UNIVERSITY OF KERALA

MSc DEGREE PROGRAMME

IN

ELECTRONICS

REVISED REGULATIONS, SCHEME & SYLLABUS 2019

1. Eligibility

The eligibility for admission to MSc Electronics degree course in affiliated institutions under Kerala University is a BSc Degree in Electronics/Physics/Computer Science/BCA with not less than 50 % marks in optional subjects or 2.0 CGPA (s) out of 4.0 or 5.0 CCPA(s) out of 10.0 subject to the usual concessions allowed for backward classes and other communities as specified from time to time.

2. Admission

The admission to the MSc degree course shall be as per the rules and regulations of the University. Students admitted under this programme are governed by the Regulations in force

3. Programme structure and duration

The duration of the programme shall be 4 semesters. The duration of each semester will be 70 working days. A candidate who could not complete and pass all examinations within four (4) years since his first admission to MSc programme will not be allowed to continue and he/she has to quit the programme

The programme shall include two types of courses. Core courses and Elective courses. There will be five core courses and two practical courses in first semester. In the second semester there will be three core courses, one elective course and two practical course. In the third semester there will be three core course, one elective course, one practical course and one mini project. In the forth semester there will be one core courses, one elective course, a seminar and main project. At the end of the programme there will be a comprehensive viva-voce which covers questions from all courses in the programme.

4. Evaluation

Candidates in each semester will be evaluated by continuous evaluation and end semester University examination. The individual maximum marks allotted for continuous assessment and University examination for each subject is as prescribed by the scheme of study.

5. Sessional Marks

Therewillbecontinuousevaluation(CE)basedoncontinuousassessmentforeachcourse and carries 25% weightage as shownbelow: The faculty member concerned will do the continuous assessment for each semester.

(a) Theory

Component	Marks
Attendance	5
Assignment	7.5 (minimum 2
Classtests	12.5 (minimum twotests)

*Class tests***:** For each course there shall be a minimum of two written tests during a semester.

*Assignments***:** Each student is required to submit two assignments for a theory course.

(b) Practical

Component	Marks
Attendance	5
Performance	5
Laboratoryrecord	5
Test	5

Separaterecordsaretobeusedforeachpracticalcourse.Acandidateshallbepermittedto attend the end semester practical examination only if he/she submits a duly certified record book. This is to be endorsed by the externalexaminer.

6. END SEMESTEREXAMINATION for theory papers

There will end semester examination (ESE) conducted by the University for each course and carries 75% weightage. The question paper consists of two parts
Part A (27 marks). Nine compulsory questions of 3 marks each
Part B (48 marks). Students must answer two out of three questions from each module. Each question carries 8 marks.

7. Pass Requirements

For each subject (including the practical), a student should get a minimum of 40% marks for the university examination and 50% aggregate for the sessional and university examination together for subjects in the 1^{st} , 2^{nd} , 3^{rd} semesters. For the seminar and project in the 4^{th} semester each student should a minimum of 50% for the sessional. For the viva-voce examination in the 4^{th} semester, each student should get a minimum of 50% aggregate for the university examination.

I. GENERAL STRUCTURE FOR MSc. ELECTRONICS – 2019 Scheme

Semester 1

Sub Code	Subject Name	End Semester Exam.Hrs.	Instructional Hrs/week			Marks for CE	Marks for ESE	Total Marks
			L		P			
PGE 101T	Advanced Mathematics	3	4		0	25	75	100
PGE 102T	Solid State Electronics	3	4		0	25	75	100
PGE 103T	Mixed Circuit Design	3	3		0	25	75	100
PGE 104T	Communication Systems	3	3		0	25	75	100
PGE 105T	Programming in $C^{++}$and Data Structures	3	3		0	25	75	100
PGE 106P	IntegratedCircuits Lab	3	0		4	25	75	100
PGE 107P	Programming in C^{++}Lab	3	0		4	25	75	100
	Total		17	0	8	175	525	700

Semester II

Sub Code	Subject Name	End Semester Exam.Hrs.	Instructional Hrs/week			Marks for CE	Marks for ESE	Total Marks
			L		P			
PGE 201 T	Digital Systems Design with VHDL	3	4		0	25	75	100
PGE 202T	Microprocessor and Microcontroller	3	5		0	25	75	100
PGE 203T	Control systems	3	4		0	25	75	100
PGE 204T	Elective I	3	4		0	25	75	100
PGE 205P	Microprocessor and Microcontroller Lab	3			4	25	75	100
PGE 206P	Communication Engineering Lab	3	0		4	25	75	100
	Total		17	0	8	150	450	600

SEMESTER III

Sub Code	Subject Name	End Semester Exam.Hrs.	Instructional Hrs/week			Marks for CE	Marks for ESE	Total Marks
			L		P			
PGE 301 T	Embedded Systems	3	4		0	25	75	100
PGE 302T	Digital Image Processing	3	4		0	25	75	100
PGE 303T	RF and Microwave Technologies	3	5		0	25	75	100
PGE 304T	Elective II	3	4		0	25	75	100
PGE 305P	Computer Aided Design	3	0		4	25	75	100
PGE 306P	Mini Project	3	0		4	50	50	100
	Total		17	0	8	175	425	600

Semester IV

Sub Code	Subject Name	End Semester Exam.Hrs.	Instructional Hrs/week			Marks for CE	Marks for ESE	Total Marks
			L		P			
PGE 401 T	IOT and Python Programming	3	4		0	25	75	100
PGE 402T	Elective III	3	4		0	25	75	100
PGE 403P	Seminar				3	50	0	50
PGE 404P	Project				14	250	0	250
PGE 405P	Viva Voce	1	0		0	0	100	100
	Total		8	0	17	350	250	600

Elective I:
1Advanced Wireless Communication
2 Digital & Data Communication
3 Fuzzy Systems and Applications

Elective II:
1. Robotics
2. Information Theory & Coding
3. Satellite and Optical Communication

Elective III
1 Biomedical Electronics
2 Machine Learning

PGE 101 T ADVANCED MATHEMATICS

MODULE I

Descriptive Statistics-Treatment of data: Descriptive measures - Measures of central tendency-measures of Dispersion-Moments-Coefficient of Skewness, Kurtosis

Probability Distribution: Axioms of Probability, Random variable -Bernoulli′s, Binomial Poisson Distributions-Normal distributions

MODULE II

Linear models in Engineering-Systems of linear equations, Row reduction and Echelon forms, vector Equations, Matrix Equation, Solution sets of linear systems, linear independence, linear transformation, models in engineering, matrix operations, Invertible Matrices, Matrix factorizations, Solutions of linear systems, Leontief Input-output Model, Application to computer Graphics. Determinants-Properties - Grame′s Rule, Vector Spaces & Sub Spaces, Null &Column Spaces, linear transformations, bases, Co-ordinate systems, dimension, Rank, Change of difference basis, Application to difference Equations and Markov chains.

