VIDYASAGAR UNIVERSITY

Midnapore, West Bengal

PROPOSED CURRICULUM & SYLLABUS (DRAFT) OF

BACHELOR OF SCIENCE (HONOURS)

MAJOR IN ELECTRONICS

4-YEAR UNDERGRADUATE PROGRAMME

(w.e.f. Academic Year 2023-2024)

Based on

Curriculum & Credit Framework for Undergraduate Programmes

(CCFUP), 2023 & NEP, 2020

VIDYASAGAR UNIVERSITY
BACHELOR OF SCIENCE (HONOURS) MAJOR IN ELECTRONICS
(under CCFUP, 2023)

Level	YR.	SEM	Course Type	Course Code	Course Title	Credit	L-T-P	Marks		
								CA	ESE	TOTAL
B.Sc. (Hons.)	3rd	V	SEMESTER-V							
			Major-8	ELCHMJ08	T: Instrumentation; P: Practical	4	3-0-1	15	60	75
			Major-9	ELCHMJ09	T: Signal and Systems; P: Practical	4	3-0-1	15	60	75
			Major-10	ELCHMJ10	T: Digital-II: Sequential circuits, Memory and VHDL; P: Practical	4	3-0-1	15	60	75
			Major Elective-01	ELCHDSE1	Numerical Analysis; P: Practical	4	3-0-1	15	60	75
			Minor-5 (Disc.-I)	ELCMIN05	T: Communication Electronics; P: Practical *(To be taken from other Discipline)*	4	3-0-1	15	60	75
					Semester-V Total	20				375
		VI	SEMESTER-VI							
			Major-11	ELCHMJ11	T: Microprocessor and Microcontroller; P: Practical	4	3-0-1	15	60	75
			Major-12	ELCHMJ12	T: Electronic Communications; P: Practical	4	3-0-1	15	60	75
			Major-13	ELCHMJ13	T: Photonics P: Practical	4	3-0-1	15	60	75
			Major Elective-02	ELCHDSE2	T: Control System; P: Practical	4	3-0-1	15	60	75
			Minor-6 (Disc.-II)	ELCMIN06	T: Analog and Digital Communications; P: Practical *(To be taken from other Discipline)*	4	3-0-1	15	60	75
					Semester-VI Total	20				375
					YEAR-3	40				750
			Eligible to be awarded Bachelor of Science in Electronics *on Exit*			126	Marks (Year: I+II+III)			2325

MJ = Major, MI = Minor Course, DSE = Discipline Specific Elective Course, CA= Continuous Assessment, ESE= End Semester Examination, T = Theory, P= Practical, L-T-P = Lecture-Tutorial-Practical

SEMESTER-V

MAJOR (MJ)

Major – 8
Instrumentation
[Credits: Theory-03, Practicals-01]

Course contents: **Credit-03 Lectures 60**

Unit-1 (10 Lectures)

DC and AC indicating Instruments: Accuracy and precision, Types of errors, PMMC galvanometer, sensitivity, Loading effect , Conversion of Galvanometer into ammeter, Voltmeter and Shunt type ohmmeter, Multimeter.

Unit- 2 (18 Lectures)

Oscilloscopes: CRT, wave form display and electrostatic focusing, time base and sweep synchronisation, measurement of voltage, frequency and phase by CRO, Oscilloscope probes, Dual trace oscilloscope, Dual Beam Oscilloscope, DSO, CRO specifications (bandwidth, sensitivity, rise time).
Signal Generators: Audio oscillator, Pulse Generator, Function generators.

Unit - 3 (12 Lectures)

Transducers: Basic requirements of transducers, Transducers for measurement of non- electrical quantities: Types and their principle of working, measurement of Linear displacement, Acceleration, Flow rate, Liquid level, strain, Force, Pressure, Temperature.

Unit - 4 (20 Lectures)

Data acquisition systems: Block diagram, brief description of preamplifier, signal conditioner, instrumentation amplifier, waveform generator, A/D and D/A converter blocks, computer controlled test and measurement system.
Bio-medical instrumentation: Bio-Amplifiers: Bio potentials - Bio-electricity - Necessity for special types of amplifiers for biological signal amplifications - Different types of Bio-OP- Amps. Electrodes for ECG, EEG, and EMG, block diagram of ECG and EEG systems, brief analysis of graphs.

