UNIVERSITY OF KERALA

B. TECH. DEGREE COURSE

(2018 SCHEME)

SYLLABUS FOR

V SEMESTER

ELECTRONICS and COMMUNICATION ENGINEERING

SCHEME -2018

V 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				
18.501	Engineering Mathematics IV (TRF) (Complex Analysis & Linear Algebra)	4	3	1	-	50	3	100	150
18.502	Engineering Management for Electronics Engineers (T)	3	2	1	-	50	3	100	150
18.503	Microprocessors & Microcontrollers (T)	3	3	1	-	50	3	100	150
18.504	Power Electronics & Instrumentation (T)	3	3	1	-	50	3	100	150
18.505	Applied Electromagnetic Theory (T)	4	3	1	-	50	3	100	150
18.506	Elective I	3	3	1		50	3	100	150
18.507	Communication Engineering Lab (T)	2	-	-	3	50	3	100	150
18.508	Digital Signal Processing Lab (T)	2	-	-	3	50	3	100	150
	Total	**24**	**17**	**6**	**6**	**400**		**800**	**1200**

18. 506 Elective I

18.506.1	Digital System Design (T)
18.506.2	Optimization Techniques (T)
18.506.3	Biomedical Engineering (T)
18.506.4	Artificial Neural Networks (T)

18.501 ENGINEERING MATHEMATICS – IV (TRF)

(COMPLEX ANALYSIS AND LINEAR ALGEBRA)

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

Course Objective:

- *To introduce the basic notion in complex analysis such as Analytic Functions, Harmonic functions and their applications in fluid mechanics and differentiations and integration of complex functions ,transformations and their applications in engineering fields.*

- *Many fundamental ideas of Linear Algebra are introduced as a part of this course. Linear transformations provide a dynamic and graphical view of matrix-vector multiplication. Orthogonality plays an important role in computer calculations.*

Module – I

Complex Differentiation: Limits, continuity and differentiation of complex functions. Analytic functions – Cauchy Riemann equations in Cartesian form (proof of necessary part only).Properties of analytic functions – harmonic functions. Milne Thomson method.

Conformal mapping: Conformality and properties of the transformations $w = \frac{1}{z}$, $w = z^2$, $w = z + \frac{1}{z}$, $w = \sin z$, $w = e^z$ - Bilinear transformations- Schwarz-Christoffel Formula

Module – II

Complex Integration: Line integral – Cauchy's integral theorem – Cauchy's integral formula – Taylor's and Laurent's series – zeros and singularities – residues and residue theorem. Evaluation of real definite integrals – $\int_0^{2\pi} f(sinx, cosx)dx$, $\int_{-\infty}^{\infty} f(x)dx$ (with no poles on the real axis). (Proof of theorems not required)-Jordan's inequality-Jordan's Lemma (No proof). ,

Module – III

Vector spaces and subspaces- Null spaces, Column spaces and linear transformations-Kernal and range of a linear transformation -Linearly independent sets-Bases –Bases for nulA and ColA - Co-ordinate systems -Dimension of vector space -Rank -Change of basis.

Module – IV

Inner product spaces -Length and orthogonality -Orthogonal sets-Orthogonal and orthonormal bases -Orthogonal projection -Gram-Schmidt process -Least square problem - Quadratic forms- Constrained optimization of quadratic forms -Singular value decomposition (proof of the theorem are not included).

References:

1. O'Neil P. V., Advanced Engineering Mathematics, Cengage Learning, 2011.

2. Kreyszig E., Advanced Engineering Mathematics, 9/e, Wiley India, 2013.

3. Grewal B. S., Higher Engineering Mathematics, 13/e, Khanna Publications, 2012.

4. Lay D. C., Linear Algebra with Applications, 3/e, Pearson Education, 2006.

5. Bronson R. and G. B. Costa, Linear Algebra-an introduction, Elsevier Academic Press, 2007.

6. Williams G., Linear Algebra with Applications, Jones and Bartlett Learning, 2012.

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 master the concepts of complex analysis and linear algebra which they can use later in their career.