MODULE III

Eigen values & Eigen Vectors- Characteristic equation, Diagonalization. linear transformations, complex eigen values, Application to differential equations. Orthogonality & Least-squares-inner product, length and orthogonality, orthogonality sets and projections, Gram-Schmidt process, Least-squares problems, Symmetric matrices & quadratic forms-constrained optimization, singular value decomposition, Application to image processing, Numerical techniques- Gaussian elimination, LU decomposition, Practical difficulties in solving equations, Iterative methods for solving linear equations.

References:

1. Yannisviniotis: Probability &Random Processes for Electrical engineers, McGraw Hill
2. Paoulis: Probability, Random variables &Stochastic processes,3rd edition, McGraw Hill
3. David C Lay: Linear Algebra and its Applications,2nd edition, Peason Education Asia
4. GaretyhWilliams:Linear Algebra with applications,4th edition, Jones & Bartlett, Mathematics
5. Arch W.Naylor R Sell:Linear Operator Theory ,Vol40,Springer
6. Jorge I Aunon,V.Chandrasekar:Introduction to Probability & Random processes, McGraw Hill

PGE 102T SOLID STATE ELECTRONICS

Module I

Quantum Mechanics-Wave nature of particles-uncertaintyPrinciple-Wave motion- Superposition Principle-De-Broglie Hypothesis-Time dependent and independent Schrodinger wave Equation-Planck's concept of energy & Quantization particle in one dimensional infinite potential well-Finite and infinite square well-Particle in Box-Square potential –Barrier and quantum mechanical Tunneling. Structure of Solids and Crystal Theory – Lattice, Basis and Unit Cells, Important Structures, X-Ray and Neutron Crystallography and the Reciprocal Lattice.

Module II

Energy Bands in Solids: Energy Band Diagram, Direct and Indirect band gap semiconductors, Effective mass. Semiconductors- Intrinsic and extrinsic. Carrier Concentration-Fermi-Dirac distribution function, Electron and Hole concentration at equilibrium, Temperature dependence of intrinsic carrier concentration& majority carrier concentration in extrinsic semiconductor, Equilibrium electron hole concentration. Carrier transport in semiconductors - mobility and conductivity. Variation of mobility with temperature & doping. Constancy of Fermi level at equilibrium. Hall Effect. Quasi Fermi level, Diffusion of charge carriers. Einstein relation. Continuity equation. PN junction under thermal equilibrium-Equilibrium energy band diagram - Distribution of carrier concentration, potential, electric field and charge density.

Module III

Introduction to nanotechnology and nano electronics, Impacts, Limitation of conventional microelectronics. Introduction to methods of fabrication of nonmaterial –different approaches. Fabrication of nano-layers- Physical Vapor Deposition, Chemical Vapor Deposition, Epitaxy, Molecular Beam Epitaxy, Ion Implantation, Formation of Silicon Dioxide. Fabrication of nano particles-ball milling, laser ablation (PLD), sol gel, self-assembly, preparation of quantum dots (qualitative treatment only)

Text Book

1. B Premlet: Engineering Physics, (Tata Mc-Graw-Hill) Module I
2. V.SureshBabu:Solid state devices& technology, (Sanguine technical publishers)Module II
3. B Premlet: Nano electronics, (Phasor Books) Module III

References

1. W.R Fahrner: Nanotechnology&Nanoelectronics, (Springer 2005)
2. M STyagi:Introduction to semiconductor materials and devices (Wiley India)
3. D A Neeman:Semiconductor Physics& Devices(Tata Mc-Graw-Hill)

Question Paper

The question paper consists of two parts. Part A covering the entire syllabus for 27 marks. This shall contain nine compulsory questions of 3 marks each. Part B (48marks). Students must answer two out of three questions from each module. Each question carries 8 marks. (Minimum 60% problems, derivation and proof)

PGE103TMIXEDCIRCUITDESIGN

ModuleI

Linear op amp circuits: Inverting and noninverting amplifier, Summing amplifier, Integrator, Differentiator, Differential amplifier, Instrumentation amplifier, Precision rectifiers, Oscillators, Phase-shift, Wein- bridge, multivibrators – Astable, Monostable, Schmitt Trigger. Biquadratic filter of low pass, high pass, band pass and band elimination filters, switched capacitor resistor, Switched capacitor filter

ModuleII

MOS Technology, MOSFET Device physics, VI characteristics, Long channel MOSFET, Short channel effect of MOSFET, switching characteristics, Pass transistors and transmission gate logic, Differential amplifiers- CMRR – CMOS Op Amp- Frequency Compensation of op amps, Analog Multipliers

ModuleIII

Sample and hold circuits, CMOS VCO, Charge pump PLL, PFD, ADCs and DACs, Charge Scaling DAC, Pipeline ADC, Cyclic ADC, Charge distribution ADC.

References:

1. Sergio Franco, Design with Amplifiers and Analog Integrated Circuits, TMH,3ed
2. Gakewad, Op-Amps and Linear Integrated Circuits, PHI/ Pearson Education, 4 edition
3. Baker, Li, Boyce, CMOS: Circuit Design, Layout and Simulation, Prentice Hall India 2000
4. Phillip E. Allen, Douglas R.Holbery , CMOS Analog Circuit Design, Oxford , 2004
5. Razavi B, Design of Analog CMOS Integrated Circuit Design, Mc G Hill, 2001

QuestionPaper

The question paper consists of two parts. Part A covering the entire syllabus for 27 marks. This shall contain nine compulsory questions of 3 marks each. Part B (48 marks). Students must answer two not of three questions from each module, Each question carries 8 marks

(Minimum 60% problems, derivation and proof)

PGE 104T Communication Systems

Module I

Overview of communication system, Bandwidth, Modulation, Need for modulation, Analog modulation types.

