UNIVERSITY OF KERALA

B. TECH. DEGREE COURSE

(2018 SCHEME)

SYLLABUS FOR

VI SEMESTER

ELECTRONICS and COMMUNICATION ENGINEERING

SCHEME -2018

VI SEMESTER

ELECTRONICS and COMMUNICATION ENGINEERING (T)

Course No	Name of subject	Credits	Weekly load, hours			C A Marks	Exam Duration Hrs	U E Max Marks	Total Marks
			L	T	D/ P				
18.601	VLSI Design (T)	4	3	1	-	50	3	100	150
18.602	Digital Communication(T)	3	3	1	-	50	3	100	150
18.603	Control Systems (T)	4	3	1	-	50	3	100	150
18.604	Antenna & Wave Propagation (T)	3	3	1	-	50	3	100	150
18.605	Introduction to Python (T)	3	3	1	-	50	3	100	150
18.606	Elective II	3	2	1	-	50	3	100	150
18.607	Microcontroller Lab (T)	2	-	-	3	50	3	100	150
18.608	Electronic Product Design & Mini Project (T)	2	1	-	2	50	3	100	150
	Total	**24**	**18**	**6**	**5**	**400**		**800**	**1200**

18. 606 Elective II

18.606.1	Speech Processing (T)
18.606.2	Image Processing (T)
18.606.3	Professional Ethics (T)
18.606.4	Mixed Signal Circuits Design (T)

18.601 VLSI DESIGN (T)

Teaching Scheme: 3(L) - 1(T) - 0(P) **Credits**: 4

Course Objectives:

- *Explain device physics of MOS transistor, challenges in device scaling to submicron regime and short channel effects.*
- *Identify state of the art in unit processes to fabricate CMOS chip and develop an idea on the environmental impacts of these processes.*
- *Explain the characteristics of CMOS inverters*
- *Design data path elements like adders and multipliers in different algorithms, memory elements like RAM, ROM, PLAs.*
- *Draw Stick diagram and layout of inverters and gates.*
- *Distinguish between different test generation methods and explain reliability aspects of VLSI circuits.*

Module – I

Material Preparation- Purification, Crystal growth (CZ and FZ process), Wafer Preparation. Thermal Oxidation: Growth mechanisms, Dry and Wet oxidation, Deal Grove model. Diffusion Fick's Laws, Pre deposition and drive in processes, diffusion system. Ion implantation-Range Theory, channelling, annealing. Epitaxy-VPE and MBE. Lithography-Photo lithographic sequence, Electron Beam Lithography, X-ray Lithography, etching and metal deposition. CMOS IC Fabrication Sequence- n well, p well, and twin tub process.

Module – II

Review of MOS transistor theory- Saturation and Linear regions of Operation of NMOS and PMOS. Review of Short channel and secondary effects of MOSFET. MOSFET Capacitances- Oxide related capacitances, Junction Capacitances. MOSFET Scaling - Constant field, Constant voltage and generalized scaling. Stick diagram and Layout – Design rules (λ and μ rules).

Module – III

CMOS inverter - DC characteristics, Noise margin. Propagation delay, Static and Dynamic Power dissipation. CMOS logic design -Static logic and Dynamic logic, Pass transistor logic, Complementary pass transistor logic, Transmission gates, realization of functions. CMOS system design- Adders, Static adder, Carry bypass adder, Linear Carry select adder, Square root carry select adder, Carry look ahead adder, Array multipliers.

Module – IV

Read Only Memory- 4x4 MOS ROM Cell Arrays(OR,NOR,NAND),Random Access Memory –SRAM-6 transistor CMOS SRAM cell, DRAM-Three transistor and One transistor Dynamic Memory Cell. Sense amplifiers – Differential, Single ended. Reliability and testing of VLSI circuits – General concept, CMOS testing, Test generation methods. Introduction to VLSI design tools. Introduction to PLDs and FPGAs, Design of PLAs.

References:

1. Tyagi M.S., *Introduction to Semiconductor Materials*, Wiley India
2. Jan M Rabaey, *Digital Integrated Circuits* PHI 2008
3. John P Uyemura, *Introduction to VLSI Circuits and Systems*, Wiley India, 2008
4. Neil H E Weste and Kamram Eshrahian, *Principles of CMOS VLSI Design*, 2/e, Pearson Education.
5. Yuan Taur, Tak Hning, *Fundamentals of Modern VLSI Devices*, Cambridge Uni. Press, 2000.
6. Gandhi S K, *VLSI Fabrication Principles*, 2/e, Prentice Hall.
7. Wayne Wolf, *Modern VLSI Design Systems on Chip*, 3/e, Pearson Education.

