Indian Institute of Information Technology Bhagalpur

Computer Science and Engineering (CSE)

B.Tech. Course Curricula and Syllabus

Semester-V

Curricula:

Course Code	Course name	L	T	P	C
EC301	**Digital Signal Processing**	**3**	**0**	**0**	**3**
CS301	Data Communication	3	0	0	3
CS302	Software Engineering	3	0	0	3
EC304	**IoT and Embedded System**	**3**	**0**	**0**	**3**
CS303	**Artificial Intelligence**	**3**	**0**	**2**	**4**
EC311	**Digital Signal Processing LAB**	**0**	**0**	**3**	**2**
EC312	**IOT and Embedded System LAB**	**0**	**0**	**3**	**2**
CS311	Software Engineering LAB	0	0	3	2
SAI-S-II	**Academia Internship**	**0**	**0**	**0**	**1**

Syllabus:

Course Code	**Course name**	**L**	**T**	**P**	**C**	**Year**	**Semester**
EC301	Digital Signal Processing	3	0	0	3	3rd	5th

Course objective: The main objectives of the course are: to identify the signals and systems, apply the principles of discrete-time signal analysis to perform various signal operations, apply the principles of z-transforms to finite difference equations, apply the principles of Fourier transform analysis to describe the frequency characteristics of discrete-time signals and systems, apply the principles of signal analysis to filtering and use computer programming tools to process and visualize signals.

Topic	**Contents**	**No. of Lectures**
Module-I	Review of discrete time signals, systems and transforms: Discrete time signals, systems and their classification; Analysis of discrete time LTI systems: impulse response, difference equation, frequency response, transfer function, DTFT, DTFS and Z-transform.	**08**
Module-II	Ideal filter characteristics, low-pass, high-pass, band-pass and band-stop filters, Paley-Wiener criterion, digital resonators, notch filters, comb filters, Butterworth filter, chebyshev filter**,** inverse systems, minimum phase, maximum phase and mixed phase systems.	**08**
Module-III	Signal flow graph representation, basic structures for FIR and IIR systems (direct, parallel, cascade and polyphase forms), transposition theorem, ladder and lattice structures; Design of FIR filters using windows, frequency sampling, Remez algorithm and least mean square error methods; Design of IIR filters using impulse invariance, bilinear transformation and frequency transformations.	**09**

Module-IV	Computational problem, DFT relations, DFT properties, fast Fourier transform (FFT) algorithms (radix-2, decimation-in-time, decimation-in-frequency), Goertzel algorithm, linear convolution using DFT.	**08**
Module-V	Finite word-length effects in digital filters: Fixed and floating point representation of numbers, quantization noise in signal representations, finite word-length effects in coefficient representation, round-off noise, SQNR computation and limit cycle; Introduction to multi-rate signal processing: Decimation, interpolation, poly-phase decomposition.	**09**
	Total	**42**
Text	1. S. K. Mitra, Digital Signal Processing: *A Computer-Based Approach*, Tata McGraw Hill, 2nd edition, 2001. 2. J. G. Proakis and D. G. Manolakis, Digital Signal Processing: Principles, Algorithms and Applications, PHI, 4th edition, 2007.	
Reference	1. A. V. Oppenheim and R. W. Shafer, *Discrete-Time Signal Processing*; PHI, 2nd edition, 2004.	

Course Code	**Course Name**	**L**	**T**	**P**	**C**	**Year**	**Semester**
CS301	Data Communications	3	0	0	3	3rd	5th

Course Objective: The objective of this course is to provide an overview of the concepts and fundamentals of data communications networks. This subject introduces the basic of networks such as dataflow, physical structures, network models, categories of networks which is necessary to study the computer networking concepts in future semester. Introduce the student with the physical layer concepts in data communication, transmission media, Analog and Digital transmission methodologies.