Angle modulation: Types, Frequency Modulation, Sinusoidal FM, Frequency spectrum for sinusoidal FM,

Average power in sinusoidal FM. Non sinusoidal Modulation: Deviation ratio.

Phase modulation, Equivalence between FM and PM, Sinusoidal PM, Digital PM.

Angle modulator circuits:Varactor diode modulator, Transistor modulator.

FM transmitters, FM Broadcast.

Angle Modulation Detectors: Basic detection of FM signals, Foster- seely discriminator, Ratio detector.

AFC, Amplitude limiters, Noise in FM system, Pre- emphasis and De- emphasis, FM broadcast receivers, FM stereo receiver.

Module II

Introduction to modern wireless system: cellular concept, Frequency reuse, Handoff strategies, Interference and system capacity, Improving coverage and capacity in cellular system, Principle of GSM and CDMA. Fading and Multipath channels and their parameters.

Radar- Principles – The range equation. Principles, operation of CW and FM Radar. MTI and pulse Doppler Radar.

Module III

Orthogonal Frequency Division Multiplexing: Basics, Orthogonality, Frequency Domain Orthogonality, Performance of OFDM withvariousmodulationschemes, Reduction of ISI, The OFDM Transmitter, Initial Block diagram, OFDMA in mobile cellular network, Single Carrier FDMA.

Textbooks:

1.Electronics communications, Dennis Roddy and John coolen, 4e, Eastern Economy Edition, Prentice hall of India (I module)

2. Micro wave and radar Engineering, Dr. Kulkarni, 4e, Umesh(II module)

3. Wireless communications: Principles and practice, 2e, Theodore s Rappaport, Pearson (II module).

4. AN INTRODUCTION TO LTE, LTE-ADVANCED, SAE AND 4G MOBILE COMMUNICATIONS, Christopher Cox, John Wiley & Sons, Ltd., Publication (III module)

PGE 105T PROGRAMMING IN C^{++} AND DATA STRUCTURES

Module I

Classes- Objects, access modifiers, arrays, pointer to arrays, constants, reference, dynamic memory allocation using new & delete operation, friend function, constructors, function overloading, operator overloading-unary, binary, inheritance, polymorphism, virtual function, files and streams.

Module II

Abstract data type and data structures. Classes and objects, complexity of algorithms, worst case, average case and best case. Linked Lists – singly linked list –traversing, insertion, deletion - Garbage collection. Stack, Queue- implementation application. Hash tables and hashing techniques. Collision resolution techniques.

Module III

Trees-Binary trees, Traversal, operations, Binary search tree – searching, insertion, deletion. Graphs - representation, traversal- Depth first search, Breadth first search. -Minimum spanning tree – Prim's and Kruskal's algorithm. Dijkstra's single source shortest path algorithm.

Text book

2. D Samanta-Classic Data Structures-PHI

Reference

1. Balaguruswami-Programming in C++-Shaunm's series
2. Richard F Gilburg, B A Frouzan: Data Structures: A pseudocode Approach with C++
3.
4.Robert Kruse et al: Data Structures and program design in C-PHI.2nd Edition

Question Paper

The question paper consists of two parts. Part A covering the entire syllabus for 27 marks. This shall contain nine compulsory questions of 3 marks each. Part B (48marks). Students must answer two out of three questions from each module. Each question carries 8 marks. (Minimum 40% program)

PGE 106P INTEGRATED CIRCUITS LAB

1. To study Differential amplifier using op-amp
2. To study Schmitt trigger using op-amp
3. To study comparator using op-amp
4. To study window detector using op-amp LM311
5. To study precision rectifier using op-amp
6. To study triangular and square wave generators using op-amp
7. To study I to V and V to I converter using op-amp
8. To study Wein bridge oscillator using op-amp with amplitude stabilization
9. To study the instrumentation amplifier using op-amp
10. To study counter ramp ADC and R-2R ladder DAC
11. To study 723 voltage regulator with short circuit and fold back protection
12. To study BCD adder using 7483 IC
13. To study the master slave J-K flip flop and verify the truth table
14. To study Johnson counter using CD 4017
15. To study Mod 10 counter using IC 7490 and verify the truth table
16. To study Multiplexer IC 74150 and De-multiplexer IC 74154
17. To setup a 7 segment LED display using BCD counter decoder IC
18. To study ADC 0808 and DAC 0800

Note: Students have to perform at least 15 experiments from the above list

Note: For University examination the following guidelines should be followed regarding the award of marks

(a) Circuit and design : 15 Marks

(b) Performance (Wiring, usage of equipment and troubleshooting) : 15 Marks

(c) Result : 20 Marks

(d) Viva-voce : 20 Marks

(e) Record : 5 Marks

PGE 107P PROGRAMMING IN C^{++} LAB

19. Program to find the factorial of a given number
20. Program to find the number of vowels from a given line
21. Program to find Transpose of a Matrix
22. Program to find whether the given string is palindrome or not
23. Program to find the occurrence of a number in an array
24. Write a program to create a file and copy the content to another file
25. Program to find the volume of a sphere, Cylinder and Cone using overloading
26. Program to implement different string handling function
27. Pascal triangle
28. Matrix multiplication
29. Decimal to binary conversion
30. String operation
31. File operation
32. Array insertion and Array deletion
33. Linear and Binary search
34. Evaluation of postfix operation
35. Bubble, Merge and Insertion sort
36. Stack implementation using array
37. Stack implementation using linked list
38. Queue implementation using array

Note: Students have to perform at least 17 experiments from the above list

Note: For University examination the following guidelines should be followed regarding the award of marks

(f) Algorithm/flow chart : 10 Marks
(g) Program : 20 Marks
(h) Result : 20 Marks
(i) Viva-voce : 20 Marks
(j) Record : 5 Marks

PGE 201T DIGITAL SYSTEMS DESIGN WITH VHDL

Module I

Concepts of Digital System Design Process, Design automation, Hardware Description Language, Hardware Simulation, Oblivious Simulation, Event-driven simulation, Hardware synthesis, Level of abstraction. VHDL Language - Design methodology based on VHDL, Elements of VHDL, Describing components, Packages, Top down design, verification, Top down design with VHDL, Subprograms, VHDL operators, Conventions & Syntax. Basic concept in VHDL - Characterizing Hardware Language, Timing, Concurrency, Hardware modeling, Objects & Classes.

