Alignment of SRU IoT courses with ARM university courses

S. No.	Year / Sem	Course Name
1.	II-II	Introduction to IoT
2.	III-I	Microcontroller for Embedded System
3.	III-I	Microcontroller for Embedded System Lab
4.	III-I (PE-I)	Computer Architecture
5.	III-II	Distributed IoT System
6.	III-II	Distributed IoT System Lab
7.	III-II	Digital Signal Processing
8.	III-II	Digital signal processing lab
9.	IV-I	Cloud Computing
10.	IV-I	Embedded Linux
11.	IV-I	VLSI Design and Technology
12.	IV-I	VLSI Design and Technology Lab
13.	IV-I (PE-4)	Low Power VLSI
14.	IV-II (PE-5)	Security in IoT
15.	IV-II (PE-5)	Introduction to Robotics Systems
16.	IV-II (PE-5)	Estimating the IoT Projects and Project management
17.	IV-II (PE-6)	Graphics and Mobile Gaming

INTRODUCTION TO IOT

Year /Sem: II-II

Unit-I

Introduction: What is IoT, Genesis of IoT, IoT and Digitization, IoT Architecture, IoT Impact, Convergence of IT and oT, IoT Challenges, IoT Network Architecture and Design, The Core IoT Functional Stack, IoT Data Management and Compute Stack.

Unit-II

IoT Physical Devices #1:

System on chip Architechure Overview, Programming and Debugging, General Purpose Input output, Interrupts, Timers

Unit-III

IoT Physical Devices #2:

SoC Additional Interfaces - Analog to Digital Converter, Digital to Analog to Converter, Pulse Width Modulation. Implementation of SoC Addional interfaces using Sensors and Actuators

Unit-IV

IoT Device Networking #1

On-chip communications Protocols - USART, I2C, SPI. Industrial Networking - RS482 and MODBUS, Vechicle Networking Standards

Unit-V

IoT Device Networking #2

Wireless Interfaces - GPS, RF, Bluetooth, WIFI, LoRa, Implementing the wireless interfaces

Text Books:

1. IoT Fundamentals - Networking Technologies, Protocols and Use Cases for the Internet of Things (English, Paperback, Rowan Trollope, David Hanes, Patrick Grossetete, Jerome Henry, Rob Barton, Gonzalo Salgueiro)
2. ArshdeepBahga and Vijay Madisetti, “Internet of Things – A Hands on Approach”,Universities Press, 2015.
3. Foundational Elements of an IoT Solutions: The Edge, The Cloud Application Development, Joe Biron and Jonathan Follett.

Reference Books:

1. Rethinking the Internet of Things: A Scalable Approach to Connecting Everything, by Francis daCosta, ISBN: 978-1-4302-5740-0, 2013
2. Architecting the Internet of Things, by Dieter Uckelmann, Mark Harrison and Florian Michahelles, ISBN: 978-3-642-19157-2, 2011
3. Marco Schwartz, “Internet of Things with the Arduino Yun”, Packt Publishing, 2014

MICROCONTROLLER FOR EMBEDDED SYSTEM

Year /Sem: III-I

UNIT I

Introduction

Introduction,8/16/32 bit microprocessors and controllers Microcontroller vs. Microprocessor.

CORTEX-M0+ Processor Core

Microcontroller vs. Microprocessor, Cortex-M0+ Core, Architectures and Memory Speed, Instruction Set, Modes for Addressing Memory, KL25Z GPIO Ports,

UNIT II

C Code as Implemented in Assembly Language

Programmer's World: The Land of Chocolate!, Processor's World, Program Translation Stages, Examining Assembly Code before Debugger, A Warning About Code Optimizations, Application Binary Interface, Using Registers - AAPCS Register Use Conventions, AAPCS Core Register, Memory requirements, accessing data in Memory

UNITIII

InterfacingAnalog Interfacing

Analog to Digital conversion concepts, Digital to Analog Converter, Timers.

