B.TECH. II Semester-3	L	T	P	C
CS 301: Computer Architecture & Organization	3	0	2	4

Instruction Set Architecture, Basic Input/Output, Software	10 Hours
Instruction Set Architecture: Memory Locations and Addresses, Memory Operations, Instructions and Instruction Sequencing, Addressing Modes, Assembly Language, Stacks, Subroutines, Additional Instructions, Dealing with 32-Bit Immediate Values, CISC Instruction Sets, RISC and CISC Styles, Example Programs, Encoding of Machine Instructions, Concluding Remarks *Accessing I/O Devices*: I/O Device Interface, Program-Controlled I/O, An Example of a RISC-Style I/O Program, An Example of a CISC-Style I/O Program *Interrupts*: Enabling and Disabling Interrupts, Handling Multiple Devices, Controlling I/O Device Behavior, Processor Control Register, Example of Interrupt Programs, Exceptions. Concluding Remarks *Software*: The Assembly Process, Loading and Executing Object Programs, The Linker, The Complier, The Debugger, Using a High-Level Language for I/O Tasks, Interaction between Assembly Language and C Language, The Operating System, Concluding Remarks	
Basic Processing Unit, Pipelining	**10 Hours**
Basic Processing Unit: Some Fundamental Concepts, Instruction Execution, Hardware Components, Instruction Fetch and Execution Steps, Control Signals, Hardwired Control, CISC-Style Processors, Concluding Remarks *Pipelining*: Basic Concept - The Ideal Case, Pipeline Organization, Pipelining Issues, Data Dependencies, Memory Delays, Branch Delays, Resource Limitations, Performance Evaluation, Superscalar Operation, Pipelining in CISC Processors, Concluding Remarks	
Input/Output Organization, The Memory System	**10 Hours**
Input/Output Organization: Bus Structure. Bus Operation: Synchronous Bus, Asynchronous Bus, Electrical Considerations. Arbitration. Interface Circuits: Parallel Interface, Serial Interface *Interconnection Standards*: USB, FireWire, PCI Bus, SCSI Bus, SATA, SAS, PCI Express. Concluding Remarks *The Memory System*: Basic Concepts, Semiconductor RAM Memories, Read-only Memories, Direct Memory Access, Memory Hierarchy, Cache Memories, Performance Considerations, Virtual Memory, Memory Management Requirements, Secondary Storage, Concluding Remarks	
Arithmetic, Parallel Processing and Performance	**12 Hours**
Arithmetic: Addition and Subtraction of Signed Numbers, Design of Fast Adders, Multiplication of Unsigned Numbers, Multiplication of Signed Numbers, Fast Multiplication, Integer Division, Floating-Point Numbers and Operations, Decimal-to-Binary Conversion, Concluding Remarks *Parallel Processing and Performance*: Hardware Multithreading, Vector (SIMD) Processing, Shared-Memory Multiprocessors, Cache Coherence, Message-Passing Multicomputers, Parallel Programming for Multiprocessors, Performance Modeling, Concluding Remarks	
Total Contact Time: 42 Hours	

Recommended Books
1. C. Hamacher, Z. Vranesic and S. Zaky, "Computer Organization and Embedded Systems", 6th Edition, McGraw-Hill, 2001. 2. A. S. Tanenbaum, "Structured Computer Organization", 6th Edition, PHI, reprint 1995. 3. W. Stallings, "Computer Organization & Architecture : Designing For Performance", 6th Edition, PHI, 2002. 4. "Digital Logic and Computer Design", Mano Morris, 3rd Edition, Pearson Education, 2005. 5. M. Mano, "Computer Systems Architecture", 3rd Edition, PHI, reprint 1997. 6. John L. Hannessy, David A. Patterson, "Computer Organization and Design", 2nd Edition, Morgan Kaufmaan, reprint-2003.

B.TECH. II Semester-3	L	T	P	C
EC 302: Microprocessor & Interfacing	3	0	2	4

Microprocessor - Based Systems: Hardware and Interfacing	10 Hours

Microprocessors, Microprocessor Instruction Set and Computer Languages, From Large Computers to Single Chip Microcontrollers, Application: Microprocessor-Controlled Temperature System (MCTS)

The 8085 Programming Model, Instruction Classification, Instruction, Data Format, and Storage, How to Write, Assemble, and Execute a Simple Program, Overview of the 8085 Instruction Set, Writing and Hand Assembling a Program

Microprocessor Architecture and Its Operations, Memory, Input and Output (I/O) Devices, Example of a Microcomputer System, Microprocessor-Based System Application (MCTS)