Topic		Hour
Module I	Data communication basics: Data communication components, Data Representation, Data Flow; Networks: Physical Structures, Network Models, Categories of Networks, Interconnection Networks, Internetwork: The Internet, Protocols and standards.	6
Module II	Data and signals: Analog signals, Digital signals; Transmission impairment: Attenuation, distortion, noise; Data rate limits: Nyquist rate, Shannon capacity; Performance: Bandwidth, throughput, latency, bandwidth-delay product.	6
Module III	Digital transmission: line coding, PCM, ADPCM, DM; transmission modes.	6
Module IV	Analog transmission: modulation techniques; Bandwidth utilization, multiplexing and spreading: FDM, WDM, TDM, STDM; xDSL; Spread spectrum.	10
Module V	Transmission media: Guided (twisted pair, coaxial, fiber optic) and unguided media; Balanced and unbalanced signalling; interfacing; Principles of switching; Local area networks: Ethernet, Fast Ethernet, introduction to Gigabit Ethernet and WLANs; Hubs, bridges and switches; Error detection and correction.	7
	Total	35
Text	1. Data Communications and Networking; B Forouzan; 5th Edition, Tata McGraw Hill; 2013. 2. Data and Computer Communications; W Stallings; 10th Edition, Pearson India Education Services Pvt.Ltd; 2013.	
Reference	1. Computer Networks; A S Tanenbaum, ; 5th Edition, Pearson India Education Services Pvt.Ltd; 2013.	

Course Code	Course Name	L	T	P	C	Year	Semester
CS302	Software Engineering	3	0	0	3	3rd	5th
Course Objective: Concepts and techniques relevant to production of large software systems is discussed in these course. It helps students to develop skills that will enable them to construct software of high quality – software that is reliable, and that is reasonably easy to understand, modify and maintain.							
Topic							Hour
Module I	Introduction: Overview of System Engineering, Design and Analysis. System Development Life Cycle, Waterfall Model, Spiral Model, Feasibility Analysis, Technical Feasibility, Cost- Benefit Analysis, COCOMO Model. Software Process- Generic Process Model, Prescriptive Process Model, Specialized, Unified Process, Etc.						6
Module II	Software Requirements and Software Design: Requirements Engineering, System Requirement Specification – DFD, Data Dictionary, ER diagram, Process Organization & Interactions. System Design – Problem Partitioning, Top-Down and Bottom-Up Design; Decision Tree, Decision Table and Structured English; Functional Vs. Object- Oriented Approach.						7
Module III	Modeling with UML: Modeling Concepts and Diagrams - Use Case Diagram- Class Diagrams - Interaction Diagrams - State Chart Diagrams – Activity Diagrams - Package Diagrams - Component Diagrams – Deployment Diagrams - Diagram Organization- Diagram Extensions. Design Process- Design Concepts: Abstraction, Architecture, Patterns, Separation of Concerns, Modularity, Information Hiding, Functional Independence, Refinement, Aspects, Refactoring, Object Oriented Design Concepts, Design Classes- Design Model: Data, Architectural, Interface, Component, Deployment Level Design Elements.						7
Module IV	Software Implementation: Coding and Documentation - Structured Programming, Object Oriented Programming, Information Hiding, Reuse, System Structured Coding Techniques-Coding Styles-Standards and Guidelines. Documentation Guidelines-Modern Programming Language Features: Type Checking-User Defined Data Types-Data Abstraction-Exception Handling-Concurrency Mechanism.						7
Module V	Software Testing, Quality and Verification, Software Maintenance: Software Quality- Software Quality Dilemma- Achieving Software Quality-Testing: Strategic Approach to software Testing- Strategic Issues. Levels of Testing, Integration Testing, Test case Specification, Reliability Assessment. Strategies for Conventional Software, Object oriented software, Validating Testing- System Testing- Art of Debugging, Validation & Verification Metrics, Monitoring & Control. Software Maintenance-Software Supportability, Reengineering-Business Process Reengineering, Software Reengineering, Reverse Engineering- Restructuring, Forward Engineering- Economics of Reengineering.						8
						Total	35
Text	1. Software Engineering – A Practitioner's Approach; Roger S Pressman, ; 7th Edition, Mc-Graw Hill; 2017.						

	2. Fundamentals of Software Engineering; Rajib Mall, ; 5th Edition, Prentice Hall India; 2018.
Reference	1.. Software Engineering Concepts; Richard Fairley, ; 2nd Edition, TMH; 2008. 2. Software Engineering; Ian Sommerville, ; 10th Edition, Pearson Education; 2017. 3.. An Integrated Approach to Software Engineering; P Jalote, ; 2nd Edition, Narosa Publishing House; 2003.

Course Code	Course name	L	T	P	C	Year	Semester
EC304	IoT & Embedded Systems	3	0	0	3	3rd	5th

Course objective: This main objective of this course facilitates to design, describe, validate and optimise embedded electronic systems in different industrial application areas. More particularly, the architecture of advanced processors, their instruction sets, interfacings to develop different kinds of systems.

