MAHATMA GANDHI UNIVERSITY

PRIYADARSHINI HILLS, KOTTAYAM – 686 560

CURRICULUM
FOR
MSc ELECTRONICS

&

MSc APPLIED ELECTRONICS

(2019 Admission onwards)

Contents

I. List of Members of Expert Committee in Syllabus Revision in Electronics (PG)

Chairman:

Dr. Praveen N

Associate Professor and Head,

PG Department of Electronics, N S S College, Rajakumari.

Members:

1. Dr. Jacob Abraham, Associate Professor, BPC II College, Piravom
2. Sri. Sunil Kumar K V, Associate Professor, N S S College, Rajakumari
3. Smt. Baby Girija B, Assistant Professor, N S S College, Rajakumari
4. Dr. Saritha M, Associate Professor, N S S College, Rajakumari
5. Dr. Reji A P, Assistant Professor, N S S College, Rajakumari

II. Acknowledgement.

Expert Committee on PG Syllabus Revision (Electronics) wish to express whole-hearted gratitude to Prof.(Dr.) Sabu Thomas, Professor in Charge of Honourable Vice-Chancellor of Mahatma Gandhi University for his efficient guidance and motivation rendered in this syllabus restructuring of M.Sc. Electronics and M.Sc. Applied Electronicsunder PGCSS.

We sincerely express our gratitude to Prof. Praveen Kumar V S, Syndicate Member, for his co-ordination and timely suggestions in materialising this syllabus restructuring. Also we acknowledge the support given by Dr. P. KPadmakumar, Member, Syndicate and convener of this syllabus revision.

We sincerely thank Registrar of the University for thesupport extended for the syllabus restructuring activities. We thank the Academic Section and the Finance Section for extending their service for Syllabus restructuring.

Special thanks to the facultyfrom various colleges who participated, contributed and suggested constructively during the workshop.

For the Expert Committee in PG Syllabus Revision (Electronics),

Dr. Praveen N
(Chairman)

Kottayam
03-04-2019

III. AIMS AND OBJECTIVES OF THE PROGRAMME – M.Sc. ELECTRONICS& M.Sc. APPLIED ELECTRONICS

Aims:

Post graduate education in Electronics aims to mould scholars, researchers and technocrats who play a vital role in shaping the technological arena. The curriculum, course content and assessment play major roles in shaping scholars and researchers. Hence it should be compromised with basic knowledge to latest up to date trends in the field. Based on this view, the expert committee has formulated the syllabus and curriculum of M.Sc. Electronics and M.Sc. Applied Electronics (PGCSS) with a spectrum of topics that will satisfy the current requirement of the industry and research.

M.Sc. Electronics programme aims to develop the following abilities:

- Impart the basic and up-to-date knowledge in the electronics with sufficient practical sessions.
- To be specific, subject areas like Digital signal processing, Embedded Electronics, Control system, Digital Design, Artificial Intelligence, Deep learning, Optical communication techniques etc. are discussed with adequate theory knowledge which will help to develop the system.
- To have practical knowledge in these subjects.

PROGRAM SPECIFIC OUTCOMES- M.SC. ELECTRONICS

1. Prepare students to pursue research in Electromagnetics, Signal Processing, Image Processing, Artificial Intelligence and ANN, Robotics
2. To become an entrepreneur in embedded based system, digital and analog system design
3. To develop multi-skilled engineers who are able to spearhead the progress of the nation in the information age

IV.COURSE DESIGN: M.Sc. Electronics

The M.Sc Electronics programme must include (a) Programme Core courses, (b) Programme Electives in the core area, (c) practical sessions and (d) Project. The minimum credit of the courses is 3 and maximum credit is 4. The number of Courses for the restructured programme contain 12 compulsory core courses 3 core electives from the frontier

research areas, a Programme Project, and 4 laboratory courses each in all the four semesters for augmenting the subject of study.

V. PROGRAMME STRUCTURE: MSc Electronics

1	Programme Duration	4 Semesters
2	Total Credits required for successful completion of the Programme	80
3	Core subjects including electives	15
4	No. of Elective courses	3
5	No. of laboratory courses	4
6	Minimum attendance required	75%

M.Sc. Applied Electronics programme aims to develop the following abilities:

- Impart the basic and up-to-date knowledge in the electronics with sufficient practical sessions.
- To be specific, subject areas like Digital signal processing, Embedded Electronics, Control system, Digital Design, Artificial Intelligence, Deep learning, Optical communication techniques etc. are discussed with adequate theory knowledge which will help to develop the system.
- To have practical knowledge in these subjects.

PROGRAM SPECIFIC OUTCOMES- M.SC. APPLIED ELECTRONICS

1. Prepare students to excel in Digital Signal Processing, VLSI Design, Internet of Things, Artificial Neural Networks, Image Processing, Robotics
2. To become an entrepreneur in embedded based system, digital and analog system design
3. To develop multi-skilled engineers who are able to spearhead the progress of the nation in the information age

VI.COURSE DESIGN: M.Sc. APPLIED ELECTRONICS

The M.ScApplied Electronics programme must include (a) Programme Core courses, (b) Programme Electives in the core area, (c) practical sessions and (d) Project. The minimum credit of the courses is 3 and maximum credit is 5. The number of Courses for the

restructured programme contain 12 compulsory core courses 3 core electives from the frontier research areas, a Programme Project, and 4 laboratory courses each in all the four semesters for augmenting the subject of study.

VII. PROGRAMME STRUCTURE: MScApplied Electronics

1	Programme Duration	4 Semesters
2	Total Credits required for successful completion of the Programme	80
3	Core subjects including electives	15
4	No. of Elective courses	3
5	No. of laboratory courses	4
6	Minimum attendance required	75%

X. EVALUATION METHODS: PGCSS

DIRECT GRADING SYSTEM

Direct Grading System based on a 7 – point scale is used to evaluate the performance (External and Internal Examination of students)

For all courses (theory & practical) / semester/overall programme letter grades and **GPA/SGPA/CGPA** are given on the following scale :

Range	Grade	Indicator
4.50 to 5.00	A+	Outstanding
4.00 to 4.49	A	Excellent
3.50 to 3.99	B+	Very good
3.00 to 3.49	B	Good(Average)
2.50 to 2.99	C+	Fair
2.00 to 2.49	C	Marginal
up to 1.99	D	Deficient(Fail)

No separate minimum is required for Internal evaluation for a pass, but a minimum **C** grade is required for a pass in an external evaluation. However, a minimum **C grade** is required for pass in a course

1. Evaluation first stage - Both internal and external (to be done by the teacher)

Grade	Grade Points
A+	**5**
A	**4**
B	**3**
C	**2**
D	**1**
E	**0**

Theory-External

Maximum weight for external evaluation is **30.**Therefore Maximum Weighted Grade Point (WGP) is **150**

Weight : Different types of questions shall be given different weights to quantify their range as follows:

Sl.No.	Type of Questions	Weight	Number of questions to be answered
1.	Short Answer type questions	1	8 out of 10
2	Short essay/ problem solving type questions	2	6 out of 8
3.	Long Essay type questions	5	2 out of 4

Theory-Internal

For Theory(Internal)- Components and Weightage

	Components	Weightage
i.	Assignment	1
ii	Seminar	2
iii.	Best Two Test papers	1 each (2)
	Total	**5**

(For test papers all questions shall be set in such a way that the answers can be awarded A+,A,B,C,D,E grade.)

Practical

For Practical(External)-Components and Weightage

Components	Weightage
Written / Lab test	7
Lab involvement and Record	3
Viva	5
Total	**15**

Practical-Internal

For Practical(Internal)- Components and Weightage

Components	Weightage
Written/Lab test	2
Lab involvement and Record	1
Viva	2
Total	**5**

Project- External

For Project(External) Components and Weightage

Components	Weightage
Relevance of the topic and analysis	3
Project content and presentation	7
Project viva	5
Total	**15**

Project- Internal

For Project(Internal)- Components and Weightage

Components	Weightage
Relevance of the topic and analysis	2
Project content and presentation	2
Project viva	1
Total	**5**

Comprehensive viva-voce

Comprehensive viva-voce(External)-components and weightage

Components	**Weightage**
Course viva (all courses from first semester to fourth semester)	15
Total	**15**

Comprehensive viva (Internal)- Components and Weightage

Components	**Weightage**
Course viva (all courses from first semester to fourth semester)	5
Total	**5**

IX. Detailed Syllabus

I. M.Sc. Electronics

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Syllabus Structure–M.Sc. Electronics

Course Code	Title of the Course	Type of the Course	Hours per week	Credits	Total Credit
FIRST SEMESTER					
EL010101	Network Analysis and Synthesis	Core	4	**4**	**19**
EL010102	Electronic Circuits Analysis	Core	4	**4**	
EL010103	IC Fabrication and MEMS	Core	4	**4**	
EL010104	Digital Communication Techniques	Core	3	**3**	
EL010105	Advanced Electronics Circuit Lab	Practical	10	**4**	
SECOND SEMESTER					
EL010201	Digital Signal Processing & Applications	Core	4	**4**	**19**
EL010202	AVR based Embedded Systems	Core	4	**4**	
EL010203	Mobile Computing	Core	4	**4**	
EL010204	VLSI Design and Analysis	Core	3	**3**	
EL010205	Microcontrollers and DSP Lab	Practical	10	**4**	
THIRD SEMESTER					
EL010301	Digital System Design	Core	4	**4**	**19**
EL010302	Control Systems	Core	4	**4**	
EL010303	Object Oriented Programming	Core	4	**4**	
EL8xxxx1	Elective	Elective	3	**3**	
EL010304	Object Oriented Programming Lab	Practical	10	**4**	
FOURTH SEMESTER					
EL010401	ARM Processor Based Embedded System	Core	5	**4**	**23**
EL8xxxxx	Elective	Elective	5	**4**	
EL8xxxxx	Elective	Elective	5	**4**	
EL010402	VHDL Programming Lab	Practical	10	**4**	
EL010403	Project Work	Project		**4**	
EL010404	Comprehensive Viva Voce	Viva-Voce		**3**	
				Total Credit	**80**

Elective courses for MSc Electronics

NAME OF THE PROGRAMME	GROUP-A		GROUP-B		GROUP -C	
	COURSE CODES	**NAME OF THE COURSES**	**COURSE CODES**	**NAME OF THE COURSES**	**COURSE CODES**	**NAME OF THE COURSES**
01 Electronics (M.Sc.)	EL800301	Artificial Neural Networks and Deep Learning	EL810301	Robotics	EL820301	Image Processing
	EL800402	Advanced Electromagnetics	EL810402	Bio-medical Electronics	EL820402	Nano Technology
	EL800403	Fiber Optic Communication Techniques	EL810403	Optical Sensor Technology	EL820403	Secure Communication

Courses EL800403, EL810301, EL810402, EL810403, EL820402 and EL820403 are common with elective courses of M.Sc. Applied Electronics

SEMESTER I

Semester	Course Code	Course Title	Course category	Hours per week	Credit
I	EL010101	Network Analysis and Synthesis	Core	4	4
	EL010102	Electronic Circuits Analysis	Core	4	4
	EL010103	IC Fabrication and MEMS	Core	4	4
	EL010104	Digital Communication Techniques	Core	3	3
	EL010105	Advanced Electronics Circuit Lab	Practical	10	4
				Total Credit	**19**

EL010101 ADVANCED NETWORKS AND SYSTEMS

Hours: 72
Credit: 4

Course Objectives:

- To get a thorough knowledge of basic circuit laws, Laplace and Fourier Transforms and its applications
- To understand general properties of signals and systems
- To analyse and systhsispassive networks.

Module I: Review of basic circuit concepts

Circuit elements and Kirchoff's laws, Review of network theorems- Superposition Theorem, Substitution Theorem, Compensation Theorem, Thevenin's, Norton's, Millman's, Maximum Power Transfer theorem, Reciprocity Theorem- AC and DC Analysis

18 Hours

Module II: Laplace and Fourier Transform Analysis

Network Analysis using Laplace Transform- Laplace transformation- Inverse Laplace Transformation- Important theorems regarding Laplace Transformation- Applications of Laplace Transformation in analyzing simple series and parallel networks (RL, RC and RLC circuits)- Laplace and Fourier Transforms of different signal waveforms.

18 Hours

Module III: Properties of Signals and Systems.

Characteristics of signals- Unit step function, Impulse and Ramp functions. Linearity- Time invariance, Stability and Causality- Special properties of Linear Time Invariant systems- Relation between Transfer function and impulse response- Network functions-Poles and Zeros- Pole-zero plot, Time domain behaviour from pole-zero plot

18 Hours

Module IV: Passive network synthesis

Hurwitz polynomials- Positive real functions- Synthesis of RL, LC and RC networks by I^{st} and II^{nd} Foster and Couer methods.

18 Hours

Text Books

1. Network and systems, ROY CHOUDHARY
2. Network Analysis, G.K MITHAL
3. Circuits and Networks, A. Sudhakar,Shyam Mohan
4. Basic Circuit Theory, DESOR,KUO
5. Network Analysis, VAN VALKENBERG
6. Network Lines and Fields, RYDER
7. Principle of Network Synthesis, , VAN VALKENBERG

EL010102 ELECTRONIC DEVICES & CIRCUIT ANAYSIS

Hours: 72
Credit: 4

Objectives of the course:

- To study the characteristics and analysis of active electronic devices
- To familiarize the operation amplifiers and its applications
- To know the design of various applications of analog ICs
- To understand the various power electronic devices and its applications

Module 1 : Semiconductor diode-BJT-Introduction-Operation-Common Base- Common Emitter- Common Collector-Configuration-Amplifying action-FET-Introduction-construction of JFET-Depletion Type MOSFET-Enhancement Type MOSFET

(12hrs)

Module 2 :BJT- Transistor modeling-parameters-r_e Transistor model-Hybrid equivalent model-BJT Small signal analysis-CE Voltage divider bias-FET Small signal analysis-JFET Voltage divider bias- Low frequency Response-BJT Amplifier- Low frequency Response-FET Amplifier- High frequency Response-BJT Amplifier- High frequency Response-FET Amplifier-Transistor-Cascade-Cascode-Darlingtonconnection

(16hrs)

Module 3 : Operational Amplifiers-Introduction –Configurations-Inverting-Non Inverting Amplifiers-Integrator-Differentiator- Astable - Monostablemultivibrators -Zero crossing Detector-Schmitt trigger-Triangular wave generator-Oscillators-Phase shift –Wein bridge-Active filters

(15hrs)

Module 4 : Thyristor- characteristics - Turn-on methods-characteristics-PUT-TRIAC-UJT-Phase controlled rectifier-Single phase half wave with RL load-Full wave controlled converters-Commutation Techniques-Load-Resonant-pulse-Complementary-Impulse-External pulse- Line commutation

(15hrs)

Module 5: Chopper-Operation-Step Up-Types-Inverter-single phase bridge inverter-AC voltage controller-single phase voltage controller with R & RL load-Cycloconverter-single phase-step-up-step-down-Cycloconverter

(14hrs)

Text books:

1. Electronic Devices & Circuit Theory - ROBERT L BOYLESTED,LOUIS NASHELSKY (**Module 1,2**)
2. Op-Amp and Linear Integrated Circuits- RAMAKANT GAYAKWAD (**Module 3**)
3. Power Electronics - Dr.P.S. BIMBHRA (**Module 4,5**)

References:

1. Electronic Devices & Circuits An Introduction-ALLEN MOTTERSHEAD
2. Integrated Electronics –JACOB MILLMAN,CHRISTOS C HAKIAS
3. Power Electronics –MUHAMMAD H RASHID

EL010103 IC FABRICATION AND MEMS

Hour:72
Credit:4

Objectives of the Course:

- To study the IC Fabrication Techniques
- To familiarize the MES technology, fabrication and applications

Module I:

OVERVIEW AND WORKING PRINCIPLES OF MEMS

MEMS and Microsystems – Typical MEMS and Microsystems products – Microsystems and Microelectronics –Miniaturization – Applications of Microsystems –Microsensors, Microactuators, Microgrippers, Micromotors, Microvalves, Micropumps and Microaccelerometers .

18 Hours

Module II:

FABRICATION & MICROSYSTEM DESIGN

Ions and Ionization – Doping – Scaling Laws for Electrical design – Substrate and wafers – Silicon as a substrate – Silicon compounds – Piezoresistors – Piezocrystals – Gallium Arsenide,Quartz -Polymers in MEMS –PMMA . Micro System Fabrication Processes – Photolithography,Ion Implantation , Diffusion, Oxidation , Chemical Vapour Deposition, Physical Vapour Deposition – Sputtering , Deposition by Epitaxy, Etching. Thin film deposition and characterization Techniques: XRD, TEM, SEM, EDX, Thin film active and passive devices.

20 Hours

Module III:

Overview of Micromanufacturing- Bulk Micromanufacturing, Surface Micromachining and LIGA Process.Microsystem Design- Design Considerations – Use of CAD tool in Microsystem Design.

16 Hours

Module IV:

Microsystem Packaging : General considerations in Packaging Design- Levels of Microsystem Packaging. Bonding Techniques for MEMS :Surface Bonding, Anodic bonding ,Wire Bonding.Overview of MEMS areas : RF MEMS, Bio- MEMS, MOEMS, NEMS.

