation and thresholding, image measurement, image file systems, application of image processing
3. Prasarat: Pengolahan Sinyal Digital
<table>
<thead>
<tr>
<th>Course Title</th>
<th>Credits</th>
<th>Objective</th>
<th>Material</th>
<th>Reference</th>
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<tbody>
<tr>
<td>19. ASSEMBLY LANGUAGE PROGRAMMING (TKE304)</td>
<td>2</td>
<td>Objective: The student will have good understanding of assembly language programming, either theoretical and practical.</td>
<td>Material: Basic function and instruction: I/O, shift memory/register, logic and arithmetic, sequence and program control, register, addressing and emulator</td>
<td>Reference: 1.</td>
</tr>
</tbody>
</table>
2. Samuel C. Lee, Digital Circuit and Logic Design  
3. John D. Lenk, Handbook of Digital Electronics |
3. Teknik Digital, Dasar Elektronika |
2. Bernard Grab, Electronic Circuit and Applications  
| 23. ADVANCE SYSTEM IDENTIFICATION (TKE228)       | 2       | Objective: The student will be able to identify and simulate nonlinear system with varying methods. | Material: Nonlinear systems, Nonlinear systems response, Nonlinear systems modeling, Neural networks modeling, Fuzzy identification. | Reference: 1. Norgaard dkk, Neural Networks for Modelling and Control of Dynamic Systems, Springer  
4. Teknik Digital, Dasar Elektronika, Komponen Sistem Kontrol |
| 26. PATERN RECOGNITION (TKE119)                 | 2       | Objective: The student will be have good understanding of patern recognition princip, could analy and design patern recognition algorithm. | Material: Patern recognition concept, decision function, clasification using decision function. | Reference: 28 |
Reference : 1. Principles of Pattern Recognition  

27. POWER ELECTRONIC (TKE408)  
Objective : The student will be able to analyze and design power electronic circuit for AC to AC, DC to DC, DC to AC  
and AC to DC converter.  
Material : Power electronic component, power electronic circuit and controller, rectifier, DC Chopper, inverter and  
cycloconverter, natural and forced commutation, AC-AC converter, harmonics.  

28. INTERFACE AND PERIPHERAL (TKE106)  
Objective : The student will have good understanding of interface and peripheral basic concept, either in digital system  
or computer  
Material : Bus Interfacing, I/O Interfacing, Memory Interfacing, Bidirectional communication, Handshaking, Serial  
& Parallel interfacing, Data Transfer, Standar digital Interfacing, Timing system, Interrupt & DMA system, D/A, A/D, transducer,  
Signal conditioning, actuator, LAN, WAN, Software Interfacing.  
Prasyarat : - Mikroprosessor.

29. DIGITAL SIGNAL PROCESSING (TKE108)  
Objective : The student will be have good understanding of digital signal and could analyze and design digital signal  
processing systems  
Material : Signal sample concept, time and frequency analysis, Konsep pencuplikan sinyal, analisis waktu-  
frekuensi, Tranformasi Fourier transform, DFT and FFT, Z transform, Digital filter design, digital signal  
processing for noise reduction.  
Reference : 1. Roman Kuc, Introduction to Digital Signal Processing  
Condition : Math of Engineering II, Digital Engineering

30. STANDARITATION (TKE037)  
As According To MKB of University Diponegoro.

31. OBJECT ORIENTED PROGRAMMING (TKE324)  
Objective : The student will be have good understanding of object oriented programming and could practice it  
Material : Part of C language, constant and variable, expression and function, basic class, program flow,  
pointer, reference, advance function, array, inheritance, polymorphism, stream, object oriented analyze and  
design.  
McGraw-Hill  
Condition : - Algoritma dan Struktur Data  
- Rekayasa Perangkat Lunak