The 8085 MPU, Example of an 8085-Based Microcomputer, Memory Interfacing

Basic Interfacing Concepts, Interfacing Output Displays, Interfacing Input Devices, Memory-Mapped I/O

Programming the 8085	8 Hours

Data Transfer (Copy) Operations, Arithmetic Operations, Logic Operations, Branch Operations, Writing Assembly Language Programs, Debugging a Program

Programming Techniques: Looping, Counting, and Indexing, Additional Data Transfer and 16-Bit Arithmetic Instructions, Arithmetic Operations Related to Memory, Logic Operations: Rotate, Logic Operations: Compare, Dynamic Debugging

Counters and Time Delays, Illustrative Programs: Hexadecimal Counter, Zero-to-Nine (Modulo Ten) Counter, Generating Pulse Waveforms, Debugging Counter and Time-Delay Programs

Stack, Subroutine, Restart, Conditional Call, and Return Instructions, Advanced Subroutine Concepts

Code Conversion, BCD Arithmetic, and 16-Bit Data Operations

Interfacing Peripherals (I/Os) with 8085 and Applications	12 Hours

The 8085 Interrupt, 8085 Vectored Interrupts, Restart as Software Instructions, Additional I/O Concepts and Processes

Digital-to-Analog (D/A) Converters, Analog-to-Digital (A/D) Converters

Basic Concepts in Programmable Devices, The 8155: Multipurpose Programmable Device, The 8279 Programmable Keyboard/Display Interface

The 8255A Programmable Peripheral Interface, Interfacing Keyboard and Seven-Segment Display, The 8254 (8253) Programmable Interval Timer, The 8259A Programmable Interrupt Controller, Direct Memory Access (DMA) and the 8237 DMA Controller

Basic Concepts in Serial I/O, Software-Controlled Asynchronous Serial I/O, The 8085-Serial I/ Lines: SOD and SID, Hardware-Controlled Serial I/O using Programmable Chips

Interfacing Scanned Multiplexed Displays and Liquid Crystal Displays, Interfacing a Matrix Keyboard

INTEL 8086 - 16-Bit Microprocessor	12 Hours

Introduction, Architecture of 8086 (EU, BIU, Min & Max mode operations), Accessing Memory Locations, Pin Details of 8086

Addressing Modes in 8086, Segment Override Prefix, Instruction Set of 8086(Data Transfer, Arithmetic, Logical, Flag Manipulation, Control Transfer, Shift/Rotate, String, Machine or Processor Control), 8086 Assembly Language Programming (Line assembler, Time Delay, Assembler directives, TASM/MASM), Program Development Process, Modular Programming

Physical Memory Organisation in 8086, Formation of System Bus, Interfacing RAM and EPROM Chips using only logic gates, Interfacing RAM/EPROM chips using decoder IC and logic gates, I/O

Interfacing (I/O instructions in 8086, I/O-mapped and memory-mapped I/O), Interfacing 8-bit Input device with 8086 (8-bit address using logic gates, 8-bit address using 74LS318, 16-bit address using logic gates), Interfacing 8-bit Output Device with 8086, Interfacing 8-bit and 16-bit I/O devices or ports with 8086

8086-based systems: 8086 in Minimum Mode configuration, 8086 in Maximum Mode configuration, 8086 System Bus timings, Design of Minimum Mode 8086-based system

Total Contact Time: 42 Hours

Recommended Books

1. Gaonkar R. S., "Microprocessor Architecture, Programming and Applications with 8085", Penram International, Indian 5th Edition, 2002.
2. Douglas Hall, "Microprocessors Interfacing ",Tata McGraw Hill, 2nd Edition,1991.
3. Walter A. Triebel, Avtar Singh, "The 8088 and 8086 Microprocessors, Programming, Interfacing, Hardware and Applications", PHI Pvt. Ltd, 4th Edition,2002.
4. Ram B., "Fundamental of Microprocessor & Microcomputers", Dhanpat Rai Publications, 6th Edition,2003.
5. Kenneth Ayala, "The 8086 Microprocessor: Programming & Interfacing the PC", 2007.
6. N. Senthil Kumar, "Microprocessor and Interfacing: 8086, 8051, 8096, and advanced processors", Oxford University Press.