Serial Communication

Overview, Software Structure – Handling asynchronous Communication, Software Structure – Parsing Messages, KL25Z and Freedom Specifics, Asynchronous serial (UART) Communications, SPI Communications, I2C Communications, Protocol Comparison

UNITIV

Interrupts

Exception and Interrupt Concepts - Example System with Interrupt, Example Program Requirements & Design, Example Exception Handler, Types of interrupts, Interrupt service routine (ISR).

UNITV

Embedded Systems Design

Introduction, Options for Building Embedded Systems, Example Embedded System: Attributes of Embedded Systems, MCU Hardware & Software for Concurrency, , Impact of Constraints, Target Board - FRDM-KL25Z, CPU Scheduling, Scheduling Approaches, Event-Triggered Scheduling using Interrupts, Static Schedule Example, Dynamic Schedule, Common Schedulers – (Cyclic executive - non-preemptive and static, Run-To-Completion Scheduler, Preemptive Scheduler) Task State and Scheduling Rules,

Text books

1. Embedded Systems Fundamentals on Arm Cortex-M based Microcontrollers: A Practical Approach by Alexander G. Dean
2. The Designer's Guide to the Cortex-M Processor Family: A Tutorial Approach by Trevor Martin

3. The Definitive Guide to the ARM Cortex-M0 by Joseph Yiu
4. The Definitive Guide to ARM® Cortex®-M3 and Cortex®-M4 Processors, Third Edition by Joseph Yiu

References

1. Joseph Yiu, "The definitive guide to ARM Cortex-M3", Elsevier, 2nd Edition
2. VenkatramaniB. and Bhaskar M. "Digital Signal Processors: Architecture,Programming and Applications" , TMH , 2nd Edition
3. Sloss Andrew N, Symes Dominic, Wright Chris, "ARM System Developer's Guide: Designing and Optimizing", Morgan KaufmanPublication.
4. Steve furber, "ARM System-on-Chip Architecture", PearsonEducation
5. White Paper: Cortex-M for Beginners - An overview of the Arm Cortex-M processor family and comparison
6. Technical references and user manuals on www.arm.com, NXPSemiconductor www.nxp.com and Texas Instruments www.ti.com

MICROCONTROLLER FOR EMBEDDED SYSTEM LAB

Year /Sem: III-I

LIST OF EXPIREMENTS

CYCLE-I

1. Processing Text in Assembly Language
2. C as implemented in Assembly Lab Exercise
3. General Purpose I/O Lab Exercise: Basic User Interface,

CYCLE-II

4. ADC Lab Exercise: Voltage Monitor
5. DAC Lab Exercise: Signal Generator
6. Timer Lab Exercise: Signal Generator with Precision Timing and Buffering
7. Serial Communications Lab Exercise: Performance Analysis
8. Interrupt Lab Exercise: Stack Use and Timing Behavior

CASE STUDY:

Develop microcontroller based Embedded systems

COMPUTER ARCHITECTURE

(Professional Elective-1)

Year/Sem: III-I

UNIT- I

Fundamentals of Computer Design: Fundamentals of Computer design, Changing faces of computing and task of computer designer, Technology trends, Cost price and their trends, measuring and reporting performance, quantitative principles of computer design, Amdahl's law. Instruction set principles and examples- Introduction, classifying instruction set- memory addressing- type and size of operands, operations in the instruction set.

UNIT – II

Pipelines: Introduction, basic RISC instruction set, Simple implementation of RISC instruction set, Classic five stage pipe line for RISC processor, Basic performance issues in pipelining, Pipeline hazards, Reducing pipeline branch penalties.

Memory Hierarchy Design: Introduction, review of ABC of cache, Cache performance, Reducing cache miss penalty, Virtual memory.

UNIT - III

Instruction Level Parallelism the Hardware Approach: Instruction-Level parallelism, Dynamic scheduling, Dynamic scheduling using Tomasulo's approach, Branch prediction, high performance instruction delivery- hardware based speculation.