18 Hours

TEXT BOOKS

1. “MEMS & Micro Systems Design and Manufacture” – Tai-Ran-Hsu, TMH, 2002 Edition.

References:

1. Julian W Gardner, Microsensors : Principles and Applications- John Wiley & Sons, 1994

2. Mark Madou, Fundamentals of Micro Fabrication,CRC Press , New York , 1997
3. Stephen D Senturia, Microsystem design , Springer (India) ,2006
4. Thomas B Jones, Electromechanics and MEMS , Cambridge University Press 2001

EL010104 DIGITAL COMMUNICATION TECHNIQUES

Credits: 3
Hours: 54

Objective of the course:

- To understand information theory and coding
- To familiarize various coding techniques and methods
- To understand convolutional codes and cryptography
- To get the knowledge on digital modulation techniques and their comparison.

Module I: Information, Entropy, Information rate, Classification of codes, Kraft Mc Millan inequality, source coding theorem, Shanon-Fano coding, Huffmann coding, Extended Huffmann coding, Shanon's channel capacity theorem, joint and conditional entropy, mutual information, discrete memory-less channel, BSC, BEC

10 Hours

Module II:
Hamming weight, Hamming distance, Types of codes, Linear Block codes, Repetition codes, Syndrome decoding, Syndrome property, minimum distance decoding, Cyclic codes, Syndrome calculation, encoder and decoder, important cyclic codes

10 Hours

Module III:
Convolutional codes- Quad tree Trellis state diagram, encoding-decoding, time domain approach and transform domain approach, Sequential search and Viterbi algorithm, Principle of turbo coding, Cryptography, Secret key cryptography, block and stream ciphers, DES, data encryption standard, public key cryptography, digital signatures

10 Hours

Module IV:
Digital Modulation Techniques: Phase Shift Keying, Amplitude Shift Keying, Frequency Shift Keying,Coherent Detection of PSK and FSK, Non Coherent Detection of Differential Phase Shift Keying, Binary Differential Phase Shift Keying and FSK, QPSK, Minimum Shift Keying (MSK), Gaussian Minimum Shift Keying (GMSK), M-ary Signalling, Probability of Error in each Scheme, Comparison of Digital Modulation Techniques.

12 Hours

Module V:
Spread Spectrum Techniques- Overview of Spread Spectrum Techniques, Pseudonoise (PN) Sequences, Properties of PseudonoiseSequences, Theory of Spread Spectrum Modulation, Model of Spread Spectrum Digital Communication System, Direct-Sequence Spread Spectrum (DSSS) Systems: Generation and Detection, Example of Direct Sequencing, Processing Gain and Performance, Frequency Hopping Spread-Spectrum (FHSS) Systems: Example, Robustness, Frequency Hopping with Diversity, Fast Hopping versus Slow

Hopping, FFH/MFSK Demodulator, Processing Gain,Synchronization : Acquisition and Tracking.

12 Hours

Text Books:

1. Digital Communications - Simon Haykin, 4th Edition, John Wiley & Sons, Inc.
2. Taub's Principles of Communication Systems by H Taub, D L Schilling and G Saha, Third Edition 2008, TMH Education Pvt Ltd, New Delhi.
3. Analog and Digital Communications by Hwei P. Hsu, Schaum'sOutline Series, McGraw Hill Education Pvt. Ltd.
4. Digital Communication Fundamentals and Applications byBernardSklar and Pabitra Kumar Ray, PearsonEducation, 2006
5. Advanced Electronic Communication Systems by Wayne Thomasi, Sixth Edition, PHI.
6. Modern Digital and Analog Communication Systems by B. P. Lathi, Oxford University Press, Fourth Edition.
7. Digital and Analog Communication Systems by K Sam Shanmugam, John Wiley and Sons Pvt. Ltd.

EL010105 ADVANCED ELECTRONICS CIRCUITS LAB

Credits: 4
Hours: 180

Objectives of the course:

- To familiarize the designing and troubleshooting the digital circuits, analog circuits, IC based circuits
- To get in-depth knowledge on op-amp circuits and their applications
- To familiarize the power electronics based devices and their applications
- To design and set up various modulation based circuits

PART 1-DIGITAL LAB

1. Shift register using IC.
2. Ripple counter using IC.
3. Ring counter using IC.
4. Decade counter using IC.
5. A/D Converter
6. D/A Converter

PART 2-OP AMP LAB

7. Operational Amplifiers Characteristics
8. Design of filters (low pass, High pass, Band pass, Band Rejection, Notch)
9. Waveform Generators (Sine Wave, Triangle and Square wave)
10. Wave shaping circuits and Precision Rectifiers
11. Schmitt Trigger
12. Multivibrators
13. Log amplifiers

PART 3-Power Electronics Lab

14. SCR Characteristics
15. TRIAC Characteristics
16. Single Phase Inverter
17. UJT Relaxation Oscillator
18. Commutation Techniques

PART 4-Communication Lab

19. AM
20. FM
21. VCO & Frequency Multiplier
22. PCM
23. Time Division Multiplexing

24. BFSK

Note: Do any 16 experiments from above list-Minimum 3 experiments from each group

SEMESTER II

Semester	Course Code	Course Title	Course category	Hours per week	Credit
II	EL010201	Digital Signal Processing & Applications	Core	4	**4**
	EL010202	AVR based Embedded Systems	Core	4	**4**
	EL010203	Mobile Computing	Core	4	**4**
	EL010204	VLSI Design and Analysis	Core	3	**3**
	EL010205	Microcontrollers and DSP Lab	Practical	10	**4**
				Total credit	**19**

EL010201 DIGITAL SIGNAL PROCESSING & APPLICATIONS

Hours: 72
Credit: 4

Objectives of the course:

- To get a thorough knowledge on FFT and its applications
- To familiarize digital IIR and FIR filter designing and its realization
- To discuss the various applications of DSP

Module I:

Discrete-Time signals and systems-Discrete Time signals and systems- Classification of Discrete Time Systems, Linear convolution, Circular convolution, Analysis of LTI system using Z-Transform.

14 Hours

Module II:

Discrete – Time Fourier Transform (DTFT). Definition of DFT, Inverse DFT, Properties of DFT, Fast Fourier Transforms (FFT), DIT Radix-2 FFT, DIF Radix-2 FFT.

16 Hours

Module III:

System Realization- Structures for realization of IIR Systems- Direct Form-I, Direct Form II, Transposed form, Cascaded form, parallel form, lattice structure, ladder structure. Realization of FIR systems- Direct form realization, transposed form, cascade form, lattice structure, linear phase realisation.

14 Hours

Module IV:

Design of linear phase FIR filter using windows method, Frequency sampling method.Analog design approximation of Butterworth and Chebyshev filter. Design of IIR filters by indirect methods – Impulse Invariant methods. Bilinear Transformation method.Design of HPF, BPF using frequency transformation.

16 Hours

Module V:

Applications of Digital Signal Processing – speech processing – speech coding and decoding ADPCM- Linear prediction coding. Speech recognition, speech synthesis, digital vocoder, Musical sound processing, digital radio, Digital Television, RADAR, Biomedical signal processing

Introduction to MATLAB –programming and applications to DSP

12 Hours

Text Books:

1. Digital Signal Processing – Second Edition, A Anand Kumar, PHI learning

2. Alan V. Oppenheim. Ronald W. Schaufcr and John R. Buck. ‘Discrete Time Signal Processing’
3. John G. Proakis and Dimitris G. Manolakis, ‘Digital Signal Processing principle, Algorithms and application’ 3rd edition Prentice Hall of India Pvt. Ltd
4. Ashok Ambardar. ‘Analog and Digital Signal Processing’
5. MATLAB: An Introduction with Applications, 4ed Paperback – 2012by Amos Gila-Wiley

EL010202 AVR BASED EMBEDDED SYSTEM

Hours: 72
Credit: 4

Objectives of the course:

- To give an in-depth knowledge on AVR microcontroller
- To get a thorough knowledge on AVR assembly language programming
- To familiarise the interfacing of AVR and its applications

Module 1 Introduction to AVR microcontroller

Overview of AVR family, AVR Microcontroller architecture, status register, Special function registers, RAM, ROM & EEPROM space, On-chip peripherals, ATmega32 pin configuration & function of each pin.

14 Hours

Module 2. AVR assembly language programming

AVR data types and assembler directives, Addressing modes of AVR, Data transfer, Arithmetic, Logic and Compare, Rotate and Shift, Branch and Call instructions, AVR studio setup for assembly language programming, AVR I/O Port Programming, Time delay loop, Look-up table, Bit addressability, MACROs.

16 Hours

Module 3 AVR programming in C

AVR Data types, AVR I/O port programming, Logical operation , Data conversion , Memory allocation , EEPROM access, ADC programming, DAC Interfacing , Sensor interfacing and signal conditioning.

14 Hours

Module 4 Timer and Interrupt Programming

Programming timers 0,1 and 2, AVR Interrupt, Programming Timer interrupt , programming external hardware interrupt, Serial Port programming using interrupt.

14 Hours

Module 5 Peripheral interfacing

LCD and Keyboard Interfacing, Relay and opto isolator interfacing, Stepper motor Interfacing , DC Motor control using PWM . DS1307 RTC Interfacing, SPI Programming , MAX 7221 interfacing and programming , I2C bus protocol

14 Hours

Text book:

1.The AVR Microcontroller and Embedded Systems Using Assembly and C, By Muhammad Ali Mazidi, SarmadNaimi and SepehrNaimi, Pearson Education.

References

1. Programming and Customizing the AVR Micro controller, By DhananjayGadre, McGraw Hill Education
2. AVR ATmega32 data sheet

EL010203 MOBILE COMPUTING

Hours:72
Credit:4

Objectives of the course:

- To introduce mobile computing technology,
- To know the various emerging technologies in mobile communications
- To familiarize the various mobile communication standards and applications

Module I: Introduction- Mobility of bits and bytes, wireless, mobile computing, middleware and gateways, application and services, security in mobile computing, standards, mobile computing architecture, internet ubiquitous network, architecture for mobile computing, three tier architecture, design consideration for mobile computing, mobile computing through internet. Mobile computing through telephony, evolution, multiple access procedure, satellite communication systems, mobile computing through telephone-TAPI

18 Hours

Module II: Emerging technologies- Bluetooth, RFID, WiMAX, Mobile IP, IP V.6, GSM-GSM architecture, GSM entities, call routing in GSM, PLMN interfaces, GSM addresses and identifiers, network aspects in GSM, mobility management, GSM frequency allocation, personal communication service, authentication and security, SMS, value added services through SMS, accessing the SMS bearer.

18 Hours

Module III: GPRS-GPRS and packet data network, GPRS network architecture, GPRS network operations, data services in GPRS, applications, limitations for GPRS, billing and charging, EDGE,WAP- MMS, GPRS applications. CDMA and 3G-introduction, spread spectrum technology, IS-95, CDMA Vs GSM, wireless data 3G networks, applications on 3G. Introduction to 4G network architecture

18 Hours

Module IV: Wireless LAN- Introduction, advantages, IEEE 802.11 standard, wireless LAN architecture, mobility in wireless LAN, deploying wireless LAN, mobile adhoc-networks and sensor networks, wireless LAN security, wireless access in vehicular environment, wireless local loop, hyper LAN, Wi-Fi Vs 3G. Intelligent networks and inter networking- introduction, fundamentals of call processing, intelligence in the network, SS#7 signalling, IN conceptual model, softswitch, programmable networks, technologies and interfaces for IN, SS7 security, MAPsec, VPN., VOIP-H.323 framework for VOIP, SIP, comparison between H.323 and SIP, real time protocols, convergence technologies, call routing, Applications.Introduction to LTE architecture.

18 Hours

Text Book: Mobile Computing- Technology, Applications and Service Creation, Asoke K Talukder, Hasan Ahmed, Rupa R Yavagal, Second Edition, Mc Graw Hill Education.

Reference books/articles:1. Mobile Computing-Kumkum Garg, Ebook
2. Fundamentals of Mobile Computing Paperback – 2012
by Prasant Kumar PattnaikRajib Mall
3.Web:http://www.cse.unt.edu/~rdantu/FALL_2013_WIRELESS_NETWORKS/LTE_Alcatel_White_Paper.pdf

EL010204 VLSI DESIGN AND ANALYSIS

Hours: 54
Credit: 3

Objectives of the Course:

- To get a thorough knowledge on MOS technology
- To familiarize the basic IC fabrication process
- To discuss the various MOS circuit design process and FPGA
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Module 1. Introduction to MOS Technology

nMOS Fabrication--Silicon Wafer Preparation—Summary of an nMOS process— Basic CMOS Technology—CMOS Fabrication- The p-well Process—The n-well Process—The Twin-Tub Process—SOI Process—BiCMOS Technology.

10 Hours

Module 2. Basic Electrical Properties of MOS and CMOS Circuits

nMOS and pMOS Enhancement Mode Transistors—V-I Characteristics of MOS Transistors—MOS Device Equations—Basic DC Equations—Threshold Voltage—Body Effect—The Pass Transistor—The nMOS Inverter——The CMOS Inverter—DC Characteristics—Switching Characteristics of CMOS Inverter

10 Hours

Module 3. MOS Circuit Design Process

Why Design Rules—MOS Layers—Stick Diagrams—nMOS Design Styles—CMOS Design Styles—Design Rules and Layout—Scaling of MOS Circuits—Scaling Models and Scaling Factors—Scaling Factors for Device Parameters—Limitations of Scaling . NMOS and CMOS inverters . Charge-Coupled Device (CCD)- Structure, charge storage and transfer;

12 Hours

Module 4. Subsystem Design and Layout

Architectural Issues—Switch Logic:-Pass Transistors and Transmission Gates—Gate Logic:-The Inverter,Two-input nMOS and CMOS Nand& Nor Gates—Examples of Structured Design(Combinational Logic):-Clocked Sequential Circuits:-Two-phase clocking, Charge Storage, Dynamic Register Element, Dynamic Shift Register—Design of 4*4 Barrel Shifter

12 Hours

Module 5.Field Programmable Gate Arrays

Field Programmable Gate Arrays, Xilinx FPGA ,Implementation in FPGAs. Comparison between Silicon and Gallium Arsenide Technology.

10 Hours

Text Books

1.Basic VLSI Design- -Douglas A.Pucknell-Third Edition-PHI Publication**(Module-1,2,3,4,5)**
2.Principles of VLSI Design-Neil H.E.Weste&Kamaran-Second Edition-Pearson Education**(Module-1,2)**
3 .VLSI Design – A.Albert Raj and T. Latha- PHI Publications
4 Jan M Rabaey, Digital Integrated Circuits – A Design Perspective,Prentice Hall, Second Edition 2005

Reference Text Books

1. Integrated Circuits K R Botkar Khanna Publishers
2. Modern VLSI Design –Wayne Woolf –Third Edition –PHI Publication

EL010205 MICROCONTROLLER AND SIGNAL PROCESSING LAB

Hours: 180
Credit:4

Objectives of the Course:

- To familiarize the AVR microcontroller programming methods
- To study how to interface AVR with various peripherals and controlling devices
- To familiarize MATLAB programming and its applications in DSP

I AVR BASED EXPERIMENTS

1. 8 bit addition, subtraction
2. Multiplication with and without using MUL instruction
3. Division
4. Ascending order
5. Descending order
6. Find out largest number
7. Find out smallest number
8. Swapping
9. Count number of ones in a byte
10. Find out odd and even numbers in an array

At least 8 experiments should be done and recorded

Interfacing programs

1. Stepper motor interface
2. DC motor interface
3. Keyboard interface
4. LCD interface
5. PWM
6. LED interface and Delay programming
7. Buzzer interface
8. Relay interface
9. Timer programming
10. Opto isolator interface
11. DS1307 RTC interfacing
12. MAX 7221 interface

At least 20 experiments should be done and recorded

II. MATLAB BASED PROGRAMS

1. Generation of Signals
2. Arithmetic operations
3. Matrix operation
4. DFT computations
5. FFT computations
6. Convolution of two discrete signals
7. Correlationof two discrete signals

At least 5 experiments should be executed and recorded

SEMESTER III

Semester	Course Code	Course Title	Course category	Hours per week	Credit
III	EL010301	Digital System Design	Core	4	**4**
	EL010302	Control Systems	Core	4	**4**
	EL010303	Object Oriented Programming	Core	4	**4**
	EL8xxxxx	Elective	Elective	3	**3**
	EL010304	Object Oriented Programming Lab	Practical	10	**4**
				Total Credit	**19**

EL010301 DIGITAL SYSTEM DESIGN

Hours:72
Credit: 4

Objectives of the course:

- To get an in-depth knowledge on digital systems
- To design digital circuits
- To get a knowledge on Finite State Machines
- To introduce VHDL and to familiarize the design of digital circuits using VHDL

Module I:

Introduction to combinational logic design. Quine McCluskey method, Adders, subtractors, binary parallel adder, look ahead carry adder, adder subtractor, BCD adder, binary multiplexer, code convertors, encoders and decoders, priority encoders, decoders. Threshold logic. Introduction to flip-flops, conversion of different flip-flops (SR to JK, SR to D, JK to SR, T, D, D to T, T to D), Shift registers and counters.