B.TECH. II Semester-3	L	T	P	C
EC 303: Communication Engineering	3	0	2	4

Prerequisite
Signals & Systems

Unit - 1	14 Hours
Introduction: Historical Background, Applications, Primary Resources and Operational Requirements, Underpinning theories of Communication Systems *Fourier Representation of Signals and Systems*: The Fourier Transform, Properties of the Fourier Transform, The Inverse Relationship Between Time and Frequency, Dirac Delta Function, Fourier Transform of Periodic Signals. Transmission of Signals through Linear Systems: Convolution Revisited, Ideal Low-Pass Filters, Correlation and Spectral Density: Energy Signals, Power Spectral Density, Numerical Computation of the Fourier Transform, Theme Example: Twisted Pairs for Telephony *Amplitude Modulation*: Amplitude Modulation, *Virtues, Limitations, and Modifications of Amplitude Modulation*, Double Sideband-Suppressed Carrier Modulation, Costas Receiver, Quadrature-Carrier Multiplexing, Single-Sideband Modulation, Vestigial Sideband Modulation, Baseband Representation of Modulated Waves and Band-Pass Filters, Theme Examples	

Unit - 2	10 Hours
Angle Modulation: Basic Definitions, Properties of Angle-Modulated Waves, Relationship between PM and FM waves, Narrow-Band Frequency Modulation, Wide-Band Frequency Modulation, Transmission Bandwidth of FM Waves, Generation of FM waves, Demodulation of FM signals, Theme Example: FM Stereo Multiplexing	

Unit - 3	10 Hours
Pulse Modulation: Sampling Process, Pulse-Amplitude Modulation, Pulse-Position Modulation, Completing the Transition from Analog to Digital, Quantization Process, Pulse-Code Modulation, Delta Modulation, Differential Pulse-Code Modulation, Line Codes, Theme Examples	

Unit - 4	8 Hours
Baseband Data Transmission: Baseband Transmission of Digital Data, The Intersymbol Interference Problem, The Nyquist Channel, Raised-Cosine Pulse Spectrum, Baseband Transmission of M-ary Data, The Eye Pattern, Computer Experiment: Eye Diagrams for Binary and Quaternary Systems, Theme Example: Equalization	

Total Contact Time: 42 Hours

Recommended Books
Text-Book 1. Simon Haykin, and Michael Moher, "Introduction to Analog and Digital Communication", John Wiley & Sons, 2nd Edition. Reference Books 2. Lathi B. P., and Ding Zhi, "Modern Digital & Analog Communication Systems", Oxford University Press, 4th Edition, 2010. 3. Proakis J., and Salehi M., "Fundamental of Communication Systems", PHI/Pearson Education-LPE, 2nd Edition, 2006. 4. Carlson Bruce A., "Communication Systems- An Introduction To Signal And Noise In Electrical Communication", McGraw-Hill, 5th Edition, 2009. 5. Leon W. Couch, "Digital & Analog Communication Systems", Pearson Education-LPE, 6th Edition, 2004.

B.TECH. II Semester-3	L	T	P	C
CS 304: Automata and Formal Languages	3	1	0	4

Unit - 1	12 Hours
Introduction: Basic Mathematical Objects: Sets, Logic, Functions, Relations, Strings, Alphabets, Languages. Mathematical Induction: Inductive proofs, Principles; Recursive Definitions; Set Notation. *Finite Automata and Regular Expressions*: Finite State systems, Regular Languages & Regular Expressions, Deterministic Finite Automata; Nondeterministic Finite Automata, Kleene' Theorem; Two-way Finite Automata, Finite Automata with output, Properties of Regular Sets: The Pumping Lemma for Regular sets, Closure properties, Decision properties of regular languages, Equivalence and minimization of Automata.	
Unit - 2	12 Hours
Context Free Grammars: Definition, Derivation trees & Ambiguity, Inherent ambiguity, Parse tree, Application of CFG, Simplification of CFG, Normal form of CFG, Chomsky Normal form and Chomsky Hierarchy, Unrestricted grammars, Context-sensitive languages, Relations between classes of languages, Properties of Context Free Languages: The Pumping Lemma, Closure properties, Decision properties of CFL.	
Unit - 3	10 Hours
Pushdown Automata: Definitions, Languages of PDA, Equivalence of PDA and CFG , Deterministic PDA. T*uring Machines*: Turing Machine Model, Language of a Turing Machine, Programming techniques of the TM, Variations of TM (Multiple TM, One-tape and Multi-tape TM etc.), Deterministic and Non Deterministic TM, Universal TM, Churche thesis, Recursively Enumerable Languages.	
Unit - 4	8 Hours
Computational Complexity: Time and Space Complexity, Growth Rate, Complexity classes, Tractable and Non tractable Problems: P and NP, Cooks's theorem.	
Total Contact Time: (42 + 14) Hours	