UNIT – IV

Multi Processors and Thread Level Parallelism: Multi Processors and Thread level Parallelism- Introduction, Characteristics of application domain, Systematic shared memory architecture, Distributed shared – memory architecture, Synchronization.

UNIT – V

Inter Connection and Networks: Introduction, Interconnection network media, Practical issues in interconnecting networks, Examples of inter connection, Cluster, Designing of clusters.

TEXT BOOK:

1. John L. Hennessy, David A. Patterson, "Computer Architecture: A Quantitative Approach", 3rd Edition, Elsevier.
2. John P. Shen and Miikko H. Lipasti, "Modern Processor Design: Fundamentals of Super Scalar Processors", 2002, Beta Edition,McGraw-Hill

REFERENCE BOOKS

1. Kai Hwang, Faye A.Brigs., "Computer Architecture and Parallel Processing", Mc GrawHill.
2. DezsoSima, Terence Fountain, Peter Kacsuk, "Advanced Computer Architecture - A Design Space Approach", PearsonEducation.

DISTRIBUTED IOT SYSTEMS

Year/Sem: III-II

Unit-I

Smart Objects: The "Things" in IoT, Sensors, Actuators, and Smart Objects, Hardware Communications Criteria (Ethernet, Wi-Fi, Bluetooth, Zigbee) M2M To IOT -M2M Vs IOT

Unit-II

Communication & Networking Technologies in IoT: Introduction Sensor Networks, Network Layer Model(OSI or TCP/IP), Network Topologies, Communication Models; Wired: RS232, RS485, CAN, Ethernet. Wireless: Bluetooth, WLAN, GPS, LoRa, Cellular.

Unit-III

IoT Gateway: Introduction Gateway, Edge vs Fog Computing, Communication Models - Edge, Fog and M2M, Data Exchange Formats(JSON, XML), MQTT Protocol, HTTP REST, CoAP, XMPP and AMQP, Protocol Interoperability & Bridging, Data Aggregation using Gateway.

Unit-IV

Real-Time Operating System: Introduction, Real-Time Systems Concepts, Kernel Structure, Task Management, Semaphores, Mutual Exclusion (MUTEX), Message Mailbox, Message Queue, Memory Management, Porting RTOS.

Unit-V

Case Studies: Smart and Connected Cities, An IoT Strategy for Smarter Cities, Smart City IoT Architecture. IoT Wearables, Health care systems, Agri and Allied sectors.

Text Books:

1. Hands-On Industrial Internet of Things: Create a powerful Industrial IoT infrastructure using Industry 4.0 - by Giacomo Veneri and Antonio Capasso.
2. Mastering the FreeRTOS Real Time Kernel – a Hands On Tutorial Guide

References:

1. Rethinking the Internet of Things: A Scalable Approach to Connecting Everything, by Francis daCosta, ISBN: 978-1-4302-5740-0, 2013
2. Architecting the Internet of Things, by Dieter Uckelmann, Mark Harrison and Florian Michahelles, ISBN: 978-3-642-19157-2, 2011 Arduino Yun", Packt Publishing, 2014.
3. IoT and Edge Computing for Architects: Implementing edge and IoT systems from sensors to clouds with communication systems, analytics, and security, 2nd Edition by Perry Lea.

DISTRIBUTED IoT LAB

Year/Sem: III-II

List of Experiments:

1. Understanding the Distributed System
2. IoT System - Thing, Gateway, Server/Cloud.
3. Working with Various Types of Sensors.
4. Wired protocols: RS232, RS485
5. Wireless protocols: Bluetooth, WLAN, GPS, LoRa, Celluar
6. IoT Gateway: Data Exchange Formats (JSON, XML).
7. MQTT Protocol
8. HTTP REST, CoAP
9. XMPP and AMQP
10. RTOS (Real-Time Operating System)

DIGITAL SIGNAL PROCESSING

Year/Sem : III-II

UNIT-I

Discrete-Time Fourier Transform (DTFT)

Introduction**,** Discrete-Time Signals, and Systems,Discrete-Time Fourier Transform, Frequency domain representation of discrete-time signals and systems, Properties.