Suggested Books:

1. Electrical Measurement in Measuring Instruments. Goldwing E.W. and Widdies
2. Electrical and Electronics Measurement and Instrumentation Sahwany A.K.
3. Instrumentation devices and systems: Rangan, Sarma, Mani, TMH
4. Instrumentation measurement and analysis: Nakra B C, Chaudry K K, TMH

5. Handbook of biomedical instrumentation: Khandpur R S, TMH
6. Measurement systems applications and design: Doeblin E O, McGraw Hill, 1990.
7. Electron measurements and instrumentation techniques: Cooper W D and Helfric A D, PHI, 1989.
8. Biomedical instrumentation and measurements: Leslie-Cromwell, Fred J Weibell, Erich A Pfieffer, PHI, 1994.
9. Mechatronics – principles and applications, Godfrey C Onwubolu, Elsevier, 2006

Instrumentation Lab: Credit 01 **Credit: 01**

1. Design of multi range ammeter and voltmeter using galvanometer.
2. To determine the Characteristics of resistance transducer –Strain Gauge (Measurement of Strain using half and full bridge.)
3. To determine the Characteristics of LVDT.
4. To determine the Characteristics of Thermistors and RTD.
5. Measurement of temperature by Thermocouples and study of transducers like AD590 (two terminal temperature sensor), PT-100, J- type, K-type.
6. Characterization of bio potential amplifier for ECG signals.
7. Study on ECG simulator
8. Measurement of heart sound using electronic stethoscope. Study on ECG heart rate monitor /simulator
9. Study of pulse rate monitor with alarm system
10. Measurement of respiration rate using thermister /other electrodes.

OR

Tutorial/ Submission of Dissertation/ Term project/ student Seminar on **Instrumentation**

Major – 9
Signals and Systems
[Credits: Theory-03, Practicals-01]

Course contents: **Credit-03** **Lectures 60**

Unit-1 (17 Lectures)

Signals and Systems: Continuous and discrete time signals, Transformation of the independent variable, Exponential and sinusoidal signals, Impulse and unit step functions, Continuous-Time and Discrete-Time Systems, Basic System Properties.

Unit-2 (13 Lectures)

Linear Time-Invariant Systems (LTI): Discrete time LTI systems, the Convolution Sum, Continuous time LTI systems, the Convolution integral. Properties of LTI systems, Commutative, Distributive, Associative. LTI systems with and without memory, Invariability, Causality, Stability, Unit Step response. Differential and Difference equation formulation, Block diagram representation of first order systems.

Unit-3 (18 Lectures)

Fourier Series Representation of Periodic Signals: Continuous-Time periodic signals, Convergence of the Fourier series, Properties of continuous-Time Fourier series, Discrete-Time periodic signals, Properties of Discrete-Time Fourier series. Frequency-Selective filters, Simple RC high pass and low pass filters
Fourier Transform: Aperiodic signals, Periodic signals, Properties of Continuous-time Fourier transform, Convolution and Multiplication Properties, Properties of Fourier transform and basic Fourier transform Pairs.

Unit-4 (12 Lectures)

Laplace Transform: Laplace Transform, Inverse Laplace Transform, Properties of the Laplace Transform, Laplace Transform Pairs, Laplace Transform for signals, Laplace Transform Methods in Circuit Analysis, Impulse and Step response of RL, RC and RLC circuits.

Suggested Books:

1. V. Oppenheim, A. S. Wilsky and S. H. Nawab, Signals and Systems, Pearson Education (2007)
2. S. Haykin and B. V. Veen, Signal and Systems, John Wiley & Sons (2004)
3. C. Alexander and M. Sadiku, Fundamentals of Electric Circuits , McGraw Hill (2008)
4. H. P. Hsu, Signals and Systems, Tata McGraw Hill (2007)
5. S. T. Karris, Signal and Systems: with MATLAB Computing and Simulink Modelling,Orchard Publications (2008)
6. W. Y. Young, Signals and Systems with MATLAB, Springer (2009)

7. M. Roberts, Fundamentals of Signals and Systems, Tata McGraw Hill (2007)

Signals & Systems Lab: **Credit: 01**

(Scilab/MATLAB/ Other Mathematical Simulation software)

1. Generation of Signals: continuous time
2. Generation of Signals: discrete time
3. Time shifting and time scaling of signals.
4. Convolution of Signals
5. Solution of Difference equations.
6. Fourier series representation of continuous time signals.
7. Fourier transform of continuous time signals.
8. Laplace transform of continuous time signals.
9. Introduction to Xcos/similar function and calculation of output of systems represented by block diagrams.

