Specialization/Minor in Internet of Things

EFFECTIVE FOR 2021-22 BATCH

2ND YEAR TO 4TH YEAR

Eligible Branches to adopt as Specialization

1. B.Tech.- Computer Science and Engineering

2. B.Tech.- Electronics and Communication Engineering

3. B.Tech.- Electronics Engineering

Evaluation Schemes for Specializations/Minor in B.Tech

				Periods			Evaluation Scheme		Total Marks	Credits
S.N.	Code	Sem	Subject	L	T	P	Internal	External		
1.	SIT301	3rd	Sensor Technology	3	0	0	50	100	150	3
2.	SIT401	4th	CLOUD ARCHITECTURES	3	0	0	50	100	150	3
3.	SIT501	5th	Microcontrollers andinterfacing (using embedded C)	3	0	0	50	100	150	3
4.	SIT601	6th	Machine Learning	3	0	0	50	100	150	3
5.	SIT701	7th	Computer Programming inPython	3	0	0	50	100	150	3
6.	SIT801	8th	Embedded System Design	3	0	0	50	100	150	3
				18	0	0	300	600	900	18

Table title: Specialization in Internet of things

VEER MADHO SINGH BHANDARI
UTTARAKHAND TECHNICAL UNIVERSITY DEHRADUN

SIT301	SENSOR TECHNOLOGY	L	T	P	C
		3	0	0	3

	Contents	Hours
Unit 1	Sensors Fundamentals and Characteristics Sensors, Signals and Systems; Sensor Classification; Units of Measurements; Sensor Characteristics	8
Unit 2	Physical Principles of Sensing Electric Charges, Fields, and Potentials; Capacitance; Magnetism; Induction; Resistance; Piezoelectric Effect; Hall Effect; Temperature and Thermal Properties of Material; Heat Transfer; Light; Dynamic Models of Sensor Elements	8
Unit 3	Interface Electronic Circuits Input Characteristics of Interface Circuits, Amplifiers, Excitation Circuits, Analog to Digital Converters, Direct Digitization and Processing, Bridge Circuits, Data Transmission, Batteries for Low Power Sensors	8
Unit 4	Sensors in Different Application Area Occupancy and Motion Detectors; Position, Displacement, andLevel; Velocity and Acceleration; Force, Strain, and TactileSensors; Pressure Sensors, Temperature Sensors	8
Unit 5	Sensor Materials and Technologies Materials, Surface Processing, Nano-Technology	8

Suggested Readings :

1. J. Fraden, Handbook of Modern Sensors:Physical, Designs, and Applications, AIP Press, Springer
2. D. Patranabis, Sensors and Transducers, PHI Publication, New Delhi
3. Mechatronics- Ganesh S. Hegde, Published by University Science Press (An imprint of Laxmi Publication Private Limited).

SIT401	CLOUD ARCHITECTURES	L	T	P	C
		3	0	0	3

Contents		Hours
Unit 1	CLOUD COMPUTING FUNDAMENTALS Cloud Computing definition, private, public and hybrid cloud. Cloud types; IaaS, PaaS, SaaS. Benefits and challenges of cloud computing, public vs private clouds, role of virtualization in enabling the cloud; Business Agility: Benefits and challenges to Cloud architecture. Application availability, performance, security and disaster recovery; next generation Cloud Applications.	8
Unit 2	CLOUD APPLICATIONS Technologies and the processes required when deploying web services; Deploying a web service from inside and outside a cloud architecture, advantages and disadvantages	8
Unit 3	- MANAGEMENT OF CLOUD SERVICES Reliability, availability and security of services deployed from the cloud. Performance and scalability of services, tools and technologies used to manage cloud services deployment; Cloud Economics : Cloud Computing infrastructures available for implementing cloud based services. Economics of choosing a Cloud platform for an organization, based on application requirements, economic constraints and business needs (e.g Amazon, Microsoft and Google, Salesforce.com, Ubuntu and Redhat)	8
Unit 4	APPLICATION DEVELOPMENT Service creation environments to develop cloud based applications. Development environments for service development; Amazon, Azure, Google App.	8
Unit 5	CLOUD IT MODEL Analysis of Case Studies when deciding to adopt cloud computing architecture. How to decide if the cloud is right for your requirements. Cloud based service, applications and development platform deployment so as to improve the total cost of ownership	8

Suggested Readings :

1. Gautam Shroff, "Enterprise Cloud Computing Technology Architecture Applications", Cambridge University Press; 1 edition, 2010.