Internal Continuous Assessment *(Maximum Marks-50)*

50% - Tests (minimum 2)

30% - Assignments (minimum 2) such as home work, problem solving, quiz, literature survey, seminar, term-project, software exercises, etc.

20% - Regularity in the class

University Examination Pattern:

Examination duration: 3 hours *Maximum Total Marks: 100*

The question paper shall consist of 2 parts.

Part A (20 marks) - Ten Short answer questions of 2 marks each. All questions are compulsory. There should be at least two questions from each module and not more than three questions from any module.

Part B (80 Marks) - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

***Note:** Question paper should contain minimum 40% Analysis/Numerical Problems.*

Course Outcome:

On completing the course, the student shall be able to:

- *Explain device physics of MOS transistor, challenges in device scaling to submicron regime and short channel effects.*
- *Identify state of the art in unit processes to fabricate CMOS chip and develop an idea on the environmental impacts of these processes.*
- *Explain the characteristics of CMOS inverters and design static and dynamic logic using CMOS.*
- *Design data path elements like adders and multipliers in different algorithms, memory elements like RAM, ROM, PLAs.*
- *Distinguish between different test generation methods and explain reliability aspects of VLSI circuits.*

18.602 DIGITAL COMMUNICATION (T)

Teaching Scheme: 3(L) - 1(T) - 0(P) **Credits**: 3

Course Objective:

- *To familiarize the concept of Digital representation of analog source*
- *To introduce to various aspects of distortion less data transmission*
- *To analyse the need for introducing ISI in controlled manner*
- *To understand signal space representation of signal using Gram Schmidt orthonormalisation procedure*
- *To analyse the error probability for different modulation schemes like BPSK, BFSK, QPSK etc*
- *To understand the principle of spread spectrum communication and to illustrate the concept of FHSS and DSSS*
- *To understand various Multiple Access Techniques*

Module – I

Pulse Modulation, Sampling process, Aliasing, Reconstruction, PAM, Quantization, PCM, Noise in PCM system, Delta modulation, Delta-Sigma modulation, DPCM, ADPCM, ADM, Processing Gain. Performance comparison of various pulse modulation schemes, Line codes, PSD of various line codes.

Module – II

Base band Pulse Transmission- Matched filter, properties, Error rate due to noise, ISI

Nyquist criterion for distortion less transmission, Ideal solution, Raised cosine spectrum, eye pattern.
Correlative level coding- Duobinary coding, precoding, Modified duobinary coding, Generalized Partial response signaling, optimum linear receiver. Adaptive Equalization, LMS algorithm.

Module – III

Signalling Over AWGN Channel: Signal space Analysis, Geometric representation of signals, Gram Schmidt orthogonization procedure. Conversion of the continuous AWGN channel into a vector channel, Likelihood function, Maximum Likelihood decoding, correlation receiver.
Digital Modulation schemes: Pass Band transmission model, Coherent modulation schemes- BPSK, QPSK and BFSK. Non coherent orthogonal modulation schemes , Differential phase shift keying, Detection of binary modulation schemes in the presence of noise, BER for BPSK, QPSK, BFSK, M-ary Quadrature Amplitude Modulation (QAM)

Module – IV

Pseudo noise sequences, Properties of PN sequences. Generation of PN Sequences, maximal length codes and gold codes, Spread spectrum Communication: Direct sequence spread

spectrum with coherent binary phase shift keying, Processing gain, Probability of error, Anti jam Characteristics, Frequency Hop spread spectrum with MFSK, Slow and Fast frequency hoping.

Multiple Access Techniques: TDMA and FDMA , CDMA and SDMA.- RAKE receiver.

Multipath channels: classification, Coherence time, Coherence bandwidth, Statistical characterization of multi path channels, Binary signaling over a Rayleigh fading channel, Diversity techniques: Diversity in time, frequency and space.

References:

1. Symon Haykins, Digital *Communication Systems*, Wiley India, 2013.
2. Symon Haykins, *Communication Systems*, 4/e Wiley India, 2012.
3. Won Y Yang *et al*., *Matlab/Simulink for Digital Communication*, 2/e SP Surya Page Turners, 2012.
4. Sklar, Ray, *Digital Communication, Fundamental and Applications*, 2/e Pearson, 2011
5. Glover & Grant, Digital Communication, Prentice Hall, 2000.
6. Das Mullick Chatterjee, *Principles of Digital Communication*, Wiley Eastern Ltd.