OR

Tutorial/ Submission of Dissertation/ Term project/ student Seminar on **Signals & Systems**

Major – 10
Digital-II: Sequential circuits, Memory and VHDL
[Credits: Theory-03, Practicals-01]

Course contents: **Credit-03** **Lectures 60**

Unit-1: Sequential logic design:
Latches and Flip flops , S-R Flip flop, J-K Flip flop, T and D type Flip flop, Clocked and edge triggered Flip flops, master slave flip flop, Registers, Counters (synchronous and asynchronous and modulo-N), State Table, State Diagrams, counter design using excitation table and equations, Ring counter and Johnson counter.
Programmable Logic Devices: Basic concepts-ROM, PLA, PAL, CPLD, FPGA, SRAM, DRAM.

Unit-2: Introduction to VHDL:

A Brief History of HDL, Structure of HDL Module, Comparison of VHDL and Verilog, Introduction to Simulation and Synthesis Tools, Test Benches. VHDL Modules, Delays, data flow style, behavioral style, structural style, mixed design style, simulating design. Introduction to Language Elements, Keywords, Identifiers, White Space Characters, Comments, format. VHDL terms, describing hardware in VHDL, entity, architectures, concurrent signal assignment, event scheduling, statement concurrency, structural designs, sequential behavior, process statements, process declarative region, process statement region, process execution, sequential statements, architecture selection, configuration statements, power of configurations.

Unit-3: Behavioral Modelling:
Introduction to behavioural modelling, inertial delay, transport delay , inertial delay model, transport delay model, transport vs inertial delay, simulation delta drivers, driver creation, generics, block statements, guarded blocks.

Unit-4: Sequential Processing:
Process statement, sensitivity list, signal assignment vs variable assignment, sequential statements, IF, CASE, LOOP, NEXT, EXIT and ASSERT statements, assertion BNF, WAIT ON signal, WAIT UNTIL expression, WAIT FOR time expression, multiple wait conditions, WAIT Time-Out, Sensitivity List vs WAIT Statement Concurrent Assignment, Passive Processes.

Unit-5: Data types:
Object types-signal, variable, constant, Data types–scalar types, composite types, incomplete types, File Type caveats, subtypes, Subprograms and functions.

Suggested Readings:

1. M. Morris Mano Digital System Design, Pearson Education Asia,(Fourth Edition)
2. Thomas L. Flyod, Digital Fundamentals, Pearson Education Asia (1994)
3. W. H. Gothmann, Digital Electronics: An Introduction To Theory And Practice, Prentice Hall of India(2000)
4. R. L. Tokheim, Digital Principles, Schaum's Outline Series, Tata McGraw- Hill (1994)
5. Verilog HDL-A guide to digital design and synthesis-Samir Palnitkar, Pearson, 2nd edition.

Digital Electronics and Verilog/VHDL Lab: **Credit: 01**

(Hardware and Circuit Simulation Software)

1. To build a Flip- Flop Circuits using elementary gates. (RS, Clocked RS, D-type).
2. Design a counter using D/T/JK Flip-Flop.
3. Design a shift register and study Serial and parallel shifting of data.
4. Write code to realize basic and derived logic gates using VHDL
5. Half adder, Full Adder using basic and derived gates using VHDL.
6. Half subtractor and Full Subtractor using basic and derived gates using VHDL.
7. Clocked D FF, T FF and JK FF (with Reset inputs) using VHDL.
8. Multiplexer (4x1, 8x1) and Demultiplexer using logic gates using VHDL.
9. Decoder (2x4, 3x8), Encoders and Priority Encoders using VHDL.
10. Design and simulation of a 4 bit Adder using VHDL.
11. Code converters (Binary to Gray and vice versa) using VHDL.
12. 2 bit Magnitude comparator using VHDL.
13. 3 bit Ripple counter using VHDL.