18.502 ENGINEERING MANAGEMENT FOR ELECTRONICS ENGINEERS (T)

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

Course Objectives:

This paper prepares engineers to fulfil their managerial responsibilities, acquire useful business perspectives and takes on the much needed leadership roles to meet the new challenges.

Module – I

Introduction to Management: definitions, Functions of engineering management- Brief description of each function. System concept. Types of organization structures - Types of companies and their formation.

Early Contributions and Ethics in engineering management: Scientific Management-contributions of Taylor, Gilbreth's, Human relations approach-contributions of Mayo, McGregor's Theory.

Module – II

Personal Management – Objectives and functions – Recruitment, Selection, Training and Induction concepts and Techniques.

Financial Management, Functions of Financial Management, Capital, Sources of Finance-Shares Debentures.

Introduction to Marketing and its Environment- Marketing mix, Product Life Cycle.

Module – III

Fatigue and methods of eliminating fatigue-industrial relations-Industrial disputes-Collective bargaining-Trade unions-workers participation in management in Indian context.

Labour welfare and social security-Industrial safety-Methods and Techniques.

Cost concept - Break even analysis (simple problems). Depreciation - Methods of calculating depreciation.

Module – IV

Basic concepts quality, Quality Control, Control chart for variables and attributes, TQM, applications, Acceptance sampling, Quality circles.

Introduction to Reliability, failure density curve, Reliability of system connected in series and parallel, failure rate calculations, MTTF and MTBF , maintainability, replacement.

References:

1. Gupta A. K., *Engineering Management,* S. Chand, 2010.
2. Mahajan M., *Statistical Quality Control*, Dhanpat Rai, 2012.
3. Stephen P Robbins, David A.Deceyo,Fundamentals of Management, Pearson Education
4. Robbins and Coulter,Management,13th Edition,2016, 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 20% Numerical Problems.*

Course Outcome:

After the completion of this course, students will be familiar with the managerial techniques and shall be confident to take up leadership roles and managerial challenges.

18.503 MICROPROCESSORS AND MICROCONTROLLERS (T)

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

Course Objectives:

- *This subject deals with the fundamental operating concepts of microprocessors and microcontrollers.*
- *To appreciate the advantages in using microprocessors and microcontrollers in engineering applications.*
- *To design a microcontroller based system with the help of interfacing devices.*
- *To apply this knowledge to more advanced structures*

Module – I

Introduction to microprocessors, 8085 architecture, microprocessor initiated operations and bus organization, internal data operations, external initiated operations, registers, machine cycles and bus timings, memory interfacing, interfacing concepts for I/O devices. 8085 programming model, instruction classification, interrupts, assembly level programming..

Module – II

Introduction to microcontrollers, comparison: microcontrollers and microprocessors, 8051 architecture- memory organization, registers and I/O ports. Addressing modes, instruction sets, and assembly language programming. Watchdog timer, Power down mode: idle/sleep mode concepts. Interrupts: comparison of interrupt with polling, Interrupt handling and programming , Timer operation: timer modes and assembly level programming.

Module – III

Serial port : modes of operation ,assembly level Programming ,Interfacing to RS232.

Interfacing : keyboard, stepper motor, ADC , DAC, RTC DS 12887 and LCD module interface

Applications - square wave and rectangular wave generation. Introduction to software development tools: IDE, Cross compiler, cross assembler, builder, Linker, debugger.

Module – IV

Microcontroller RISC family-ARM processor fundamentals: Register Organisation, pipeline,

core. ARM instruction sets: data processing, branch, load-store, interrupts & program status register instructions. Exceptions & interrupts: handling & priorities. PIC microcontrollers - introduction, architecture (block diagram explanation only).