Module II

Type declaration and usage, Enumeration type for multi value logic, Array declaration, VHDL Operators, subprogram parameters, Types and overloading, Array attributes, Type attributes, Signal attributes, Entity attributes. Sequential processing - Process statement, Signal assignment versus Variable assignment, Sequential statements - IF, CASE, LOOP, ASSERT, WAIT etc., Concurrent assignment problem, Passive processes. Structural Specification of Hardware - Inverter model, NANO gate model.

Module III

Modeling Flip- Flops using VHDL Processes, Logic Design of Comparator, VHDL description of comparator, VHDL Models for a Multiplexer. Logic design of Latch, Flip-flop, VHDL model for Counter and Registers. Subprograms and Packages - Subprograms, Functions, Conversion functions, Resolution functions, Procedures. Packages, Package declaration, Deferred constants, Subprogram declarations, Package body Introduction to CPLD, FPGA & design with CPLD and FPGA.

References:

1. Wakerly J. F , Digital Design - Principles and Practices, 4/e, Pearson Education,2008.

2. Roth C.H., Digital System Design Using VHDL, Cengage Learning, 2008 .

3. J.Bhasker, VHDL Primer, 3/e, Pearson Education, India.

4. Perry D. L., VHDL Programming by Example, 4/e, TMH,2008.

5. Brown S. and Vranesic Z., Fundamentals of Digital Logic with VHDL Design, 2/e,TMH.2008.

6. Pedroni V. A., Circuit design with VHDL, PHI,2008. 7. Kevin Skahill.: VHDL for Programmable Logic, Addison & Wesley.

Question Paper The question paper consists of two parts. Part A covering the entire syllabus for 27 marks. This shall contain nine compulsory questions of 3 marks each. Part B (48 marks). Students must answer two out of three questions from each module. Each question carries 8 marks. (Minimum 50% problems, design and program)

PGE 202T MICROPROCESSOR AND MICROCONTROLLER

Module I

Introduction to microprocessor, CISC and RISC, architecture of 8086 microprocessor, clock and reset signal generation, pin functions of 8086, system bus timing, Addressing modes, Instructions and programming, Assembler directives, Subroutine and macro, Interrupts and their processing, Maximum and minimum modes, Memory interfacing, I/O interfacing.

Module II

Introduction to microcontrollers, embedded processors. 8051 architecture- memory organization, registers and I/O ports. Addressing modes, instruction sets, and assembly language programming. Power down mode, idle/sleep mode. Programming timer/counter. Interrupts handling and programming. Serial communication using 8051- Interfacing with RS23 2. ·

Module III

Interfacing with 8086 - keyboard, display and ADC interface using 8255, Peripheral interface using 8259 interrupt controller, 8088 coprocessor and its interface with 8086. 8051· interfacing - keyboard, ADC, DAC, and LCD module interface. Applications - square wave and rectangular wave generation, frequency counter and temperature measurement.

References:

1.Douglas V. Hall : Microprocessors and Interfacing, TMH, New Hill

2.Muhammad Ali Mazidi, !he 8051 microcontroller and Embedded System, 2006, Pearson Education

3.Kenneth J Ayala 8051 m1crocontroller: Architecture,programming and Application

PGE 203T CONTROL SYSTEMS

Module I

Basic Ele1nents of Control Systen1 - Open loop and Closed loop syste1ns - examples- Concept of feedback - Transfer function, modelling of electrical, translational and rotational mechanical syste111s - Block diagra1n reduction techniques - Signal flow graph- Mason's gain formula -Standard test signals, natural frequency and damping ratio. - Definitions of poles, zeros, order and type.

Module II

Analysis of continuous time systems - time domain solution of first order systems - time constant - time domain solution of second order systems - determination of response for standard inputs using transfer functions - steady state error - P - PI - and PID compensation. Concept of Stability: absolute, relative and marginal, nature of system response - Routh Hurwitz techniques - Root locus techniques: Basic properties of Root Loci- Construction of Root Loci and analysis of control system.

Module III

Frequency Response- Bode plot, Polar plot, Nyquist plot - Frequency Domain specifications from plot. Compensator Networks: Series, Parallel, Series-Parallel compensation- Lead, Lag and Lead lag compensators.

References:

1. J. Nagrath and M.GopaL "Control System engineering", New Age International Publishers.

2. M.Gopal, "Control System - Principles and Design", Tata McGraw Hill.

3. Benjamin.C.Kuo, "'Automatic Control System", ?111 Edn. Prentice Hall of India, New Delhi

4. Norman.S.Nise, "Control System Engineering", 5thEdn Wiley

5. S.K.Bhattacharya, "Control Systems Engineering', 5thEdn. Wiley.

6.Schaum 's Series Book, "Feedback Control Systems".

Question Paper The question paper consists of two parts. Part A covering the entire syllabus for 27 marks. This shall contain nine compulsory questions of 3 marks each. Part B (48 marks). Students must answer two out of three questions from each module. Each question carries 8 marks.

PGE 204.1T ADVANCED WIRELESS COMMUNICATION SYSTEMS

Module I

Essential functions of SDR, Hardware Architecture, Software Architecture, SDR Development and Design.
Properties of sdr and cr, Physical and Link Layers of cr, Position Awareness, Network Awareness, Cognitive Services for the User, Network Support, Cognitive Radio Architecture, Cognitive Radio Performance Analysis, Services Offered to Wireless Networks through Infrastructure.

Module II

Multiple Antenna Techniques, Architecture of the LTE Air Interface, Cell Acquisition, Data Transmission and Reception, Random Access, Air Interface Layer2, Architecture maps, Building the Cognitive Radio Architecture on Software defined Radio Architecture, The XG Network architecture, spectrum sensing, spectrum management, spectrum mobility, spectrum sharing, upper layer issues, cross – layer design,
Implementing SDR using lab-view and USRP.

Module III

Introduction to 4G. Power-On and Power-Off Procedures, Security Procedure, Mobility Management, Inter-System Operation, Delivery of Voice and Text Messages over LTE, Introduction to 5G, cognitive radio for 5g.

Textbooks:

1. AN INTRODUCTION TO LTE, LTE-ADVANCED, SAE AND 4G MOBILE COMMUNICATIONS, 2012, John Wiley & Sons Ltd, ISBN: 9781119970385(module II and III).
2. Fundamentals of 5G mobile networks, Jonathan Rodriguez, 2015, John Wiley & Sons, Ltd. (III module).