MAJOR ELECTIVE (DSE)

Major (Elective 1)
Numerical Analysis

[Credits: Theory-03, Practicals-01]

Course contents: **Credit-03** **Lectures 60**

Unit-1 (16 Lectures)

Numerical Methods: Floating point, Round-off error, Error propagation, Stability, Programming errors.
Solution of Transcendental and Polynomial Equations: Bisection method, Secant and Regula Falsi Methods, Newton Raphson method, Rate of convergence, General Iteration Methods, Newton's Method for Systems, Method for Complex Roots, Roots of Polynomial Equations.

Unit-2 (14 Lectures)

Interpolation and Polynomial Approximations: Taylor Series and Calculation of Functions, Langrange Interpolation, Newton Divided Difference Interpolation (forward and backward difference formulae), Truncation errors.
Curve Fitting: Least square fitting, Curve fitting, Interpolation by Spline functions.

Unit-3 (16 Lectures)

Numerical Integration: Trapezoidal Rule, Error bounds and estimate for the Trapezoidal rule, Simpson's Rule, Error of Simpson's rule.
Numerical Differentiation: Finite difference method and applications to electrostatic boundary value problems.
Numerical methods for first order differential equations: Euler-Cauchy Method, Heun's Method, Classical Runge Kutta method of fourth order. Methods for system and higher order equations.

Unit- 4 (14 Lectures)

Numerical Methods in Linear Algebra: Linear systems Ax=B, Gauss Elimination, Partial Pivoting, LU factorization, Doolittle's, Crout's and Cholesky's method. Matrix Inversion, Gauss-Jordon, Iterative Methods: Gauss-Seidel Iteration, Jacobian Iteration.
Matrix Eigen value: Power Method.

Recommended Reading:

1. E. Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons (1999).
2. V. Rajaraman, Computer Oriented Numerical Methods, Prentice Hall India, Third Edition.
3. S. S. Sastry, Introductory Methods of Numerical Analysis, Prentice Hall India (2008).
4. M. K. Jain, S. R. K. Iyengar and R. K. Jain, Numerical Methods: Problems and Solutions, New Age International (2007).
5. B.S. Grewal, Numerical Methods in Engineering and Science with Programs in C and C++, Khanna Publishers (2012).

Numerical Techniques Lab **Credit 01**

1. Program to implement Bisection Method
2. Program to implement Secant Method
3. Program to implement Regula falsi method
4. Program to implement Newton Raphson Method
5. Program to implement Trapezoidal rule
6. Program to implement Simpson's rule
7. Program to implement RungeKutta Method
8. Program to implement Euler-Cauchy Method
9. Program to implement Gauss-Jordon Method
10. Program to implement Gauss-Seidel Iteration

MINOR (MI)

Minor-5

Communication Electronics

[Credits: Theory-03, Practicals-01]

Minor (MI)-5T: Communication Electronics **Credits 03**

Course contents:

Unit-1 **(16 Lectures)**

Noise and Transmission lines: Noise-Introduction, internal and external noises, signal to noise ratio and noise figure. Different noise.
Amplitude Modulation/demodulation techniques: Modulation: AM, FM & PM.
Amplitude modulation: Modulation index, expression for instantaneous voltage, power relations, frequency spectrum, DSBTC, DSBSC and SSBSC Modulation techniques. Limitations of AM.
Demodulation- AM detection: principles of detection, Rectifier and envelope detector.
Block diagram of AM transmitter and Receiver, Super Heterodyne receiver.

Unit-2 **(12 Lectures)**

Frequency Modulation/demodulation techniques: Frequency Modulation: definition, modulation index, FM frequency spectrum, bandwidth requirements, frequency deviation, direct and indirect generation of FM.
FM detector – Slope detector-circuit, FM detection by PLL. Block diagram of FM transmitter and Receiver. Comparison of AM and FM.

Unit- 3 **(16 Lectures)**

Digital communication: Introduction to pulse and digital communications, sampling theorem, types- PAM, PWM, PPM, PCM – quantization, advantages and applications, digital modulations (FSK, PSK, and ASK). Advantage and disadvantages of digital transmission, characteristics of data transmission circuits – Shannon limit for information capacity, bandwidth requirements, data transmission speed, concepts of TDM and FDM.