2. Toby Velte, Anthony Velte, Robert Elsenpeter, "Cloud Computing, A Practical Approach" McGraw-Hill Osborne Media; 1 edition , 2009.

3. Dimitris N. Chorafas, "Cloud Computing Strategies" CRC Press; 1 edition,2010.

VEER MADHO SINGH BHANDARI
UTTARAKHAND TECHNICAL UNIVERSITY DEHRADUN

SIT501	MICROCONTROLLERS AND INTERFACING (USING EMBEDDED C)	L	T	P	C
		3	0	0	3

	Contents	Hours
Unit 1	Introduction , Microcontrollers and Embedded systems, Overview of the 8051, Inside the 8051, Addressing modes, assembly programming, 8051 data types and directives, Interfacing with 8051, Programming the 8051 timers	8
Unit 2	MSP430x5x series block diagram, address space, on-chip peripherals (analog and digital), and Register sets. Instruction set, instruction formats, and various addressing modes of 16-bit microcontroller; Sample embedded system on MSP430 microcontroller. Memory Mapped Peripherals, programming System registers, I/O pin multiplexing, pull up/down registers, GPIO control. Interrupts and interrupt programming	12
Unit 3	Watch dog timer, system clocks, Timer & Real Time Clock (RTC), PWM control, timing generation and measurements. Analog interfacing and data acquisition ADC and Comparator in MSP430, data transfer using DMA.	8
Unit 4	Serial communication basics, Synchronous/Asynchronous interfaces (like UART, USB, SPI, and I2C). UART protocol, I2C protocol, SPI protocol. Implementing and programming UART, I2C, SPI interface using MSP430, Interfacing external devices.	8
Unit 5	Internet of Things (IoT) overview and architecture, Overview of wireless sensor networks and design examples. Various wireless connectivity: NFC, ZigBee, Bluetooth, Bluetooth Low Energy, Wi-Fi. Adding Wi-Fi capability to the Microcontroller, Embedded Wi-Fi, User APIs for Wireless and Networking applications, Building IoT applications using CC3100 user API for connecting sensor	9

Suggested Readings :

1.   Mazidi Ali Muhammad, Mazidi Gillispie Janice, and Mc Kinlay Rolin D " The 8051 Microcontroller and Embedded Systems using Assembly and C", Pearson Publication.
2. John H Davies, "MSP430 Microcontroller Basics" Newnes Publication.

SIT601	MACHINE LEARNING	L	T	P	C
		3	0	0	3

Contents		Hours
Unit 1	OVERVIEW IoT-An Architectural Overview– Building an architecture, Main design principles and needed capabilities, An IoT architecture outline, standards considerations. M2M and IoT Technology Fundamentals- Devices and gateways, Local and wide area networking, Data management, Business processes in IoT, Everything as a Service(XaaS), M2M and IoT Analytics, Knowledge Management	8
Unit 2	REFERENCE ARCHITECTURE IoT Architecture-State of the Art – Introduction, State of the art, Reference Model and architecture, IoT reference Model - IoT Reference Architecture- Introduction, Functional View, Information View, Deployment and Operational View, Other Relevant architectural views. Real-World Design Constraints- Introduction, Technical Design constraints-hardware is popular again, Data representation and visualization, Interaction and remote control.	8
Unit 3	IOT DATA LINK LAYER & NETWORK LAYER PROTOCOLS PHY/MAC Layer(3GPP MTC, IEEE 802.11, IEEE 802.15), Wireless HART,Z- Wave,Bluetooth Low Energy, Zigbee Smart Energy, DASH7 - Network Layer-IPv4, IPv6, 6LoWPAN, 6TiSCH,ND, DHCP, ICMP, RPL, CORPL, CARP	8
Unit 4	TRANSPORT & SESSION LAYER PROTOCOLS Transport Layer (TCP, MPTCP, UDP, DCCP, SCTP)-(TLS, DTLS) – Session Layer- HTTP, CoAP, XMPP, AMQP, MQTT	8
Unit 5	SERVICE LAYER PROTOCOLS & SECURITY Service Layer -oneM2M, ETSI M2M, OMA, BBF – Security in IoT Protocols – MAC 802.15.4 , 6LoWPAN, RPL, Application Layer	8