16 Hours

Module II:

Finite State Machines- Capabilities and limitations of FSM, mathematical representation of synchronous sequential machines, Mealy, Moor model FSM, state equivalence and machine minimization, distinguishable states and distinguishable sequences, minimization of completely specified sequential machines using partition techniques, simplification of incompletely specified machines. Merger chart method, concept of minimal cover table. Algorthmic state machines, components of ASM chart, salient features of ASM chart, introductory examples of ASM charts, ASM for binary multiplier.

16 Hours

Module III

Introduction to VHDL, Capabilities- Hardware abstraction- Basic terminology- Entity declaration- Architecture body- Configuration declaration- Package declaration- Package body.

12Hours

Module IV:

Identifiers- Data objects- Data types- Operators- Generics- Functions & procedures- Function overloading & operator overloading.

14 Hours

Module V:

Behavioralmodeling- Data flow Modeling- Structural modelling, Hardware modelling example: Moore FSM, Mealy FSM, VHDL test bench programs.

14 Hours

Text Book: 1. Fundamentals of Digital Circuits, AAnand Kumar, Third Edition-PHI Learning.

2. J.BHASKER "VHDL PRIMER" Prentice Hall, 1999

References: 1. Digital Design- With and Introduction to the Verilog HDL- M. Morris Mano, Michael D Giletti.- 5th Edition, Pearson

EL010302 CONTROL SYSTEMS

Hours: 72
Credit: 4

Objectives of the course:

- To understand the basic knowledge on control system and its classification
- To study in detail the need for block diagram and signal flow graph representation
- To have an idea about the concept of stability and various techniques for stability analysis
- To understand the various plots used for analysing control systems
- To introduce the concept of state space modelling of systems
- To discuss the various real time applications of control system including PLC and SCADA

Module I

Introduction

Introduction to control systems- classification of control systems- Block diagram and signal flow graphs- block diagrams- closed loop system- reduction techniques, Signal flow graph- construction, properties, Mason's gain formula, block diagram to signal flow graph and vice versa.

14 Hours

Module II

Time Response Analysis

Time Response analysis, Standard test signals, time response of first order systems, second order systems. Steady state Errors and error constants-Type 0, Type-1 and Type -2 systems.Effect of adding poles and zeros to transfer functions. P, PI, PD and PID controllers

16 Hours

Module III:

Stability

Routh Stability criterion, Root locus technique, construction of Root Loci, Effect of adding Poles and zeros to G(s)H(s), Frequency response analysis- Polar and Bode plots, Gain margin and phase margin computation, Nyquist plot, Nyquist stability criterion

16 Hours

Module IV

Compensation and State variable analysis

Compensation- types of compensators, realization of basic compensators-lead, lag and lead-lag compensators

State- Space representing of systems – Block diagram for State Equation- Transfer function decomposition – Solution of state equation- Transfer matrix

14 Hours

Module V:

PLC and SCADA

Relay Logic and Ladder diagram. Programmable Controllers. Programmable Logic Controller (PLC), General architecture – input and out circuits, Power supplySupervisory Control and Data Acquisition (SCADA) – centralized monitoring and controlling concepts, general architecture of a SCADA system.

12 Hours

Text books: 1. Control Systems- AAnand Kumar, PHI Edition

2. Programmable Logic Controllers (English) 3rd Edition: Author: Frank Petruzella Publisher: Tata McGraw Hill
3. Programmable Logic Controllers: Programming Methods and Applications (With CD) (English) 1st Edition: Author: HACKWORTH Publisher: Pearson India
4. SCADA: Supervisory Control and Data Acquisition, 4th Edition Author:StuartA.Boyer

References:

1. Control Systems Engineering, I.J. Nagrath and M. Gopal, , New Age International Publishers, 2003.
2. Modern Control Engineering, K. Ogata, Pearson Education Asia/ PHI, 4th Edition, 2002.
3. Linear Control Systems, Prof.B.S.Manke, Khanna Publishers.
4. Automatic Control systems, Benjamin C. Kuo, Pearson Education, New Delhi, 2003.
5. Control Systems, A. NagoorKani, First Edition, RBA Publications

EL010303 OBJECT ORIENTED PROGRAMMING

Hours : 72
Credit: 4

Objectives of the course:

- To acquire knowledge on Object-Oriented Programming
- To introduce Python programming concepts in Python
- To understand the Raspberry Pisingle board computer and its programming using Python

Module: I

Introduction to Python – Features of Python, Python Virtual Machine(PVM), Memory management in Python, Comparison between C and Python. Writing and execution of a Python program, Input & Output statements. Datatypes – Built-in type, Bool datatype, Sequences, Sets, Literals, Constants, Identifiers and Reserved words, Naming conventions in Python. Strings and Characters – Creating Strings, Escape Characters, String formatting operators, String formatting functions.
Operators - Arithmetic, Assignment, Unary minus, Relational,Logical, Boolean, Bitwise, Membership and Identity Operators, Mathematical functions.
Lists – creating lists, updating the elements in a list, Built in list operators - concatenation, repetition & membership, Built-in List Methods. Tuples – creating tuples, accessing tuple elements, basic operaations on tuples, functions to process tuples. Dictionaries – creating dictionaries, Operations on Dictionaries, Dictionary Methods, Datatype conversions.

14 Hours

Module II:

Control statements – Conditional Statements :if statement, if…else statement, nested if statement, Looping : while loop, for loop, infinite loops, nested loops, Control Statements : break statement, continue statement, pass statement, assert statement, return statement.

Arrays- creating an array, Importing the array module, Indexing and Slicing on arrays, Types of arrays, Working with arrays using numpy, Mathematical operations on arrays.

Functions – Function definition, Function call, Returning from a function, Returning multiple values, Function arguments- formal & actual, positional, keyword, default, variable length arguments, Local & Global variables, passing a group of elements to a function, Recursive functions, Anonymous functions or Lambadas.

14Hours

Module III :
Classes and objects- Creating a Class, the self-variable, Constructor, Types of variables, Namespaces, Types of Methods, Passing members of one class to another class, Inner classes, Inheritance and Polymorphism- Constructors in Inheritance, Overriding super class

constructors and Methods, the super() Method, Types of Inheritance. Polymorphism- Operator overloading, Method overloading, Method overriding.

18Hours

Module IV:

Exceptions- Errors in Python Programing, Exceptions, Exception handling, Types of Exceptions, the except block, the assert statement, user defined exceptions, logging the Exceptions.

Files- Types, Opening and Closing a file, working with text and binary files, Knowing whether a file exist or not, the with statement, Pickles, seek() and tell methods, Working with Directories,

Regular expressions, Sequence characters, Quantifiers and Special Characters in regular expressions, using regular expressions on files.

12Hours

Module V:

Introduction to Raspberry Pi- about the hardware, Raspberry Pi pin out, Interfacing with the Raspberry Pi- Controlling the brightness of an LED, Toggling with a push switch, Make a buzzing sound, Switching a high power DC device using a transistor, Speed Control of DC motor, Measuring Light using SPI, Measuring Temperature using I2C. [Refer Text books 3 &4]

14Hours

Text books

1. Core Python Programming – Dr. Nageswara Rao, 2017 edition, Dreamtech Press.
2. Introduction to Computing and Problem Solving Using Python – E Balaguruswamy, 1e/ Mc Graw Hill.
3. Raspberry Pi Cookbook – Simon Monk, 1e/ O'ReillyMedia, Inc.
4. https://learn.sparkfun.com/tutorials/python-programming-tutorial-getting-started-with-the-raspberry-pi/all

References

1. Introduction to Computing Using Python - LjubomirPerkovic, 2nd Edition, Wiley
2. Taming Python by Programming – Dr. Jeeva Jose, Khanna Publishing
3. Getting started with Raspberry Pi – Matt Richardson and Shawn Wallace, 1e/ O'ReillyMedia, Inc.

EL010304 OBJECT ORIENTED PROGRAMMING LAB

Hours:180
Credit : 4

Objectives of the Course:

- To acquire programming skills on Object-Oriented Programming concepts in Python
- To get a practical knowledge on interfacing Raspberry Pi with Python

PART I – Basic Programs using Python

1. Programs based on datatypes, Input & Output and Control Statements
2. Programs based on Arrays
3. Programs based on Strings
4. Programs based on Functions
5. Programs based on Lists and Tuples
6. Programs based on Dictionaries
7. Programs based on Classes and Objects
8. Programs based on Inheritance
9. Programs based on Polymorphism
10. Programs based on Exceptions
11. Programs based on Files
12. Programs based on Regular Expressions

*[Any **ten** programs]*

PART II - Programs for interfacing with Raspberry Pi

1. Push switch and LED interfacing
2. Buzzer interfacing
3. Speed control of DC motor
4. Direction control of DC motor
5. Keypad interfacing
6. Measurement of Light
7. Measurement of Temparature
8. LCD display interfacing

*[Any **five** programs]*

References

1. Core Python Programming – Dr. Nageswara Rao, 2017 edition, Dreamtech Press.
2. Introduction to Computing and Problem Solving Using Python – E Balaguruswamy, 1e/ Mc Graw Hill.
3. Raspberry Pi Cookbook – Simon Monk, 1e/ O'ReillyMedia, Inc.
4. https://learn.sparkfun.com/tutorials/python-programming-tutorial-getting-started-with-the-raspberry-pi/all

SEMESTER IV

Semester	Course Code	Course Title	Course category	Hours per week	Credit
IV	EL010401	ARM Processor Based Embedded System	Core	5	**4**
	EL8xxxxx	Elective	Elective	5	**4**
	EL8xxxxx	Elective	Elective	5	**4**
	EL010402	VHDL Programming Lab	Practical	10	**3**
	EL010403	Project Work	Project		**5**

ELECTIVES-M.Sc. ELECTRONICS PROGRAMME

NAME OF THE PROGRAMME	GROUP-A		GROUP-B		GROUP -C	
	COURSE CODES	**NAME OF THE COURSES**	**COURSE CODES**	**NAME OF THE COURSES**	**COURSE CODES**	**NAME OF THE COURSES**
01 Electronics (M.Sc.)	EL800301	Artificial Neural Networks and Deep Learning	EL810301	Robotics	EL820301	Image Processing
	EL800402	Advanced Electromagnetics	EL810402	Bio-medical Electronics	EL820402	Nano Technology
	EL800403	Fiber Optic Communication Techniques	EL810403	Optical Sensor Technology	EL820403	Secure Communication

EL010401 ARM PROCESSOR BASED EMBEDDED SYSTEM

Hours: 90
Credit:4

Objectives of the Course:

- To equip the students to use ARM Processor
- To get a thorough knowledge of using ARM Processor with Embedded C Programmingfor Application Development
- To understand how practically apply gained theoretical knowledge in order to design, analyse and implement embedded systems.

Module I:

ARM Embedded Systems

The RISC Design Philosophy, The ARM Design Philosophy, Embedded System Hardware, Embedded System Software. Background of ARM and ARM Architecture, Processor Naming, Instruction Set Development Thumb technology and instruction set architecture, Cortex M3 processor Application, cortex M3 block diagram. Cortex M3 operation mode,Memory map.

18 Hours

Module II:

ARM Processor Fundamentals

General purpose Registers, Link registers, Program Counter, Stack Pointer, Current Program Status Registers,Pipeline, and the Vector Table, Core Extensions, Architecture Revisions. ARM Processor Exceptions and Modes, Vector Table, Exception Priorities, ARM Processor Interrupts, Assigning Interrupts, Interrupt Latency, IRQ and FIQ Exceptions, Enabling and Disabling FIQ and IRQ Exceptions.

18 Hours

Module III:

Introduction to the ARM Instruction

Data Processing Instructions, BranchInstructions, Load-Store Instructions, Software Interrupt Instruction, Program Status Register Instructions, LoadingConstants, condition code, Conditional Execution.

18 Hours

Module IV:

Addressing modes and Thumb Instruction Set

Thumb Register Usage,ARM-Thumb Interworking,Other Branch Instructions,Data Processing Instructions,Single-Register Load-Store Instructions,Multiple-Register Load-Store Instructions,Stack Instructions,Software Interrupt Instruction

Module V:

Efficient C Programming

Overview of C Compilers and Optimization, Basic C Data Types, C Looping Structures, Register Allocation,Function Calls, Pointer Aliasing, Structure Arrangement, Bit-fields,Unaligned Data and Endianness, Division, Floating Point, Inline Functions and Inline Assembly.

18 Hours

Text book:

1. ARM System Developer's Guide -Designing and Optimizing System Software by Andrew N Sloss , Dominic Symes , and Chris Wright ; Morgan Kaufman publishers , an imprint of Elsevier
2. The Definitive Guide to the ARM Cortex -M3 - Second Edition , by Joseph yiuNewnes publishers an imprint of Elsevier
3. ARM System-on-Chip Architecture, 2/e, SteveFurber, Pearson

ELECTIVES-M.Sc. ELECTRONICS PROGRAMME
GROUP - A

EL800301ARTIFICIAL NEURAL NETWORKS AND DEEP LEARNING

Hours: 54
Credits: 3

Module I

Introduction-Perceptrons, Sigmoid neurons, architecture of neural networks, a simple network to classify handwritten digits, Learning with gradient descent, Implementing our network to classify digits, towards deep learning, Warm up: a fast matrix-based approach to computing the output from a neural network, The two assumptions about the cost function, The Hadamard, product, Proof of the four fundamental equations, The backpropagation algorithm

12 Hours

Module II

The cross-entropy cost function , Introducing the cross-entropy cost function, Using the cross-entropy to classify MNIST digits, the cross-entropy, Softmax, Overfitting and regularization, Other techniques for regularization, choosing a neural network's hyper-parameters

12 Hours

Module III

Two caveats, Universality with one input and one output, Many input variables, Extension beyond sigmoid neuronsFixing up the step functions

10 Hours

Module IV

The vanishing gradient problem, unstable gradients in deep neural nets unstable gradients in more complex networks

10 Hours

Module V

Introducing convolutional networks , Convolutional neural networks in practice, The code for our convolutional networks , Recent progress in image recognition , Other approaches to deep neural nets, On the future of neural networks

10 Hours

Text Book: Neural Networks and Deep Learning- Michael Nielsen - E-book available at: http://neuralnetworksanddeeplearning.com

References:

1. Neural Network: A comprehensive foundation – Simon Haykin –Pearson Education – Second Edition
2. Introduction to Artificial Neural Systems: J.M. Zurada, Jaico Publishing House, New Delhi
3. Artificial Neural Network :B.Yagna Narayana, PHI
4. Artificial Intelligence- A Modern Approach. Second Edition, Stuart Russel, Peter Norvig, PHI/Pearson Education.
5. I.A. Basheer , M. Hajmeer: Artificial neural networks: fundamentals, computing, design, and application *Journal of Microbiological Methods 43 (2000) 3–31*

EL800402 ADVANCED ELECTROMAGNETICS

Hours: 90
Credit: 4

Objectives of the Course:

- To describe the basic principles of RF and microwave devices and circuits.
- To understand representation of RF and microwave devices by means of S-parameters.
- To understand the basic principles of radiation and antennas

Module I:

Introduction- Review of Maxwell's equations, boundary conditions, power flow and Poynting vector. Propagation of uniform plane waves in lossy media, conductors, dielectrics, skin depth, polarization, phase velocity and group velocity.

18 Hours

Module II:

RF Transmission lines, sinusoidal steady state excitation, transmission line equations, propagation constants, impedance matching, , VSWR. Smith Chart, Microstrip transmission line, TE and TM modes in rectangular waveguide, wave impedance.

18 Hours

Module III:

Microwave devices-Limitations of conventional tubes at microwave frequencies Velocitymodulation, Basic Principles of two cavity Klystron and reflex Klystrons, Principles of operation of Magnetron and Travelling Wave Tubes, Microwave Solid State Devices, Transferred Electron devices, Gunn effect, PIN diode, YIG Devices.

18 Hours

Module IV:

Passive Microwave components-Attenuators, Phase shifters, directional couplers, HybridCircuits, Faraday Rotation in Ferrites, Isolator, Circulator, Switch and Modulator, S parameters measurements

18 Hours

Module V:

Radiation and Antennas-Potential functions, Retarded potential, Radiation mechanism,Antenna structures , Antenna parameters- Gain, directivity, aperture, radiation pattern, types of antennas and applications, Antenna arrays, two element array, broadside and end fire array.