UNIT-II

Discrete Fourier Transform (DFT)

Computation of DFT, Properties of DFT, Linear convolution, Circular convolution of sequences.
Fast Fourier Transform (FFT): Derivation of Radix-2 FFT algorithms: Decimation in Time, Decimation in Frequency, Inverse FFT.

UNIT-III

IIR Digital Filters

Analog filter approximations, Butterworth and Chebyshev, design of IIR digital filters from analog filters: Impulse Invariant Techniques, Bilinear transformation method, Realization of IIR Digital Filters – Direct, Canonic, Cascade and Parallel forms.

UNIT-IV

FIR Digital Filters

Characteristics of FIR digital filters, frequency response, Design of FIR digital filters: Fourier method, window techniques,Realization of FIR Digital Filters – Transversal Structure, Linear Phase Realization, comparison of IIR and FIR filters.

UNIT V

Adaptive Filters

Basic adaptive FIR filter, cost function , Steepest Descent and the Least Means Squares (LMS) algorithm.Pros and cons of using the LMS algorithm.

Text books

1. John G. Proakis and Dimitris G. Manolakis, “Digital Signal Processing, Principles, Algorithms and Applications”, Pearson Education / PHI, 4th Edition, 2007.
2. Mithra, “Digital Signal Processing”, McGraw Hill Publications.

Reference Books

1. Li Tan, “Digital Signal Processing- Fundamentals and Applications”, Elsevier, 2008.
2. Robert J. Schilling and Sandra L. Harris, “Fundamentals of Digital Signal Processing Using Matlab”, Thomson, 2007.
3. Ramesh Babu P, “Digital Signal Processing”, SciTech, 4th Edition, 2013.

4. Digital Signal Processing using Arm Cortex-M based Microcontrollers: Theory and Practice https://www.arm.com/resources/education/textbooks/dsptextbook
5. Digital Signal Processing Using the ARM Cortex M4 Paperback by Donald S. Reay

DIGITAL SIGNAL PROCESSING LAB

Year/Sem : III-II

LIST OF EXPERIMENTS

DEMO EXPERIMENTS:

I. Introduction

1. Generation of Sinusoidal signal based on recursive difference equations

II. Multirate signal processing

1. Decimation process
2. Interpolation process
3. I/D sampling rate converters

III. Adaptive Filters

1. Implements an adaptive FIR filter for system identification.
2. Evaluate an adaptive filter that applies the Least Mean Squares (LMS) algorithm

STRUCTURED EXPERIMENTS:

IV. Computation

1. To find DFT / IDFT of given DT signal
2. To find the frequency response of a given system given in (transfer function/differential equation form)
3. Implementation of FFT of a given sequence
4. Determination of the power spectrum of a given signal(s)

DESIGN EXPERIMENTS:

V. Implementation

1. LP FIR filter for a given sequence
2. HP FIR filter for a given sequence
3. LP IIR filter for a given sequence
4. HP IIR filter for a given sequence

OPEN-ENDED EXPERIMENTS (EXAMPLE):

VI. Open-ended problem

1. An audio application such as to plot a time and frequency display of microphone plus a cosine using DSP, Read a wav file, and match with their respective spectrograms
2. Noise removal: add noise above 3KHz and then remove, interference suppression using 400Hz tone.

CLOUD COMPUTING

Year/Sem: IV-I

Unit-I
INTRODUCTION:
Introduction to Cloud Computing-Definition, Evolution of Cloud Computing, Underlying Principles of Parallel and Distributed Computing, Characteristics, Components

Unit-II
CLOUD COMPUTING SERVICES: Cloud provider, SAAS, PAAS, IAAS and other Organizational scenarios of clouds.

