B.TECH. III Semester-VI	L	T	P	C
CS 601: Introduction to machine learning	3	0	0	4

INTRODUCTION TO MACHINE LEARNING	12 Hours
Introduction: Machine learning, Terminologies in machine learning, Types of machine learning, designing a learning system, Application of machine learning.	
SUPERVISED, UNSUPERVISED, REINFORCEMENTLEARNING	**12 Hours**
SUPERVISED: Linear Regression, Gradient Descent, Normal Equations, Logistic Regression, Perceptron, classification, Generative Models, Gaussian Discriminant Analysis, Naive Bayes, Kernel Method, SVM, Gaussian Processes. UNSUPERVISED: K-means, Gaussian Mixture Model, Expectation Maximization, Factor Analysis, Principal Components Analysis. REINFORCEMENT LEARNING: Markov Decision Processes, Bellman's Equations, Value Iteration and Policy Iteration, Value Function Approximation, Q-Learning.	
DECISION TREE LEARNING AND CLUSTERING	**12 Hours**
Introduction, Univariate trees like Classification Trees, Regression Trees, Pruning, Rule extraction from trees, Learning Rules from data, Multivariate Trees, Tree Ensembles: Decision trees, Random Forests, Boosting and Gradient Boosting, Issues in Decision Tree Learning. Clustering: Choosing distance metrics, Different clustering approaches, hierarchical agglomerative clustering, k-means Lloyd's algorithm, DBSCAN, Relative merits of each method, clustering tendency and quality.	
OVERVIEW OF DEEP LEARNING	**8 Hours**
INTRODUCTION TO DEEP LEARNING: Deep Neural Network, Restricted Boltzmann machine, Convolution Neural Network, Auto-Encoders, Deep Belief Network, Recurrent Neural Network, Transfer learning.	

Recommended Books

1. Tom Mitchell, Machine Learning, McGraw-Hill.
2. EthemAlpaydin, "Introduction to Machine Learning", MIT Press, 2004
3. Cathy O'Neil and Rachel Schutt, "Doing Data Science, Straight Talk From The Frontline", O'Reilly, 2014.
4. Joel Grus, "Data Science from Scratch: First Principles with Python", O'Reilly Media, 2015.
5. 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

The Wire The CMOS Inverter	12 Hours
Introduction, A first Glance, Interconnect Parameters: Capacitance, Resistance, Inductance Electrical Wire Models: The Ideal Wire, The Lumped Model, The Lumped RC Model, The Distributed RC Line, The Transmission Line	

SPICE Wire Models: Distributed RC Lines in SPICE, Transmission Line Models in SPICE Perspective: A look into the Future Introduction, The Static CMOS Inverter — An Intuitive Perspective Evaluating the Robustness of the CMOS Inverter (The Static Behavior): Switching Threshold, Noise Margins, Robustness Revisited Performance of CMOS Inverter (The Dynamic Behavior): Computing the Capacitances, Propagation Delay: First-Order Analysis, Propagation Delay from a Design Perspective Power, Energy, and Energy-Delay: Dynamic Power Consumption, Static Consumption, Putting It All Together, Analyzing Power Consumption Using SPICE Perspective: Technology Scaling and its Impact on the Inverter Metrics	
Designing Combinational Logic Gates in CMOS	**10 Hours**
Introduction Static CMOS Design: Complementary CMOS, Ratioed Logic, Pass-Transistor Logic Dynamic CMOS Design: Dynamic Logic (Basic Principles), Speed and Power Dissipation of Dynamic Logic, Issues in Dynamic Design, Cascading Dynamic Gates Perspectives: How to Choose a Logic Style, Designing Logic for Reduced Supply Voltages	
Designing Sequential Logic Circuits	**12 Hours**
Introduction: Timing Metrics for Sequential Circuits, Classification of Memory Elements Static Latches and Registers: The Bistability Principle, Multiplexer-Based Latches, Master-Slave Edge-Triggered Register, Low-Voltage Static Latches, Static SR Flip-Flops—Writing Data by Pure Force Dynamic Latches and Registers: Dynamic Transmission-Gate Edge-triggered Registers, C2MOS—A Clock-Skew Insensitive Approach, True Single-Phase Clocked Register (TSPCR) Alternative Register Styles: Pulse Registers, Sense-Amplifier Based Registers Pipelining (An approach to optimize sequential circuits): Latch- vs. Register-Based Pipelines, NORA-CMOS—A Logic Style for Pipelined Structures Non-Bistable Sequential Circuits: The Schmitt Trigger, Monostable Sequential Circuits, Astable Circuits Perspective: Choosing a Clocking Strategy	
Implementation Strategies for Digital ICs	**8 Hours**
Introduction, From Custom to Semicustom and Structured Array Design Approaches, Custom Circuit Design, Cell-Based Design Methodology: Standard Cell, Compiled Cells, Macrocells, Megacells and Intellectual Property, Semi-Custom Design Flow Array-Based Implementation Approaches: Pre-Diffused (or Mask-Programmable) Arrays, Pre-Wired Arrays Perspective: The Implementation Platform of the Future	
Total Contact Time: 42 Hours	

