

B.TECH. III Semester-6	L	T	P	C
CS 601: Machine Learning	3	0	2	4

Prerequisite
Linear Algebra, Matrix Calculus, Probability and Statistics

Unit - 1	14 Hours
<u>Introduction</u> <u>Supervised Learning</u> : Linear Regression (Gradient Descent, Normal Equations), Weighted Linear Regression (LWR), Logistic Regression, Perceptron, (cross-)Entropy, Natural Gradient, Exponential Family and Generalized Linear Models, Generative Models (Gaussian Discriminant Analysis, Naive Bayes), k-Nearest Neighbours, Kernel Method (SVM, Gaussian Processes), Tree Ensembles (Decision trees, Random Forests, Boosting and Gradient Boosting)	
Unit - 2	8 Hours
<u>Learning Theory</u> : Regularization, Bias-Variance Decomposition and Tradeoff, Concentration Inequalities, Generalization and Uniform Convergence, VC-dimension <u>Deep Learning</u> : Neural Networks, Backpropagation, Deep Architectures	
Unit - 3	10 Hours
<u>Unsupervised Learning</u> : K-means, Gaussian Mixture Model (GMM), Expectation Maximization (EM), Variational Auto-encoder (VAE), Factor Analysis, Principal Components Analysis (PCA), Independent Components Analysis (ICA)	
Unit - 4	10 Hours
<u>Reinforcement Learning</u> : Markov Decision Processes (MDP), Bellmans Equations, Value Iteration and Policy Iteration, Value Function Approximation, Q-Learning <u>Applications</u> : Advice on structuring an ML project, Evaluation Metrics, Recent Applications	
Total Contact Time: 42 Hours	

Recommended Books
1. Alpaydin, Introduction to Machine Learning , Third Edition, PHI 2. Haykin, Neural Networks and Learning Machines, PHI 3. Chris Bishop, Pattern Recognition and Machine Learning, Springer 4. Tom Mitchell, Machine Learning, McGraw-Hill. 5. Ethem Alpaydin, "Introduction to Machine Learning", MIT Press, 2004 6. Cathy O'Neil & Rachel Schutt, "Doing Data Science, Straight Talk From The Frontline", O'Reilly, 2014. 7. Joel Grus, "Data Science from Scratch: First Principles with Python", O'Reilly Media, 2015. 8. Wes McKinney, "Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython", O'Reilly Media, 2012.

B.TECH. III Semester-6	L	T	P	C
EC 602: Digital VLSI Design	3	0	2	4

Unit - 1	14 Hours
<p><u>CMOS Logic-Gate Circuits</u>: Switch-Level Transistor Model, The CMOS Inverter, General Structure of CMOS Logic, The Two Input NOR gate, The Two Input NAND gate, A Complex gate, Obtaining the PUN from the PDN and vice versa, The Exclusive-OR function, Summary of the Synthesis Method</p> <p><u>Digital Logic Inverters</u>: The Voltage-Transfer Characteristics (VTC), Noise Margins, The Ideal VTC, Inverter Implementation</p> <p><u>The CMOS Inverter</u>: Circuit Operation, The Voltage-Transfer Characteristics (VTC), The Situation when Q_N and Q_P are not matched</p> <p><u>Dynamic Operation of the CMOS Inverter</u>: Propagation Delay, Determining the Propagation Delay of the CMOS Inverter, Determining the Equivalent Load Capacitance C</p> <p><u>Transistor Sizing</u>: Inverter Sizing, Transistor Sizing in CMOS Logic Gates, Effects of Fan-In and Fan-Out on Propagation Delay, Driving a Large Capacitance</p> <p><u>Power Dissipation</u>: Sources of Power Dissipation, Power-Delay and Energy-Delay Products</p>	
Unit - 2	14 Hours
<p><u>Introduction</u>: Digital IC Technologies and Logic-Circuit Families, Styles for Digital System Design, Design Abstraction and Computer Aids</p> <p><u>Delay</u>: Introduction, Transient Response, RC Delay Model, Linear Delay Model, Logical Efforts of Paths, Timing Analysis Delay Models</p> <p><u>Pseudo-NMOS Logic Circuits</u>: The Pseudo-NMOS Inverter, Static Characteristics, Derivation of the VTC, Dynamic Operation, Design, Gate Circuits</p> <p><u>Pass-Transistor Logic Circuits</u>: An Essential Design Requirement, Operation with NMOS Transistors as Switches, Restoring the Value of V_{OH} to V_{DD}, The Use of CMOS Transmission Gates as Switches, Examples of Pass-Transistor Logic Circuits</p> <p><u>Dynamic MOS Logic Circuits</u>: The Basic Principle, Nonideal Effects, Domino CMOS Logic</p> <p><u>Bipolar and BiCMOS Logic Circuits</u>: Emitter-Coupled Logic (ECL), BiCMOS Digital Circuits</p>	
Unit - 3	14 Hours
<p><u>Introduction</u>: Memory Circuits</p> <p><u>Latches & Flip-Flops</u>: The Latch, The SR Flip-Flop, CMOS Implementation of SR Flip-Flops, A Simpler CMOS Implementation of the Clocked SR Flip-Flop, D Flip-Flop Circuits</p> <p><u>Semiconductor Memories - Types & Architectures</u>: Memory-Chip Organization, Memory-Chip Timing</p> <p><u>Random-Access Memory (RAM) Cells</u>: Static Memory (SRAM) Cell, Dynamic Memory (DRAM) Cell</p> <p><u>Sense Amplifiers and Address Decoders</u>: The Sense Amplifier, The Row-Address Decoder, The Column-Address Decoder, Pulse-Generation Circuits</p> <p><u>Read-Only Memory (ROM)</u>: A MOS ROM, Mask Programmable ROMs, Programmable ROMs (PROMs, EPROMs, and Flash)</p> <p><u>CMOS Image Sensors</u></p>	
Total Contact Time: 42 Hours	