Unit- 4 **(16 Lectures)**

Cellular Communication: Concept of cellular mobile communication – cell and cell splitting, frequency bands used in cellular communication, absolute RF channel numbers (ARFCN),

frequency reuse, roaming and hand off, authentication of the SIM card of the subscribers, IMEI number, concept of TDMA, FDMA, CDMA and GSM technology, 2G, 3G and 4G concepts **Satellite communication:** Introduction to Satellite communication, Orbits of Satellites, Block diagram of satellite transponder and its importance.

Suggested Books:

1. Electronic Communication, George Kennedy, 3rd edition, TMH.
2. Electronic Communication, Roddy and Coolen, 4th edition, PHI.
3. Electronic Communication systems, Kennedy & Davis, IV edition-TATA McGraw Hill.
4. Advanced Electronic Communication systems, Wayne Tomasi- 6th edition, Low priced edition- Pearson education

Minor (MI)-5P: Communication Electronics (Practical) Credits 01

1. Amplitude modulator and Amplitude demodulator
2. Study of FM modulator using IC8038
3. Study of VCO using IC 566
4. Study of Time Division Multiplexing and de multiplexing
5. Study of AM Transmitter/Receiver
6. Study of FM Transmitter/Receiver
7. ASK modulator and demodulator
8. Study of FSK modulation
9. Study of PWM and PPM
10. Study of PAM modulator and demodulator

SEMESTER-VI

MAJOR (MJ)

Major-11
Microprocessor and Microcontrollers
[Credits 04; Full Marks: 75]

Course contents: **Credits 03 (60L)**

Unit-1 **(30Lectures)**

Introduction to Microprocessor: Introduction, Applications, Basic block diagram, Speed, Word size, Memory capacity, Classification of microprocessors (mention of different microprocessors being used)

Microprocessor8085: Features, Architecture-block diagram, General purpose registers, register pairs, flags, stack pointer, program counter, types of buses. Multiplexed address and data bus, generation of control signals, pin description of microprocessor 8085.Basic interfacing concepts, Memory mapped I/O and I/O mapped I/O.

8085 Instructions: Operation code, Operand & Mnemonics. Instruction set of 8085, instruction classification, addressing modes, instruction format. Data transfer instructions, arithmetic instructions, increment & decrement instructions, logical instructions, branch instructions and machine control instructions. Assembly language programming examples.

Stack operations, subroutine, call and return instructions. Delay loops, use of counters, timing diagrams-instruction cycle, machine cycle, T-states, time delay. Interrupt structure of 8085A microprocessor, processing of vectored and non-vectored interrupts, latency time and response time; Handling multiple interrupts

Unit-2 **(05 Lectures)**

Introduction of Microprocessor 8086: Architecture, Addressing modes, instruction set, interrupts, Programming, Memory and I/O interfacing.

Unit-3 **(15 Lectures)**

Introduction to Microcontrollers: Basic block diagram, comparison of microcontroller with microprocessors, comparison of 8 bit, 16 bit and 32 bit microcontrollers. MICROCONTROLLER 8051- architecture -internal block diagram, key features of 8051, pin diagram, memory organization, Internal RAM memory, Internal ROM. General purpose data memory, special purpose/function registers, external memory.

Microprocessor and Microcontrollers lab: **Credits 01 (30 Hrs)**

8085Assemblylanguageprograms:

1. Program to transfer a block of data.
2. Program for multi byte addition

3. Program for multi byte subtraction
4. Program to multiply two 8-bit numbers.
5. Program to divide a 16 bit number by 8 bit number.
6. Program to search a given number in a given list.
7. Program to generate terms of Fibonacci series.
8. Program to find minimum and maximum among N numbers
9. Program to find the square root of an integer.
10. Program to find GCD of two numbers.
11. Program to sort numbers in ascending/descending order.
12. Program to verify the truth table of logic gates.