Recommended Books

Text-Book

1. Rabaey Jan, ChandrakasanAnantha Nikolic, "Digital Integrated Circuits: A Design Perspective", Pearson Education, 2nd Ed., 2nd Impression, 2008.

Reference-Books

2. Hodges D. A. and Jackson H. G. "Analysis And Design Of Digital Integrated Circuits", 3rd Ed., McGraw-Hill, 2004.
3. Baker R. J., Li H. W. and Boyce D. E., "CMOS Circuits Design Layout and Simulation", PHI 2nd 2005.
4. Sung-Mo Kang and Leblebici Y., "CMOS Digital Integrated Circuits: Analysis And Design", Tata McGraw-Hill, 3rd Ed., 2003.
5. Weste Neil H.E, Harris D. and Banerjee A., "CMOS VLSI Design: A Circuits And Systems Perspective", Pearson Education, 3rd Ed., 2002.

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

HTML, Javascript, JQuery	10 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, An Overview about HTML (Basic Tags), HTML5 forms, GET and POST data, Introduction to Cascading style sheets, CSS3 Properties (BOX model, Advance Selectors), Responsive Designs, Need of responsive designs (bootstrap), Introduction to Javascript and jquery, Angular JS (A Client Side MVC framework).

Php, Database Connectivity	10 Hours

Introduction to PHP, Associative arrays, Include, require, header, Developing Dynamic Content/Web page using PHP, Sessions and Cookies, Database Connectivity Using PHP and Insert Record into Database, Update, Delete and View Records from Database, Building a CRUD application, AJAX, How AJAX works, Case Study on Code Management Tool (Github), Secure Web Applications, Usability of web applications, Accessibility of web applications, Introduction to MVC, Model View Controller, Performance Optimization of Web Application.

Php Framework	12 Hours

Introduction to PHP Framework (LARAVEL), MVC Routing, Static and Dynamic Routing, Route Parameters, Named Routes, Route Groups, HTTP Middleware Introduction, Defining Middleware, Registering Middleware, Middleware Parameters, Blade Templates Introduction, Template Inheritance, Defining A Layout, Extending A Layout, Database: Migrations, How to Work on View Section in LARAVEL, Basic Usage, Passing Data To Views, Sharing Data With All Views, Introduction Generating Migrations, Migration Structure, Running Migrations, Rolling Back Migrations, Writing Migrations, Creating Tables, Renaming / Dropping Tables, Database Seeding in LARAVEL, Writing Seeder, Running Seeder.

MVC in LARAVEL, Web Services	10 Hours

MVC Controller in LARAVEL, Introduction Basic Controllers, Controller Middleware, MVC Model and Eloquent ORM in LARAVEL, Getting Started, Relationships, Collections, Introduction to Web Services, Restful Services, Introduction to SOAP Services, SOAP Service Architecture, WSDL with SOAP Service, UDDI with SOAP, Web Application Testing, Test Driven Development(TDD), TDD and Traditional Testing, Introduction to CMS Systems (Wordpress/Magneto).

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.