18 Hours

Text Books:

1. Samuel Y. Liao, Microwave Devices and Circuits, Pearson 3rd Edition, 2003
2. K. C. Gupta Microwaves, New Age International Ltd.1995.
3. RajeshwariChatterji: Microwave, Millimeter wave and sub-millimeter wave vacuum electron devices, Affiliated East - West Press, 1994

References:

1. Stephen C. C. Harsany: `Principles of Microwave Technology', Prentice Hall, 1997
2. Peter A. Rizzi, Microwave Engineering: Passive Circuits. 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, 4th edition, John Wiley and Sons (ASIA), 2011
6. Paul C. R. and S. A. Nassar, "Introduction to Electromagnetic fields ", McGrawHill, 1987

EL800403 OPTICAL FIBER COMMUNICATION SYSTEMS

Total Hours: 90
Total Credits: 4

Objectives of the course:

- To get a basic understanding of fundamental principles of Optical Fiber Technology, different Multiplexing Techniques
- To familiarize the different Testing Equipment for optical fiber communication
- To understand the fiber optic network basics

Module I:

Introduction, Fibre Structures &Wave guiding

Overview of Optical Fiber Communications—Advantages of Optical Fibers—Optical Spectral Bands—Key Elements of Optical Fiber System—Basic Optical Laws and Definitions—Optical fiber Modes and Configurations:Fiber Types,Rays&Modes,Step Index Fiber Structure,Wave Representation—Mode Theory for Circular Waveguides:Overview of Modes,Maxwell's Equations, Waveguide Equations,Wave equations for Step-Index Fibers—Single Mode Fibers—Graded-Index Fibre Structure—Fiber Materials—Fiber Fabrication--Fiber Optic Cables

18 Hours

Module II:

Signal Degradation in Optical Fibers &Optical Sources

Attenuation:Attenuation Units,Absorption,Scattering Losses,Bending Losses,Core and Cladding Losses—Signal Distortion in Fibers:Intramodal Dispersion,Group Delay,Material Dispersion,Waveguide Dispersion,Polarization-Mode Dispersion

Light Emitting Diodes(LEDs):LED Structure,Light Source Materials—Laser Diodes:Laser Diode Modes and Threshold Conditions,Laser Diode Rate Equations,Laser Diode Structure and radiation Patterns,Single Mode Lasers—Reliability Considerations

18 Hours

Module II:

Power Launcing , Coupling & Photodetectors

Power Launching—Source to Fiber Power Launching:Source Output Patterns—Lensing Scheme for Coupling Improvement:Nonimaging Microsphere,Laser-Diode to Fiber Coupling—Fiber-to-Fiber Joints:Mechanical Misalignment,Fiber End-Face Preparation—Fiber Splicing:Splicing Techniques—Optical Fiber Connectors:Connector Types

Photo Detectors—Physical Principles of Photodiodes:The *pin* Photo-detector,Avalanche Photodiode—Detector Response Time:Depletion Layer Photocurrent,Response Time—Comparisons of Photodetectors—Solar Cells

18 Hours

Module IV:

Optical Networks

Optical Networks—Network Concepts: Network Terminology, Network Categories, NetworkLayers,Optical layers—Network Topologies—WDM & Operational Principles--SONET/SDH: Transmission Formats and Speeds—High Speed Light Wave Links—Optical Add/Drop Multiplexing;OADM Configurations

18 Hours

Module V:

Measurement & Monitoring Techniques

Optical Switching: Optical Cross connect PerformanceMeasurement andMonitoring—Basic Test Equipment: Test Support Lasers, Optical Spectrum Analyser, Multiple Function Testers, Optical Power Attenuators, Conformance Analyser Visual Fault Indicator—Optical Power Measurements: Definition of Optical Power, Optical Power Meters—Eye Diagram Tests— Optical Time-Domain Reflectometer(OTDR).

18 Hours

Text Book

Optical Fiber Communication—Gerd Keiser—Fourth Edition—Mc Graw Hill Publication

Reference Text Books

1. Optical Fiber Communications—John M.Senior—Third Edition—Pearson Education
2. Semiconductor Optoelectronics Sevices—Pallb Bhattacharya—Secod Edition—PHI Publication
2. Electronics Communication Systems--Wayne Thomasi,--5th Edition--Pearson Publication.

ELECTIVE-GROUP B

EL810301 ROBOTICS

Hours: 54
Credits: 3

Objective of the Course:

- To get an introduction about Robots and Robotics
- To understand the kinematics and dynamics of Industrial Robotics arms and mobile robots
- To get an introduction about various types sensors and actuators for Robots
- To understand the design of robot controllers and Programming of robotic systems

Module 1

Introduction: Definitions. Robot classification-Cartesian, Cylindrical, Spherical Work envelope, Repeatability, Precision, Accuracy, Types of joints, Prismatic, Revolute, Ball and Socket, Degree of Freedom, Joint Variables

Book No.-1, 2, 4

25 Hours

Module 2

Sensors and actuators: Sensors, Position Sensors-Potentiometric, Velocity and Speed measurements, Proximity Sensors, Touch and slip sensors, Force and torque sensors, Actuators-Hydraulic and Pneumatic, DC motor and Stepper motors

Book No.-2, 3

25Hours

Module 3

Robot Programming: Teach In, Teach Through, High level Languages- robot talk, Comparison of Teaching and Programming methods, Software and speed up.

Book No – 3

20Hours

Module 4

Industrial applications: Loading and Unloading, Die Casting, Spot and Arc welding, Selection of Robots

Book No. -2, 4

20Hours

TEXT BOOK:

1. Schilling, Robert J.” Fundamentals of Robotics” PHI, 1996
2. Richardd. Klafter,” Robotic Engineering”’phi,1996
3. Fu, Gonzalez, and Lee, robotics-control,sensing,vision and intelligence”,McGraw hill
4. Groover, Weiss, Nagel and Odrey “Industrial robotics technology, programming &applications” McGraw hill.

REFERENCE:

1. R. K. Mittal, I J Nagrath,"Robotics and Control", McGraw Hill
2.ArtificialIntelligence,ElaineRich,KevinKnight,TataMcGrawHill
3. Moshe Shoham- A text book of robotics-basic concept,koganpage,london-1982

EL810402 BIOMEDICAL ELECTRONICS

Hours: 90
Credits: 4

Objectives of the Course:

- To understand the basics of instrumentation and various biomedical sensors
- To understand the measurement of physiological quantities
- To familiarize the various instrumentation related to biomedical equipment

Module I:

Introduction to Biomedical Instrumentation, Bio signals and Electrodes

Role of Technology in Modern Healthcare—Role of Biomedical Engineer—Man-Instrument System—Origin of Bio signals—Classification of Biomedical Instruments—Performance Parameters of Instruments—Physiological System—Bio-potential Electrodes; Electrode-Electrolyte Interface, Half-cells and their Potentials, Silver-Silver Chloride Electrodes, Biomedical Recording Electrodes, Circuit Model of Electrodes—Bioelectric Amplifiers—Errors in Measurement System

18 Hours

Module II:.

Transducers & Biosensors

Introduction—Classification of Transducers—Performance Characteristics of Transducers—Displacement, Position and Motion Transducers (Potentiometric, Variable Capacitance, Variable Inductance, LVDT, Linear Encoders, Piezo-electric) — Pressure Transducers (LVDT, Strain Gauge) — Transducers for Body Temperature Measurement (Thermocouples, Electric Resistance Thermometer)—Thermistors (Radiation Thermometry, Silicon Diode, Chemical Thermometry)—Photoelectric Transducers (Photovoltaic, Photo emissive, Silicon Diode, Diode Arrays)—Optical Fiber Sensors (Advantages & Types)—Biosensors—Smart Sensors

18 Hours

Module III:

Physiological Systems and Measurements

Cardiovascular System—Blood Pressure and its Measurement—Blood Flow Meters—Pulse Oximeter--Heart Sound and its Measurement—ECG; Leads and Electrodes of ECG,ECG Waveform, ECG Recorder, Holter Monitor—VCG—Cardiac Stress Test--Respiratory System—Spirometry

Anatomy and Organization of Brain—EEG; Origin of EEG Signal, EEG Signal Recording, EEG Artefacts, EEG Wave Analysis, EEG Evoked Potentials, Limitations of EEG—EMG; Application of EMG,EMG Procedure and Signal Analysis, Nerve Conduction Study—Audiometer.

18 Hours

Module IV:

Clinical Laboratory Instruments, Imaging Techniques and Patient Monitoring Systems

Tests on Blood—Blood Gases—Auto Analyzers—Electrophoresis—Colorimeter—Spectrophotometer—Flame Photometer—Ultrasonic Imaging—CT Scan; EBCT—MRI—Thermal Imaging System—Artificial Cardiac Pacemaker—Defibrillator—Ventilator—Diathermy—Computer Assisted Patient Monitoring System—Measurement of Heart Rate—Measurement of Blood Pressure—Measurement of Respiratory Rate—Intelligent Patient Monitoring

18 Hours

Module V:

Laser Applications, Telemedicine and Patient Safety

Role of Lasers in Healthcare—Laser Interaction with Tissue and Surgical Procedure—Laser Doppler Blood Flowmeter—Laser for Eye Surgery—Laser Lithotripsy—Laser in Dentistry—Lasers in Dermatology-Ray System.

Telemedicine and its Applications—Patient Safety and Biomedical Equipment—Physiological Effect of Electricity—Shock Hazards—Classification of Medical Devices and their Safety Standards—Accident Prevention Methods

18 Hours

Text Books:

1. Introduction to Biomedical Instrumentation—Mandeep Sing—PHI Publication(Module 1,3,4,5)
2. Hand Book of Biomedical Instrumentation—R.S.Khandpur, Second Edition-McGraw Hill Education (Module 1,2,3,4)
3. Biomedical Instrumentation and Measurements—Leslie Cromwell, Second Edition—PHI Publication (Module 1,2,3)

EL810403 OPTICAL SENSOR TECHNOLOGY

Contact Hours: 90
Credits: 4

MODULE 1 **18 Hours**

Light beam as a sensing tool- simple optical sensors- single and double optic sensorsmeasurementsof small displacements- radius of curvature-lamp and scale arrangement- angle ofrotation - speed of rotation - stroboscope, method of Triangulation, projected fringe technique,lidar for atmospheric remote sensing. lidar equation.

MODULE 2 **18 Hours**

Interferometry for precision measurements, two-beam interferometry, Michelson interferometer,ringe displacement and fringe counting, heterodyne interferometer, super heterodyne interferometry, electron speckle pattern interferometry photo-elasticmeasurements. Moiretechnique.

MODULE 3 **18 Hours**

Optical fibre sensors - general features- types of OFS- intrinsic and extrinsic sensors, shutterbased multimode OFS —simple fibre based sensors for displacement, temperature and pressuremeasurements- reflective FOS and applications, Fibre Bragg grating based sensors.Light transmission in microbend fibres- microbend OFS- measurements with microbend sensorsevanescentwave phenomenon- evanescent wave FOS- chemical sensors using EWFOSdistributedsensing with FOS- OTDR and applications, FO smart sensing.

MODULE 4 **18 Hours**

Interferometric FOS- basic principles- interferometric configurations- Mach-Zender, Michelsonand Fabri-Perot configurations- component, and construction of interferometic FOSapplicationsof interometric FOS- Sagnac interferometer- fibre gyro, OTDR and applications.

Text Books

1) Fibre Optic Sensors- B D Gupta
2) Fundamentals of Fibre Optics in Telecommunications and Sensor Systems- B.P. Pal, Wiley Eastern(1994)
3) Optics –AjoyGhatak, Tata McGraw Hill, 3 rd Ed (2005)
4) Lasers, Theory and Applications - Ghatak&Thyagarajan, Mcmillan India Ltd (2002)
5) Optical measurement techniques and applications- P K Rastogi. Artech House (1997)
6) Optical Fibre sensors, components and subsystems Vol. 3- Brain Culshaw and John Dakin, Artech House Inc. (1996) 7.
7) Optoelectronic Devices and Systems- S C Gupta, PHI (2005)

ELECTIVE- GROUP C

EL820301 IMAGE PROCESSING

Contact Hours: 54
Credits: 3

Objectives of the Course:

- To introduce digital image processing fundamentals
- To study the basic digital image enhancement techniques in spatial and frequency domains
- To understand the various colour image standards and their processing
- To create an awareness in image and video compression standards

Module 1:

Introduction to image processing – overview of image processing, Nature of image processing, Image processing and related fields. Digital image representation, Types of images, Fundamental steps in image processing, Image processing applications, Digital imaging system

Image Sensing and acquisition, sampling and quantization, basic relationships between pixels, linear and non-linear operations

18 Hours

Module 2

Image enhancement in spatial domain-basic gray level transformations, histogram processing, spatial filtering-smoothing and sharpening filters.

Image enhancement in frequency domain-smoothing and sharpening filters, homomorphic filtering

Image Restoration-Restoration models, noise models, restoration in presence of noise, periodic noise removal by frequency domain filtering, linear position invariant degradations, estimation of degradation, inverse filtering, minimum mean square error filtering-Weiner filtering. Geometric transformations

18 Hours

Module 3

Colour image Processing – Introduction, Devices for colour imaging, colour image storage and processing, colour models-RGB, CMY, HIS, Pseudo colour image processing, basics of full-colour image processing, colour transformations, smoothing and sharpening.

18 Hours

Module 4

Image compression – Image compression model, Compression types – lossy and lossless compression, Types of redundancy, Image and video compression standards - JPEG and MPEG

18 Hours

Module 5

Image Segmentation- Detection of discontinuities, edge linking and boundary detection, thresholding, region based segmentation, segmentation by morphological watersheds

18 Hours

Text Books:

1. Digital Image Processing – Rafael C. Gonzalez
2. Digital Image Processing – S.Sridhar

Reference book:

1. Digital Image Processing – S. Jayaraman

EL820402 NANOTECHNOLOGY

Hours: 90
Credits: 4

Objectives of the Course:

- To familiarize the nanoscience and nanotechnology materials
- To understand the nanofabrication process
- To get an idea about nanoscale characterization and various applications of nanotechnology

Module I:

Introduction to nanotechnology : Foundations in nanosciences-Introduction- Scientific Revolutions-Basic Science Behind Nanotechnology-Nanometre: How big or small-Nanotechnology-Materials at nanoscale-Quantum Confinement in Nanomaterials-Rationale Behind the Downsizing of the Materials-Prime materials in Nanotechnology- Nanomaterials: natural and man-made-Semiconductor nanomaterials-Polymers and Composites-Metal nanoparticles-Biomaterials-Unique properties of nanomaterials-Microstructure and defects in monocrystalline materials-Effect of nano dimensions on material behaviour(magnetic, electrical, optical and thermal properties).

25 Hours

Module II:

Nano fabrication :Introduction-Synthesis of Nanopowders using Top down and Bottom up methods-Top down fabrication methods-Arc discharge method-Laser Ablation method –Ball Miling-Inert gas Condensation-Bottom up fabrication methods- Homogenous nucleation-CVD-MBE-Sol Gel method-Hydro thermal Synthesis-Microwave method-Challenges in fabrication.

25Hours

Module III :

Nanoscale characterization-Introduction-XRD (principle and theory) –SEM, TEM, AFM, STM (principle, construction and working, advantages and disadvantages)- Raman spectroscopy (principle, construction and working)-Nano indentation.

20 Hours

Module IV :

Application of nanomaterials -Nano electronics and electronics applications-MEMS/NEMS-Nanosensors-Nanocatalysts and Nanochemistry- Nanophotonics– Nanocomputers-Nanobiotechnology- Nanomedical applications- Food and Agriculture Industry-Cosmetics and Consumer Goods- Structure and Engineering-Automotive Industry-Water Treatment and The Environment- Textiles-Paints-Energy-Defence and Space Applications-

Structural Applications. Nanostructured materials with high application potential- Quantum wells- Quantum dots-Carbon nanotubes –GaNnano wires-Multilayered films.

20 Hours

Text books:

1. Nanotechnology : The Science Of Small-M.A Shah & K.A Shah ,WileyPublication -First Edition 2013 (Module 1,2,3)
2. Textbook Of Nanoscience And Nanotechnology -B S Murty,P Shankar, Baldev Raj, B Rath And James Murday- Universities Press,First Edition 2012.(Module 1,2,3,4)
3. Introduction To Nanotechnology-Charles P .Poole, Jr., Frank J. Owens- Wiley IndiaEdition 2012 .(Module 4)

Reference text books:

1. Introduction To Nanoscience And Nanotechnology- K.K. Chattopadhyay,A.N.Banerjee-Phi Publication ,Fourth Printing 2012.(module 2,3,4)
2. Nano : The Essentials- T.Pradeep- McGraw Hill Education, Seventh Reprint 2012.(Module 1,3,4)
3. Nanotechnology: Basic Science And Emerging Technologies-Mick Wilson,KamaliKannangara,GeoffSmith,michelleSimmons,BurkhardRaguse-Overseas Press2005 (Module 1,2,3,4)
4. Nanotechnology – A Gentle Introduction to the Next Big Idea-Mark Ratner ,Daniel Ratner,Pearson Education Inc.

EL820403 SECURE COMMUNICATION

Contact Hours: 90
Total Credit:4

Module 1 **9 Hours**

Introduction- Security Trends, OSI Security Architecture. Security attacks-Passive attacks, Active attacks. Security Services-Authentication, Access Control, Data Confidentiality, Data Integrity, Nonrepudiation, Availability Service, Security Mechanisms-Model for Network Security

Module 2 **12 Hours**

Classical Encryption Techniques -Symmetric Cipher model-Cryptography, Cryptanalysis. Substitution Technique -Caeser Cipher, Monoalphabetic Cipher, Playfair Cipher, Hill Cipher, Polyalphabetic Cipher, One time Pad, Transposition Techniques, Rotor Machines, Steganography

Module 3 **8 Hours**

Block Cipher Principles, Data Encryption Standard, Strength of DES, Differential and Linear Cryptanalysis, Block Cipher Design Principles.