References:

1. Gaonkar, *Microprocessor Architecture Programming and Applications with the 8085,* 5/e, Prentice Hall, 2002.
2. Mazidi M. A., *The 8051 Microcontroller and Embedded System,* 2/e, Pearson, 2009.
3. PIC 16F877 Data book
4. ARM processor Data book.
5. Ayala K., *The 8051 Microcontroller,* Cengage, 3/e, 2004.
6. Seal D., *ARM Architecture Reference Manual,* Addison Wesley, 2/e, 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 25% Problems and Assembly level Programming. Assembly level Programming only for 8085 & 8051.*

Course Outcome:

The student should be able to

- *Distinguish various types of processor architectures of 8085, 8051, ARM and PIC*
- *Develop programming skills in assembly language for 8085 and 8051.*

18.504 POWER ELECTRONICS AND INSTRUMENTATION (T)

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

Course Objectives:

- *To provide an insight on the concepts of Power Electronics and Electronic Instruments*
- *To study the application of Power electronics such as Switched mode regulators and inverters*
- *To develop understanding of the concept of Transducers and Digital Instruments*

Module – I

Linear electronics Vs Power electronics- power semiconductor switches.
Power diodes-structure, TRIAC, Power transistors-Power BJT, Power MOSFET, GTO & IGBT, Steady state and switching characteristics of Power BJT, Power MOSFET , & IGBT.

Isolated converters- Flyback, Forward, Push Pull, Half Bridge and Full Bridge Converters-waveforms and equations. (Derivation not required).

Module– II

Introduction to switched mode regulator. Buck, Boost and Buck-Boost DC-DC converters. Waveforms and Expression of DC-DC converters for output voltage, voltage and current ripple under continuous conduction mode (derivation not required)

Overview of SMPS. Switched mode inverters- principles of PWM switching schemes .Single phase inverters-half Bridge and full bridge inverter. UPS – online and offline. Three phase inverters – PWM and space vector modulation in three phase inverters.

Module – III

Measurement of: resistance using Wheatstones' bridge, inductance using Maxwell-Weinbridge and capacitance using Schering's bridge.

Transducers-Classification, selection of transducers. Resistance transducers- Principle of operation, strain gauge. Inductive transducers: LVDT, eddy current transducers . Capacitive transducers-different types, capacitor microphone, Hall effect transducers.

Module – IV

Digital Storage Oscilloscope- operations- control- application . Spectrum analyzers, Frequency synthesizers (Block Diagram only)
Electronic Multimeter, Audio power meter, RF power meter. Digital Instruments-Basics, Digital measurement of time, phase, frequency and Digital Voltmeter and digital LCR meter.

References:

1. Muhammad .H.Rashid, Power Electronics Circuits, Devices and Applications, Pearson Education.
2. P.S.Bimbhra, Power Electronics, Khanna Publishers, New Delhi.
3. Umanand.L, Power Electronics-Essentials and application, Wiley-India
4. Ghosh A. K., Introduction to Measurements and Instrumentation, PHI, 4/e, 2013.
5. Bell D. A., Electronic Instrumentation and Measurements, PHI, 2012.
6. Anand M. M. S., Electronic Instruments and Instrumentation Technology, PHI, 2013.

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 course, the student will be able to explain the working of various power electronic devices and the concept of digital instruments.

18.505 APPLIED ELECTROMAGNETIC THEORY (T)

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

Course Objectives:

- To impart knowledge on the basic concepts of electric and magnetic fields.
- To educate scientifically about Maxwell equations and Poynting theorem.
- To become familiar with propagation of signal through transmission lines and waveguides.

Module – I

Review of vector calculus, spherical and cylindrical coordinate system, coordinate transformation. Curl, Divergence, Gradient in spherical and cylindrical coordinate system. Electric field – Coulomb's law, Stokes theorem, Gauss law and amperes current law(proof not required). Poisson and Laplace equations (proof not required), Determination of E and V using Laplace equation.

Derivation of capacitance and inductance of two wire transmission line and coaxial cable. Energy stored in Electric and Magnetic field.