B.TECH. III Semester-6	L	T	P	C
EC 604: Embedded Systems	3	0	2	4

Introduction to Embedded Systems	6 Hours
Embedded Systems: Introduction to Embedded Systems, Definition, Embedded Systems Vs General Computing Systems, ASICs, PLDs, Commercial off-the-shelf components (COTS), History of Embedded Systems, Classification, Major Application areas, Purpose of embedded systems, Characteristics and Quality attributes of embedded systems	
ARM: Architecture and Software Development	**16 Hours**
Registers, Current Program Status Register, Pipeline, Exception, Interrupt And Vector Table, Memory Map, ARM And Thumb Mode Memory Management Unit, ARM Architecture, ARM Architecture Revision, Cortex Processor Architecture Arm & Thumb Instruction Set: Data Processing Instruction, Branch Instruction, Load Store Instruction, Program Status Resister Instruction, Loading Constant, Stack Instruction, Conditional Execution Fundamentals of Compilers, Memory Allocation, Pre-processing, Effective use of #pragmas, Stack Memory, Processing of Function calls in Embedded Systems	
RTOS based Embedded System Design	**12 Hours**
Operating System Basics, Types of Operating Systems, Tasks, Process and Threads, Multiprocessing and Multitasking, Task Scheduling, Task Operations, Structure, Synchronization, Communication and Concurrency. Defining Semaphores, Operations and Use, Exceptions, Interrupts and Timers Exceptions, Interrupts, Applications, Processing of Exceptions and Spurious Interrupts, Real Time CLO scks, Programmable Timers, Timer Interrupt Service Routines (ISR), Soft Timers	
Task Communications	**8 Hours**
Shared Memory, Message Passing, Remote Procedure Call and Sockets, Task Synchronization: Task Communication/Synchronization issues, Task Synchronization, Techniques, Device Drivers, How to Choose an RTOS	
Total Contact Time: 42 Hours	

Recommended Books

1. Introduction to Embedded Systems - Shibu K.V, Mc Graw Hill.
2. Embedded Systems - Raj Kamal, TMH.
3. Embedded System Design - Frank Vahid, Tony Givargis, John Wiley.
4. Embedded Systems – Lyla, Pearson, 2013
5. An Embedded Software Primer - David E. Simon, Pearson Education
6. Embedded Real-time Systems Programming -Sri Ram Iyer and Pankaj Gupta (TMH)
7. Sloss A. N., Symes D. and Wright C., "ARM System Developer's Guide", Morgan Kaufmann Publishers, 1st Ed., 3rd Reprint, 2006.
8.Modern Compiler Implementation in C, Andrew W. Appel, Cambridge University Press.

B.TECH. III Semester-VI	L	T	P	C
CS 631: Mathematical optimization	3	0	0	3

Linear Programming	10 Hours
Basic Problem, Graphical Solution, Simplex Method, Slack Variables, Simplex Method for Resource Requirements, General Constraints, Duality, Duality for Non-standard Linear Programs, Duality Theorems, Sensitivity Analysis, Changes in Objective Function Coefficients, Theory for Simplex Method.	
Unconstrained extrema	**10 Hours**
Mathematical Background, Types of Subsets of R^n, Continuous Functions, Existence of Extrema, Differentiation in Multi-Dimensions, Second Derivative and Taylor's Theorem, Quadratic Forms, Derivative Conditions, First Derivative Conditions, Second Derivative Conditions.	
Constrained extrema	**10 Hours**
Implicit Function Theorem, Extrema with Equality Constraints, Interpretation of Lagrange Multipliers, Extrema with Inequality Constraints: Necessary Conditions, Extrema with Inequality Constraints: Sufficient Conditions, Convex Structures, Karush-Kuhn-Tucker Theorem under Convexity, Rescaled Convex Functions, Global Extrema for Concave Functions, Proof of Karush-Kuhn-Tucker Theorem, Second-Order Conditions for Extrema of Constrained Functions.	
Dynamic programming	**12 Hours**
Parametric Maximization and Correspondences, Budget Correspondence for Commodity Bundles, Existence of a Nash Equilibrium, Finite-Horizon Dynamic Programming, Supremum and Infimum, General Theorems, Infinite-Horizon Dynamic Program, Examples, Theorems for Bounded Reward Function, Theorems for One-Sector Economy, Continuity of Value Function.	

Recommended Books

1. Russell C. Walker, Introduction to Mathematical Programming, 4th edition, Pearson Learning.
2. R. Clark Robinson, Introduction to Mathematical Optimization, 2013
3. Wayne L. Winston, Operations Research - Applications and algorithms, Fourth edition.
4. Edwin K. P. Chong, Stanislaw H. Zak, An Introduction to optimization, Fourth Edition.