PGE 204.2T DIGITAL AND DATA COMMUNICATION

Module I

Pulse modulation – Sampling process – PAM – Quantization – PCM. Digital multiplexers- Modifications of PCM – Delta modulation – DPCM – ADPCM- ADM. Baseband pulse Transmission, Matched filter – Nyquist criterion for distortion less transmission- eye pattern- optimum linear receiver- Adaptive equalization.

Module II

Signal space Analysis. Geometric representation of signals – conversion of the continuous AWGN channel in to a vector channel – Likelihood function – coherent detection of signals in noise- correlation receiver- probability of error. Pass band digital Transmission- Transmission model – coherent phase shift keying – Coherent frequency shift keying - Detection of signals with unknown phase – Non coherent orthogonal modulation – Differential Phase shift keying – comparison of digital modulation schemes.

Module III

Data transmission concepts and terminology – analog and digital data transmission- Transmission impairments- Transmission media- wireless Transmission. Data encoding- spread spectrum. Asynchronous and synchronous transmission. Interfacing. Data link control- flow control- error detection and control. Multiplexing: Frequency division multiplexing- Synchronous time division multiplexing – statistical time division multiplexing.

References:

1. Simon Haykin – communication systems – 4th edition- John- wiley& sons. Inc.
2. Bernard sklar : Digital Communication – 2nd edn, Pearson education ,2001.
3. Harnoldkolimbris, Digital communication systems-1st edn, Pearson education ,2000.
4. Marvin K. Simon, Sami M.Hinedi, William C. Lindsey: Digital communication Techniques- PHI.
5. William Stallings – Data and Computer Communication. 6th edn- PHI.

PGE 204.3T FUZZY SYSTEMS AND APPLICATIOS

Module I

Introduction to fuzzy sets and systems – crispness, vagueness- uncertainty and fuzziness. Basics fuzzy sets, membership functions, support of a fuzzy set height, normalized fuzzy set, α cuts. Properties of Fuzzy set. Operation on fuzzy set – complement, intersection, union, equality & subset hood.

Module II

Law of excluded middle, law of contradiction, concentration, dilation, contrast intensification.
Type -2 fuzzy sets, Extension Principle and its application. Fuzzy relation, operation on fuzzy relation, Projection, max – mini composition, cylindrical extension. Reflexivity, symmetry and Transitivity. Fuzzy prepositions, fuzzy connectives, linguistic variables, linguistic hedges. Fuzzy quantifiers.

Module III

Approximate reasoning or fuzzy inference, generalized modus ponens (GMP), generalized diagram of fuzzy logic controllers, Multi input multi output control system. Automatic train operating system.

References:

1. Timothy J. Ross, Fuzzy logic with Engineering applications, 2nd edn, McGraw Hill.
2. Zimmerman H.J, Fuzzy set theory and its applications, 4thed, Springer, 2001.
3. Ganesh M, Introduction to fuzzy sets and Fuzzy logic, PHI, 2006.

PGE 205P MICROPROCESSOR AND MICROCONTROLLER LAB

Programs to be done in the kit

39. Addition / subtraction of 32- bit numbers
40. 16 – bit multiplication
41. Prime number generation
42. Fibonacci series
43. Bubble sorting
44. Square root of 16 -bit number
45. Comparison of string
46. Division of 32-bit numbers
47. Find a character from an array

Note:Students have to perform at least 6 experiments from the above list

Microcontroller experiments (8081)

1. Sum of series of 8- bit binary/BCD numbers
2. 8-bit multiplication and division
3. Decimal to Hex and Hex to Decimal conversion
4. LCM and HCF of two 8-bit numbers
5. Sorting

Note: Students have to perform all experiments from the above list

Interfacing using 8086 and 8051 kit

1. Stepper motor interfacing
2. Waveform generation using DAC
3. ASCII character reading from keyboard
4. ADC interfacing

Note:Students have to perform all experiments from the above list

Note: For University examination the following guidelines should be followed regarding the award of marks

(k) Algorithm/flow chart : 10 Marks
(l) Program : 20 Marks
(m) Result : 20 Marks
(n) Viva-voce : 20 Marks
(o) Record : 5 Marks

PGE 206P COMMUNICATION ENGINEERING LAB

48. AM generation using discrete components
49. AM generation using envelope detector
50. AM detection using envelope detector
51. IF tuned amplifier
52. FM using 555 IC
53. Study of 565 PLL – measurement of lock range and capture range
54. FM generation and demodulation using 565
55. Frequency multiplier using 565
56. PAM modulator and demodulator
57. PWM generation and demodulation using 555 IC
58. PPM generation and demodulation using 555 IC
59. Pseudo Random Binary Sequence generator
60. Delta modulation and demodulation
61. ASK modulation and demodulation
62. FSK modulation and demodulation
63. Digital pulse detector
64. TDM generation
65. BPSK modulation and demodulation

Note: Students have to perform at least 15 experiments from the above list

Note: For University examination the following guidelines should be followed regarding the award of marks

(p) Circuit and design : 15 Marks
(q) Performance (Wiring, usage of equipment and troubleshooting) : 15 Marks
(r) Result : 20 Marks
(s) Viva-voce : 20 Marks
(t) Record : 5 Marks

PGE 301T: EMBEDDED SYSTEMS

Module - I

Introduction to Embedded Systems- Processor Embedded into a system, Hardware units and devices, embedded software. Processor and Memory Organization Structural Units in a Processor, Processor selection for an Embedded system. Memory devices, Memory selection for an Embedded system. Allocation of Memory in Program Cache and Memory management links. Interfacing Processors, Memories and Input Output devices introduction to RTOS Industrial and control applications of embedded systems. introduction to development and testing tools.

Module - II

RISC microcontroller (PIC16F88X), block diagram, pin details, on Chip features &Peripherals, addressing modes, instruction set, timers, counters, Hardware stack & stack operation, interrupt structure, instruction set, and capture/ compare/PWM Module, Power saving modes.

Interfacing: Interfacing standards, USART-RS232, RS 485, SPI, basic concepts of I2C, USB, Analog interfacing and applications, ADC, LCDs, PC Keyboard, touch screen.

Module -III

Arm Design philosophy – Embedded system hardware, Arm processor fundamentals- Register, CPSR, pipeline, Instruction set Overview - data processing, branch, load-store, interrupt and program status register instructions. Exceptions & interrupts: handling & priorities.