Module – II

Displacement current density, continuity equation. Magnetic vector potential. Relation between scalar potential and vector potential. Maxwell's equation from fundamental laws. Boundary condition of electric field and magnetic field from Maxwell's equations.

Solution of wave equation, propagation of plane EM wave in perfect dielectric, lossy medium, good conductor media-attenuation, phase velocity, group velocity, skin depth.

Reflection and refraction of plane electromagnetic waves at boundaries for normal & oblique incidence (parallel and perpendicular polarization), Snell's law of refraction, Brewster angle.

Module – III

Power density of EM wave, Poynting vector theorem, Complex Poynting vector. Polarization of electromagnetic wave-linear, circular and elliptical polarisation. Uniform lossless transmission line - line parameters, Transmission line equations, Voltage and Current distribution of a line terminated with load, Reflection coefficient and VSWR. Derivation of input impedance of transmission line. Transmission line as circuit elements (L and C). Half wave and quarter wave transmission lines.

Module – IV

Development of Smith chart - calculation of line impedance and VSWR using smith chart. Single stub matching (Smith chart and analytical method). Parallel-Plate Waveguide - TE &TM waves. The hollow rectangular wave guide – modes of propagation of wave- dominant mode, group velocity and phase velocity- derivation and simple problems only Attenuation in wave guides, guide wavelength and impedance-derivation and simple problems only.

References:

Text Books:

1. Mathew N O Sadiku, Elements of Electromagnetics, Oxford University Press, 6/e, 2014.
2. William, H., Jf Hayt, and John A. Buck. Engineering Electromagnetics. McGraw-Hill, 8/e McGraw-Hill, 2014.
3. John D. Kraus, Electromagnetics, 5/e, TMH, 2010.
4. Joseph A Edminister , Electromagnetics, Schaum's Outline Series McGraw Hill, 4/e, 1995
5. Nannapaneni Narayana Rao, Elements of Engineering Electromagnetics, Pearson, 6/e, 2006.
6. Jordan E. C. and K. G. Balmain, *Electromagnetic waves and Radiating Systems*, 2/e, PHI, 2013.

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% and maximum 70% Analysis and Problems.*

Course Outcome:

At the end of the course, students shall be able:

- *To develop a solid foundation and a fresh perspective in the analysis and application of electromagnetic fields.*
- *To analyze the propagation of electromagnetic waves in different media.*
- *To analyze the characteristics of transmission lines and waveguides*

18.506.1 DIGITAL SYSTEM DESIGN(T) (ELECTIVE I)

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

Course Objective:

- *To study synthesis and study of CSSN*
- *To study synthesis and design of ASC*
- *To study hazards and design hazard free circuits*
- *To study PLA folding*
- *To study architecture of one CPLDs and FPGA family*

Module -I

Analysis of clocked Synchronous Sequential Networks(CSSN). Modelling of CSSN-State assignment and reduction. Design of CSSN. Iterative circuits.ASM Chart and its realization.Analysis of Asynchronous Sequential Circuits (ASC).Flow table reduction-Races in ASC.State assignment problem and the transition table Design of AS. Design of vending machine controller.

Module – II

Hazards – static and dynamic hazards – essential. Design of Hazard free circuits – Data synchronizers.Mixed operating mode asynchronous circuits. Practical issues- clock skew and jitter. Synchronous and asynchronous inputs – switch bouncing. Fault table method – path sensitization method – Boolean difference method.

Module – III

Kohavi algorithm. Automatic test pattern generation – Built in Self Test(BIST). PLA Minimization - PLA folding. Foldable compatibility Matrix- Practical PLA. Fault model in PLA

Test generation and Testable PLA Design.

Module – IV

CPLDs and FPGAs - Xilinx XC 9500 CPLD family, functional block diagram– input output block architecture - switch matrix

FPGAs – Xilinx XC 4000 FPGA family – configurable logic block – input output block,Programmable interconnect

Reference:-

1. Donald G Givone, Digital Principles & Design, Tata McGraw Hill,2003
2. John M Yarbrough, Digital Logic Applications and Design, ThomsonLearning
3. John F Wakerly, Digital Design, Pearson Education, Delhi2002
4. RichardE.Haskell,DarrinM.Hanna,Introduction to Digital Design Using Digilent FPGA Boards, LBE Books- LLC
5. N. N. Biswas, Logic Design Theory,PHI
6. Morris Mano, M.D.Ciletti, Digital Design, 5th Edition,PHI.