B.TECH. III Semester –VI	L	T	P	C
CS 632: Cloud computing and big data infrastructure	3	0	0	3

Introduction to cloud computing	10 Hours
Overview of Computing like Grid, Cluster, distributed etc., Cloud Computing Vision, Characteristics and Benefits, Challenges of Cloud Computing, Cloud Computing platforms and technologies like Amazon AWS, Google, Facebook, Cloud Computing Architecture: Cloud Computing Reference	

Model, Service Models, Deployment Models like Public, Private, Hybrid etc, Cloud Computing Challenges, Cloud using open source tools like Eucalyptus, OpenStack.

Virtualization	**10 Hours**
Introduction to Virtualization, Characteristics of Virtualization, Taxonomy of Virtualization like Machine Level Virtualization, Hardware Level Virtualization like Hypervisors, Hardware Virtualization Techniques like full, para, partial, OS Level Virtualization, Storage, Network and Desktop Virtualization, Advantages and Disadvantages of it, Technologies like Xen, VMWare, Hyper-V.	

Introduction to big data	**6 Hours**
History of Data Management, Evolution of Big Data, 4 V's of Big Data, Types of Data like unstructured, semi structured and structured, Elements of Big Data, Careers and Future in Big Data, Characteristics, Challenges, Features and Applications of Big Data, Use of big data in social networking, preventing fraudulent activities and retail industry.	

Technologies of handling big data	**16 Hours**
Distributed and Parallel Computing for Big Data, Introducing Hadoop, Cloud Computing and Big Data, In-Memory Computing Technology for Big Data, Understanding Hadoop Ecosystem: Hadoop Ecosystem, Hadoop Distributed File System, MapReduce, Introducing HBase, Combining HBase and HDFS, Understanding MapReduce Fundamentals and HBase: The MapReduce Framework, Techniques to Optimize MapReduce Jobs, Uses of MapReduce, Role of HBase in Big Data Processing.	

Recommended Books

1. Mastering Cloud Computing by RajkumarBuyya, Christian Vecchiola, S.ThamaraiSelvi, McGraw Hill Education (India) Private Limited, 2013
2. Dr. Kumar Saurabh, "Cloud Computing 2nd Kindle Edition", Wile India,2012
3. Big Data, Black Book: Covers Hadoop, MapReduce, Hive, YARN, Pig, R and Data Visualization, Dreamtech Press, 1st Edition, 2016
4. Arvind Sathi, Big Data Analytics: Disruptive Technologies for Changing the Game, MC Press, 2012
5. Tom White, Hadoop: The Definitive Guide, O'Reilly Media, Third Edition, 2012.

B.TECH. III Semester-VI	**L**	**T**	**P**	**C**
CS 633: Introduction to game design	**3**	**0**	**2**	**4**

Introduction	**10 Hours**
History of Video Games, Impact of Games on Society, Introduction to the Class, Role of the Game Designer, Game Design, Game types, Game genres, Game Writing, UI Layout, Asset Management, game state, gamer services and Interactive Storytelling Understanding Hardware, Input Devices, Output Devices, Network Requirements, Managing Game Performance, CPU vs GPU, and Graphics Networking Performance, Dramatic elements of games and Narrative Design, Narrative Game.	

Game design and development	**12 Hours**
Concepts: Mathematical concepts, Collision Detection and resolution, Real-time game Physics, Graphics, System dynamics, Challenge, Skill and Chance, Character Animation, Animate basic characters, Transform objects, Artificial Intelligence Agents, Architecture, and Techniques,	

Overview of Path finding, Audio Programming, Conceptualization, Communication, Networking and Multiplayer.
Audio visual design and production **10 Hours**
Visual Design, 3D Modeling using 3D Studio Max, 3D Environments, 2D Textures and Texture mapping, Special Effects, Lighting, Animation, Cinematography, Audio design and production, Social play Games as culture, Introduction to Unity and 3D games.
Working with unity and scripting **10 Hours**
Level design and properties of living things, Functionality, Completeness and Balance, Simple Playtesting and Quality Assurance, Design a board game, Game economies, Black Friday, the board game, Unity Demos, Courses Wiki, Lesson Files, Managing Project, Interface and Assets, Unity Interfaces, Prototyping and Scripting Basics, Collection, Inventory and HUD, Building Unity Game, Terrain, Unity Terrain Assets, Camera, Layer, GUI, Curves, Surfaces, Visible Surface.