Unit-III
RESOURCE MANAGEMENT AND SECURITY IN CLOUD: Inter Cloud Resource Management – Resource Provisioning and Resource Provisioning Methods – Global Exchange of Cloud Resources – Security Overview – Cloud Security Challenges – Software-as-a-Service Security – Security Governance – Virtual Machine Security – IAM – Security Standards.

Unit-IV
CLOUD DEPLOYMENT: Deploy application over cloud. Comparison among SAAS, PAAS, IAAS

Unit-V
Edge and Fog Computing: Introduction to Edge Computing Scenario's and Use cases - Edge computing purpose and definition, Edge computing use cases, Edge computing hardware architectures, Edge platforms. Introduction to Fog Computing, Characteristics, Application Scenarios, Issues, and challenges.
Fog Computing Architecture: Communication and Network Model, Programming Models,
Edge vs Fog Computing, Communication Models - Edge, Fog and M2M.

Text Books:

1. Barrie Sosinsky ,"Cloud Computing Bible", Wiley-India, 1st Edition, 2011.
2. Toby Velte , Anthony Velte , Robert C. Elsenpeter, "Cloud Computing: A Practical Approach", Tata McGraw Hill, 1 st Edition, 2009.
3. Kumar Saurabh, ”Cloud Computing”, Wiley India, 1st Edition, 2016.

References:

1. George Reese, “Cloud Application Architectures: Building Applications and Infrastructure in the Cloud”, O'reilly, 1 st Edition, 2009.
2. John W. Rittinghouse, James F. Ransome, “Cloud Computing Implementation, Management, and Security”, CRC Press, 1st Edition, 2009.

EMBEDDED LINUX

Year/Sem : IV-I

Unit-I

Linux and Embedded Systems: An Introduction

What is an Embedded System?, Embedded system components, Basic software, Operating systems for embedded systems, Why Linux-based embedded systems?, Linux evolution, Linux-based embedded system: examples

Linux-based embedded system components, Reference hardware model, implementations, CPU memory map, The role of the bootloader, An example of bootloader operations, Linux kernel, Device tree, System programs, Application, Typical layout of the root filesystem

Unit-II

Anatomy of a Linux-based System

Linux architecture, Conceptual view of the kernel, Process scheduler, Memory manager, external interfaces, Memory manager architecture, Virtual file system, i-node, File interface, Virtual file system architecture, Inter-process communication, Inter-process communication architecture

Unit-III

Configuration & Build Process of an Embedded Linux System

Introduction, The workflow, Build systems, Buildroot vs Yocto – general aspects, Buildroot vs Yocto – configuration, The build system workflow – configuration files, The build system workflow – user configuration, Machine (BSP) configuration, Distribution policy, source fetching, patching, configure/compile/install, output analysis/packaging, image generation, SDK generation

Unit-IV

Introduction to Linux kernel modules

Introduction, CPU – I/O interface, CPU – I/O interface with polling, CPU – I/O interface with interrupt, CPU – I/O interface latency, Direct memory access (DMA) architecture, Direct memory access (DMA) transfer modes, I/O taxonomy, Typical operations, Linux devices, The Virtual File System (VFS) abstraction, VFS, VFS functions – include/linux/fs.h, The device file concept, Linux kernel modules

Unit-V

Communication Between Kernel and User Space

Introduction, The reference use case, The CPU/Device interface, The module level, file operations, implementation, The module level – open()/release(), read() implementation, Passing data to/from the kernel, The module level – write() implementation, The module level – communication with the device, Memory mapped I/O, Memory mapped I/O – initialization, Memory mapped I/O – clean-up, Memory mapped I/O – read, Memory mapped I/O – write, GPIO-based I/O, GPIO-based I/O – initialization, GPIO-based I/O – clean-up, GPIO-based I/O – read, GPIO-based I/O – write, Interrupts, Requesting the interrupt line, Freeing the interrupt line, The interrupt handler, Interrupt handling, Top-half and bottom-half, Needed support, Work queue, The user level, The user level – the application

Text Books:

1. Mastering Embedded Linux Programming - Paperback – Import, 30 June 2017 by Chris Simmonds
2. Mastering Linux Kernel Development: A kernel developer's reference manual Paperback – 1 January 2017 by Raghu Bharadwaj.