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 50 % for theory, derivation, proof and 50% for logical/numerical problems.*

Course Outcome:

At the end of the course, students will be able to

- *Analyze and design clocked synchronous sequential circuits.*
- *Analyze and design asynchronous sequential circuits.*
- *Diagnose faults in digital circuits ,PLA*
- *Interpret architecture of CPLDs and FPGA*

18.506.2 OPTIMIZATION TECHNIQUES(T) (ELECTIVE I)

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

Course Objective:

- *To impart knowledge about the need and origin of optimization methods.*
- *To get a broad picture of the various applications of optimization methods used in engineering.*
- *To define optimization problem and its various components*

Module -I

Introduction: Engineering applications of optimization, Formulation of design problems as mathematical programming problems, objective function, constraints, classification of optimization problems/techniques. Optimization techniques: Classical optimization, unconstrained single and multivariable minimization- necessary and sufficient conditions for optimality,uni-modality, convexity.

Module – II

Linear programming problems-I: Mathematical formulation of LP Problems, slack, surplus and artificial variables. Reduction of a LPP to the standard form, feasible solutions. Graphical solution method, simplex algorithm and solution using tabular method, optimality conditions and degeneracy. Duality in linear programming

Module – III

Transportation Problem: Formulation of transportation problem, Basic feasible solution using different methods- East West corner method, Vogel approximation method, Optimality methods, MODI method, Unbalanced transportation problem. Game theory: Introduction, 2-person zero-sum game, Saddle point; Mini-Max and Maxi-Min Theorems (statement only); Graphical solution (2x n, m x 2 game), dominance property.

Network path Models: Tree Networks –Minimal Spanning Tree - Prim's Algorithm. Shortest path problems- solution methods – Dijkstra's Method.

Module – IV

Nonlinear unconstrained optimization: Single variable optimization methods- Fibonacci search method, Newton- Raphson method. Multi-variable methods- Hook-Jeeves pattern search method, Cauchy's (steepest descent) method. Modern methods of optimization: Introduction to Genetic algorithm, Cross over, Mutation, Reproduction, Simple examples of applications in electronics engineering. Introduction to optimization tools and softwares. Solution of optimization Problems using MATLAB.

Reference:-

1. SingiresuSRao,"EngineeringoptimizationTheoryandPractice",NewAge International, 2009
2. H.A. Taha, " Operations Research", 5/e, Macmillan Publishing Company,1992.
3. Kalynamoy Deb. "Optimization for Engineering Design- Algorithms and Examples", Prentice-Hall of India Pvt. Ltd., New Delhi
4. Hadley, G. "Linear programming", Narosa Publishing House, New Delhi
5. Ashok D Belegundu, Tirupathi R Chandrupatla, "Optimization concepts and Application in Engineering", Pearson Education.

6. J. S. Arora, Introduction to Optimum Design, McGraw-Hill BookCompany.

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 30 % for theory and 70% for logical/numerical problems, derivation and proof.*

Course Outcome:

At the end of the course, students will be able to

- *Get thorough understanding of optimization techniques*
- *Formulate and solving the engineering optimization problems*

18.506.3 BIOMEDICAL ENGINEERING (T) (ELECTIVE I)

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

Course Objective:

The purpose of this course is:

- *To introduce student to basic biomedical engineering technology*
- *To study the anatomy & physiology of major systems of the body in designing equipment for medical treatments.*
- *To impart knowledge about the principle and working of different types of bio-medical electronic equipment/devices.*

Module – I

Introduction,biomedical instrumentation system. Origins of Bioelectric signals and characteristics of ECG,EMG,ERG,EOG; Electrical equivalent of cell, Nernest relation, Physiological Transducers- Pressure Transducers, Temperature sensors, Pulse sensors; Sources of bioelectric potential, resting potential, action potential, propagation of action potentials in nerves; rhythmic excitation of heart.