Suggested Readings :

1. Artificial Intelligence and Machine Learning, By Vinod Chandra S.S., Anand Hareendran S.

2. Basics of Artificial Intelligence & Machine Learning, by Dr Dheeraj Mehrotra.

3. Artificial Intelligence, By Rajiv Chopra

SIT701	COMPUTER PROGRAMMING IN PYTHON	L	T	P	C
		3	0	0	3

	Contents	Hours
Unit 1	Introduction to Python Programming Language. : Introduction to Python Language, Strengths and Weaknesses, IDLE, Dynamic Types, Naming Conventions, String Values, String Operations, String Slices, String Operators, Numeric Data Types, Conversions, Built In Functions	8
Unit 2	Data Collections and Language Component : Introduction, Control Flow and Syntax, Indenting, The if Statement, Relational Operators, Logical, Operators, True or False, Bit Wise Operators, The while Loop, break and continue, The for Loop, Lists, Tuples, Sets, Dictionaries, Sorting Dictionaries, Copying Collections	12
Unit 3	Object and Classes : Classes in Python, Principles of Object Orientation, Creating Classes, Instance Methods, File Organization, Special Methods, Class Variables, Inheritance, Polymorphism, Type Identification, Custom Exception Classes	8
Unit 4	Functions and Modules : Introduction, Defining Your Own Functions, Parameters, Function Documentation, Keyword and Optional Parameters, Passing Collections to a Function, Variable Number of Arguments, Scope, Functions - "First Class Citizens", Passing Functions to a Function, Mapping Functions in a Dictionary, Lambda, Modules	8
Unit 5	I/O and Error Handling In Python : Introduction, Data Streams, Creating Your Own Data Streams, Access Modes, Writing Data to a File, Reading Data From a File, Additional File Methods, Using Pipes as Data Streams, Handling IO Exceptions, Working with Directories, Metadata, Errors, Run Time Errors, The Exception Model, Exception Hierarchy, Handling Multiple Exceptions	9

Text Books:

1. Dive into Python, Mike
2. Learning Python, 4th Edition by Mark Lutz
3. **Programming Python, 4th Edition by Mark Lutz**

VEER MADHO SINGH BHANDARI
UTTARAKHAND TECHNICAL UNIVERSITY DEHRADUN

SIT801	**EMBEDDED SYSTEM DESIGN**	**L**	**T**	**P**	**C**
		3	0	0	3

	Contents	**Hours**
Unit 1	Introduction to Embedded System Design,Categories of ES,Overview of Embedded System Architecture, Recent Trends in Embedded Systems, Hardware Architecture of Embedded System,Real-time Embedded Systems and Robots, Robots and Robotics, Microprocessors and Microcontrollers, Microcontroller or Embedded Controller	8
Unit 2	Robotics: Classification of Robots, Degree of freedom, Kinematics; Multidisciplinary approach: Motors-DC motors, Stepper Motors, Servo Motors; Power Transmission-Type of Gears, Gear Assembly, CAM follower, Sensors, Open- loop and Closed-loop Controls, Architecture of 8051 Microcontroller-Assembly language programming (data types, directives, flag bits, PSW, register banks and Stacks)	12
Unit 3	Jump, Loop and Call instruction, Time delay for various 9051 chip, I/O programming and I/O bit manipulation, Interface of LED module, Key Scanning Case studies to design sensor(LDR),Motor Driver(H-bridge)module	8
Unit 4	Case studies of Closed-loop control and a learning robot-Hardware requirement, Locomotion and obstruction sensing, Learning process, Picking another set of points Addressing Modes of 8051,Power Management of 8051,Timer Interrupts, Multiplexed displays Case studies to Design an Intelligent Clock	8

Text Books:

1. Subrata Ghoshal,"Embedded Systems & Robots", engage Learning
2. M.A.Mazidi, J.G.Mazidi, R.D.Mckinlay,"8051MicrocontrollerandEmbeddedSystems",Pearson.
3. Dr.K.V.K.Prasad,"Embedded/Real-TimeSystems:ConceptsDesign&Programming",Dreamtech