Recommended Books
1. Steve Rabin, Introduction to Game Development, Cengage Technology (2010). 2. Michael Dawson, Beginning C++ Through Game Programming, Cengage Learning (2010). 3. Kelly C., Programming 2D Games, A K Peters/CRC Press(2012). 4. A. Thorn, Learn Unity for 2D Game Development, Apress, (2013).

B.TECH. II Semester-6	**L**	**T**	**P**	**C**
EC 641: Information Theory & Coding	**3**	**0**	**2**	**4**

Prerequisite
Digital logic design, Communication Engineering, Digital Communication.

1. Information and Sources **10 Hrs**
Introduction, The Definition of Information, The Zero-memory Information Source, properties of Entropy, Extension of a Zero-memory Source, The Markov Information Source, The Adjoint Source.
2. **Source Coding, Channels and Mutual information** **12 Hrs**
Properties of Codes, Uniquely Decodable Codes, Instantaneous Codes, Construction of an Instantaneous Code, Kraft's Inequality. The Average Length of A Code, A method of Encoding for Special Sources, Shannon's First Theorem, Coding without Extensions, Huffman Codes, Code Efficiency And Redundancy. Introduction, Information Channels, Probability Relations in a Channel, A priori and A Posteriori Entropy, Mutual information, Properties of Mutual Information, Noiseless Channels and Deterministic Channels, Cascaded Channels, Additivity of Mutual Information.
3. Linear Block Codes **10 Hrs**
Introduction and basic definitions, Encoding and Decoding of a linear block codes, Syndrome decoding, Perfect Codes, Hamming Codes, Minimum Distance, Error Correction And Error Detection

Capabilities.	
4. Cyclic, BCH & Convolution codes	**10 Hrs**
Introduction to Cyclic Codes, Polynomials, Cyclic Code Generation, Quasi-cyclic and Shortened Cyclic Codes, Burst Error Correction, Fire Codes, Golay Codes, BCH Codes, Convolution Codes and Turbo Codes.	
Total: 42 Hrs	

Recommended Books

1. RanjanBose,"Information theory, coding and cryptography", Tata McGraw-Hill,2nd Edition,2008.
2. Giridhar K, "Information Theory & Coding", Pooja Publications, 2010.
3. Skalar, Digital Communications,
4. Carlson A., Communication Systems, 3rd Ed., McGraw Hill, 1986.
5. Proakis J.J., Digital Communications, 2nd Ed., McGraw Hill, 1989.
6. Blahut R.F., Digital transmission of Information, Addison Wesley 1990.

B.TECH. III Semester-6	**L**	**T**	**P**	**C**
EC 642: MEMS	**3**	**0**	**0**	**3**

Introduction to MEMS **Introduction to Microfabrication** **Review of Essential Electrical and Mechanical Concepts**	**8 Hours**
MEMS: The History of MEMS Development, The Intrinsic Characteristics of MEMS, Devices (Sensors and Actuators), Sensor Noise and Design Complexity Microfabrication: Overview of Microfabrication, Frequently used Microfabrication Processes, Microelectronics Fabrication Process Flow, Silicon-Based MEMS processes, Packaging and Integration, New Materials and Fabrication Processes, Process Selection & Design Review of Concepts: Conductivity of Semiconductors, Crystal Planes and Orientations, Stress and Strain, Flexural Beam Bending Analysis under Simple Loading Conditions, Torsional Deflections, Intrinsic Stress, Dynamic System, Resonant Frequency and Quality Factor, Active Tuning of Spring Constant and Resonant Frequency	
Sensors and Actuators	**18 Hours**
Electrostatic Sensing and Actuation: Introduction, Parallel-Plate Capacitor, Applications of Parallel-Plate Capacitors (Inertia Sensor, Pressure Sensor, Flow Sensor, Tactile Sensor, Parallel-Plate Actuators), Interdigitated Finger Capacitors, Applications of Comb-Drive Devices Thermal Sensing and Actuation: Introduction, Sensors and Actuators based on Thermal Expansion, Thermal Couples, Thermal Resistors, Applications Piezoresistive Sensors: Origin and Expression of Piezoresistivity, Piezoresistive Sensor Materials, Stress Analysis of Mechanical Elements, Application of Piezoresistive Sensors Piezoelectric Sensors: Introduction, Properties of Piezoelectric Materials, Applications	