Module – II

Electro cardiography-cardiac action potential, electrocardiogram, Human nervous system-Neuron, action potential of brain, brain waves.ECG and EEG lead configurations, ECG and EEG recording system, analysis of ECG and EEG signal, vector cardiography, phonocardiagraphy and echocardiography. Characteristics of Blood Flow, Heart Sounds Electrocardiography, Measurement of Blood Pressure, Measurement of Blood Flow and Cardiac output, Non invasive pressure measurements-auscultatory, oscillometric, ultra sonic, EMG: nerve conduction velocity, instrumentation system for EMG

Module – III

Physiology of Respiratory system, Tests and Instrumentation for the respiratory measurements, respiratory gas analyzers.Diagnosis Equipments: Principle, block schematic diagram,working and applications of oxi meters, plethysmograph , pH meter,blood cell counter, flame photometer, spectrophotometer ,colorimeter and chromatographs. Therapeutic Equipments: Principle, block schematic diagram, working and applications of pacemakers, cardiac defibrillators,heart–lung machine, dialyzers, surgical diathermy equipment,electrotherapy, infant incubators, ventilators and automatic drug delivery systems.

Module – IV

Medical Imaging systems: (Basic Principle only).X-ray imaging: Properties and production of X-rays, X-ray machine,applications of X-rays in medicine.Computed Tomography. Ultrasonic imaging systems: Basic pulse echo system, propagation of ultrasonic through tissues and reflections, display types, A-Scan, B-Scan, M-Scan, applications. Magnetic Resonance Imaging: principle, magnetic relaxation and MRI parameters, basic NMR imaging system, MRI instrumentation system, advantages, risks and limitations.Positron Emission Tomography,Biomedical

Telemetry system: Components of biotelemetry system, application of telemetry in medicine, single channel telemetry system for ECG and temperature, multi channel telemetry system,implantable telemetry system.

Reference:-

1. Cromwell, *Biomedical Instrumentation and Measurement*, Pearson, 2009.
2. Khandpur R. S., *Handbook of Biomedical Instrumentation*, 2/e, TMH, 2003.
3. Isaac N. Bankman, *Handbook of Medical Imaging*, Academic Press, 2000.
4. Cho and Manbir Singh, *Foundations of Medical Imaging*, John Wiley, 1993.
5. Raja Rao and Guha, *Medical Electronics and Biomedical Instrumentation*, Universities Press, 2009.
6. Singh, *Biomedical Instrumentation*, PHI, 2014.

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:

At the end of the course, students will be able to

- *Design instruments useful to the medical community.*
- *Evaluate alternate assumptions, approaches, procedures, tradeoffs, and results related to engineering and biological problems.*

18.506.4 ARTIFICIAL NEURAL NETWORKS (T)

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

Course Objectives:

- *To learn concepts of Artificial neural networks.*
- *To learn various architecture of ANN*
- *To study the methods of operating informations in ANN.*

Module – I

Introduction to Neural Networks - Applications - Typical architecture of Artificial Neural Networks - Common activation function, Mc. Culloh Pitts Neuron – Architecture, logic implementatons. Supervised and Unsupervised learning- Learning Algorithms .Linear Separability -Pattern Classification – Hebb Net, Perceptrons, ADALINE networks (Architecture, Algorithm and simple Applications).

Module – II

Pattern Association- training algorithms- Hetro Associative Network, Auto Associative Network, Hopfield Network, BAM Network. Self organizing Maps - Learning Vector Quantization (Architecture, Algorithm and Applications.

Module – III

Counter Propagation Network (Architecture, Algorithm and Applications). Conjugate Gradient Learning- Back Propagation algorithm-Multilayer feed forward network (Architecture, Algorithm and applications).