1. To provide in depth knowledge about embedded processor, its hardware and software.
2. To explain programming concepts and embedded programming in C and assembly language
3. To explain real-time operating systems, inter-task communication and an embedded software development tool.

Topic	Contents	No. of Lectures
Module-I	An introduction to Embedded system design & modelling with unified mark-up language; 8-bit and 16- bit, von Neumann and Harvard architectures, CISC and RISC architectures; Advanced RISC Machines, Open source core (LEOX), Introduction to microcontrollers, ARM versions, ARM instruction set: assembly language, Thumb instruction set, memory organization, data operations and flow control; Input/output mechanisms, isolated and memory mapped IO; interrupts and real time operations, ARM interrupts vectors, priorities and latency; co-processors; cache memory and memory management.	**09**
Module-II	Embedded Platforms: bus protocols, system bus configuration, USB and SPI buses, DMA, ARM bus; memory devices: memory device configuration, ROM, RAM, DRAM; I/O devices: timers, counters, ADC & DAC, keyboards, displays and touch screens. Processes: multiple tasks and multiple processes; process abstraction; context switching: cooperative multitasking, pre-emptive multitasking, process and object-oriented design	**09**
Module-III	Operating Systems: operating systems and RTOS; scheduling polices; inter-process communication; Networks: distributed embedded architectures: networks abstractions, hardware and software architectures; networks for embedded systems: I2C bus, CAN bus.	**09**
Module-IV	An Introduction to Internet-of-Things, Sensing, Actuation, Basics of Networking; Communication Protocols, Sensor Networks, Machine-to-Machine Communications, Wireless medium access issues, MAC protocol survey, Survey routing protocols, Sensor deployment & Node discovery, Data aggregation & dissemination	**07**
Module-V	Developing IoTs: Introduction to Python, Introduction to different IoT tools, Developing applications through IoT tools, Developing	**08**

	sensor based application through embedded system platform, Implementing IoT concepts with python; Domain specific applications of IoT: Home automation, Industry applications, Surveillance applications, Other IoT applications.	
	Total	**42**
Text	1. A. N. Sloss, D. Symes, and C. Wright, *ARM system developer's guide: Designing and optimizing system software*; Elsevier, 1st edition. 2008. 2. Pethuru Raj and Anupama C. Raman, *The Internet of Things: Enabling Technologies, Platforms, and Use Cases*,CRC Press, 2017.	
Reference	1. Arshdeep Bahga and Vijay Madisetti, *Internet of Things: A Hands-on Approach*, Universities Press, 2017. 2. W. Wolf, *Computers as components: Principles of embedded computing system design*; Elsevier, 3rd edition, 2013.	

Course Code	Course name	L	T	P	C	Year	Semester
CS303	Artificial Intelligence	3	0	2	4	3rd	5th

Course Objective: The objective of the course is to present an overview of artificial intelligence (AI) principles and approaches. Develop a basic understanding of the building blocks of AI as presented in terms of intelligent agents: Search, Knowledge representation, inference, logic, and learning.

Topic	Contents	No. of Lectures
Module 1	Fundamental issues in intelligent systems: History of artificial intelligence; philosophical questions; fundamental definitions; philosophical questions; modeling the world; the role of heuristics.	**2**
Module 2	Search and constraint satisfaction: Problem spaces; brute-force search; best-first search; two-player games; constraint satisfaction.	**10**
Module 3	Knowledge representation and reasoning: Review of propositional and predicate logic; resolution and theorem proving; non-monotonic inference; probabilistic reasoning; Bayes theorem.	**8**
Module 4	AI planning systems: Definition and examples of planning systems; planning as search; operator-based planning; propositional planning.	**8**
Module 5	Sequential decision making: Achieving behaviour by specifying rewards, Markov Decision Problems.	**7**
	Total	**35**

Text Books	**1.** Stuart Russell and Peter Norvig: Artifical Intelligence: A Modern Approach, Pearson; Third edition (2013). **2.** Elaine Rich, Kevin Knight and Shivashankar B Nair, Artificial Intelligence, Tata McGraw Hill, 3rd Edition 2009.
Reference Books	1. N. J. Nilsson, "Principles of Artificial Intelligence", Narosa Publishing House, 1980.

	2. Clocksin & Mellish, Programming in PROLOG, Narosa Publ. House.