Magnetic Actuation: Essential Concepts and Principles, Fabrication of Micro Magnetic Components, Case Studies	
Micromachining	**8 Hours**
Bulk Micromachining and Silicon Anisotropic Etching: Introduction, Anisotropic Wet Etching, Dry Etching and Deep Reactive Ion Etching, Isotropic Wet Etching, Gas Phase Etchants, Native Oxides, Special Wafers and Techniques Surface Micromachining: Basic Surface Micromachining Processes, Structural and Sacrificial Materials, Acceleration of Sacrificial Etch, Stiction and anti-Stiction Methods LIGA process	
MEMS Types	**8 Hours**
Polymer MEMS: Introduction, Polymers in MEMS, Representative Applications Optical MEMS, Bio MEMS, Chemical Sensors, Mechanical Sensors, MEMS Gyro Sensors, MEMS for Space application Interfacing Electronics for MEMS	
Total Contact Time: 42 Hours	

Recommended Books
1. Chang Liu, 'Foundations of MEMS', Pearson Education Inc., 2012. 2. Stephen D Senturia, 'Microsystem Design', Springer Publication, 2000. 3. Tai Ran Hsu, "MEMS & Micro systems Design and Manufacture" Tata McGraw Hill, New Delhi, 2002.

B.TECH. III Semester-VI	L	T	P	C
CS 641: Augmented and virtual reality	3	0	0	3

Introduction to VR and AR	12 Hours

History of VR and AR, Technology and Features of Augmented Reality, Comparison of AR and VR, Challenges with AR, AR Systems and Functionality, Human factors, Human visual system, Perception of depth, color, contrast, resolution, Stereo Rendering, VR Hardware: Head-coupled displays etc. VR Software, Geometric Modelling: From 2D to 3D, 3D space curves, 3D boundary representation. The Graphics Pipeline and OpenGL, Overview and Transformations, Rotation, translation, scaling, mode view matrix, projection matrix, Lighting and Shading, OpenGL Shading Language (GLSL), GLSL vertex and fragment shaders.

Visual computation in virtual reality	10 Hours

3D Interaction Techniques: 3D Manipulation Techniques and Input Devices, 3D Travel Tasks, Travel Techniques, Theoretical Foundations of Wayfinding, Types of Centred-Wayfinding Support, Evaluating Wayfinding Aids, System Control, Classification, Graphical Menus, Voice Commands, Gestrual Commands, Tools, Muti-modal System Control Techniques, Case Study: Mixing System Control Methods, Symbolic Input Tasks.

Framing using 3D virtual reality	10 Hours

Development Tools and Frameworks in Virtual Reality: VR. X3D Standard; Vega, MultiGen, Virtools etc., World Space, World Coordinate, World Environment, Objects - Geometry, Position / Orientation, Hierarchy, Bounding Volume, Scripts and other attributes, VR Environment - VR Database, Tessellated Data, LODs, Graphical User Interface, Control Panel, 2D Controls.

VR applications	10 Hours

Pose Tracking I, Tracking with light house, Pose Tracking II. Advanced positional tracking, Panoramic Imaging and Cinematic, VR Spatial Sound and the Vestibular System, VR Engines and Other Aspects of VR, Latency, eye tracking, post-rendering warp. The Future: Virtual environment, modes of interaction Application of VR in Digital Entertainment: VR Technology in Film & TV Production. VR Technology in Physical Exercises and Games. Demonstration of Digital, Entertainment by VR.

Recommended Books

1. LaValle "Virtual Reality", Cambridge University Press, 2016.
2. Alan B Craig, William R Sherman and Jeffrey D Will, “Developing Virtual Reality Applications: Foundations of Effective Design”, Morgan Kaufmann, 2009.
3. John Vince, “Virtual Reality Systems “, Pearson Education Asia, 2007.
4. Anand R., “Augmented and Virtual Reality”, Khanna Publishing House, Delhi.