Module – IV

Adaptive Resonance Theory- ART 1 and ART 2. Cover's theorem- Radial Basis Function Networks. Boltzmann machine (Architecture, Algorithms and Applications). Introduction to Probabilistic neural network.

References:

1. Fausett L., *Fundamentals of Neural Networks,* Pearson Education. 2004.
2. Haykin S., *Neural Networks,* PHI, 3/e, 2012.
3. Freeman J. A. and D. M. Skapura, *Neural Networks - Algorithms, Applications and Programming Techniques,* Pearson Education, 2008.
4. Bose N. K. and P. Liang, *Neural Network Fundamentals with Graphs, Algorithms and Applications,* McGraw Hill, 1996.
5. Hagan M. T., H. B. Demuth and M. Beale, *Neural Network Design,* Vikas Thomson Learning, 1996.

6. Sivanandham, Sumathi, Deepa, *Introduction to Neural Networks using MATLAB,* TMH, 2005.

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 70% Problems and Algorithm.*

Course Outcome:

After successful completion of the course, students will be familiar with the concept of ANN and will be able to apply the right algorithm to solve practical problems.

18.507 COMMUNICATION ENGINEERING LAB (T)

Teaching Scheme: 0(L) - 0(T) - 4(P) **Credits**: 2

Course Objective :

- *To practise the basic theories of analog communication*
- *To study different IC and applications in communication*

List of Experiments:

1. AM generation using discrete components.
2. AM using multiplier IC AD534 or AD633.
3. AM detection using envelope detector.
4. IF tuned amplifier.
5. FM using 555 IC.
6. Study of PLL IC- Measurement of lock and capture range.
7. FM generation using PLL.
8. Pre-emphasis and de-emphasis circuits
9. Frequency multiplier using PLL.
10. PAM modulator and demodulator
11. PWM Modulation & Demodulation using 555 timer
12. PPM Modulation & Demodulation using 555 timer.

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.

25% - Circuit Design

15% - Performance (Wiring, use of equipment/instruments and trouble shooting)

35% - Result

25% - Viva voce

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

Course Outcome:

From the practical exposure, the students will be able to design communication circuits.

18.508 DIGITAL SIGNAL PROCESSING LAB (T)

Teaching Scheme: 0(L) - 0(T) - 4(P) **Credits**: 2

Course Objective :

- *To study the basics of signal processing techniques and filter design using DSP*
- *To study the basics of MATLAB and design circuits*

List of Experiments:

Part A: Experiments on Digital Signal Processors:

1. Generation of sine wave.
2. Generation of standard test signals.
3. Convolution : Linear and Circular
4. Real Time FIR Filter implementation (Low-pass, High-pass and Band-pass)
5. Real Time IIR Filter implementation (Low-pass, High-pass and Band-pass)
6. Sampling of analog signal and study of aliasing.

Part B: Experiments using MATLAB

1. Generation of waveforms (Continues and discrete).
2. Verification of Sampling Theorem.
3. Convolution: Linear Convolution, Circular Convolution, Linear Convolution using Circular Convolution.
4. DFT and IDFT of a given input sequence.
5. Linear convolution using DFT (Overlap-add and Overlap-Save methods).
6. Design & implementation of IIR filters from analog specifications. (Butterworth and Chebyshev Filters).
7. Design & implementation of FIR filters from analog specifications. (Window method).
8. Familirization of Filter design tool box.
9. Generation of AM, FM & PWM waveforms and their spectrum.
10. Study of sampling rate conversion by a rational factor.
11. Filtering of noisy signals.

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 for each batch should be based on the list of experiments prescribed, from Part A or Part B.

25% - Circuit Design (Logical design and flow diagram for software experiments)

15% - Implementation (Usage of Kits and trouble shooting, Coding for Software experiments)

35% - Result (Including debugging of Program for software

experiments) 25% - Viva voce

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

Course Outcome:

After completion the course student will be able to design circuits using DSP techniques and MATLAB.