References:

1. Linux Kernel Development (Developer's Library) Paperback – Illustrated, 1 July 2010 by Robert Love (Author)

VLSI DESIGN AND TECHNOLOGY

Year/Sem : IV-I

UNIT I

Introduction to CMOS :

CMOS Logic, Fabrication & layout, Design partitioning, Ex. Microprocessor, CMOS transistor theory, CMOS characteristics, Non ideal effects, DC transfer characteristics.

UNIT II

Delay and power

Introduction,Transient response, RC delay model, linear delay model, logical efforts of paths, timing analysis of delay models. Dynamic power, static power, delay optimization.

UNIT III

Scaling and simulation

VLSI Design Flow, MOS layers, design rules, stick and layout diagrams for NMOS, PMOS and Reliability, scaling, simulation introduction, spice models, device models, device characterization, and circuit characterization.

UNIT IV

Combinational and sequential circuit design

Circuit families, silicon on insulator circuit design, sub threshold circuit design. Sequencing static circuits, flip flops, synchronizers.

UNIT V

Data path subsystem and testing

Adders, subtractors, counters, multipliers, SRAM, clocking, testing, packaging, I/O & power distribution.

TEXT BOOK

1. CMOS VLSI Design: A Circuits and Systems Perspective-Book by David Harris and Neil Weste
2. Digital Design and Computer Architecture-Book by David Harris

REFERENCE BOOK

1. Wayne Wolf, “Modern VLSI Design”, Pearson education, 3rd edition. 1997.
2. Digital VLSI Chip Design with Cadence and Synopsys CAD Tools-Book by Erik Brunvand
3. Principles of CMOS VLSI Design, Neil H.E. Weste, K.Eshraghian, Pearson, 2009.
4. CMOS Digital Integrated Circuits Analysis and Design, Kang and Leblebici, McGraw-Hill

VLSI DESIGN AND TECHNOLOGY LAB

Year/Sem : IV-I

Design and implementation of the following Cadence/Mentor Graphics/ Synopsys/ GEDA/ Equivalent CAD tools. Draw the schematic, Layout and verify DC Analysis, AC Analysis and Transient Analysis.

List of experiments:

Cell Design and Verification

1. CMOS AND gate
2. CMOS OR gate
3. CMOS NOR gate
4. CMOS NAND gate
5. CMOS XOR gate
6. CMOS Multiplexer
7. CMOS fulladder
8. Pass transistor
9. Flip-Flop
10. Static / Dynamic logic circuit (register cell)
11. Multistage amplifiers
12. Operational amplifiers

Datapath Design and Verification

1. CMOS NOR gate
2. CMOS NAND gate
3. CMOS fulladder
4. Flip-Flop
5. Operational amplifiers

Controller Design and Verification

1. CMOS NOR gate
2. CMOS NAND gate
3. CMOS fulladder
4. Flip-Flop
5. Operational amplifiers

Full Chip Assembly

1. CMOS NOR gate
2. CMOS NAND gate
3. CMOS fulladder
4. Flip-Flop
5. Operational amplifiers

LOW POWER VLSI

(Professional Elective-4)

Year/Sem : IV-I

UNIT I

Fundamentals

Need for Low Power Circuit Design, Sources of Power Dissipation – Switching Power Dissipation, Short Circuit Power Dissipation, Leakage Power Dissipation, Glitching Power Dissipation,

UNIT II

Short Channel Effects

Drain Induced Barrier Lowering and Punch Through, Surface Scattering, Velocity Saturation, Impact Ionization, Hot Electron Effect.

