



INSTITUT TEKNOLOGI SEPULUH NOPEMBER (ITS)
FAKULTAS TEKNOLOGI ELEKTRO DAN INFORMATIKA CERDAS
DEPARTEMEN TEKNIK ELEKTRO
Program Studi Sarjana (S1) Teknik Telekomunikasi

1	Nama Mata Kuliah / Course Name : Sistem Komunikasi / <i>Communication Systems</i>
2	Kode Mata Kuliah / Course Code : EL234402
3	Kredit / Credits : 4 SKS
4	Semester / Semester : 4

Deskripsi Mata Kuliah / Course Name

Sistem Komunikasi membahas tentang perancangan sistem transmisi sinyal pesan (data) dalam format analog dan digital menggunakan sinyal/ gelombang pembawa dengan tujuan agar sinyal pesan analog/digital dapat dikirim melewati media transmisi (dengan gangguannya berupa interferensi dan filtering) dan gangguan berupa sinyal noise dan membahas perancangan teknik demodulasi dan deteksi sinyal pesan kembali dengan kemungkinan error sekecil mungkin dengan memperhatikan kriteria perancangan yaitu daya dan bandwidth yang efisien serta kompleksitas perangkat yang rendah.

Communication Systems discusses the design of message signal (data) transmission systems in analog and digital formats using carrier signals/waves with the aim that analog/digital message signals can be sent over the transmission media (with interference in the form of interference and filtering) and disturbances in the form of noise signals and discusses design of demodulation and signal detection techniques for returning messages with the smallest possible error by taking into account the design criteria, namely efficient power and bandwidth as well as low device complexity.

Capaian Pembelajaran Lulusan (CPL) Yang Dibebankan Mata Kuliah / Program Learning Outcomes Charged to The Course

1. (CPL-04) Mampu menerapkan ilmu pengetahuan alam dan matematika serta teknologi dan rekayasa informasi untuk memperoleh pemahaman komprehensif pada bidang teknik telekomunikasi.
(PLO-04) Able to apply knowledge of sciences, mathematics, and information technology to acquire comprehensive understanding of engineering principles in Telecommunication Engineering
2. (CPL-05) Mampu merancang komponen, sistem, dan proses yang logis dan realistis sesuai dengan spesifikasi yang ditentukan dengan mempertimbangkan aspek keselamatan, sosial, budaya, lingkungan, dan ekonomi.
(PLO-05) Able to design components, systems, and/or processes to meet desired needs within realistic constraints in such aspects as law, economic, environment,

social, politics, health and safety, sustainability as well as to recognize and/or utilize the potential of local and national resources with global perspective

3. (CPL-08) Mampu mengetahui dan mengaplikasi metode dan keahlian sesuai perkembangan terkini di bidang ilmu pengetahuan dan teknologi untuk menyelesaikan permasalahan di bidang Teknik Telekomunikasi dengan mengedepankan nilai-nilai universal
(PLO-08) Able to know and apply methods, skills according to the latest developments in the field of science and technology to solve electrical engineering problems by prioritizing universal values

Capaian Pembelajaran Mata Kuliah/ Course Learning Outcomes

1. Mampu memahami dan mendefinisikan konsep sistem komunikasi analog dan digital, mampu menerapkan konsep sinyal dan sistem dalam analisis sistem komunikasi serta mampu menjelaskan konsep pengubahan sinyal analog menjadi sinyal digital. / *Be able to understand and define the concept of analog and digital communication systems, be able to apply signal and system concepts in the analysis of communication systems and be able to explain the concept of converting analog signals into digital signals.*
2. Mampu memahami konsep modulasi amplitudo dan demodulasi sinkron (koheren), mampu menganalisa kinerjanya dalam gangguan derau, dan mampu melakukan simulasi proses modulasi amplitudo (analog) dan demodulasi sinkron (koheren) menggunakan software Matlab, serta mampu mengaplikasikan konsep pergeseran frekuensi dan fasa untuk aplikasi penting lainnya dalam menunjang transmisi sinyal secara analog yang hemat bandwidth dan aman. / *Be able to understand the concepts of amplitude modulation and synchronous (coherent) demodulation, be able to analyze their performance in noise disturbance, and be able to simulate the process of amplitude modulation (analog) and synchronous demodulation (coherent) using Matlab software, and be able to apply the concepts of frequency and phase shift to other important applications in supporting bandwidth-efficient and secure analog signal transmission.*
3. Mampu menjelaskan konsep pengubahan sinyal analog menjadi sinyal digital, mampu memahami konsep dasar penerima optimum untuk sistem komunikasi digital dan mampu memahami konsep ruang sinyal dan aplikasinya dalam perancangan pemancar dan penerima optimum untuk sistem modulasi digital biner dan m-ary, dan mampu menggunakan program matlab untuk simulasi dan analisis sistem komunikasi digital, serta mampu menjelaskan konsep perhitungan kinerja sistem komunikasi digital pada kanal ideal dengan gangguan interferensi derau putih Gaussian. / *Be able to explain the concept of converting analog signals into digital signals, be able to understand the basic concepts of optimum receivers for digital communication systems and be able to understand the concept of signal space and its application in designing optimum transmitters and receivers for binary and m-ary digital modulation systems, and be able to use programs matlab for simulation and analysis of digital communication systems, as*

well as being able to explain the concept of calculating the performance of digital communication systems on ideal channels with Gaussian white noise interference.