Internal Continuous Assessment *(Maximum Marks-50)*

50% - Tests (minimum 2)

30% - Assignments (minimum 2) such as home work, problem solving, quiz, literature survey, seminar, term-project, software exercises, etc.

20% - Regularity in the class

University Examination Pattern

Examination duration: 3 hours *Maximum Total Marks: 100*

The question paper shall consist of 2 parts.

Part A (20 marks) - Ten Short answer questions of 2 marks each. All questions are compulsory. There should be at least two questions from each module and not more than three questions from any module.

Part B (80 Marks) - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

Note: *Question paper should contain minimum 60% Numerical Problems/ derivations/proofs.*

Course Outcome:

After the course the student will be able to

- *Illustrate the Digital representation of analog source.*
- *Compare the performance of various Digital Pulse Modulation Schemes*
- *Analyse the need for introducing ISI in Digital Communication in a controlled manner.*
- *Compare the error probability for different digital modulation schemes like BPSK, BFSK, QPSK etc.*
- *Describe the principle of spread spectrum communication and to illustrate the concept of FHSS and DSSS*
- *Learn various Diversity Techniques*

18.603 CONTROL SYSTEMS (T)

Teaching Scheme: 3(L) - 1(T)- 0(P) **Credits**:4

Course Objectives:

- *Introduce the elements of control system and its modelling*
- *To introduce methods for analyzing the time response, the frequency response and the stability of systems.*
- *To design control systems with compensating techniques.*
- *To introduce the state variable analysis method.*

.

Module – I

Components of control system, applications, Open loop and closed loop control systems, Examples of control systems, Mathematical modeling of control systems - Mechanical and electrical systems.

Design process – Block diagram representation and reduction methods, Signal flow graph and Mason‘s rule formula.

Module – II

Standard test signals, Time response specifications. Time response of first and second order systems to unit step input, ramp input, time domain specifications - Steady state error and static error coefficients. Dynamic error coefficient.

Stability of linear control systems: methods of determining stability, Routh‘s Hurwitz Criterion.

Module – III

Frequency domain analysis: Frequency domain specifications, Correlation between time and frequency responses.

Nyquist stability criterion: fundamentals and analysis. Relative stability: gain margin and phase margin. Stability analysis with Bode plot. Root Locus Techniques: Introduction, properties and its construction.

Module – IV

Design of control systems : PI, PD and PID controllers, Design with phase lead and phase lag controllers (frequency domain approach).

State variable analysis: state transition matrix and equation, state space representation of continuous time systems. Transfer function from state variable representation. Solutions of state equations.

Concepts of Controllability and observability of linear systems, Kalman's test and Gilbert's test.

Discrete control system fundamentals :state space representation of discrete time systems. Sampled data control systems, stability test of discrete time systems :Jury's test.

References:

1. Benjamin C. Kuo, *Automatic Control Systems*, 8/e, WileyIndia.
2. Ogata K., *Discrete-time Control Systems*, 2/e, PearsonEducation.
3. Norman S Nise ,*Control System Engineering*,5/e, WileyIndia
4. Ogata K., *Modern Control Engineering*, Prentice Hall of India, 4/e, Pearson Education, 2002.
5. Richard C Dorf and Robert H Bishop, *Modern Control Systems*, 9/e, Pearson Education,2001.
6. Dean Frederick & Joe Chow, *Feedback Control Problems using MATLAB*, Addison Wesley, 2000.

Internal Continuous Assessment *(Maximum Marks-50)*

50% - Tests (minimum 2)

30% - Assignments (minimum 2) such as home work, problem solving, quiz, literature survey, seminar, term-project, software exercises, etc.

20% - Regularity in the class

University Examination Pattern:

Examination duration: 3 hours *Maximum Total Marks: 100*

The question paper shall consist of 2 parts.

Part A (20 marks) - Ten Short answer questions of 2 marks each. All questions are compulsory. There should be at least two questions from each module and not more than three questions from any module.

Part B (80 Marks) - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

Note: *Question paper should contain minimum 60 % problems, derivations and proof.*

Course Outcome:

After the studying the course the students will be able to

- *Represent mathematically a systems and deriving their transfer function model.*
- *Analyse the time response and frequency response of the systems for any input*
- *Find the stability of system*
- *Design a control system with suitable compensation techniques.*

18.604 ANTENNA & WAVE PROPAGATION (T)

Teaching Scheme: 3(L) - 1(T) - 0(P) Credits: 3

Course Objectives:

- To study various antennas, arrays and radiation patterns of antennas.
- To learn the basic working of antennas.
- To study various techniques involved in various antenna parameter measurements.
- To understand the propagation of radio waves in the atmosphere.