8051 Microcontroller Programming

1. Program to find the sum of N 8-bit numbers.
2. Program to find largest of N numbers.
3. Program to find smallest of N numbers
4. Program to find whether the given data is palindrome.
5. Program to arrange the numbers in ascending order.
6. Interfacing of stepper motor and Rotating stepper motor by N steps clockwise/ Anti clockwise with speed control.
7. LCD interfacing.
8. Speed control of DC motor using PWM (pulse delay to be implemented using timers).

Suggested Books:

1. Microprocessor Architecture, Programming and Applications with 8085, Ramesh S.Gaonkar-Wiley Eastern Limited- IV Edition.
2. Fundamentals of Microprocessor & Microcomputer: B.Ram—Danpat Rai Publications.
3. PIC Microcontrollers, Milan Verle, mikro Elektronika,1st edition (2008)
4. Muhammad Ali Mazidi, "Microprocessors and Microcontrollers", Pearson, 2006

Major-12
Electronic Communications
[Credits 04; Theory-3, Practical-01; Full Marks: 75]

Course contents:

Unit-1 **(16 Lectures)**

Noise and Transmission lines: Noise-Introduction, internal and external noises, signal to noise ratio and noise figure

Amplitude Modulation / demodulation techniques: Block diagram of electronic communication system. Modulation-need and types of modulation. Amplitude modulation – representation, modulation index, expression for instantaneous voltage, power relations, frequency spectrum, DSBTC, DSBSC and SSBSC (mention only). Limitations of AM.

Demodulation- AM detection: principles of detection, Rectifier Detector, Envelope Detector. Block diagram of AM transmitter and Receiver.

Unit-2 **(12 Lectures)**

Frequency Modulation/demodulation techniques: Frequency Modulation: definition, modulation index, WBFM, NBFM, bandwidth requirements, frequency deviation and carrier swing, FM generator-varactor diode modulator, Armstrong FM Generator.

FM detector – principle, slope detector-circuit, principle of working and waveforms. Block diagram of FM transmitter and Receiver. Comparison of AM and FM.

Unit- 3 **(16 Lectures)**

Digital communication: Introduction to pulse and digital communications, sampling theorem, Advantage and disadvantages of digital transmission, types- PAM, PWM, PPM, PCM – quantization, advantages and applications, FSK, PSK, and ASK. Shannon limit for information capacity, bandwidth requirements, data transmission speed, noise, cross talk, echo suppressors, distortion and equalizer, MODEM– modes, classification, interfacing (RS232). TDMA, FDMA, CDMA concepts, comparison of TDMA and FDMA.

Unit- 4 **(16 Lectures)**

Cellular Communication: Concept of cellular mobile communication – cell and cell splitting, frequency bands used in cellular communication, absolute RF channel numbers (ARFCN), frequency reuse, roaming and hand off, authentication of the SIM card of the subscribers, IMEI number, concept of data encryption, architecture (block diagram) of cellular mobile communication network, CDMA technology, CDMA overview, simplified block diagram of cellular phone handset, Comparative study of GSM and CDMA, 2G, 3G and 4G concepts.

Satellite communication: Introduction, to Orbit, types of orbits, Block diagram of satellite transponder.

Suggested Readings:

1. Electronic Communication, George Kennedy, 3rd edition, TMH.
2. Electronic Communication, Roddy and Coolen, 4th edition, PHI.
3. Electronic Communication systems, Kennedy & Davis, IV edition-TATA McGraw Hill.
4. Advanced Electronic Communication systems, Wayne Tomasi- 6th edition, Low priced edition- Pearson education

Communication Systems Lab 60 Lectures: **Credit- 01**

1. Amplitude modulator and Amplitude demodulator
2. Study of FM modulator using IC 8038
3. Study of VCO using IC 566
4. Study of Time Division Multiplexing and de multiplexing
5. Study of AM Transmitter/Receiver
6. Study of FM Transmitter/Receiver
7. ASK modulator and demodulator
8. Study of FSK modulation
9. Study of PWM and PPM
10. Study of PAM modulator and demodulator

MJ-13:
PHOTONICS
Credits 04 (Full Marks: 75)
[CREDITS: Theory-03, Practicals-01]

Course Content:

Unit – 1 **(22 Lectures)**

Light as an Electromagnetic Wave: Plane waves in homogeneous media, concept of spherical waves. Reflection and transmission at an interface, total internal reflection, Brewster's Law. Interaction of electromagnetic waves with dielectrics: origin of refractive index, dispersion.
Interference : Superposition of waves of same frequency, Concept of coherence, Interference by division of wave front, Young's double slit, Division of Amplitude, thin film interference, anti-reflecting films, Newton's rings; Michelson interferometer. Holography.
Diffraction: Huygen Fresnel Principle, Diffraction Integral, Fresnel and Fraunhoffer approximations. Fraunhoffer Diffraction by a single slit, rectangular aperture, double slit, Resolving power of microscopes and telescopes; Diffraction grating: Resolving power and Dispersive power

Unit - 2

Polarization: Linear, circular and elliptical polarization, polarizer-analyzer and Malus' law; Double refraction by crystals, Interference of polarized light, Wave propagation in uniaxial media. Half wave and quarter wave plates. Faraday rotation and electro-optic effect.

Unit - 3

Light Emitting Diodes: Construction, materials and operation.
Lasers: Interaction of radiation and matter, Einstein coefficients, Condition for amplification, laser cavity, threshold for laser oscillation, line shape function. Examples of common lasers. The semiconductor injection laser diode.
Photodetectors: Bolometer, Photomultiplier tube, Charge Coupled Device. Photo transistors and Photodiodes (p-i-n, avalanche), quantum efficiency and responsivity.
LCD Displays: Types of liquid crystals, Principle of Liquid Crystal Displays, applications, advantages over LED displays.

Unit - 4

Guided Waves and the Optical Fiber: Step index optical fiber, total internal reflection, graded index optical fiber, concept of linearly polarized waves in the step index circulardielectric waveguides, single mode and multimode fibers, attenuation and dispersion inopticalfiber.

Suggested Books:

1. Ajoy Ghatak, Optics, Tata McGraw Hill, New Delhi (2005)
2. E. Hecht, Optics, Pearson Education Ltd. (2002)
3. J. Wilson and J. F. B. Hawkes, Optoelectronics: An Introduction, Prentice Hall India (1996)
4. S. O. Kasap, Optoelectronics and Photonics: Principles and Practices, Pearson Education (2009)
5. Ghatak A.K. and Thyagarajan K., "Introduction to fiber optics," Cambridge Univ. Press. (1998)

Photonics Lab: **Credit 01**

1. To verify the law of Malus for plane polarized light.
2. To determine wavelength of sodium light using Michelson's Interferometer.
3. To determine wavelength of sodium light using Newton's Rings.
4. To determine the resolving power and Dispersive power of Diffraction Grating.
5. Diffraction experiments using a laser.
6. Study of Faraday rotation.
7. Study of Electro-optic Effect.
8. To determine the specific rotation of scan sugar using polarimeter.
9. To determine characteristics of LEDs and Photo- detector.
10. To measure the numerical aperture of an optical fiber.

OR

Tutorial/ Submission of Dissertation/ Term project/ student Seminar on **Photonics**

MAJOR ELECTIVE (DSE)

Major (Elective 2)
Control Systems
[Credits: Theory-03, Practicals-01]

Course contents:

Unit 1 **(16 Lectures)**

Introduction to Control Systems: Open loop and Closed loop control systems, Mathematical modeling of physical systems (Electrical, Mechanical and Thermal), Derivation of transfer function, Armature controlled and field controlled DC servomotors, AC servomotors, block diagram representation & signal flow graph, Reduction Technique, Mason's Gain Formula. Effect of feedback on control systems.

Unit 2 **(14 Lectures)**

Time Domain Analysis: Time domain performance criteria, transient response of first, second & higher order systems, steady state errors and static error constants, Performance indices.

Concept of Stability: Asymptotic stability and conditional stability, Routh – Hurwitz criterion, relative stability analysis, Root Locus plots and their applications.

Unit 3 **(14 Lectures)**

Frequency Domain Analysis: Correlation between time and frequency response, Polar and inverse polar plots, frequency domain specifications, Logarithmic plots (Bode Plots), gain and phase margins, Nyquist stability criterion, relative stability using Nyquist criterion, constant M & N circles.