Module 4 **10 Hours**

Finite Fields-Groups, Rings and Fields, Modular Arithmetic, The Euclidian Algorithm, Finite fields of the form GF(p),Polynomial arithmetic, Finite fields of the form GF(2_n)

Module 5 **15 Hours**

Advanced Encryption Standard. Confidentiality Using Symmetric Encryption -Placement of Encryption Function, Traffic Confidentiality, Key Distribution, Random Number Generation

Text Books:

1.”Cryptography and Network Security”, William Stallings,4thEdition, Pearson Education Inc.
2.”Cryptography Theory and Practice”, Douglas A Stinson,2ndEdition, Chapman & Hall, CRC press Company, Washington
3.”Security in Computing” Charles P. Pfleeger, Shari Lawrence Pfleeger, 4th Edition, Prentice Hall. 4.”Computer Security Basics” Debby Russell, G.T. Gangemi

EL010402VHDL PROGRAMMING LAB

Hours: 180
Credits: 4

Objectives of the Course:

- **To familiarize Xilinx programming environment**
- **To simulate the combinational and sequential logic circuits**

Cycle I – Introduction and Simulation of combinational Logic Circuits

1. Introduction to the xilinxise and modelsim
2. Full adder data flow / behavioural
3. Full adder structural
4. Multiplexer (8:1)
5. Demultiplexer (1:8)
6. Encoder without priority
7. Encoder with priority
8. Decoder (3:8)
9. 2 – bit comparator
10. Binary to Gray
11. Gray to binary

Cycle II –Simulation of sequential Logic Circuits

12. JK flip-flop
13. T flip-flop
14. D flip-flop
15. Asynchronous binary up counter
16. Synchronous binary up counter
17. BCD up counter
18. BCD down counter
19. Shift resisters using behavioural modelling
20. Four bit serial look ahead carry adder
21. Four bit multiplier
22. ALU using behavioural modelling
23. Traffic light controller using state machine

Note: A minimum of 8 experiments from cycle I and 10 experiments from cycle II (total 16) using VHDL should be completed and recorded.

X. Syllabus

of

M.Sc. APPLIED ELECTRONICS

M.Sc. Applied Electronics-Syllabus Structure

Course Code	Title of the Course	Type of the Course	Hours per week	Credits	
FIRST SEMESTER					
EL020101	Analog Electronic Circuits	Core	4	**4**	**19**
EL020102	Network& Control Systems	Core	4	**4**	
EL020103	Digital System Design	Core	4	**4**	
EL020104	Applied Mathematics	Core	3	**3**	
EL020105	Advanced Electronics and Programming Lab	Practical	10	**4**	
SECOND SEMESTER					
EL020201	Digital Signal Processing	Core	4	**4**	**19**
EL020202	8051 & AVR based Embedded Systems	Core	4	**4**	
EL020203	VLSI Design	Core	4	**4**	
EL020204	Microwave Devices & Systems	Core	3	**3**	
EL020205	Microcontrollers and DSP Lab	Practical	10	**4**	
THIRD SEMESTER					
EL020301	Computer Organization and Architecture	Core	4	**4**	**19**
EL020302	Artificial Neural Networks and Deep Learning	Core	4	**4**	
EL020303	Introduction to IoT and the Arduino	Core	4	**4**	
EL8xxxxx	Elective	Elective	3	**3**	
EL020304	VLSI and Arduino Lab	Practical	10	**4**	
FOURTH SEMESTER					
EL020401	Image Processing	Core	5	**4**	**23**
EL8xxxxx	Elective	Elective	5	**4**	
EL8xxxxx	Elective	Elective	5	**4**	
EL020402	Electronic Design & Simulation Lab	Practical	10	**4**	
EL020403	Project Work			**4**	
EL020404	Comprehensive Viva Voce			**3**	
				Total Credit	**80**

ELECTIVE COURSES FOR MSc APPLIED ELECTRONICS

NAME OF THE PROGRAMME	GROUP-A		GROUP-B		GROUP -C	
	COURSE CODES	**NAME OF THE COURSES**	**COURSE CODES**	**NAME OF THE COURSES**	**COURSE CODES**	**NAME OF THE COURSES**
01 Electronics (M.Sc.)	EL830301	Introduction to virtual instrumentation and multi-paradigm programming languages	EL840301	Mobile Computing	EL810301	Robotics
	EL830402	Microelectronic Mechanical Systems	EL810402	Biomedical Electronics	EL820402	Nano Technology
	EL820403	Secure Communication	EL800403	Fiber Optic Communication Techniques	EL810403	Optical Sensor Technology

Courses EL800403, EL810301, EL810402, EL810403, EL820402 and EL820403 are common with elective courses of M.Sc. Electronics

SEMESTER I

Semester	Course Code	Course Title	Course category	Hours per week	Credit
I	EL020101	Analog Electronic Circuits	Core	4	**4**
	EL020102	Network& Control Systems	Core	4	**4**
	EL020103	Digital System Design	Core	4	**4**
	EL020104	Applied Mathematics	Core	3	**3**
	EL020105	Advanced Electronics and Programming Lab	Practical	10	**4**
				Total Credit	**19**

EL020101 ANALOG ELECTRONIC CIRCUITS

Hours: 72
Credit: 4

Objectives of the course: To study the characteristics and analysis of electronic devices and also to familiarize with applications of devices.

Module I

Special Purpose Diodes – Avalanche Diode, Schottky Diode, Varicap Diode, Tunnel Diode, Gunn diode, PIN Diode, Schockely diode - V-I Characteristics and Applications. Photo transistor, opto-isolator

Module II

Transistor h-parameter analysis , Power amplifiers - Efficiency. Tuned Amplifiers - Frequency Response.FET Construction & characteristics, Depletion mode MOSFET and Enhancement mode MOSFET, VMOS, CMOS, MESFET, GaAs Devices.

Module III

Negative feed back - Types feed back with examples for each type. Effect of feedback on ac characteristic of amplifiers.Analysis with a JFET common Source Amplifier.Positive feedback - oscillators - Analysis of RC phase shift oscillator and LC oscillators - Hartley and Colpitt. (Derivation of operating frequency and design of oscillator)

Module IV

OP-AMP Circuits – Summing, difference, integrator, differentiator, Instrumentation Amplifier Analog Computer , Oscillators and Waveform Generators, Active Filters first and second order (Butterworth only). low-pass and high-pass filters, working principle of narrow band and wide band filters.

Module V

Phase Locked Loop, Interfacing Circuits – RS232C to TTL Converter. Numbering and coding schemes for semiconductor device, package systems/standards.

Text Books

1. Electronic Devices and Circuit Theory Third Edition, Robert L Boylestad& Louis Nashelsky Pearson Education
2. Electronic Devices and Circuits:- David A Bell
3. OP-Amps and Linear Integrated Circuits Third Edition, Ramakant A Gayakwad

REFERENCES

1. Electronic Device, Foyal, Fifth Edition - Addison Wesley Longman Pt. Ltd Branch 2001.
2. Integrated Electronics, Milman and Halkias, McGraw Hill publishers.
3. Data Manual (From websites)

EL020102 NETWORK& CONTROL SYSTEMS

Hours: 72
Credit: 4

Objectives of the Course:

- To familiarise the basic network theorems, system representation using block diagrams and signal flow graphs
- To understand basic types of control system and their representation
- To study the various plots associated with a control system to measure performance and stability

Module 1.

Network theorems - Substitution, superposition, Reciprocity, Maximum power transfer. Thevenin's, Norton's, Transients in linear circuits. Rise and decay of current in RL circuit – Time constant, RC circuit with impressed DC voltage, RL and RC circuits with sinusoidal voltage, DC transients in RLC circuits damping. Two port networks – z, y, h & ABCD parameters

Module II

Block diagram reduction - open and closed loop systems - signal flow graphs. Properties- Linearity, Time-Invariance, Stability and causality.LTI systems. Transfer function, Impulse response.

Module III

Transient response of first order and second order systems. Error constants - Generalized definition of Error coefficients, AC and DC servo motors and stepper motor as control system components.

Module IV

Poles, Zeros and their significance in stability analysis. Tools and Techniques for LTI control system analysis: Root Locus, Routh-Hurwit’s criterion, Bode Plot, Polar plot, Nyquist criterion. Nichols chart.

Module V

Control system compensators, Elements of Lead compensation, Lag compensation, Lag-Lead compensation, P, PI, PD & PID control.

TEXT BOOKS:

1. Circuits and Networks, Sudhakar and Manmohan
2. Basic circuit theory, Desor and Kuo, Mc. Graw Hill Book Co.Ltd.
3. Control System principles and design, M. Gopal, TMH. 1998.
4. Control Systems, A. NagoorKani, RBA Publications

REFERENCES:

1. Modern control Engineering K. Ogata, PHI, 3rd ed 1997
2. Automatic control systems, BC KUO, PHI, 7th ed, 1995
3. Principle of Network Snthesis, Van Valkenberg,
4. Modern Control Systems, Richard C. Dorf, Robert H. Bishop, Addison-Wesley.

EL020103 DIGITAL SYSTEM DESIGN

Hours:72
Credit: 4

Objectives of the course: To get an in-depth knowledge on digital systems and design of digital circuits.

Module I

Principles of combinational logic: Review of Boolean Algebra. Definition of combinational, Canonical forms, Generation of switching equations from truth tables, Karnaugh maps-3, 4 and 5 variables. Incompletely specified functions (Don't care terms). Simplifying max – term equations. Quine -McCuskey minimization technique, Quine – McCuskey using don't care terms, Reduced Prime Implicant tables.

Module II

Sequential Design: Introduction, Mealy and Moore models, State machine notation, Synchronous sequential circuit –Basic design Steps-State diagrams, state table, state assignment, choice of flip flops and output expressions, timing diagrams, Analysis of synchronous sequential circuits.

Asynchronous sequential circuit – Analysis of asynchronous sequential circuits State reduction, state assignment, Hazards.

Module III

Minimization and Transformation of Sequential Machines: The Finite State Model – Capabilities and limitations of FSM – State equivalence and machine minimization – Simplification of incompletely specified machines. Fundamental mode model – Flow table – State reduction – Minimal closed covers – Races, Cycles

Module IV

Digital Design: Digital Design Using ROMs, PALs and PLAs , BCD Adder, 32 – bit adder, State graphs for control circuits, Scoreboard and Controller, A shift and add multiplier, Array multiplier, Keypad Scanner, Binary divider. RAM based FPGAs - Antifuse FPGAs - Selecting FPGAs – CLBs, Input/Output Blocks - Programmable Interconnect (study based on Xilinx and Altera FPGAs only) Study based on Xilinx Spartan IIE - Introduction to System on a Chip

Module V

HDL: Introduction, A brief history of HDL, Structure of HDL Module, Operators, Data types, Types of Descriptions, Simulation and synthesis, Brief comparison of VHDL and

Verilog. Data-Flow Descriptions: Highlights of Data flow descriptions, Structure of data-flow description, Data type-vectors.

VHDL Basics - Introduction to HDL - Entity - Architecture - Basic language elements - Behavioralmodeling - Data flow modeling - Structural modeling - Generics and Configurations - Subprograms & Overloading - Packages and libraries – VHDL advanced features - Test Bench - Synthesis Issues.

TEXT BOOKS

1. Digital principles and applications by MALVINO & LEACH.
2. Fundamentals of Digital logic with VHDL Design,Third edition by STEPHEN BROWN ,ZVONKO VRANESIC.
3. Fundamentals of Logic Design – Charles H. Roth, 5th ed., Cengage Learning.

REFERENCES:

1. Digital Systems Testing and Testable Design – MironAbramovici, Melvin A. Breuer and Arthur D. Friedman- John Wiley & Sons Inc.
2. Digital Design – Morris Mano, M.D.Ciletti, 4th Edition, Pearson
3. Parag K. Lala, "Digital System Design using programmable Logic Devices", Prentice Hall, NJ, 1994.
4. Z. Navabi, "VHDL Analysis and Modeling of Digital Systems", McGRAW-Hill, 1998.
5. SudhakarYalamanchili, “Introductory VHDL From Simulation to Synthesis”, Prentice Hall
6. Thomas Floyd, Digital fundamentals

EL020104 APPLIED MATHEMATICS

Hours: 54
Credit: 3

Objectives of the course: To familiarize the concepts of probability, graph theory, matrix, transforms, numerical and partial differential equations which will complement the mathematical and statistical support to the analysis of electronic theories

Module I: Probability & Fuzzy Set

Sample space, Events, Random variables, Probability density function, cumulative distribution function

Fuzzy set theory: Introduction, crisp sets - an overview, Fuzzy sets - basic concepts, Membership functions, Fuzzy set operation.

Module II: Graph theory:

Graphs- definition & examples, Incidence & degree, walks, paths and circuits, connected graphs, Trees: Basic properties, Rooted and binary trees, Binary search trees,Tree traversals, Pre-order, in-order & post-order, Spanning trees, Prims &Kruskals algorithms.

Module III : Matrix

Matrix inverse, Solution of simultaneous linear equations using Matrix methods, Elementary Transformation, Rank, Eigen value problems, Cayley Hamilton theorem.

Module IV: **Transforms**

Laplace Transform: Main properties of Laplace Transform. Laplace Transform of important signal waveforms, Laplace Transform analysis of simple network, initial and final value theorems, Convolution.

Z-Transform: Z-Transform of signals, Region of convergence, Inverse z-transform, Properties.

Fourier Transforms: Fourier series for continuous & discrete time periodic signals, Fourier transform for continuous & discrete time aperiodic signals, Properties, Power density spectrum, Sampling theorem, aliasing, Introduction to DTFT, DFT.

Module V: Numerical solution of Partial Differential Equations

Linear partial differential equation of second order - Elliptic, Parabolic & Hyperbolic equations Finite difference method – solution of Laplace's equation, One-dimensional heat equation & one-dimensional wave equation.

Text Books

1. Fundamentals of Mathematical Statistics, S.C. Gupta, V.K. Kapoor, Sulthan Chand Publications
2. Fuzzy set and Fuzzy logic theory & Applications, George J. Klie& Bo Yuvan, Printice Hall of indiaPvt. Ltd, NEW DELHI 200
3. Higher Engineering Mathematics, B.S. Grewal, Khanna Publishers
4. Graph Theory with Application to Engineering & Computer science, NarsinghDeo, PHI Learning Pvt. Ltd., 2011
5. Advanced engineering Mathematics, Michael E. Greenberg, Pearson Education.

REFERENCES

1. Mathematical methods for Physics: Arfken, A.G. Academic Press.
2. Digital Signal Processing: SanjitMitra
3. Mathematical methods for physicists and Engineers: M.A. Boas
4. Basic Graph Theory, K.R. Parthasarathy, Tata McGraw-Hill.
5. Digital signal Processing, Alan v. Oppenheim, Ronald W. Schafer, PHI Pvt Ltd.

EL020105 ADVANCED ELECTRONICS AND PROGRAMMING LAB

Hours: 180
Credit: 4

Objectives of the course: To get the practical training in analog and digital electronic circuit design and troubleshooting and to familiarize the programming language C and Python.

Analog

Wave form generators: Multivibrators (Monostable, Astable&Bistable), Triangular wave generator (Using op-amp), Wave shaping circuits , S.M.P.S - Voltage controlled oscillatorAmplifiers: RC coupled amplifier ,FET amplifier. (Spice analysis) Butterworth filters Low pass filter - High pass filters - Band pass filters -Band reject filters (Spice analysis) IGMF filtersLow pass filters - High pass filters - Band pass filters -Band reject filters Universal filters - Chebychev filters (Spice analysis)
Communication:Frequency modulation using PLL - Amplitude modulation using Op. Amp. - Frequency shift keying by PLL - M S K circuit using PLL -Simulation of inductance using Op.Amp gyrator - Negative impedance converter - Frequency multiplication by using PLL

Digital

1. Timer circuits Experiments using 555 timer. (Astable / Monostable),
2. Study of IC's. (Using breadboard)
    1. Familiarization of digital Ics. Astable and monostablemultivibrator using logic gates.
3. Study of combinational, sequential & CMOS circuits (Using SPICE)
    1. Combinational Circuits-
        1. Adder/Subtractor.
        2. Comprators
        3. Encoder/Decoder.
        4. Mux/Demux.
        5. Code converters.
    2. Sequential Circuits-
        1. Flip-Flops.
        2. Shift Registers.
        3. Counters
        4. Sequence Generations.
    3. CMOS Circuits-
        1. Inverter.
        2. Universal Gates.
        3. Boolean Expressions.