References:

1. Rajkamal, “Embedded system Architecture, Programming and Design”, Tata MCGraw Hill 2005
2. Andrew N. Sloss, Dominic Symes, Chris Wright, ARM System Developer’s Guide –Designing and Optimizing System Software, Elsevier Publications, 2007.
3. Wayne Wolf, Computers as Components: Principles of Embedded Computing system.
4. Microchip - Microcontroller application notes / data sheets
5. Douglas V. Hall, “Microprocessors and Interfacing Programming and Hardware”,McGrawHillBook, Company, 1986

Question paper

The question paper consists of two parts, Part A covering the entire syllabus for 27 marks. This shall contain nine compulsory questions of 3 marks each. Part B (48 Marks) Students must answer two out of three questions form each module. Each question carries 8 marks.

PGE 302T DIGITAL IMAGE PROCESSING

Module I

Digital image Fundamentals: Fundamental Steps in digital image processing, Basic relationships between pixels, Kronecker delta functions, PSF, Contrast, Brightness, Match-Band effect, Basic grey level Transformations, Perspective Projection. Image Registration, Vector and Matrix operations. Color models – RGB, CMY, CMYK. Conversion between color models. Color Transformations-Formulation, ColorCompliments,,Color Slicing, Tone and Color Corrections

Module II

Image Enhancement operations: Histogram of an image Computation Histogram, Histogram Equalization, Histogram Specification. Contrast stretching, Window slicing, Bit extraction, Change Detection, Grey scale reversal, Median filtering, Spatial operations: point operations, Spatial domain operations, Spatial filtering – Spatial low pass, High pass operations. Root filtering, Homomorphic filtering. Inverse filtering, Wiener filtering.

Module – III

Image Restoration: DTF from degraded Image spectrum, Noise Modelling, Morphological image processing: Introduction, reflection, Translation, Erosion and Dilation. Opening and Closing. Image Segmentation by thresholding, Region Based segmentation using region growing, Region Splitting and Merging. Water shed transformation. Edge Detection technique using gradient operators: - Sobel, Robert, and prewitt. Image compression Models: Lossy and Lossless compression. Introduction to JPEG & JPEG 2000.

References:

1. Rafel C. Gonzalez, Richard E Woods: “Digital Image Processing” 2/e, Pearson Education
2. Anil K. Jain: “Fundamentals of Image Processing”
3. Kenneth R Castleman: “Digital Image Processing” 2/e PHI/ Pearson Education.

Question paper

The question paper consists of two parts, Part A covering the entire syllabus for 27 marks. This shall contain nine compulsory questions of 3 marks each. Part B (48 Marks) Students must answer two out of three questions form each module. Each question carries 8 marks.(Minimum 40 % problem and proof)

PGE 303TRF AND MICROWAVE TECHNOLOGIES

MODULE I

Maxwell's equations, wave equations, Propagation of waves in RectangularWaveguide,TEM,TE,TM,HE wave definitions, TE and TM modes,TE and TM modes in rectangular waveguide, Poynting vector ,Propagation of uniform plane waves in lossy media, conductors and dielectrics, phase velocity and group velocity.

Transmission lines: Types of transmission lines,Two wire parallel transmission lines,Voltage and Current relationship on a transmission line,CharacteristicsImpedance,Reflectioncoefficient,InputImpedance,VSWR,Impedance at a voltage minimum and at a voltage maximum,Losses due to mismatch in transmission lines,Impedancematching,Microstrip transmission line, Types of Microstriplines,Smith Chart.

MODULE II

Microwave devices: Limitations of conventional tubes at microwave frequencies, Basic principles of operation of two cavity Klystron amplifier, multicavityKlystron,two cavity Klystron oscillator and Reflex Klystrons, Principles of operation of Magnetron and Travelling Wave Tube, Solid State Microwave Devices- Basic theory of Gunn diode and PIN diode. Microwave components: T junctions-H plane, E plane, E-H plane and Magic T, Circulator and Isolator, Directional couplers.

MODULE III

Radiation and antennas: Antenna structures, Antenna parameters- Gain, directivity, aperture, radiation pattern, types of antennas-Yagi-Uda, Rhombic, Horn, Helical and Loop, Antenna arrays-broadside and end fire array.

TEXT BOOKS:

1. Samuel y.Liao,Microwave Devices and Circuits,Pearson 3rd Edition, 2003
2. 2.K.C.Gupta ,Microwaves,New Age Internattional Ltd.1995
3. RajeswaryChattergee:Microwave ,Millimeter wave and sub-millimetre wave vacuum electron devices,Affiliated East-west Press,1994
4. M. Kulkarni, Microwave and Radar Engineering,Umesh Publications,3rd Edition,2003

References:

1. Stephen C.C.Harsany: □Principles of Microwave Technology□,Prentice Hall,1997
2. Peter A. Rizzi,MicrowaveEngineering:PassiveCircuits.New Delhi:PHI,2001
3. Edward C. Jordan,Electromagnetic waves and Radiating Systems.2nd Edition,Pearson,2015
4. Robert E.Collin,Foundations for Microwave Engineering,McGraw Hill,1998
5. D.M. Pazar, Microwave Engineering ,4thedition ,John Wiley and Sons(ASIA),2011
6. Paul C.R. and S.A. Nassar,□Introduction to Electromagnetic fields″,McGraw Hill,1987

PGE 304.1T ROBOTICS

Module I

Introduction:Definition-Robot Classification-Co-Ordinate Transformation-Cartesian,Cylindrical,Spherical-work envelope-repeatability precision – Accuracy-types of Joints – prismatic-Revolute Ball and Socket-Degrees of freedom, Joint variables.

Module II

Robot hardware: Robot sensors and proximity sensor-range sensor-visual sensor-Auditory sensor-Touch and Slip sensor-Force and Torque sensors.
Actuators:Hydraulic and pneumatic – DC-Servo motors-Stepper motor-AC Servomotor.
Grippers:Different types.

Module III

Robot motion control:Robot motion planning-path planning-Geometric path,Obstacle avoidance-Shortest path,Trajectory planning-Boundary conditions-Control methods-Convention joint PID control-Computed torque-Non-linear feedback-Adaptive control,Variable structure control.