Unit 4 **(16 Lectures)**

State Space Analysis: Definitions of state, state variables, state space, representation of systems, Solution of time invariant, homogeneous state equation, state transition matrix and its properties.

Controllers and Compensation Techniques: Response with P, PI and PID Controllers, Concept of compensation, Lag, Lead and Lag-Lead networks.

Suggested Books:

1. J. Nagrath& M. Gopal, Control System Engineering, New Age International, 2000
2. K. Ogata, Modern Control Engineering, PHI 2002
3. B. C. Kuo , "Automatic control system", Prentice Hall of India, 2000

Control Systems (Practical) **(Credit-1)**

1. To study characteristics of: (a) Synchro transmitter receiver (b) Synchro as an error detector
2. To study position control of DC motor
3. To study speed control of DC motor
4. To find characteristics of AC servo motor
5. To study time response of type 0, 1 and 2 systems
6. To study frequency response of first and second order systems
7. To study time response characteristics of a second order system.
8. To study effect of damping factor on performance of second order system
9. To study frequency response of Lead and Lag networks.
10. Study of P, PI and PID controller.

OR

Tutorial/ Submission of Dissertation/ Term project/ student Seminar on **Control Systems**

MINOR (MI)

Minor-6

Analog and Digital Communications

[THEORY & PRACTICAL, CREDITS: 04; FM-75]

Minor (MI)-6: Analog and Digital Communications Credits 04(Full Marks: 75)

Minor (MI)-6T: Analog and Digital Communications (Theory) Credits 03 (45l)

Course contents:

Unit-1 (16 Lectures)

Noise and Transmission lines: Noise-Introduction, internal and external noises, signal to noise ratio and noise figure. Different noise.

Amplitude Modulation/demodulation techniques: Modulation: AM, FM & PM.

Amplitude modulation: Modulation index, expression for instantaneous voltage, power relations, frequency spectrum, DSBTC, DSBSC and SSBSC Modulation techniques. Limitations of AM.

Demodulation- AM detection: principles of detection, Rectifier and envelope detector.

Block diagram of AM transmitter and Receiver, Super Heterodyne receiver.

Unit-2 (12 Lectures)

Frequency Modulation/demodulation techniques: Frequency Modulation: definition, modulation index, FM frequency spectrum, bandwidth requirements, frequency deviation, direct and indirect generation of FM.

FM detector – Slope detector-circuit, FM detection by PLL. Block diagram of FM transmitter and Receiver. Comparison of AM and FM.

Unit- 3 (16 Lectures)

Digital communication: Introduction to pulse and digital communications, sampling theorem, types- PAM, PWM, PPM, PCM – quantization, advantages and applications, digital modulations (FSK, PSK, and ASK). Advantage and disadvantages of digital transmission, characteristics of data transmission circuits – Shannon limit for information capacity, bandwidth requirements, data transmission speed, concepts of TDM and FDM.

Unit- 4 (16 Lectures)

Cellular Communication: Concept of cellular mobile communication – cell and cell splitting, frequency bands used in cellular communication, absolute RF channel numbers (ARFCN), frequency reuse, roaming and hand off, authentication of the SIM card of the subscribers, IMEI number, concept of TDMA, FDMA, CDMA and GSM technology, 2G, 3G and 4G concepts.

Satellite communication: Introduction to Satellite communication, Orbits of Satellites, Block diagram of satellite transponder and its importance.

Suggested Readings:

1. Electronic Communication, George Kennedy, 3rd edition, TMH.
2. Electronic Communication, Roddy and Coolen, 4th edition, PHI.
3. Electronic Communication systems, Kennedy & Davis, IV edition-TATA McGraw Hill.
4. Advanced Electronic Communication systems, Wayne Tomasi- 6th edition, Low priced edition- Pearson education.

Minor (MI)-6P: Analog and Digital Communications (Practical) Credits 01 (30Hrs.)

1. Amplitude modulator and Amplitude demodulator
2. Study of FM modulator using IC8038
3. Study of VCO using IC 566
4. Study of Time Division Multiplexing and de multiplexing
5. Study of AM Transmitter/Receiver
6. Study of FM Transmitter/Receiver
7. ASK modulator and demodulator
8. Study of FSK modulation
9. Study of PWM and PPM
10. Study of PAM modulator and demodulator