4. Mampu merancang bentuk spektrum dan pulsa sinyal modulasi digital linier sehingga dapat dioperasikan pada lingkungan terbatas bandwidth dan mampu merancang teknik ekualiser sederhana untuk mengatasi adanya distorsi inter-symbol-interference akibat kanal tak ideal / *Able to design spectrum shape and linear digital modulation pulse signal so that it can be operated in bandwidth limited environment and able to design simple equalizer technique to overcome inter-symbol-interference distortion due to non-ideal channels.*

Pokok Bahasan / Contents

1. Konsep sistem komunikasi analog dan digital, Review sinyal dan sistem : Konsep sinyal dan spektrum sinyal komunikasi: konsep sinyal energi dan sinyal daya, pengertian dan bandwidth sinyal baseband dan sinyal passband, Okorelasi dan rapat spektral daya. / *Concept of analog and digital communication systems, Review of signals and systems: Concept of signals and spectrum of communication signals: concepts of energy signals and power signals, definition and bandwidth of baseband signals and passband signals, Ocorrelation and power spectral density.*
2. Konsep transmisi ideal, respon impuls kanal ideal dan kanal non ideal. Bandwidth dan efek filtering kanal, distorsi kanal fading dan ekualiser serta penyaringan kuadratur dan transformasi Hilbert. / *The concept of ideal transmission, ideal channel impulse response and non-ideal channels. Bandwidth and channel filtering effects, channel fading distortion and equalizer as well as quadrature filtering and Hilbert transform.*
3. Konsep modulasi dan demodulasi amplitudo : DSB, AM, SSB dan VSB dan konsep modulasi untuk aplikasi lainnya seperti multipleksing dan scrambling serta konsep penggunaan perangkat ICT untuk mensimulasikan modulasi dan demodulasi analog menggunakan software Matlab. / *Amplitude modulation and demodulation concepts: DSB, AM, SSB and VSB and modulation concepts for other applications such as multiplexing and scrambling as well as the concept of using ICT devices to simulate analog modulation and demodulation using Matlab software.*
4. Konsep perhitungan kinerja sistem komunikasi analog dalam lingkungan AWGN. / *The concept of calculating the performance of an analog communication system in an AWGN environment.*
5. Konsep konversi sinyal pesan analog menjadi sinyal pesan digital. / *The concept of converting analog message signals into digital message signals.*
6. Konsep penerima optimum sinkron/koheren sistem komunikasi digital: Penerima Matched Filter dan korelator, detektor maximum likelihood. / *Optimum synchronous/coherent receiver concept for digital communication systems: Matched filter receiver and correlator, maximum likelihood detector*

7. Konsep ruang sinyal dan representasi set sinyal berdurasi terbatas , dan prosedur Gram-Schmidt untuk mendapatkan sinyal basis orthonormal. / *Concept of signal space and finite duration signal set representation, and Gram-Schmidt procedure to obtain orthonormal basis signals.*
8. Konsep perancangan penerima koheren dan pemancar untuk sistem komunikasi digital biner. / *Coherent receiver and transmitter design concepts for binary digital communication systems.*
9. Konsep simulasi dari sistem komunikasi digital biner menggunakan software Matlab. / *Simulation concept of binary digital communication system using Matlab software.*
10. Konsep perancangan penerima koheren dan pemancar untuk sistem komunikasi digital M-ary./ *Design concept of coherent receiver and transmitter for digital M-ary communication system.*
11. Konsep simulasi dari sistem komunikasi digital Biner dan M-ary menggunakan software Matlab. / *Simulation concept of binary and M-ary digital communication systems using Matlab software.*
12. Konsep perhitungan kinerja BER sistem komunikasi digital biner. / *The concept of calculating the BER performance of binary digital communication systems.*
13. Konsep perhitungan kinerja SER dan BER sistem komunikasi digital M-ary. / *The concept of calculating the performance of SER and BER digital communication system M-ary.*
14. Konsep perhitungan rapat spektral sinyal modulasi linier dan teknik pulse-shaping dan teknik coding. / *The concept of calculating the spectral density of linear modulation signals and pulse-shaping techniques and coding techniques.*
15. Konsep pengiriman sinyal modulasi digital dengan bandwidth terbatas dan terbebas inter-simbol interferensi (ISI) menggunakan filtering Nyquist dan konsep ekualisasi kanal untuk menurunkan ISI karena pengaruh kanal tak-ideal./ *The concept of sending digital modulation signals with limited bandwidth and free of inter-symbol interference (ISI) uses Nyquist filtering and the concept of channel equalization to reduce ISI due to the influence of non-ideal channels.*

Prasyarat / Pre-requisite

Analisa sinyal dan Sistem, Pengolahan Sinyal Digital; Probabilitas, Statistik, dan Proses Stokastik / Signals and Systems, Digital Signal Processing, Probability & Statistics, Stochastic Process

Pustaka / Reference

Utama / Primary :

1. Hwei Hsu, Ph.D., Schaum's outline of theory and problems of Analog and Digital Communications, 2nd Edition, Mc-Graw Hill, 2003.
2. Bernard Sklar and Pabitra Kumar Ray, Digital communications: Fundamentals and Applications, 2nd Edition, PEARSON, 2014.
3. John G. Proakis, Digital communications, 3rd Edition, Mc-Graw Hall, 1995.
4. Hiroshi Harada, Ramjee Prasad, " Simulation and Software Radio for Mobile Communications" Artech House, LONDON, 2002

Pendukung / Support:

1. Tri T. Ha, Theory and Design of Digital Communication Systems, cambridge University Press, 2011.
2. Michel C. Jeruchim, Philip Balaban, and K. Sam Shanmugan. Simulation of communication systems: modeling, methodology and techniques, 2nd Edition, Kluwer Academic Publishers, New York, 2002