Low-Power Design through Voltage Scaling –VTCMOS circuits, MTCMOS circuits,

UNIT III

Low-Power Design through Architectural Level Approach

Pipelining and Parallel Processing.

Switched Capacitance Minimization Approaches

System Level Measures, Circuit Level Measures, Mask level Measures.

UNIT IV

Low-Voltage Low-Power Adders

Introduction, Standard Adder Cells, CMOS Adder's Architectures – Ripple Carry Adders, Carry Look-Ahead Adders, Carry Select Adders, Carry Save Adders, Low-Voltage Low-Power Design Techniques –Trends of Technology and Power Supply Voltage, Low-Voltage Low-Power Logic Styles.

UNIT V

Low-Voltage Low-Power Multipliers

Introduction, Overview of Multiplication, Types of Multiplier Architectures, Braun Multiplier, Baugh- Wooley Multiplier, Booth Multiplier, Introduction to Wallace Tree Multiplier.

TEXT BOOKS

1. Kaushik Roy and Sharat C. Prasad, “Low Power CMOS VLSI Circuit Design”, John Wiley and Sons, 2000.
2. Kiat - Seng Yeo and Kaushik Roy, “Low Voltage, Low Power VLSI Subsystems”, TMH.

REFERENCE BOOKS

1. Pal, Ajit, Low-Power VLSI Circuits and Systems, Springer,2015
2. Sung-Mo Kang and Yusuf Leblebici, “CMOS Digital Integrated Circuits – Analysis and Design”, TMH, 2011.
3. Eugene D Fabricius, “Introduction to VLSI Design”, McGraw Hill, New Delhi, 1990.
4. John P Uyemura, “Introduction to VLSI Circuits and Systems”, John Wiley, New Delhi 2006.

SECURITY IN IOT
(PE-V)

Year/Sem: IV-II

Unit-I

Introduction: Introduction to IoT Security – Vulnerabilities, Attacks and Countermeasures. Information Assurance. Attack types. New security threats and vulnerabilities. Fault Trees and CPS. Countermeasures to thwart attack. Threat Modeling.

Unit-II

Security:

Security Management & Cryptology- Security Controls - Authentication, Confidentiality, Integrity; Access Control, Key Management and Protocols, Cipher – Symmetric Key Algorithms, Public Private Key Cryptography; Attacks – Dictionary and Brute Force, Lookup Tables, Reverse Look Tables, Rainbow Tables, Hashing – MDS, SHA256. SHA 512, Ripe MD, WI, Data Mining

Unit-III

Attack Surface and Threat Assessment: Embedded Devices – UART, SPI, I2C, JTAG, Attacks – Software and cloud components, Firmware devices, Web and Mobile Applications.

IoT Protocol Built-in Security Features – Transport Layer, SSL/TLS and DTLS, Kerberos, Cloud security for IoT

Unit-IV

Trust Computing:

The Trusted Computing Architecture- Introduction to Trusted Computing, TPM Provisioning, Exact Mechanics of TPM.

Unit-V

Case Studies and Discussion: Smart Agriculture, Cities, Grid, Healthcare, Homes, Supply Chain, and Transportation, Application of Security Concepts to Create IoT system.

Text Books:

1. Practical Internet of Things Security, Brian Russell & Drew Van Duren – 2016
2. Security and the IoT ecosystem, KPMG International, 2015

References:

1. Internet of Things: Privacy & Security in a Connected World, Federal Trade Comission, 2015
2. Internet of Things: IoT Governance, Privacy and Security Issues by European Research Cluster

INTRODUCTION TO ROBOTICS SYSTEMS
(PE-V)

Year/Sem: IV-II

Unit-I

Introduction:

meaning of robotics, properties of robotic systems, interacting robotic system with its environment using the sense, perceive, and act model

Unit-II

Arm Cortex-M7 Processor Architecture:

Features of ARM cortex-M7 processor, registers and their functions, processor components, bus interconnect and debug system, processor memory map, instruction set. Interrupts and their functions,

Unit-III

DC Motors and Motor controllers:

Internal components of DC motor, functions and operating principles of a Field Effect Transistor (FET), use of single FET switch in design of motor controllers, Identify the motor controller topologies; single FET, Half-bridge and H-bridge, servos motor direction control using PWM.