References:

1. Fundamentals of Robotics-Schilling,Robert.J-PHI-1996
2. Robotic Engineering-Klafter,Richardd-PHI-1996
3. Robotics-control,sensing,vision and intelligence-Fu,Gonzalez and Lee-McGraw Hill
4. A text book of robotics-basic concept-Moshe shoham-Kogamage,London-1982
5. Automated Manufacturing Systems-Actuators,Controls,Sensors and Robotics –McGraw Hill international edition 1995
6. Robotics and Automation Hand book Editor:Thomas R Kurfess,CRC Press,2005
7. Robot technology and Application-Rathmill.K-Springer-1985

PGE 304.2 T INFORMATION THEORY AND CODING

Module I

Information – Entropy, information rate, classification of codes, Kraft McMillan inequality, source coding theorem, Shannon-Fano coding, Huffman coding, Extended Huffman coding – Joint and conditional entropies, Mutual information – Discrete memory less channels – BSC, BEC – Channel capacity, Shannon limit.

Module II

Definitions and principles: Hamming weight, Hamming distance, Minimum distance decoding – Single parity codes, Hamming codes, Repetition codes – Linear block codes, Cyclic codes- Syndrome calculation, Encoder and decoder - CRC

Module III

Convolutional codes – code tree, trellis, state diagram – Encoding – Decoding: Sequential search and Viterbi algorithm – Principle of Turbo coding, Cryptography: Secret key cryptography, block and stream ciphers, DES, Public key cryptography, digital signatures.

References:

1. Dr.P.SSathya Narayana: Concepts of Information Theory & Coding, Dynaram Publications
2. R Bose, “Information Theory, Coding and Cryptography”, TMH 2007.
3. Simon Haykin: Communication Systems, 4th ed., John Wiley & Sons Pvt. Ltd.
4. Taub& Schilling: Principles of Communication Systems, 2nd ed., TMH, New Delhi.
5. Ranjan Bose: Information Theory, Coding and Cryptography, TMH, New Delhi.

Question Paper

The question paper consists of two parts. Part A covering the entire syllabus for 27 marks. This shall contain nine compulsory questions of 3 marks each. Part B (48 marks). Students must answer two out of three questions from each module. Each question carries 8 marks.
(Minimum 50% problems, derivation and proof)

PGE 304.3 T SATELLITE & OPTICAL COMMUNICATION

Module I

Kepler's law – Satellite orbits – Geostationary satellites – Antenna look angles – Satellite classification – Spacing and frequency allocation – Satellite antenna radiation patterns – Satellite system parameters – Satellite system link models – Link equations – Link Budget.

Module II

Satellite Multiple – Access System – FDM/FM Satellite systems – Multiple accessing – Channel capacity – Satellite radio navigation.

Optical transmission system concepts, optical networking, transmitting light on a fiber, light propagation in multimode fibers single mode fiber properties and characteristics, plastic optical fiber.

Module III

Optical sources and detectors: light production, LEDs, characteristics, lasers, DFB, lasers, photoconductors and photodiodes.

Optical Communication System, point to point transmission systems, modulation, transmission system limits and characteristics, optical systems engineering, control of dispersion in SM and MM fiber links, Solitons, dark solitons and spatial solitons.

References:

1. Wayne Tomasi: Advanced Electronics Communication Systems –PH1, 4thEdn, 5th Ed.Pearson Education 2001.
2. Theodore.S.Rappaport: Wireless Communication Principles and practice, PH1, 2ndedn, Pearson Education, 2002
3. William Stallings: Wireless Communications and Networks, 2002, Pearson Education Asia
4. J.R.Dutton: Understanding Optical Communications, Prentice Hall 1999.
5. G.Keiser: Optical Fiber Communications 3/e, MGH 2000.

Question Paper

The question paper consists of two parts. Part A covering the entire syllabus for 27 marks. This shall contain nine compulsory questions of 3 marks each. Part B (48 marks). Students must answer two out of three questions from each module. Each question carries 8 marks.

(Minimum 30% problems, derivation and proof)

PGE 305P COMPUTER AIDED DESIGN LAB

MATLAB & SIMULINK

1. Writing M files for creation of analog and discrete signals, plotting of signals etc.
2. Writing simple programs using MATLAB for handling arrays, files, plotting of functions and generate patterns using mesh plot, waterfall plot etc.
3. Reading an image, convert the image using colour maps, plotting histograms of the image.
4. Edge detection, Gradient calculation of an image
5. Removal of Salt & Pepper noise.
6. Perform contrast stretching on an image.
7. FIR filter design using windowing method.
8. Design of LP, HP, BP and BE filters using Simulink.
9. Steady state and transient state analysis using Simulink.
10. Z- transform.
11. Fourier analysis using Simulink.

VHDL

1. Implementation of logic gates.
2. Implementation of Half adder and Full adder.
3. Implementation of RS, D and JK flip flops.
4. Implementation of generic comparator.
5. Construction of 8-bit synchronous counter using subprograms.
6. Design and simulate a digital circuit that can extract data from serial bits by removing start and stop bits.

Note:Students have to perform at least 15 experiments from the above list

Note:For University examination the following guidelines should be followed regarding the award of marks

(u) Algorithm/flow chart : 10 Marks
(v) Program : 20 Marks
(w) Result : 20 Marks
(x) Viva-voce : 20 Marks
(y) Record : 5 Marks

PGE 306P MINIPROJECT

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 analog and digital systems covered so far. The realization of the product should include design and fabrication of PCB. Study of PCB design (single sided and double sided may use any available software. The student should submit the report at the end of the semester. The product should be demonstrated at the time of examination

Note: For the project evaluation, the following guidelines should be followed for awarding of marks

(a) Demonstration	:15 Marks
(b) Completeness and Novelty	:15 Marks
(c) Viva-Voce	:20 Marks

PGE 401T: INTERNET OF THINGS and PYTHON PROGRAMMING.

Module I

Overview, IoT Architecture-SOA based, API based, Open. Internet Principles-Overview of internet communication, IP, IP address-static and dynamic, DNS, MAC address, NAT, IPv6.Application layer protocols-HTTP. Transport services- TCP, UDP, socket programming. Network layer- forwarding & routing algorithms -Link, Distance Vector, routers. Ethernet, Wi-Fi 802.11, Cellular Internet access, IoT Standards. Typical IoT applications.