Recommended Books
<ol style="list-style-type: none"> 1. A. S. Sedra and K. C. Smith, "Microelectronic Circuits", Oxford University Press, 7th Edition. 2. Weste Neil H.E, Harris D. and Banerjee A., "CMOS VLSI Design: A Circuits And Systems Perspective", Pearson Education, 4th Edition. 3. Rabaey Jan, Chandrakasan Anantha Nikolic, "Digital Integrated Circuits: A Design Perspective", Pearson Education, 2nd Ed., 2nd Impression, 2008. 4. Sung-Mo Kang and Leblebici Y., "CMOS Digital Integrated Circuits: Analysis And Design", Tata McGraw-Hill, 3rd Ed., 2003.

B.TECH. III Semester-6	L	T	P	C
CS 603: Web Engineering	3	0	2	4

Prerequisite

Unit - 1	14 Hours
Introduction to Web Engineering, Web Programming vs. Web Engineering, Introduction to Web: HTTP, URL, Web Browser, Web Server, SMTP Server, ISP, Hyperlink, DNS, XML, Parsers and Internet based services, Web Architecture, Introduction to Javascript and jquery, Introduction to Angular JS (A Client Side MVC framework). HTTP Protocol. Resources - URIs, URL, URN - Syntax and Schemes, Relative URLs, WebSocket - Events, Methods and Attributes, Architectural components of the web - Proxies, Cache, Gateways, Tunnels, Agents	
Unit – 2	12 Hours
RESTAPI - Fundamentals, Resource Modeling, URI, Representations, Usage of HTTP, SOAP - Protocol Introduction, Comparison with REST API, Syndication Protocols (Atom, RSS), Tomcat/Apache Web Server - Overview, Configuration, Working Model & Web Site Creation, Usage of TCP/IP, Log Files, Apache Modules & Directives, Security - Anonymous Access, Authentication, Certificate based interaction, Allow & Deny of Hosts, Session Management, Client-Server Relationship; Web Server Serving Static, Embedded and Dynamic contents from DB and using Python, HTML; Getting data from Client & Link; Multi-tasking.	
Unit – 3	16 Hours
Introduction to Node.js, MongoDB, AngularJS and ExpressJS Node.js - Writing a web-server, Event Loop, Concurrency, Asynchronous coding, Callback Functions, Exception Handling, Event Emitters, Event Listeners, Promises ExpressJs - Router, Middleware, Routes, Generating HTML AngularJS - Data binding - OneWay, TwoWay Bindings, Digest Loop, Controllers, Directives Tasks, Debugging, Testing Introduction, Singleton, MVC, Proxy. Architectural Patterns – MVC. Design Patterns - Singleton, Proxy, Deploying the Services on Kubernetes/Dockers. Building and running a Docker.	
Total Contact Time: 42 Hours	

Recommended Books
1. Web Engineering: A Practitioner's Approach by Roger Pressman and David Lowe, McGraw-Hill, 2009.
2. Web 2.0 Architectures: What Entrepreneurs and Information Architects Need to Know by James Governor, Dion Hinchcliffe, and Duane Nickull, O'Reilly, 2009.
3. Web Engineering: Modelling and Implementing Web Applications: Modelling and Implementing Web Applications.
4. Web Engineering - The Discipline of Systematic Development of Web Applications, GertiKappel, Birgit Proll, Siegfried Reich, Werner Retschitzegger.
5. "JSON at Work: Practical Data Integration for the Web", 1st Edition, Tom Marrs, O'REILLY
6. "JavaScript: The Definitive Guide", 5th Edition, David Flanagan, O'REILLY
7. "HTTP: The Definitive Guide", by David Gourley, Brian Totty, Marjorie Sayer, Anshu Aggarwal, Sailu Reddy, O'REILLY
8. "REST API Design Rulebook" by Mark Masse, O'REILLY
9. "Node.js, MongoDB and AngularJS Web Development: The Definitive Guide to Building JavaScriptBased Web Applications from Server to Frontend (Developer's Library)", 1st Edition, Brad Dayley

10. "Apache: The Definitive Guide", 3rd Edition by Ben Laurie, Peter Laurie, O'REILLY
11. Tomcat: The Definitive Guide, 2nd Edition, Jason Brittain, Ian F Darwin, O'REILLY
12. "Getting MEAN with Mongo, Express, Angular, and Node", by Simon Holmes