Unit-IV

Optical Sensing in Robotics:

Distinguish between Op-Amp based inverting and non-inverting amplifier configurations, application of optical rotary encoders in sensing velocity, optical line camera in line following operation.

Unit-V

Control for Autonomous cars:

functions and properties of a feedback control system for an autonomous car, effect of friction and drag, proportional and derivative steering control in autonomous vehicle line following operation, implementation of a closed loop steering control system

Text Books:

1. Robotics, Mechatronics, and Artificial Intelligence by Newton C. Braga
2. Advanced Mechatronics and MEMS Devices by Dan Zhang
3. Intelligent Mechatronic Systems: Modeling, Control and Diagnosis by RochdiMerzouki and Arun Kumar Samantaray
4. Robot Modeling and Control by Mark W. Spong, Seth Hutchinson, and M. Vidyasagar

Reference Books:

1. Introduction to Robotics: Mechanics and Control -John J. Craig
2. A Textbook of Robotics 1: Basic Concepts - **Shoham**, M.

ESTIMATING THE IOT PROJECTS AND PROJECT MANAGEMENT
(PE-V)
Year/Sem: IV-II

GRAPHICS AND MOBILE GAMING

(Professional Elective)

UNIT I

Introduction to Graphics and Mobile Gaming: Graphic processor, GPU pipeline, representation of a 3D scene on a flat surface, Installing the tools, initializing OpenGL, creating a renderer class, Introducing the OpenGL pipeline-vertex shader, fragment shader, GPU – generations, Architecture and features. Comparison of GPU with CPU, Mali GPU, tessellation in computer graphics, geometry processing,rendering methods.

UNIT II

Introduction to Graphics API and OpenGL ES: OpenGL vs Open GL ES, OpenGL ES versions, OpenGL vs Direct3D,Rendering Pipeline and Shader Programming-fixed vs programmable rendering, pipeline shaders, programming of shaders in OpenGL ES, clipspace, rasterization, test and blending, varying variable, uniforms, textures, attributes vs uniforms.

UNIT III

3D Graphics and Matrix Manipulation: Matrices, translation using matrix, scaling, adding rotation,Adding detail with textures-understanding textures, loading textures into OpenGL, creating a new set of shaders, creating a new class structure for our vertex data, adding classes for our shader programs, drawing our texture, UV mapping, lighting up the world –simulating of light, implementing a directional light with Lambertian reflectance, adding point lights, Performance Optimization Techniques for graph processing.

UNIT IV

Introduction to Mobile Gaming: History of video games, video game engines, coding languages for game development, Game Graphics- Color cells, NTSC, artifact coloring and television interface adapters driven graphics-for generating color, composing video games in 2D and 3D, computer graphic mapping techniques for video games.

UNIT V

Video Game Design: Role playing games, sports games, racing games, fighting games, FPS games, five phases of software development process, iterative prototyping method, key components of game and game loop, features of unity 3D scenes, 3D Effects-animation techniques, particle effects, shader effect, camera model, simulation (rigid and soft body), Virtual Reality (VR)-concepts, VR vs augmented reality, phone based products, stereoscopic rendering, eye tracking, multiview rendering, multisampling and clock locking.

TEXT BOOKS

1. OpenGL ES 2 for Android: A Quick-Start Guide (Pragmatic Programmers) by Kevin Brothaler.
2. Game Design Theory by Keith Burgun.

REFERENCE BOOKS

1. Performance Optimization Techniques and Tools for Distributed Graph Processing VASILIKI KALAVRI