Module – I

Basic antenna parameters - gain, directivity, beam solid angle, beam width and effective aperture calculations. Effective height - wave polarization - antenna temperature - radiation resistance - radiation efficiency - antenna field zones - principles of reciprocity. Duality of antennas. Concept of retarded potential. Field, directivity and radiation resistance of a short dipole and half wave dipole.

Module – II

Measurement of radiation pattern, gain, directivity and impedance of antenna Arrays of point sources - field of two isotropic point sources - principle of pattern multiplication - linear arrays of ‘n‘ isotropic point sources. Grating lobes. Properties and Design of Broadside, End fire & Binomial arrays. Design of DolphChebhyshev arrays .Basic principle of beam steering.

Module – III

Travelling wave antennas. Principle and applications of V and rhombic antennas. Principles of Horn, Parabolic dish antenna, Cassegrain antenna (expression for E, H, and Gain – no derivation). Principle of Log periodic antenna array and Helical antenna, Design of rectangular Patch antenna. Antennas for mobile base station and handsets. Basic principle of smart antenna.

Module – IV

Radio wave propagation , Modes , structure of atmosphere , characteristics of ionized regions , sky wave propagation , effect of earth‘s magnetic field , MUF , skip distance ,virtual height , skip distance Ionospheric abnormalities and absorption , space wave propagation , LOS distance , Field strength of space wave , duct propagation , VHF and UHF Mobile radio propagation, tropospheric scatter propagation ,fading and diversity techniques.

References:

1. John D. Krauss, Antennas for all Applications, 3/e, TMH.
2. Balanis, Antenna Theory and Design, 3/e, Wiley Publications.
3. Jordan E.C. & K G Balmain, Electromagnetic Waves & Radiating Systems, 2/e, PHI.
4. Collin R.E, Antennas & Radio Wave Propagation, McGraw Hill. 1985.
5. Terman, Electronics & Radio Engineering, 4/e, McGraw Hill.
6. Thomas A. Milligan, Modern Antenna Design, IEEE PRESS, 2/e, Wiley Interscience.

Internal Continuous Assessment (Maximum Marks-50)

50% - Tests (minimum 2)

30% - Assignments (minimum 2) such as home work, problem solving, quiz, literature survey, seminar, term-project, software exercises, etc.

20% - Regularity in the class

University Examination Pattern*:*

Examination duration: 3 hours *Maximum Total Marks: 100*

The question paper shall consist of 2 parts.

Part A *(20 marks) - Ten Short answer questions of 2 marks each. All questions are compulsory. There should be at least two questions from each module and not more than three questions from any module.*

Part B *(80 Marks) - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.*

Note*: Question paper should contain minimum 50% problems, derivations and proof.*

Course Outcome*:*

After completion of the course the student will be able to know:

- *Various antennas, arrays and radiation patterns of antennas.*
- *The basic working of antennas.*
- *Various techniques involved in various antenna parameter measurements.*
- *The propagation of radio waves in the atmosphere*

18.605 INTRODUCTION TO PYTHON (T)

Teaching Scheme: 2(L) - 1(T) - 0(P) **Credits:** 3

Course Objectives:

- *To learn basics of Python programm*
- *To develop Problem solving skills*
- *To develop algorithmic solutions to problems*

Module – I

Introduction to Python: The python programming languages, formal and natural languages. Variables ,expressions and statements: values and types , variables, variable names and keywords, statements, evaluating expressions, operators and operands, order of operations, operations on strings, compositions, comments.

Conditionals and recursion: The modulus operator, Boolean expressions, Logical operators, conditional execution, alternative execution, chained conditionals, nested conditionals, return statement, recursion.

Module – II

Iteration: multiple assignment, while statement, tables, two dimensional tables, encapsulation and generalisation, local variables.

Functions: Function calls, Type conversion, Type coercion, math functions, composition, adding new functions, flow of execution, parameters and arguments, stack diagrams, functions with results.

Module – III

Strings and List : A compound data type, length, Traversal and the for loop, string slices, string comparison ,A find function, looping and counting, The string module, character classification.

List: List values, Accessing elements, List length, List membership, List and for loop, List operations

Tuples: Mutability and tuples, Tuple Assignment, Tuples and return values, Random numbers, counting. Dictionaries: Dictionary operation, Dictionary methods, Aliasing and copying, sparse matrices, Long integers, counting letters

Module – IV

Files and exeptions: Text files, writing variables, directories, Pickling, Exeptions. Classes and Objects:User defined compound types, attributes, Instances as arguments, sameness, Rectangles ,Instances as return values.