Module III

IoT security and Privacy-concepts, IoT security overview, IoT security framework, Privacy in IoT networks. Applied Internet of Things-Introduction, Sensor to Gateway Communication, Sensors, Gateway hardware, Gateway Software, Data Transmission -Advanced Message Queuing Protocol, BackendProcessing. Characteristics and challenges of Internet of Vehicles(IoV).

Module III

Introduction to Python language – Python data types - Objects and Graphics-Concepts, Graphics Programming, Control structures-control structures, exception handling. function basics, arguments, built in functions, mathematical functions, writing functions. Introduction to Object-oriented programming – Basic principles of Object-oriented programming in Python – Class definition, Inheritance, Polymorphism, Operator overloading.

Texts book

1. Designing the Internet of Things -- Adrian McEwen, Hakim Cassimally,(Wiley)
2. Internet of Things Principles and Paradigms -RajkumarBuyya ,AmirVahidDastjerdi, MK
3. Learning Python -- Mark Lutz, O'Reilly.
4. Programming in Python 3, A Complete Introduction to the Python Language-- Mark Summerfield Second Edition.

PGE 402.1 T BIOMEDICAL ELECTRONICS

MODULE I

The Human Body-Overview. Principle of generation and propagation of bioelectric potentials. ECG, EEG, EMG.The heart and circulatory system. Electrical activity of heart. ECG machine, Biopotential Electrodes, Transducers, Lead and Electrodes, Pacemaker, Defibrillator, Blood pressure measurements-Oscillometric and Ultrasonic Non-invasive pressure measurements. Bioelectric Amplifiers-Introduction-Isolation and chopper stabilized Amplifiers.

MODULE II

Human respiratory system and its measurement. Respiratory therapy equipment-Ventilator. The human nervous system. Neuron, Propagation of action potential through nerves, EEG Machine, Instrumentation for measuring brain function-Intensive and coronary care units. Medical laboratory Instruments-Hemodialysis Machine. Electrical Safety, Micro and Macro shock hazards.

MODULE III

Medical Imaging systems: X-ray Imaging, Application of X-rays in medicine, Computed Tomography. Ultrasonic Imaging-A-Scan, B-Scan, M-Scan, Magnetic Resonance Imaging. Benefits, Risks and Limitations of MRI. Positron Emission Tomography. PET Instrumentation System. Advantages of PET scan. Biomedical Telemetry system –Components of Biotelemetry system, Application of telemetry in Patient care.

References:

1. Joseph JCarr& John M Brown: Introduction to Biomedical Equipment Technology.4thEdn., Pearson Education.
2. R.S.Khandpur:Handbook of Biomedical Instrumentation,TMH,New Delhi.
3. T.K.Attuwood&D J Pary Smith: Introduction to Bioinformatics,1999, Pearson Education
4. John G.Webster : Medical Instumentation-Application and Design,Houghton Mifflin Company, Boston.
5. Leslie Cromwell, Fred J.Weibell and Erich A. Pferffer: Biomedical

Question Paper

The question paper consists of two parts. Part A covering the entire syllabus for 27 marks. This shall contain nine compulsory questions of 3 marks each. PARTB (48 marks). Students must answer two out of three questions from each module. Each question carries 8 marks.

PGE 402.2T: MACHINE LEARNING

Module I

Introduction to Machine Learning. Examples of Machine Learning applications - Learning associations, Classification, Regression, Unsupervised Learning, Reinforcement Learning. Supervised learning- Input representation, Hypothesis class, Version space. Design a Learning System – Perspectives and Issues in Machine Learning – Concept Learning Task – Concept Learning as Search.

Module II

Learning with Trees-Decision Trees- Constructing Decision Trees, Classification and Regression Trees, Tree construction, Issues in Decision Tree Learning-Avoiding Over-fitting, Reduced Error Pruning, the problem of Missing Attributes, Gain Ratio, Classification by Regression (CART), Ensemble Learning. – Gaussian Mixture Models – Nearest Neighbor Methods – Unsupervised Learning – K means Algorithm, Hierarchical Clustering Methods, Density based clustering

Module III

Neural Networks- The Perceptron- Multi-Layer Perceptron – Going Forwards – Going Backwards: Back Propagation Error, Training Feed Forward Network by Back Propagation. Interpolations and Basis Functions – Support Vector Machines. Discrete Markov Processes, Hidden Markov models, three basic problems of HMMs- Evaluation problem, finding state sequence, Learning model parameters. Basicconcepts of Graphical Models.

Text book

1. Introduction to Machine Learning (Adaptive Computation and Machine Learning)-- EthemAlpaydın, MIT Press, 2004.
2. Machine Learning-- Mitchell. T, McGraw Hill.
3. Machine Learning : An Artificial Intelligence Approach-- Ryszard S. Michalski, Jaime G. Carbonell, and Tom M. Mitchell, Tioga Publishing Company

PGE 403P SEMINAR

Internal Evaluation (50 Marks) The student is expected to present a seminar on one of the current topics in electronics, communication and its allied research areas. The student will undertake a detailed study on the chosen topic and must submit a report at the end of the semester. The evaluation will be done by an internal examiner appointed by the head of the institution. Maximum time for presentation and question answer session is limited to 1 hr.

Note: The distribution of marks for seminar is given below

Presentation :25 marks

Report :20 Marks

Attendance :5 Marks

PGE 404P PROJECT

Internal Evaluation (250 Marks) The student is expected to prepare a report on the project work done by him/her and present a paper highlighting the work done by him/her in a seminar. The student is expected to complete project work assigned to him/ her and submit the project report at the end of the semester. This report shall be a hard bound type. Marks shall be awarded by continuous evaluation of minimum two times in this semester. Valuation of report, results,presentation and viva will be conducted by a committee consisting of the guide, project coordinator and Head of the Department. The project is individual and not a group project.

Note: The distribution of marks for the project is given below

Presentation : 50 Marks

Report : 75 Marks

Viva : 50 Marks

Results/product : 75 Marks

PGE 405 VIVA - VOCE

There will be a comprehensive viva voce examination for each student at the end of forth semester. The oral examination will be based on the project work, seminar report and other subjects studied during the course. Students shall submit the project report and seminar report for the viva voce examination. Marks for project shall have weightage for valid results only. The marks distribution for viva voce examination is given below

General Topics : 50 Marks

Project : 35 Marks

Seminar : 15 Marks