PROGRAMMING LAB

Programmes in C Language

1. Program to understand basic structure of C Programmes.
2. Programe to implement #define directive
3. Program to show the size and use of different data types in C
4. Program which contains constants and variables
5. Program to implement the use of static variables
6. Program to implement the use of arrays
7. Program to perfrom Arithmetic operations
8. Program to perfrom Bit wise logical operations
9. Program to SET/RESET/COMPLIMENT a bit
10. Program to perfrom right shift operation s
11. Program to perfrom Left shift operations
12. Program to perfrom relational operations using if-then structure
13. Program to perfrom Boolean operations
14. Program to implement switch-case statements
15. Program to perfrom loop operations using while loops
16. Program to perfrom loop operations using do-while loops
17. Program to perfrom loop operations using 'for' loops
18. Program to create user defined functions
19. Program to create user defined functions call by value and call by reference methods
20. Program to create Structure and union

Programmes in PYTHON

1. Program to print the variable values in python
2. Programmes to show the use of Arithmatic, comparison, assignment and bitwise operations
3. Program to implement 'if', 'elif', 'else' statements
4. Program to perform different loops using 'for' loop
5. Program to perform different loops using 'while' loop
6. Program to show the use of break and continue statements
7. Program to perform different numerical operations
8. Program to perform different matrix operation
9. Program to show the use and operations of list
10. Program to show the functions of dictionary .
11. Program to show the functions of tuples.
12. Program to show the use of different built in functions such as abs(), cmp(), hex(), len(), min(), max(), long(), next(), print(), range(), raw_input(), zip()
13. Program to create functions and pass and return values
14. Program to show modular programming
15. Graph plotting using python
16. Use of libraries such as numpy, scipy, opencv, etc

SEMESTER II

Semester	Course Code	Course Title	Course category	Hours per week	Credit
II	EL020201	Digital Signal Processing	Core	4	**4**
	EL020202	8051 & AVR based Embedded Systems	Core	4	**4**
	EL020203	VLSI Design	Core	4	**4**
	EL020204	Microwave Devices & Systems	Core	3	**3**
	EL020205	Microcontrollers and DSP Lab	Practical	10	**4**
				Total Credit	**19**

EL020201 DIGITAL SIGNAL PROCESSING

Hours:72
Credit: 4

Objectives of the course:

- To get a thorough knowledge on FFT and its applications
- To familiarize digital IIR and FIR filter designing and its realization
- To discuss the multirate signal processing

Module I

Discrete signals - Decimation and interpolation - aliasing and sampling theorem, Linear time-invariant systems. Discrete - time system classification – by difference equation - Impulse response - stability, causality and convolution sum: 2- transform and system analysis.

Module II

Discrete - Time Fourier Transform (DTFT). DFT and properties, computation of DFT and IDFT using Fast Fourier Transform (FFT) - radix two DIT and DIF algorithms, Calculation of Power spectrum using DFT – Periodogram.

Module III

Design of linear phase FIR filter using windows method, Frequency sampling method.Analog design approximation of Butterworth and Chebyshev filter. Design of IIR filters by indirect methods - Impulse Invariant methods. Bilinear Z -Transformation method.Design of HPF, BPF using frequency transformation.

Module IV

Realization of IIR structure - Direct. Cascade, Parallel and Lattice structure. Realization of FIR structure - Direct and Lattice structure. Finite Word length effects in digital filter - Representation of number, Quantization, Analysis of quantization effects, Limit cycles in IIR filter – Scaling

Module V

Basics in multirate signal processing - Sampling - Ratio conversion- Sub-band coding of speech and audio signal, Musical sound processing, DSP Architectures: Multiplier and Multiplier accumulator – Modified Bus Structures and Memory access – Multi-port memory – VLIW architecture- Pipelining.

TEXT BOOKS:

1. B.S. Nair, Digital Signal Processing a»i 1 Filter Design -PHI
2. John G. Proakis and Dimitris G. Manolakis, ‘Digital Signal Processing principle, Algorithms and application’ 3 rd edition Prentice Hall of India Pvt. Ltd
3. Sanjit K. Mitra. ‘Digital Signal Processing A Computer Based Approach’

REFERENCES

1. Alan V. Oppcnheim. Ronald W. Schaufcr and John R. Buck. ‘Discrete Time Signal Processing’
2. Ashok Ambardar. ‘Analog and Digital Signal Processing’
3. EmmanualC.lfcachorundBarrie W, Jcrvis. ‘Digital Signal Processing A Practical Approach’ Addison Wesley
4. David J. Defatta, Joseph G. Lucas William S. Hodgkin. ‘Digital Signal Processing: A System Design Approach’ John Wiley

EL020202 8051 & AVR BASED EMBEDDED SYSTEMS

Hours:72
Credit: 4

Objectives of the course:

- To give an in-depth knowledge on AVR microcontroller
- To get a thorough knowledge on AVR assembly language programming
- To familiarise the interfacing of AVR and its applications

MODULE I

Over view and block diagram of 8051, Architecture of 8051, program counter and memory organization, Data types and directives, PSW, register banks, and stack, pin diagram of 8051, Interrupts and timers.Addressing modes, Instruction set of 8051, Arithmetic, Logical, Simple bit, jump, loop and call instructions and their usage.

MODULE II

Time delay generation and calculation, Timer/ Counter programming. Basics of serial communication, 8051 connections to RS232, 8051 serial port programming in assembly, Interfacing: LCD interfacing, Keyboard interfacing, ADC, DAC and sensor interfacing.

MODULE III

AVR MICROCONTROLLERS: Microcontroller and embedded processors, Overview of the AVR family, ATmega 32 Block diagram, General purpose registers in AVR, AVR data memory, Program & Data Addressing Modes, instructions with data memory, ALU instructions involving the GPRs, AVR status registers, AVR data format and directives, Program counter and program ROM space in the AVR, Harvard architecture in the AVR, RISC architecture in the AVR,

MODULE IV

Branch instructions and looping, Call instructions and Stack, Arithmetic and Logical instructions. AVR interrupts, Serial Communication- I^2C and SPI, UART, Different ports and DDR register, Literal and control Operations, Watchdog timer, Interrupts, Timers/ counter, PWM, Interrupt priority in AVR microcontroller

MODULE V

Programming in embedded C: Data types in C, time delays - I/O programming - logic operations - Programming of timer 0, timer 1, timer2-, AVR interrupts - programming of timer interrupts - programming external hardware interrupts – Programming of serial communication- I2C and SPI.

Text books:

1. The 8051 Microcontroller Architecture, programming and applications by Kenneth J.Ayala, West publishing company (St Paul, NewYork, Los angels, SanFrancisco)
2. Muhammad Ali Mazidi, SarmadNaimi and SepehrNaimi -The AVR Microcontroller and Embedded Systems using assembly and C - Pearson Education.

References

1. Mazidi ,The 8051 Microcontrollers & Embedded Systems, Pearson Education.
2. Dhananjay V. Gadre, Programming and Customizing the AVR Microcontroller,McGraw Hill

EL020203 VLSI DESIGN

Hours:72
Credit: 4

Aim of the course: To familiarize with MOS transistor theory and its fabrication techniques.

MODULE I

MOS transistor theory

MOS Transister structure, NMOS enhancement transistor, PMOS enhancement transistor. Threshold Voltage eqn, Body effect, MOS device eqn. Basic DC eqn., II order effects, MOS Models, Small signal AC characteristics, CMOS inverter – DC characteristics

MODULE II

The MOS transistor switches

Basic invertors, NAND, NOR & Compound logic circuits. Multiplexers, Memory, Circuit and System representation – Behavioural, structural & physical representations - Half Adder, Full Adder, Mux.

MODULE III

CMOS Processing Technology

An overview of wafer fabrication, wafer processing- Czochralski process, diffusion, oxidation, Epitaxy, deposition, Ion implantation, diffusion, Si gate process, Basic CMOS Technology, CMOS process, n well, p well, Twin tub, Si on insulator, interconnect, circuit elements, Effects of scaling, Layout design rules, GaAs fabrication

MODULE IV

Data & control flow in systematic structures

Introduction, Notation - 2 phase clocks, shift registers, sub system design, register - to - register transfer, combinational and sequential logic circuits, programmable logic array, Finite state machines

MODULE V

Overview of an LSI computer system

Introduction - OM project, system overview, overall structure of data path. ALU, ALU registers, Buses, Barrel shifter, register array. System timings; introduction to system timing-synchronous systems, Clock distribution- clock skey

Text Books

1. Neil H.E. Weste, Kamaran - Eshranghian "Principles of CMOS VLSI design.
2. Convey C Mead “introduction to VLSI design”

REFERENCES

1. Modern VLSI design: Wolf, Pearson Education.
2. VLSI technology: S M Sze, Mc Graw Hill pub.
3. Basic VLSI design: Douglas Pucknell, PHI.
4. Principles of CMOS VLSI Design: H E Weste, Pearson Edn.
5. Integrated Circuits: K R Botkar, Khanna Pub.
6. CMOS circuit design layout and simulation: Barter, IEEE press.
7. Introduction to VLSI: Conway, Addison weslay.

EL020204 MICROWAVE DEVICES & SYSTEMS

Hours: 54
Credit: 3

Aim: To understand the basic principles of rectangular waveguides , microwave solid state devices, antennas, microwave and radar communication.

MODULE I: Introduction to microwaves - frequency range, significance, applications. Microwave transmission lines-microstripline- stripline. Rectangular Waveguides, Cavity resonators, Microwave integrated circuits-Design and manufacturing. Types of MiC's, Technology

MODULE II: Principle of operation and applications of Crystal diode, Schottky diode and PIN diode, Transferred Electron Devices -Gunn diode- modes of operation, Gunn diode oscillator, Avalanche Transit time devices- IMPATT and TRAPATT devices. Construction and working based on energy band diagrams-Applications. Tunnel diode and Varactor diodes, Basic principle of operation of parametric amplifiers, Manley Rowe power relations, Negative resistance amplifiers. Microwave Bipolar Transistor.

MODULE III:Types of Antennas – dipole, Horn, reflector antennas, helical antennas, Antenna Parameters-Gain, Directivity, Radiation pattern & Radiation resistance. Antenna arrays- Two element array- broadside and end-fire array Microwave Planar Antenna (qualitative only) Antenna measurements, Basic concepts of Network Analyzer and Anechoic chamber.

MODULE IV: Basic principles of Microwave Communication, Principles of Microwave Links – Microwave relay Systems – block schematic of terminal transmitters and receivers – repeaters – propagation mechanism- propagation characteristics, Basic principles of design of a microwave links.

MODULE V : Radar range equation- Block schematic of pulse radar- Radar frequencies- Applications of radar- CW radar- applications of CW radar- CW radar with nonzero IF- FM CW radar-FM CW altimeter- MTI and Pulse Doppler radar, Radar Cross Section, Global Positioning System (GPS)

TEXT BOOKS / REFERENCES

1. Annapurna Das and Sisir K Das,MicrowaveEngineering,Tata Mc Graw Hill, Second Edition
2. Pozar, Microwave Engineering, Wiley. Third edition 2011
3. C. A Balanis, Antenna Theory- analysis and design, John Wiley student edition ,2nd edition.
4. Dennis Roddy and John Coolen., ―Electronic Communication 4th Edition
5. Introduction to radar systems — Merrill I Skolnik, McGraw Hill, Edition,2009.

EL020205 MICROCONTROLLERS AND DSP LAB

Hours:180
Credit:4

Aim of the course:

- To get an in-depth knowledge on 8051 Microcontroller programming and its interfacing
- To understand the programming and interfacing of AVR microcontroller
- To familiarize the simulation of DSP techniques using MATLAB/OCATAVE software

8051 Micro controller Programming

1. Familiarize an Integrated Development Environment to create a project, Compiling an Embedded C program, Assembling and Simulation/Debugging IN MCU 8051 IDE
2. Write 8051 Programs in Assembly Language to verify arithmetic and logical operations.
3. Write 8051 Programs in C/ Assembly Language find the largest/smallest number.
4. Write 8051 Programs in C/ Assembly Language for sorting numbers in ascending/descending order.
5. LED Interfacing and Delay Programming.
6. Square wave, Triangular and Sawtooth wave form generation.
7. Interfacing alphanumeric Liquid Crystal Display.
8. Interfacing 4x4 keypad.
9. Interfacing seven segment display.

AVR Experiments

1. Basic AVR Programming using Assembly OR C (using AVR Studio/any compatible IDE) Addition, Subtraction, Multiplication, Ascending Order, Descending Order, Code Conversion, Memory Swapping.
2. LED Interfacing and Delay Programming.
3. Interfacing 16x2 alphanumeric Liquid Crystal Display.
4. Interfacing 4x4 keypad.
5. Interfacing stepper motor.
6. Interfacing seven segment display.
7. DC motor speed control.
8. Interfacing serial devices such as GSM modem/GPS systems etc.
9. Timer programming
10. Serial programming
11. Interrupt handling
12. PWM Generation

DIGITAL SIGNAL PROCESSING LAB (Simulation using MATLAB / OCTAVE Using TMS320C5X/TMS320C54XX/TMS320C67XX**)**

1. Generation of Signals
2. Arithmetic operations
3. Matrix operation
4. DFT computations
5. FFT computations
6. Convolution of two discrete signals
7. Correlation of two discrete signals
8. Solving differential equations
9. Solving Z-Transform
10. Voice storing & retrieval
11. FIR Filter design
12. IIR Filter design.

SEMESTER III

Semester	Course Code	Course Title	Course category	Hours per week	Credit
III	EL020301	Computer Organization and Architecture	Core	4	**4**
	EL020302	Artificial Neural Networks and Deep Learning	Core	4	**4**
	EL020303	Introduction to IoT and the Arduino	Core	4	**4**
	EL8xxxxx	Elective	Elective	3	**3**
	EL020304	VLSI and Arduino Lab	Practical	10	**4**
				Total Credit	**19**

EL020301 COMPUTER ORGANIZATION AND ARCHITECTURE

Hours:72
Credit: 4

Aim of the Course: To discuss the basic architecture and organization of a computer

MODULE I

BASIC STRUCTURE OF COMPUTERS : Computer Types, Functional unit, Basic OPERATIONAL concepts, Bus structures, Software, Performance, multiprocessors and multi computers. Data Representation.Fixed Point Representation. Floating – Point Representation. Error Detection codes.

MODULE II

REGISTER TRANSFER LANGUAGE AND MICROOPERATIONS : Register Transfer language.Register Transfer Bus and memory transfers, Arithmetic Mircrooperatiaons, logic micro operations, shift micro operations, Arithmetic logic shift unit. Instruction codes.Computer Registers Computer instructions – Instruction cycle.Memory – Reference Instructions.Input – Output and Interrupt. STACK organization. Instruction formats. Addressing modes. DATA Transfer and manipulation. Program control. Reduced Instruction set computer.

MICRO PROGRAMMED CONTROL : Control memory, Address sequencing, microprogram example, design of control unit - Hard wired control. Microprogrammed control.

MODULE III

COMPUTER ARITHMETIC : Addition and subtraction, multiplication Algorithms, Division Algorithms, Floating – point Arithmetic operations. Decimal Arithmetic unit Decimal Arithmetic operations.

THE MEMORY SYSTEM : Basic concepts semiconductor RAM memories. Read-only memories, Cache memories - performance considerations, Virtual memories, secondary storage.Introduction to RAID.

MODULE IV

INPUT-OUTPUT ORGANIZATION : Peripheral Devices, Input-Output Interface, Asynchronous data transfer Modes of Transfer, Priority Interrupt Direct memory Access, Input –Output Processor (IOP) Serial communication; Introduction to peripheral component, Interconnect (PCI) bus. Introduction to standard serial communication protocols like RS232, USB, IEEE1394.

MODULE V

PIPELINE AND VECTOR PROCESSING : Parallel Processing, Pipelining, Arithmetic Pipeline, Instruction Pipeline, RISC, Pipeline Vector Processing, Array Processors.

MULTI PROCESSORS : Characteristics or Multiprocessors, Interconnection Structures, Interprocessor Arbitration. InterProcessor Communication and Synchronization Cache Coherance.Shared Memory Multiprocessors.

TEXT BOOKS :

1. Computer Organization – Carl Hamacher, ZvonksVranesic, SafeaZaky, Vth Edition, McGraw Hill.
2. Computer Systems Architecture – M.Moris Mano, IIIrd Edition, Pearson/PHI

REFERENCES :

1. Computer Organization and Architecture – William Stallings Sixth Edition, Pearson/PHI
2. Structured Computer Organization – Andrew S. Tanenbaum, 4th Edition PHI/Pearson
3. Fundamentals or Computer Organization and Design, – SivaraamaDandamudi Springer Int. Edition.
4. Computer Architecture a quantitative approach, John L. Hennessy and David A. Patterson, Fourth Edition Elsevier
5. Computer Architecture: Fundamentals and principles of Computer Design, Joseph D. Dumas II, BS Publication.