Classes and functions: Time, pure functions , modifiers, prototype development Vs planning.

Classes and methods: Object – oriented features, optional arguments, The initialization method, operator over loading, polymorphism.

References:

1. Downey A.et.al., How to think like a Computer Scientist: Learning with Python, John Wiley 2015
2. Lambert K.A., Fundamentals of Python – First Programs, Cengage Learning India, 2015
3. Barry .P., Head First Python ,,O'Reiley Publishers
4. Percovic.L Introduction to Computing Using Python , 2/e, John Wiley 2015

Internal Continuous Assessment *(Maximum Marks-50)*

50% - Tests (minimum 2)

30% - Assignments (minimum 2) such as home work, problem solving, quiz, literature survey, seminar, term-project, software exercises, etc.

20% - Regularity in the class

University Examination Pattern:

Examination duration: 3 hours *Maximum Total Marks: 100*

The question paper shall consist of 2 parts.

Part A (20 marks) - Ten Short answer questions of 2 marks each. All questions are compulsory. There should be at least two questions from each module and not more than three questions from any module.

Part B (80 Marks) - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

Course Outcome:

After completion of the course the student will have:

- *Ability to convert algorithms to Python Programs*
- *Ability to design modular python programs using functions*
- *Ability to design programs with interactive input and output, utilising arithematic expressions, decision making, arrays.*

18.606.1 SPEECH PROCESSING (T) (Elective II)

Teaching Scheme: 2(L) - 1(T) - 0(P) **Credits**: 3

Course Objective:

To study the Speech recognition, Identification, spectrum estimation

Module – I

Nature of Speech Signal**:** Speech production mechanism, Classification of speech sounds,

Nature of speech signal.Speech Signal Processing **:** Review of DSP, Digital models for speech signals, significance of short time analysis.

Module – II

Time Domain Methods**:** Time-domain parameters of speech, methods for extracting the parameters, zero crossings, autocorrelation function, pitch estimation.

Digital representation of Speech Waveform**:** Sampling speech signals, Review of statistical model for speech, Instantaneous quantization, Adaptive quantization, DPCM with adaptive quantization and with adaptive prediction, PCM to ADPCM conversion.

Module – III

Frequency Domain Methods**:** Short time Fourier analysis, Filter back analysis, Spectro graphic analysis, Formant extraction, Pitch extraction, Analysis – synthesis system.

Module – IV

Linear Predictive coding of Speech**:** Formulation of Linear Prediction problem in time domain, solution of normal equations, interpretation of linear prediction in auto correlation and spectral domains.

Homomorphic Speech Analysis **:**Cepstral analysis of speech, formant and pitch estimation. Speech recognition, Speech synthesis and speaker verification.

References:-

1. Rabiner L. R. and R. W. Schafer, *Digital Processing of Speech Signals*, Prentice Hall, 1978.
2. Flanagan J. L., *Speech Analysis Synthesis and Perception,* (2/e), Berlin,1983.
3. Witten I. H., *Principles of Computer Speech,* Academic Press, 1982.

Internal Continuous Assessment *(Maximum Marks-50)*

50% - Tests (minimum 2)

30% - Assignments (minimum 2) such as home work, problem solving, quiz, literature survey, seminar, term-project, software exercises, etc.

20% - Regularity in the class

University Examination Pattern:

Examination duration: 3 hours *Maximum Total Marks: 100*

The question paper shall consist of 2 parts.

Part A (20 marks) - Ten Short answer questions of 2 marks each. All questions are compulsory. There should be at least two questions from each module and not more than three questions from any module.

Part B (80 Marks) - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

Course Outcome:

After the completion of the course the student will be able to know the Speech recognition, Identification, spectrum estimation

18.606.2 IMAGE PROCESSING (T) (Elective II)

Teaching Scheme: 2(L) - 1(T) - 0(P) **Credits**: 3

Course Objective:

The students undergoing this course will be able to know.

- *Fundamentals of image processing.*
- *Various transforms used in image processing.*
- *Image processing techniques like image enhancement, reconstruction, compression and segmentation.*

Module – I

Introduction: Fundamental Steps in Image Processing - Components of a Digital Image Processing System - Structure of the human eye - Image sensing and acquisition – Gray scale and Colour Images - Image representation and modelling - Sampling and quantization

Two dimensional systems - 2-D convolution, 2-D correlation

Image transforms: 2-D Discrete Fourier transform – properties, Discrete Cosine, Walsh, Hadamard and Haar transforms.