Recommended Books
1. John E. Hopcroft, Rajeev Motwani, Jeffrey Ullman, "Introduction to Automata theory, languages computation, 3rd Edition, Pearson India, 2008. 2. John C Martin, "Introduction to Languages & the Theory of Computation", 3rd Edition, Tata McGraw-Hill, 2011. 3. Daniel I.A. Cohen, "Introduction to Computer Theory", John Wiley & Sons, 2nd Edition, Reprint 2008. 4. A. M. Natarajan, A. Tamilarasi, "Theory of Computation", New Age Publication, 1st Edition,2003. 5. Sushil Kumar Azad, "Theory of Computation, An introduction to Automata, Formal Languages and Computability", Dhanpat Ray & Co., New Delhi, 2005. 6. Andrew Ilachinski, "Cellular Automata", World Scientific, 2001. 7. Michael Sipser, "Introduction to the Theory of Computation", Cengage Learning, 3rd Edition, 2013.

B.TECH. II Semester-3	L	T	P	C
AS 305: Probability and Statistical Analysis	3	1	0	4

Probability	
Unit - 1	**9 Hours**
Introduction: Axiomatic definition, Properties, Conditional probability, Bayes rule and independence of events. _Random Variable_: Random Variables, Distribution function, Discrete and Continuous random variables, Probability mass and density functions, Expectation, Function of random variable, Moments, Moment generating function, Chebyshev's inequality.	
Unit - 2	**16 Hours**
Special Discrete Distributions: Bernoulli, Binomial, Geometric, Negative binomial, Hypergeometric, Poisson, Uniform. Special continuous distributions: Uniform, Exponential, Gamma, Normal, Weibull, Reyleigh. Random vector: Joint distributions, Marginal and conditional distributions, Moments, Independence of random variables, Covariance, Correlation, Functions of random variables. Law of Large Numbers: Weak law of large numbers, Levy's Central limit theorem (i.i.d. finite variance case), Normal and Poisson approximations to Binomial.	
Statistics	
Unit - 3	**9 Hours**
Introduction: Population, Sample, Parameters. _Point Estimation_: Method of moments, Maximum likelihood estimation, Unbiasedness, Consistency. _Interval Estimation_: Confidence interval.	
Unit - 4	**8 Hours**
Tests of Hypotheses: Null and Alternative hypothesis, Type-I and Type-II errors, Level of significance, p-value, Likelihood ratio test, Chi-square goodness of fit tests. _Regression Problem_: Scatter diagram, Simple linear regression, Least square estimation, Tests for slope, prediction problem, Graphical residual analysis, Q-Q plot to test for normality of residuals.	
Total Contact Time: (42 + 14) Hours	

Recommended Books
1. Sheldon Ross, "A First Course in Probability", 8th edition, Pearson Prentice Hall, 2009.
2. V. K. Rohatgi and A. K. Saleh, "An Introduction to Probability and Statistics", 2nd Edition, Wiley interscience, 2000.
3. R. Hogg, J. McKen and A. Craig, "Introduction to Mathematical Statistics", Pearson, 2012.
4. S. M. Ross, "Introduction to Probability and Statistics for Engineers and Scientists", 5th Edition, Academic Press, 2014.
5. K. S. Trived, "Probability and Statistics with Reliability, Queuing and Computer Science Applications", 2nd Edition, Wiley India Private Limited, 2008.
6. A. M. Mood, F. A. Grabill and D. C. Boes, "Introduction to the Theory of Statistics", 3rd Edition, McGraw Hill, 1974.
7. D. P. Bertsekas and J. N. Tsitsiklis, "Introduction to Probability", 2nd Edition, Athena Scientific, 2008.

B.TECH. I Semester-3	L	T	P	C
CS 306: ICT Workshop - II	0	0	4	2

Programming Languages Introduction to Website Development	28 Hours
HTML CSS PHP Java Script, Node JS MySQL, NoSQL ASP.net	
Introduction to MATLAB	**14 Hours**
Numerical Toolbox Symbolic Toolbox DSP Toolbox Simulink	
Introduction to Android APP Development	**14 Hours**
Total Contact Time: 56 Hours	

Recommended Books
1. I. Bayross, "Web enabled commercial application development using HTML, DHTML, JavaScript, PERLCGI", BPB Publications, 2009.
2. D. W. Mercer, A. Kent, S. D. Nowicki, D. Mercer, D. Squier and W. Choi, "Beginning PHP5", 1st Edition, Wrox, 2004.
3. S. Holzner, "Complete Reference PHP", McGraw Hill Education, 2017.
4. M. Glass, Y. Scouarnec, E. Naramore, G. Mailer, J. Stolz and J. G. Gerner, "Beginning PHP, Apache, MySql Web Development", Wrox, 2004.