EL020302ARTIFICIAL NEURAL NETWORKS AND DEEP LEARNING

Hours: 72
Credits: 4

Module I

Introduction-Perceptrons, Sigmoid neurons, architecture of neural networks, a simple network to classify handwritten digits, Learning with gradient descent, Implementing our network to classify digits, towards deep learning, Warm up: a fast matrix-based approach to computing the output from a neural network, The two assumptions about the cost function, The Hadamard, product, Proof of the four fundamental equations, The backpropagation algorithm

16 Hours

Module II

The cross-entropy cost function , Introducing the cross-entropy cost function, Using the cross-entropy to classify MNIST digits, the cross-entropy, Softmax, Overfitting and regularization, Other techniques for regularization, choosing a neural network's hyper-parameters

14 Hours

Module III

Two caveats, Universality with one input and one output, Many input variables, Extension beyond sigmoid neuronsFixing up the step functions

14 Hours

Module IV

The vanishing gradient problem, unstable gradients in deep neural nets unstable gradients in more complex networks

14 Hours

Module V

Introducing convolutional networks , Convolutional neural networks in practice, The code for our convolutional networks , Recent progress in image recognition , Other approaches to deep neural nets, On the future of neural networks

14 Hours

Text Book: Neural Networks and Deep Learning- Michael Nielsen - E-book available at: http://neuralnetworksanddeeplearning.com

References:

1. Neural Network: A comprehensive foundation – Simon Haykin –Pearson Education – Second Edition
2. Introduction to Artificial Neural Systems: J.M. Zurada, Jaico Publishing House, New Delhi
3. Artificial Neural Network :B.Yagna Narayana, PHI

4. Artificial Intelligence- A Modern Approach. Second Edition, Stuart Russel, Peter Norvig, PHI/Pearson Education.
5. I.A. Basheer , M. Hajmeer: Artificial neural networks: fundamentals, computing, design, and application *Journal of Microbiological Methods 43 (2000) 3–31*

EL020303 INTRODUCTION TO IOT AND THE ARDUINO

Hours: 72
Credit: 4

Aim of the course: To introduce IoT and its programming, Arduino platform and its programming

Module 1: Sensors and Actuators

Definition, Features, Resolution, Sensor classes based on output and data type, Sensor types- Light, Temperature, Force, Position, Speed, Sound, Chemical- Examples of Sensors- Ultra Sonic Sensor, Temperature sensor (Detailed study not required)- Sensor Errors,

Actuators-Definition, Principle of operation, Types, Soft Actuators, Examples – Relay Switch and solenoid valve (Detailed study not required)

Module 2: Introduction to Arduino

The Arduino Platform, Block diagram, Architecture, Pin functions, overview of main features such as I/O Ports, Timers, Interrupts, Serial port, PWM, ADC etc.

Module 3: Introduction to Arduino Programming.

Introduction to Arduino IDE, Arduino IDE and Sketch Overview , Understanding Arduino Syntax, Built in functions, Writing and saving program, compiling and uploading sketches.

Sample Programs – LED Blinking, Interfacing with switches, Serial communication.

Module 4: Introduction to IoT

Definition, Characteristics of IoT, Physical design of IoT, Logical design of IoT, Functional blocks of IoT,IoT service oriented architecture. Communication models & APIs.IoT&M2M(Machine to Machine), Difference between IoT and M2M,IoT networks, Software define Network

Module 5: Developing IoTs

Developing IoTs:- Introduction to different IoT tools, Developing applications through IoT tools, Developing sensor based application through embedded system platform, Implementing IoT concepts with python, Challenges in IoT:- Design challenges, Development challenges, Security challenges, Other challenges

Text Books:

1. Vijay Madisetti, ArshdeepBahga, “Internet of Things: A Hands-On Approach”
2. Programming Arduino Getting Started with Sketches by Simon Monk .
3. Arduino by Example by AdithJagadishBoloor

References:

1. J M Hughes, "Arduino :A technical Reference"
2. Jeremy Blum, "Exploring Arduino"

EL020304DESIGN AND PROGRAMMING LAB (VLSI AND ARDUINO)

Hours: 180
Credit: 4

VLSI LAB - VERILOG

I Simulation using SPICE tool

1. Inverter (CMOS - AC/ DC Analysis)
2. NAND and NOR Gates
3. Realization of XOR based on CMOS Transmission Gates
4. D Latch and Flip Flops

II Layout Design & Parasitic Extraction Using MAGIC or any Layout Editor

1. CMOS Inverter
2. NAND and NOR realization using CMOS

Experiments – Verilog (Icarus / cver including test bench)

1. Basic Gates
2. Adder / Subtractor
3. Flip Flop (D, JK,T)
4. Shift Registers (All types)
5. Parameterized Up-Down Counter
6. Parameterized Ring Counter
7. Parameterized Johnson Counter
8. N:1 Multiplexer
9. N Bit Gray Counter
10. N Bit Comparator
11. N Bit Adder-Subtractor
12. N Bit Signed Adder
13. N Bit Binary Decoder
14. N Bit Parity Generator
15. N Bit Priority Encoder
16. N Bit Parameterized Up Down Counter
17. (A) ABBA Pattern Detector (Mealy Machine)
18. (B) ABBA Pattern Detector (Moore Machine)
19. (A) 1011 Pattern Detector (Mealy Machine)
20. (B) 1011 Pattern Detector (Moore Machine)
21. AABB Pattern Detector (Moore Machine)
22. Traffic Signal Controller
23. Universal Shift Register
24. Pattern Generator
25. Sequential Parity Checker
26. Sequence Generator
27. GCD Calculator using FSM.

Arduino LAB

- LED Programmes
  - Blinking of LEDs.
  - LED fade-in and fade-out
  - Circling of LEDs.
  - Blinking of EVEN and ODD states of LEDs.
  - Traffic light system.
- Digital inputs.
  - Controlling LED using push button.
  - Use buttons/switches to perform different operations
- Analog inputs.
  - Changing the brightness of LEDs using potentiometers
  - Temperature sensor interface
- Digital output.
  - Switching ON a relay.
  - Seven segment display interface
  - Display a message on LCD screen and Scrolling of text.
  - Display the status of devices/switch on LCD
  - Controlling a DC motor, PWM.
- Advanced sensor interface
  - Interfacing with RF sensor
  - Interfacing with PIR sensor
  - Interfacing with Ultrasonic sensor
  - Displaying room temperature using LM 35 temperature sensor
- Interfacing with advanced devices/controllers
  - Stepper motor interface
  - RTC interface
  - GSM interface
  - GPS interface
  - Wifi/Bluetooth interface
  - Use of timers and interrupts for delay and periodic activities
  - RFID Tag reading
- Serial Communication (PC side use python, c or any programming language)
  - Send and receive data through serial interface
  - control devices from pc using serial interface
  - Read sensor values from pc using serial interface.

Controller design

- Each student should design a new and useful application using arduino or in VLSI and submit separate report.

VLSI, Arduino and Controller design are evaluated separately.

SEMESTER IV

Semester	Course	Course Title	Course	Hours	Credit

IV	EL020401	Image Processing	Core	5	**4**
	EL8xxxxx	Elective	Elective	5	**4**
	EL8xxxxx	Elective	Elective	5	**4**
	EL020402	Electronic Design & Simulation Lab	Practical	10	**4**
	EL020403	Project Work			**4**
	EL020404	Comprehensive Viva Voce			**3**
				Total Credit	**23**

ELECTIVE COURSES FOR MSc APPLIED ELECTRONICS

NAME OF THE PROGRAMME	GROUP-A		GROUP-B		GROUP -C	
	COURSE CODES	**NAME OF THE COURSES**	**COURSE CODES**	**NAME OF THE COURSES**	**COURSE CODES**	**NAME OF THE COURSES**
01 Electronics (M.Sc.)	EL830301	Introduction to virtual instrumentation and multi-paradigm programming languages	EL840301	Mobile Computing	EL810301	Robotics
	EL830402	Microelectronic Mechanical Systems	EL810402	Biomedical Electronics	EL820402	Nano Technology
	EL820403	Secure Communication	EL800403	Fiber Optic Communication Techniques	EL810403	Optical Sensor Technology

EL020401 IMAGE PROCESSING

Hours: 90

Credit: 4

Aim of the course: To introduce and familiarise the digital image and itsprocessing

MODULE I

Image representation and modeling - Characteristics of a digital image -Elements of visual perception - structure of the human eye – luminance - brightness - contrast - mach band effect - image fidelity criteria - classification of digital images, image file formats. Colour models - RGB, CMY, HIS

MODULE II

Image Transforms - 2D transforms: 2D signals, 2D systems, 2D transforms -convolution, Z transform, correlation, DFT, its properties, Walsh transform, Hadamard transform, Haar transform, Slant transform, DCT, KL transform and Singular Value Decomposition (SVD).

MODULE III

Image enhancement in spatial line, enhancement through point operation, types of point operators, histogram manipulation, linear gray level transformation, local and neighborhood operation, median filter, Image sharpening, image enhancement in frequency domain, homomorphic filter.

MODULE IV

Classification of Image segmentation techniques, region approach, clustering techniques, segmentation based on thresholding, edge based segmentation, classification of edges, edge detection- Prewitt, Sobel and Canny, Hough transform, active contour.

MODULE V

Image compression: need for compression, redundancy, classification of image compression schemes, Huffman coding, arithmetic coding, dictionary based compression, transform based compression, image compression standards - JPEG and MPEG.

TEXT BOOKS:

1. Gonzalez, R.C and Woods, R.E, Digital image processing Addition - Wesley.

2. Anil. K. Jain Fundamentals of digital image processing ,PHI.

REFERENCES:

1. Umbaugh, S.E Computer vision and image processing, Prentice Hall International, Inc.

2. William . K. Pratt, Digital image processing. Wiley inter science.

3. Jayaraman, Digital Image Processing.

ELECTIVE-GROUP A

EL830301 INTRODUCTION TO VIRTUAL INSTRUMENTATION AND MULTI-PARADIGM PROGRAMMING LANGUAGES

Hours: 54
Credit: 3

Aim of the Course: To understand the basic concepts of virtual instrumentation and multi-paradigm programming languages

MODULE I

Evolutions of VI, advantages, block diagram and architecture of a virtual instrument, data-flow techniques, Graphical programming, and comparison with conventional programming. Advantages of Virtual Instruments over conventional instruments – Hardware and software.

MODULE II

Graphical user interfaces – Controls and indicators – 'G' programming – Labels and Text – Shape, size and color – Owned and free labels – Data type, Format, Precision and representation – Data types – Data flow programming – Editing – Debugging and Running a Virtual Instrument – Graphical programming palettes and tools – Front panel objects – Functions and libraries.

MODULE III

Loops, WHILE Loops, CASE Structure, Formula nodes, Sequence structures – Arrays and Clusters– Array Operations – Bundle – Bundle/Unbundle by name, graphs and charts – String and file I/O – High-level and Low level file I/O's – Attribute modes Local and Global variables.

MODULE IV

Introduction to multi-paradigm programming- basic features, creating variables, mathematical functions, basic plotting - overview, creating simple plots, adding titles, axis labels, and annotations, multiple data sets in one plot, specifying line styles and colours. Matrix generation - Entering a vector, Entering a matrix, Matrix indexing, Colon operator, Linear spacing, Colon operator in a matrix, Creating a sub-matrix, Deleting row or column, Dimension, Transposing a matrix, Concatenating matrices in MATLAB, GNU Octave or Python.

MODULE V

Array operations - Matrix arithmetic operations, Array arithmetic operations, Solving linear equations, Matrix inverse, Matrix functions.

TEXT BOOKS:

1. Gary Johnson, Richard Jennings, “Lab VIEW Graphical Programming”, Third Edition, McGraw Hill, New York, 2006.
2. Sanjay Gupta and Joseph John, “Virtual Instrumentation using Lab VIEW”, Tata McGraw-Hill, First Edition, 2005.
3. “MATLAB A Practical Approach“ by Stormy Attaway.

REFERENCES

1. “Virtual Instrumentation using LabVIEW“ byJovitha Jerome second edition 2010.PHI Publishers, New Delhi.
2. Octave/Matlab Primer and Applications: EZ Guide to Commands and Graphics (GNU Octave Matlab Tutorial Series) by Dr S. Nakamura, Published by CreateSpace Independent Publishing Platform
3. GNU Octave Beginner's Guide by Jesper Schmidt Hansen, Packt Publishing.
4. Python Tricks: A Buffet of Awesome Python Features by Dan Bader, Publisher: Dan Bader
5. Python for Everybody: Exploring Data in Python 3by Dr. Charles Russell Severance (Author), Sue Blumenberg (Editor), Elliott Hauser (Editor). Publisher: CreateSpace Independent Publishing Platform.

EL830402 MICRO ELECTRO MECHANICAL SYSTEMS

Hour: 90
Credit: 4

Aim of the course: To familiarise MEMS, sensors, actuators and their operations

MODULE I: Introduction

Intrinsic Characteristics of MEMS – Energy Domains and Transducers- Sensors and Actuators – Introduction to Microfabrication - Silicon based MEMS processes – New Materials – Review of Electrical and Mechanical concepts in MEMS – Semiconductor devices – Stress and strain analysis – Flexural beam bending- Torsional deflection.

MODULE II: Sensors And Actuators-I

Electrostatic sensors – Parallel plate capacitors – Applications – Interdigitated Finger capacitor – Comb drive devices – Thermal Sensing and Actuation – Thermal expansion– Thermal couples – Thermal resistors – Applications – Magnetic Actuators – Micromagnetic components – Case studies of MEMS in magnetic actuators.

MODULE III: Sensors And Actuators-II

Piezoresistive sensors – Piezoresistive sensor materials - Stress analysis of mechanical elements – Applications to Inertia, Pressure, Tactile and Flow sensors – Piezoelectricsensors and actuators –piezoelectric effects - piezoelectric materials – Applications to Inertia , Acoustic, Tactile and Flow sensors.

MODULE IV: Micromachining

Silicon Anisotropic Etching – Anisotrophic Wet Etching – Dry Etching of Silicon – Plasma Etching – Deep Reaction Ion Etching (DRIE) – Isotropic Wet Etching – Gas Phase Etchants – Case studies - Basic surface micromachining processes – Structural and Sacrificial Materials – Acceleration of sacrificial Etch – Striction and Antistriction methods– Assembly of 3D MEMS – Foundry process.

MODULE V: Polymer And Optical MEMS

Polymers in MEMS– Polimide - SU-8 - Liquid Crystal Polymer (LCP) – PDMS – PMMA – Parylene – Fluorocarbon - Application to Acceleration, Pressure, Flow and Tactile sensors- Optical MEMS – Lenses and Mirrors – Actuators for Active Optical MEMS.

TEXT BOOKS.

1. Chang Liu, 'Foundations of MEMS', Pearson Education Inc., 2006.

2. James J.Allen, micro electro mechanical system design, CRC Press published in 2005

REFERENCES

1. NadimMaluf, " An introduction to Micro electro mechanical system design", ArtechHouse, 2000.

2. Mohamed Gad-el-Hak, editor, " The MEMS Handbook", CRC press Baco Raton, 2000

3. Tai Ran Hsu, "MEMS & Micro systems Design and Manufacture" Tata McGraw Hill, New Delhi, 2002.

4. Julian w. Gardner, Vijay k. varadan, Osama O.Awadelkarim,micro sensors mems and smart devices, John Wiley & son LTD,2002

EL820403 SECURE COMMUNICATION

Hour: 90
Credit: 4

Aim of the Course: To understand the security issues in data communication, encryption standards, cryptography techniques and ciphering.

Module 1

Introduction- Security Trends, OSI Security Architecture. Security attacks-Passive attacks, Active attacks. Security Services-Authentication, Access Control, Data Confidentiality, Data Integrity, Nonrepudiation, Availability Service, Security Mechanisms-Model for Network Security

Module 2

Classical Encryption Techniques -Symmetric Cipher model-Cryptography, Cryptanalysis. Substitution Technique -Caeser Cipher, Monoalphabetic Cipher, Playfair Cipher, Hill Cipher, Polyalphabetic Cipher, One time Pad, Transposition Techniques, Rotor Machines, Steganography

Module 3

Block Cipher Principles, Data Encryption Standard, Strength of DES, Differential and Linear Cryptanalysis, Block Cipher Design Principles.

Module 4

Finite Fields-Groups, Rings and Fields, Modular Arithmetic, The Euclidian Algorithm, Finite fields of the form GF(p),Polynomial arithmetic, Finite fields of the form GF(2^n)

Module 5

Advanced Encryption Standard. Confidentiality Using Symmetric Encryption -Placement of Encryption Function, Traffic Confidentiality, Key Distribution, Random Number Generation

Text Books:

1.”Cryptography and Network Security”, William Stallings,4thEdition, Pearson Education Inc.
2.”Cryptography Theory and Practice”, Douglas A Stinson,2ndEdition, Chapman & Hall, CRC press Company, Washington
3.”Security in Computing” Charles P. Pfleeger, Shari Lawrence Pfleeger, 4th Edition, Prentice Hall. 4.”Computer Security Basics” Debby Russell, G.T. Gangemi ,

ELECTIVES- GROUP B
EL840301 MOBILE COMPUTING

Hours: 54
Credit: 3

Objectives of the course:

- To introduce mobile computing technology,
- To know the various emerging technologies in mobile communications
- To familiarize the various mobile communication standards and applications

Module I: Introduction- Mobility of bits and bytes, wireless, mobile computing, middleware and gateways, application and services, security in mobile computing, standards, mobile computing architecture, internet ubiquitous network, architecture for mobile computing, three tier architecture, design consideration for mobile computing, mobile computing through internet. Mobile computing through telephony, evolution, multiple access procedure, satellite communication systems, mobile computing through telephone-TAPI

18 Hours

Module II: Emerging technologies- Bluetooth, RFID, WiMAX, Mobile IP, IP V.6, GSM-GSM architecture, GSM entities, call routing in GSM, PLMN interfaces, GSM addresses and identifiers, network aspects in GSM, mobility management, GSM frequency allocation, personal communication service, authentication and security, SMS, value added services through SMS, accessing the SMS bearer.