Module – II

Image Enhancement: Point Operations - Spatial Filters, Filter Masks, Smoothing Filters, Sharpening Filters, High Boost Filters - Frequency domain Filters, Smoothing Filters, Sharpening Filters, Homomorphic filters – Histogram Processing

Image Restoration: Restoration/Degradation model – Estimation of Degradation Function, Restoration using Spatial Filters, Mean Filter, Order Statistic Filter, Adaptive Filter, Inverse Filter, Wiener Filter.

Module – III

Image Segmentation: Point and Line Detection - Edge detections, Gradient operators, Canny Edge Detector - Polygonal Fit Algorithm – Region Growing – Region Splitting and Merging - Thresholding.

Image Representation: Boundary Following, Chain codes, Maximum Perimeter Polygon algorithm, Signatures, boundary segments, skeletons - Boundary descriptors – Regional descriptors – Relational descriptors – Co-occurrence matrix.

Module – IV

Morphological Processing- erosion and dilation, opening and closing, Hit/Miss transformation, Boundary Extraction, Hole Filling, Convex Hull, Thinning, Thickening and Pruning.

Image Compression: Image Compressions models – Huffmann Coding - Arithmetic Coding – Image Compression Standards.

Colour Image Processing: Colour Models, RGB, CMY, HSI – Colour Transformation – Smoothing and Sharpening, Segmentation based on colour.

References:

1. Rafael C Gonzalez and Richard E. Woods, *Digital Image Processing*, 3/e, Addison Wesley.
2. Anil K Jain, *Fundamentals of Digital Image Processing*, PHI, New Delhi, 1995.
3. Jayaraman S., S. Esakkirajan, T Veerakumar, *Digital Image Processing*, TMH, 2009.
4. Kenneth R Castleman, *Digital Image Processing*, PHI, 1995.
5. William K Pratt, *Digital Image Processing*, Wiley India 2/e.
6. Sid Ahmed M A, *Image Processing Theory, Algorithm and Architectures*, McGraw-Hill, 1995.

Internal Continuous Assessment *(Maximum Marks-50)*

50% - Tests (minimum 2)

30% - Assignments (minimum 2) such as home work, problem solving, quiz, literature survey, seminar, term-project, software exercises, etc.

20% - Regularity in the class

University Examination Pattern:

Examination duration: 3 hours *Maximum Total Marks: 100*

The question paper shall consist of 2 parts.

Part A (20 marks) - Five Short answer questions of 4 marks each. All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

Part B (80 Marks) - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

Course Outcome:

After successful completion of this course, the students will be able to know the fundamental concepts of image processing.

18.606.3 PROFESSIONAL ETHICS (T) (Elective II)

Teaching Scheme: 2(L) - 1(T) - 0(P) **Credits:** 3

Course Objectives:

- *To create awareness on professional ethics for engineers.*
- *To instil human values and integrity.*
- *To respect the rights of others and develop a global perspective.*

Module – I

Understanding Professional Ethics and Human Values Current scenario, contradictions, dilemmas, need for value education and self esteem, Human values, morals, values, integrity, civic virtues, work ethics, respect for others, living peacefully , caring, honesty, courage, valuing time, co operation, commitment, empathy, self confidence, character.

Module – II

Ethics for Engineers, its importance, code of ethics, person and virtue , habits and morals, 4 main virtues, ethical theories, Kohlberg's theory, Gilligan's theory, towards a comprehensive approach to moral behaviour, truth, approach to knowledge in technology, environmental ethics and sustainability, problems of environmental ethics in engineering.

Module – III

Engineering as people serving profession , engineer's responsibility to environment, principles of sustainability, industrial, economic, environmental, agricultural and urban sustainability, Sustainable development. Responsibility for safety and risk, types of risk, designing for safety, risk benefit analysis.

Module – IV

Professional rights and responsibilities, sense of loyalty, confidentiality , knowledge gained confidentiality, collective bargaining, conflict of interest, occupational crime, acceptance of bribes/gifts, Global Issues, computer ethics, weapons development, engineers as expert witness and advisors, ethics and research, Intellectual Property Rights, ethical audit and procedure.

References:

1. Mike W Martin, Roland Schinzinger, *Ethics in Engineering*, Tata McGraw -Hill, 2013.
2. Govindarajan, Natarajan, Senthil Kumar, *Engineering Ethics*, PHI , 2009.
3. Aarne Vesblind P, Alastair S Gunn, *Engineering Ethics and the Environment*, Cambridge Universities Press.1998.

4. Edmund Seebauer, Robert Barry, *Fundamentals of Ethics for Scientists and Engineers*, Oxford University Press, 2001.

5. Gaur R. R., R. Sangal, G. P. Bagaria, *A Foundation Course in Value Education and Professional Ethics*, Excel Books, New Delhi, 2009.

Internal Continuous Assessment *(Maximum Marks-50)*

50% - Tests (minimum 2)

30% - Assignments (minimum 2) such as home work, problem solving, quiz, literature survey, seminar, term-project, software exercises, etc.

20% - Regularity in the class

University Examination Pattern:

Examination duration: 3 hours *Maximum Total Marks: 100*

The question paper shall consist of 2 parts.

Part A (20 marks) - Ten Short answer questions of 2 marks each. All questions are compulsory. There should be at least two questions from each module and not more than three questions from any module.

Part B (80 Marks) - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

Course Outcome:

After the completion of this course, student will be familiar with the human values and ethics in engineering.

18.606.4 MIXED SIGNAL CIRCUIT DESIGN (T) (Elective II)

Teaching Scheme: 2(L) - 1(T) - 0(P) **Credits:** 3

Course Objectives:

The course shall provide

- *Understanding on analog and digital models of short channel*
- *Switching characteristics of static circuits, pass transistor and transmission gate logic.*
- *Design of Two stage OP AMPS, Compensation circuits, Open Loop Comparators.*
- *Design of dynamic circuits, Design Concept of ADCs and DACs*
- *Use of Mixed signal simulation tools*

Module – I

Analog and digital MOSFET models of MOS, CMOS inverter – DC characteristics – switching characteristics, Static logic gates- NAND and NOR gates- DC and Switching characteristics-pass transistor and transmission gate logic.

Module – II

Single Stage Amplifiers: Common Source with resistive load, diode connected loads and current source load, source follower, Common gate and Cascode stage.

Differential Amplifiers- Differential and common mode gains, and CMRR with resistive load, Differential pair with MOS load, Current Mirror Load Differential Amplifiers, Design of current mirror load differential amplifiers.

Module – III

CMOS OP AMPS- Characterization of OP AMP, Two Stage Operational Amplifiers - Frequency compensation of OPAMPS - miller compensation, controlling right half plane zero, Design of classical Two Stage OP AMP, Design of Two Stage open Loop Comparator, Principle of Analog Multiplier.

Module – IV

Dynamic analog circuits – charge injection and capacitive feed through in MOS switch – sample and hold circuits, Switched Capacitor Circuits- Switched Capacitor Integrator, Sense amplifiers-Single Ended and Dual Ended.

Data Converters DAC and ADC Specifications-DNL, INL, latency, SNR, Dynamic Range. DAC Architecture – Resistor String, Current steering, Charge Scaling and Pipeline types. ADC Architecture- Flash and Pipe line types.

References:

1. Baker, Li, Boyce, *CMOS: Circuits Design, Layout and Simulation*, Prentice Hall India, 2000.
2. Phillip E. Allen, Douglas R. Holbery, *CMOS Analog Circuit Design*, Oxford, 2004.
3. Behzad Razavi, *Design of Analog CMOS Integrated Circuits*, Tata McGraw Hill.
4. Adel S. Sedra and Kenneth C. Smith, *Microelectronic Circuits – Theory and Applications*, 5/e, Oxford University Press.

Internal Continuous Assessment *(Maximum Marks-50)*

50% - Tests (minimum 2)

30% - Assignments (minimum 2) such as home work, problem solving, quiz, literature survey, seminar, term-project, software exercises, etc.

20% - Regularity in the class

University Examination Pattern:

Examination duration: 3 hours *Maximum Total Marks: 100*

The question paper shall consist of 2 parts.

Part A (20 marks) - Ten Short answer questions of 2 marks each. All questions are compulsory. There should be at least two questions from each module and not more than three questions from any module.

Part B (80 Marks) - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

***Note:** Question paper should contain minimum 60% Design, Analysis and Problems.*

Course Outcome:

At the end of the course, the student shall be able to

- *Illustrate analog and digital models of MOS transistor.*
- *Design static logic circuits taking into account the threshold parameters in switching characteristics*
- *Design of classical two stage OPAMP and Comparators*
- *Identify the problems in dynamic circuits and Design of data converters (ADC and DAC) for specific applications.*
- *Use modern simulation tool in mixed signal design.*

18.607 MICROCONTROLLER LAB (T)

Teaching Scheme: 0(L) - 0(T) - 3(P) **Credits**: 2

Course Objective :

- *Practise Assembly Language Programs to perform simple mathematical and logical operations*
- *Understand interface experiments*

List of Experiments:

PART A : Programming experiments using 8051 Trainer Kit.