18 Hours

Module III: GPRS-GPRS and packet data network, GPRS network architecture, GPRS network operations, data services in GPRS, applications, limitations for GPRS, billing and charging, EDGE,WAP- MMS, GPRS applications. CDMA and 3G-introduction, spread spectrum technology, IS-95, CDMA Vs GSM, wireless data 3G networks, applications on 3G. Introduction to 4G network architecture

18 Hours

Module IV: Wireless LAN- Introduction, advantages, IEEE 802.11 standard, wireless LAN architecture, mobility in wireless LAN, deploying wireless LAN, mobile adhoc-networks and sensor networks, wireless LAN security, wireless access in vehicular environment, wireless local loop, hyper LAN, Wi-Fi Vs 3G. Intelligent networks and inter networking- introduction, fundamentals of call processing, intelligence in the network, SS#7 signalling, IN conceptual model, softswitch, programmable networks, technologies and interfaces for IN, SS7 security, MAPsec, VPN., VOIP-H.323 framework for VOIP, SIP, comparison between H.323 and SIP, real time protocols, convergence technologies, call routing, Applications.Introduction to LTE architecture.

18 Hours

Text Book: Mobile Computing- Technology, Applications and Service Creation, Asoke K Talukder, Hasan Ahmed, Rupa R Yavagal, Second Edition, Mc Graw Hill Education.

Reference books/articles:1. Mobile Computing-Kumkum Garg, Ebook
2. Fundamentals of Mobile Computing Paperback – 2012
by Prasant Kumar PattnaikRajib Mall
3.Web:http://www.cse.unt.edu/~rdantu/FALL_2013_WIRELESS_NETWORKS/LTE_Alcatel_White_Paper.pdf

EL810402 BIOMEDICAL ELECTRONICS

Hours: 90
Credits: 4

Objectives of the Course:

- To understand the basics of instrumentation and various biomedical sensors
- To understand the measurement of physiological quantities
- To familiarize the various instrumentation related to biomedical equipment

Module I:

Introduction to Biomedical Instrumentation, Bio signals and Electrodes

Role of Technology in Modern Healthcare—Role of Biomedical Engineer—Man-Instrument System—Origin of Bio signals—Classification of Biomedical Instruments—Performance Parameters of Instruments—Physiological System—Bio-potential Electrodes; Electrode-Electrolyte Interface, Half-cells and their Potentials, Silver-Silver Chloride Electrodes, Biomedical Recording Electrodes, Circuit Model of Electrodes—Bioelectric Amplifiers—Errors in Measurement System

18 Hours

Module II:.

Transducers & Biosensors

Introduction—Classification of Transducers—Performance Characteristics of Transducers—Displacement, Position and Motion Transducers (Potentiometric, Variable Capacitance, Variable Inductance, LVDT, Linear Encoders, Piezo-electric) — Pressure Transducers (LVDT, Strain Gauge) — Transducers for Body Temperature Measurement (Thermocouples, Electric Resistance Thermometer)—Thermistors (Radiation Thermometry, Silicon Diode, Chemical Thermometry)—Photoelectric Transducers (Photovoltaic, Photo emissive, Silicon Diode, Diode Arrays)—Optical Fiber Sensors (Advantages & Types)—Biosensors—Smart Sensors

18 Hours

Module III:

Physiological Systems and Measurements

Cardiovascular System—Blood Pressure and its Measurement—Blood Flow Meters—Pulse Oximeter--Heart Sound and its Measurement—ECG; Leads and Electrodes of ECG,ECG Waveform, ECG Recorder, Holter Monitor—VCG—Cardiac Stress Test--Respiratory System—Spirometry

Anatomy and Organization of Brain—EEG; Origin of EEG Signal, EEG Signal Recording, EEG Artefacts, EEG Wave Analysis, EEG Evoked Potentials, Limitations of EEG—EMG; Application of EMG,EMG Procedure and Signal Analysis, Nerve Conduction Study—Audiometer.

18 Hours

Module IV:

Clinical Laboratory Instruments, Imaging Techniques and Patient Monitoring Systems

Tests on Blood—Blood Gases—Auto Analyzers—Electrophoresis—Colorimeter—Spectrophotometer—Flame Photometer—Ultrasonic Imaging—CT Scan; EBCT—MRI—Thermal Imaging System—Artificial Cardiac Pacemaker—Defibrillator—Ventilator—Diathermy—Computer Assisted Patient Monitoring System—Measurement of Heart Rate—Measurement of Blood Pressure—Measurement of Respiratory Rate—Intelligent Patient Monitoring

18 Hours

Module V:

Laser Applications, Telemedicine and Patient Safety

Role of Lasers in Healthcare—Laser Interaction with Tissue and Surgical Procedure—Laser Doppler Blood Flowmeter—Laser for Eye Surgery—Laser Lithotripsy—Laser in Dentistry—Lasers in Dermatology-Ray System.

Telemedicine and its Applications—Patient Safety and Biomedical Equipment—Physiological Effect of Electricity—Shock Hazards—Classification of Medical Devices and their Safety Standards—Accident Prevention Methods

18 Hours

Text Books:

1. Introduction to Biomedical Instrumentation—Mandeep Sing—PHI Publication(Module 1,3,4,5)
2. Hand Book of Biomedical Instrumentation—R.S.Khandpur, Second Edition-McGraw Hill Education (Module 1,2,3,4)
3. Biomedical Instrumentation and Measurements—Leslie Cromwell, Second Edition—PHI Publication (Module 1,2,3)

EL800403 OPTICAL FIBER COMMUNICATION SYSTEMS

Total Hours: 90
Total Credits: 4

Objectives of the course:

- To get a basic understanding of fundamental principles of Optical Fiber Technology, different Multiplexing Techniques
- To familiarize the different Testing Equipment for optical fiber communication
- To understand the fiber optic network basics

Module I:

Introduction, Fibre Structures & Wave guiding

Overview of Optical Fiber Communications—Advantages of Optical Fibers—Optical Spectral Bands—Key Elements of Optical Fiber System—Basic Optical Laws and Definitions—Optical fiber Modes and Configurations: Fiber Types, Rays& Modes, Step Index Fiber Structure, Wave Representation—Mode Theory for Circular Waveguides: Overview of Modes, Maxwell's Equations, Waveguide Equations, Wave equations for Step-Index Fibers— Single Mode Fibers—Graded-Index Fibre Structure—Fiber Materials—Fiber Fabrication-- Fiber Optic Cables

18 Hours

Module II:

Signal Degradation in Optical Fibers &Optical Sources

Attenuation: Attenuation Units, Absorption, Scattering Losses, Bending Losses, Core and Cladding Losses—Signal Distortion in Fibers: Intramodal Dispersion, Group Delay, Material Dispersion, Waveguide Dispersion, Polarization-Mode Dispersion

Light Emitting Diodes(LEDs): LED Structure, Light Source Materials—Laser Diodes: Laser Diode Modes and Threshold Conditions, Laser Diode Rate Equations, Laser Diode Structure and radiation Patterns, Single Mode Lasers—Reliability Considerations

18 Hours

Module II:

Power Launcing , Coupling & Photodetectors

Power Launching—Source to Fiber Power Launching: Source Output Patterns—Lensing Scheme for Coupling Improvement: Nonimaging Microsphere, Laser-Diode to Fiber Coupling—Fiber-to-Fiber Joints: Mechanical Misalignment, Fiber End-Face Preparation—Fiber Splicing: Splicing Techniques—Optical Fiber Connectors: Connector Types

Photo Detectors—Physical Principles of Photodiodes: The *pin* Photo-detector, Avalanche Photodiode—Detector Response Time: Depletion Layer Photocurrent, Response Time—Comparisons of Photodetectors—Solar Cells

18 Hours

Module IV:

Optical Networks

Optical Networks—Network Concepts: Network Terminology, Network Categories, Network Layers, Optical layers—Network Topologies—WDM & Operational Principles--SONET/SDH: Transmission Formats and Speeds—High Speed Light Wave Links—Optical Add/Drop Multiplexing; OADM Configurations

18 Hours

Module V:

Measurement & Monitoring Techniques

Optical Switching: Optical Cross connect Performance Measurement and Monitoring—Basic Test Equipment: Test Support Lasers, Optical Spectrum Analyser, Multiple Function Testers, Optical Power Attenuators, Conformance Analyser Visual Fault Indicator—Optical Power Measurements: Definition of Optical Power, Optical Power Meters—Eye Diagram Tests— Optical Time-Domain Reflectometer(OTDR).

18 Hours

Text Book

Optical Fiber Communication—Gerd Keiser—Fourth Edition—Mc Graw Hill Publication

Reference Text Books

3. Optical Fiber Communications—John M.Senior—Third Edition—Pearson Education
2. Semiconductor Optoelectronics Sevices—Pallb Bhattacharya—Secod Edition—PHI Publication
4. Electronics Communication Systems--Wayne Thomasi,--5th Edition--Pearson Publication.

ELECTIVES- GROUP C EL810301 ROBOTICS

Hour: 54

Credit: 3

Aim of the course: To introduce Robotics, its kinematics, various actuators, sensors and automation

MODULE I:INTRODUCTION:

Robotics and programmable automation, historical background, laws of robotics, robot definition, robot anatomy and systems, human systems and robotics.specification of robotics

MODULE II:ROBOT KINEMATICS

Introduction, forward and reverse kinematics of three degree of freedom robot arm, forward and reverse transformation of a four degrees of freedom manipulator in 3-D, homogeneous transformations kinematic equation using homogeneous transformations.

MODULE III:ROBOT DRIVES, ACTUATORS AND CONTROL

Function of drive systems, general types of fluids, pump classification, pneumatic system, electrical drives, DC: motors, stepper motor and drives mechanisms

MODULE IV:ROBOT END-EFFECTORS

Classification of end-effectors, drive system for grippers, mechanical, magnetic, vacuum and adhesive grippers, hooks, scoops and others devices, active and passive. Grippers

MODULE V:SENSORS AND INTELLIGENT ROBOTS

Artificial intelligence and automated manufacturing, AI and robotics, need for sensing systeMS, sensory devices, types of sensors, robot vision systems

TEXT BOOKS:

l. Robotics Techology And Flexible Automation , S.R. Deb

From Tata Mc Graw Hill

REFERENCES

l. Robotics Principles And Practice Dr. K.C. Jain and Dr. L.N. Aggarwal, Khanna Publishers

2. Introduction To Robotics, Mechnics and Control, John J. Craig, Addison Wesley

EL820402 NANOTECHNOLOGY

Hours: 90
Credits: 4

Objectives of the Course:

- To familiarize the nanoscience and nanotechnology materials
- To understand the nanofabrication process
- To get an idea about nanoscale characterization and various applications of nanotechnology

Module I:

Introduction to nanotechnology : Foundations in nanosciences-Introduction- Scientific Revolutions-Basic Science Behind Nanotechnology-Nanometre: How big or small-Nanotechnology-Materials at nanoscale-Quantum Confinement in Nanomaterials-Rationale Behind the Downsizing of the Materials-Prime materials in Nanotechnology- Nanomaterials: natural and man-made-Semiconductor nanomaterials-Polymers and Composites-Metal nanoparticles-Biomaterials-Unique properties of nanomaterials-Microstructure and defects in monocrystalline materials-Effect of nano dimensions on material behaviour(magnetic, electrical, optical and thermal properties).

25 Hours

Module II:

Nano fabrication :Introduction-Synthesis of Nanopowders using Top down and Bottom up methods-Top down fabrication methods-Arc discharge method-Laser Ablation method –Ball Miling-Inert gas Condensation-Bottom up fabrication methods- Homogenous nucleation-CVD-MBE-Sol Gel method-Hydro thermal Synthesis-Microwave method-Challenges in fabrication.

25Hours

Module III :

Nanoscale characterization-Introduction-XRD (principle and theory) –SEM, TEM, AFM, STM (principle, construction and working, advantages and disadvantages)- Raman spectroscopy (principle, construction and working)-Nano indentation.

20 Hours

Module IV :

Application of nanomaterials -Nano electronics and electronics applications-MEMS/NEMS-Nanosensors-Nanocatalysts and Nanochemistry- Nanophotonics– Nanocomputers-Nanobiotechnology- Nanomedical applications- Food and Agriculture Industry-Cosmetics and Consumer Goods- Structure and Engineering-Automotive Industry-Water Treatment and The Environment- Textiles-Paints-Energy-Defence and Space Applications-

Structural Applications. Nanostructured materials with high application potential- Quantum wells- Quantum dots-Carbon nanotubes –GaNnano wires-Multilayered films.

20 Hours

Text books:

1. Nanotechnology : The Science Of Small-M.A Shah & K.A Shah ,WileyPublication -First Edition 2013 (Module 1,2,3)
2. Textbook Of Nanoscience And Nanotechnology -B S Murty,P Shankar, Baldev Raj, B Rath And James Murday- Universities Press,First Edition 2012.(Module 1,2,3,4)
3. Introduction To Nanotechnology-Charles P .Poole, Jr., Frank J. Owens- Wiley IndiaEdition 2012 .(Module 4)

Reference text books:

1. Introduction To Nanoscience And Nanotechnology- K.K. Chattopadhyay,A.N.Banerjee-Phi Publication ,Fourth Printing 2012.(module 2,3,4)
2. Nano : The Essentials- T.Pradeep- McGraw Hill Education, Seventh Reprint 2012.(Module 1,3,4)
3. Nanotechnology: Basic Science And Emerging Technologies-Mick Wilson,KamaliKannangara,GeoffSmith,michelleSimmons,BurkhardRaguse-Overseas Press2005 (Module 1,2,3,4)
4. Nanotechnology – A Gentle Introduction to the Next Big Idea-Mark Ratner ,Daniel Ratner,Pearson Education Inc.

EL810403 OPTICAL SENSOR TECHNOLOGY

Contact Hours: 90
Credits: 4

MODULE 1 **18 Hours**

Light beam as a sensing tool- simple optical sensors- single and double optic sensorsmeasurementsof small displacements- radius of curvature-lamp and scale arrangement- angle ofrotation - speed of rotation - stroboscope, method of Triangulation, projected fringe technique,lidar for atmospheric remote sensing. lidar equation.

MODULE 2 **18 Hours**

Interferometry for precision measurements, two-beam interferometry, Michelson interferometer,ringe displacement and fringe counting, heterodyne interferometer, super heterodyne interferometry, electron speckle pattern interferometry photo-elasticmeasurements. Moiretechnique.

MODULE 3 **18 Hours**

Optical fibre sensors - general features- types of OFS- intrinsic and extrinsic sensors, shutterbased multimode OFS —simple fibre based sensors for displacement, temperature and pressuremeasurements- reflective FOS and applications, Fibre Bragg grating based sensors.Light transmission in microbend fibres- microbend OFS- measurements with microbend sensorsevanescentwave phenomenon- evanescent wave FOS- chemical sensors using EWFOSdistributedsensing with FOS- OTDR and applications, FO smart sensing.

MODULE 4 **18 Hours**

Interferometric FOS- basic principles- interferometric configurations- Mach-Zender, Michelsonand Fabri-Perot configurations- component, and construction of interferometic FOSapplicationsof interometric FOS- Sagnac interferometer- fibre gyro, OTDR and applications.

Text Books

1) Fibre Optic Sensors- B D Gupta
2) Fundamentals of Fibre Optics in Telecommunications and Sensor Systems- B.P. Pal, Wiley Eastern(1994)
3) Optics –AjoyGhatak, Tata McGraw Hill, 3 rd Ed (2005)
4) Lasers, Theory and Applications - Ghatak&Thyagarajan, Mcmillan India Ltd (2002)
5) Optical measurement techniques and applications- P K Rastogi. Artech House (1997)
6) Optical Fibre sensors, components and subsystems Vol. 3- Brain Culshaw and John Dakin, Artech House Inc. (1996) 7.
7) Optoelectronic Devices and Systems- S C Gupta, PHI (2005)

EL020402 ELECTRONIC DESIGN & SIMULATION LAB

Hour: 180
Credit: 4

Objectives of the course: To introduce the students to FOSS environment, FOSS tools for electronic design and simulation, open-source electronics prototyping platform and open source hardware IP-cores.

1. Familiarization of Free and Open Source Software environment and FOSS tools for electronic design
    1. Verilog simulation and synthesis tool - Icarus Verilog
    2. Open-source simulator for the VHDL language – GHDL
    3. ECAD (electronic CAD) or EDA (electronic design automation) application suite – gEDA
    4. Mixed-level/mixed-signal circuit simulator – Ngspice/Qucs
    5. Interactive editor for VLSI layouts – MAGIC
    6. CAD tools for the specification, design and validation of digital VLSI circuits Alliance
    7. EDA software suite for the creation of schematics and printed circuit board – KiCAD
    8. Free software integrated development environment for microcontrollers based on 8051 – MCU 8051 IDE
    9. High-level programming language, for numerical computations – QtOctave

2. Open-source electronics prototyping platforms
    1. Arduino - an open-source electronics prototyping platform based on flexible hardware and software
    2. Beagle board – ARM based open hardware design
    3. PI DEVICES

3. Open source hardware IP cores, SoC etc.
    1. Study of arithmetic cores such as 8bit microprocessor cores, Open RISC ASIC,
    2. signal processing cores etc.

4. Web Design
    1. Basic concepts of web design.
    2. Control devices using web interface by any of the open source electronic prototype
    3. Monitor remote activities and device status via web interface