1. Addition of series of 8 bit binary and decimal numbers.
2. Subtraction of 2 decimal numbers.
3. Addition and subtraction of two 16 bit numbers.
4. Multiplication and division of 8 bit numbers.
5. Sorting of a series of 8 bit numbers.
6. LCM and HCF of two 8 bit numbers.
7. Matrix addition
8. Square, Square root, Fibonacci series.
9. Other simple mathematical operations on 8-bit data.

PART B : Interfacing experiments.

1. Stepper motor interface.
2. Display interface.
3. Realization of Boolean expression using port.
4. Waveform generation using lookup tables.
5. PWM generation.

Internal Continuous Assessment *(Maximum Marks-50)*

40% - Test
40% - Class work and Record
20% - Regularity in the class

University Examination Pattern:

Examination duration: 3 hours *Maximum Total Marks: 100*

Questions based on experiments prescribed in the list.

The following guidelines should be followed regarding award of marks

10% - Flow Chart/Algorithm

20% - Programming with suitable comments

10% - Implementation (Usage of Kits and trouble shooting)

35% - Result

25% - Viva voce

Candidate shall submit the certified fair record for endorsement by the external examiner.

Course Outcome:

The student shall be familiar to

- *Assembly Language Programming to execute simple mathematical and logical operations*
- *Perform interface experiments*

18.608 ELECTRONIC PRODUCT DESIGN & MINI PROJECT (T)

Teaching Scheme: 1(L) - 0(T) - 3(P) **Credits**: 2

Course Objective :

- *Explain the stages of product development process.*
- *Predict the reliability of electronic products.*
- *Design electronic products considering safety aspects and hazardous environment.*
- *Assemble electronic circuits using modern hardware after simulation the circuit.*
- *Construct products considering environmental safety and sustainable development.*

This course includes both theory and practical works

I.THEORY

Theory classes are to be conducted 1 hour/week, based on the following syllabus:

DESIGN (Theory only)

Definition of a product, New Product development process. Creativity techniques. Elements of aesthetics. Ergonomics. Control panel organization. Electronic systems and needs. Physical integration of circuits, packages, boards and full electronic systems. Introduction to reliability, Reliability considerations in electronic products, Effect of reliability on product design and pricing. EMI and RFI studies. Restriction of Hazardous Substances compliance.

References:

1. Kaduskar and Baru, *Electronic Product Design*, Wiley India, 2012.
2. Kevin Otto and Kristin Wood, ―*Product Design,* Pearson Education, 2003.
3. Flurschiem CH: *Industrial Design and Engg.*, Design Council, London and Springer Verlag, 1983.
4. Ernest J Mccormick: *Human Factors in Engg. And Design,* McGraw Hill, 2009.

II. A) PRACTICAL

In addition to this, the following experiments should also be done in the lab.

1. Discrete component circuits.
2. Timer ICs and Op-Amp ICs based circuits.
3. Digital ICs based circuits.
4. Microcontroller based circuits.
5. Combination of the above**.**
6. PCB design software (OrCAD Layout or similar) familiarization.

B) MINIPROJECT

For Mini project, 2 hours/week is allotted.

Each student should conceive, design, develop and realize an electronic product. The basic elements of product design - the function ergonomics and aesthetics - should be considered while conceiving and designing the product. The electronic part of the product should be an application of the analog & digital systems covered up to the 6^{th} semester.

The realization of the product should include design and fabrication of PCB. The student should submit a soft bound report at the end of the semester. The product should be demonstrated at the time of examination.

Internal Continuous Assessment *(Maximum Marks-50)*

40% - An end semester written examination is to be conducted based on the Theory part (Design), with two hour duration for 20 Marks.

40% - 20 marks is to be awarded for the Mini project, after evaluation at the end of the semester including project report.

20% - 10 marks for the attendance.

University Examination Pattern:

Examination duration: 3 hours *Maximum Total Marks: 100*

Practical examination will be conducted for Computer Aided PCB Design & PCB Assembling based on the work done in the class. The mini project will also be evaluated during the practical examination.

The following guidelines should be followed regarding award of marks

25% - PCB assembling of the given circuit on a single sided given PCB -

20% - Result/working of the assembled circuit -

30% - Evaluation of the finished Mini project done by the student -

25% - Viva voce (Based only on the Mini Project done by the student) -

Candidate shall submit the certified fair record and the mini project report (Soft bounded) for endorsement by the external examiner.

Course Outcome:

At the end of the course, the student shall be able to

- *Identify and decide the stages of product development process.*
- *Design and construct reliable electronic products considering safety aspects.*
- *Assemble electronic circuits using modern hardware after simulation the circuit.*