The Internet Technologies program is generally aimed at providing familiarity with various integral aspects of technology based learning. The approach involves theory part as well as practical sessions like a Flipped classroom. Sharing video before the class and conducting assessment like quizzes and hand-on session are the major activities drawn in like MOOC platform. Emphasizing the realistic understanding of the industrial based study is associated with the practical and hand-on sessions of each courses involved. The learner will have a thorough knowledge of the architecture as well as the applications of internet and the technologies behind. A simple chat system to social collaborative applications can be well designed and construct while acquired the technology behind the computing architecture and deployment models. By acquiring the mechanism of web service, socket programming, mobile apps, virtual simulations, serious games, cloud computing and collaborative applications like Facebook, twitter etc. the learner can build their own applications which can be utilized in industrial as well as educational purpose.
**CURRICULUM**

**First Semester**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Type</th>
<th>Course</th>
<th>L T P</th>
<th>Cr</th>
</tr>
</thead>
<tbody>
<tr>
<td>CS601</td>
<td>FC</td>
<td>Modern Computer Architecture</td>
<td>3 0 1</td>
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</tr>
<tr>
<td>CS602</td>
<td>FC</td>
<td>Advanced Algorithms and Analysis</td>
<td>3 0 1</td>
<td>4</td>
</tr>
<tr>
<td>CS621</td>
<td>SC</td>
<td>Systems Security</td>
<td>3 0 0</td>
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<tr>
<td>CS603</td>
<td>FC</td>
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Credits 17

*Non-Credit Course

**Second Semester**

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<tr>
<th>Course Code</th>
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<tr>
<td>CS622</td>
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<td>Parallel and Distributed Systems</td>
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<tr>
<td>IT621</td>
<td>SC</td>
<td>Internet Networks</td>
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<td>CS624</td>
<td>SC</td>
<td>Enterprise Architecture</td>
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<tr>
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<td>Elective-II</td>
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<tr>
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<td>Elective-III</td>
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<tr>
<td>CS625</td>
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<tr>
<td>EN600</td>
<td>HU</td>
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Credits 20

*Non-Credit Course
### Third Semester

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<td>E</td>
<td>Elective –V</td>
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**IT798**  
**P**  
Dissertation  
**10**  

**Credits 16**

### Fourth Semester

<table>
<thead>
<tr>
<th>Course Code</th>
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<tbody>
<tr>
<td>IT799</td>
<td>P</td>
<td>Dissertation</td>
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**Credits 12**

**Total Credits: 65**
# List of Courses

## Foundation Core

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course</th>
<th>L T P</th>
<th>Cr</th>
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</thead>
<tbody>
<tr>
<td>CS601</td>
<td>Modern Computer Architecture</td>
<td>3 0 1</td>
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<tr>
<td>CS602</td>
<td>Advanced Algorithms and Analysis</td>
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<tr>
<td>CS603</td>
<td>Mathematical Foundations of Computer Science</td>
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## Subject Core

<table>
<thead>
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<th>Course Code</th>
<th>Course</th>
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<tbody>
<tr>
<td>CS621</td>
<td>Systems Security</td>
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</tr>
<tr>
<td>CS622</td>
<td>Parallel and Distributed Systems</td>
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<td>4</td>
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<tr>
<td>IT621</td>
<td>Internet Networks</td>
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<td>Enterprise Architecture</td>
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<tr>
<td>CS625</td>
<td>Negotiated Studies</td>
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## Electives

### Elective-I

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<tr>
<td>IT 701</td>
<td>Design of Internet Applications</td>
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<td>IT 702</td>
<td>Mobile Networks</td>
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### Elective-II

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<td>IT 704</td>
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<td>IT707</td>
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<td>IT709</td>
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<td><strong>Project Work</strong></td>
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<td>IT799</td>
<td>Dissertation</td>
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</table>

TEXTBOOKS / REFERENCES:

CS602 ADVANCED ALGORITHMS AND ANALYSIS


TEXT BOOKS / REFERENCES:

CS621 SYSTEMS SECURITY 3-0-0-3


TEXTBOOKS / REFERENCES:

CS 603 MATHEMATICAL FOUNDATIONS OF COMPUTER SCIENCE 3-0-0-3

Logic: Propositional Calculus, Resolution in the propositional calculus, Predicate calculus, Resolution in the predicate calculus. Linear Algebra: Review of Matrices: Geometry of linear equations, Vector spaces and subspaces, linear independence, basis and dimensions, linear transformations, orthogonality, projections and least square applications. Probability and Advanced Statistics: Introduction to probability concepts, Bayesian approach to distributions, two dimensional random variables and joint probability distributions, stochastic independence of random variables, stochastic convergence and limit theorems, stopping rules for simulation experiments, multivariate

TEXTBOOKS / REFERENCES:
2. Nils Nilsson, “Artificial Intelligence, A New synthesis” PHI

CS622 PARALLEL AND DISTRIBUTED SYSTEMS 3-0-1-4

Introduction: Basics of parallelization and parallelization strategies. Parallel/distributed programming models and interfaces - shared memory vs. message passing vs. remote procedure call (RPC) vs. global address space languages: e.g., pthreads, MPI, MapReduce, OpenMP, HPF, UPC, language-level threads (e.g., Java). Parallel machine architectures - shared and distributed memory machines, multicore and multithreaded chips, interconnection networks. Parallel program optimization techniques - synchronization granularity, dependences, scheduling, load balancing. Synchronization - hardware primitives, logical and physical clocks, mutual exclusion, distributed transactions, transactional memory. Consistency and coherence - data-centric versus client-centric consistency models, cache coherence protocols. Fault tolerance and reliability - fail-stop versus byzantine failure models, two- and three-phase commits, reliable group communication, check pointing, message logging.

Hadoop open-source framework - Spark.

TEXT BOOKS / REFERENCES:

Cloud Computing Overview - Essential characteristics – On-demand self-service, Broad network access, Location independent resource pooling, Rapid elasticity, Measured service.

Cloud Computing Architecture - Cloud computing stack, Comparison with traditional computing architecture (client/server), Services provided at various levels, How Cloud Computing Works, Role of Networks in Cloud computing, protocols used.

Cloud Service Models - Infrastructure as a Service(IaaS), Platform as a Service(PaaS), Software as a Service(SaaS).


Cloud Data Centers - Datacenter Components, Design Considerations, Power Calculations. Cloud Storage - Cloud Storage Concepts, Distributed File Systems, Cloud Databases


Study of CloudSim:-System architecture simulation with CloudSim.

Open Source Tools - Red Hat’s Cloud – OpenStack- OS independent-http://opensource.com/resources/what-is-openstack. - KVM (Kernel-based Virtual Machine);Deltacloud; Eucalyptus; Cloud.com; OpenNebula; Traffic Server; Cloudera; Puppet; Enomaly; Joyent; Zoho; Globus Nimbus; Reservoir

Hands-on: Create a cloud instance using Google cloud platform and connect it using web and mobile devices. https://cloud.google.com/

TEXTBOOKS / REFERENCES:

CS624 ENTERPRISE ARCHITECTURES 3-0-1-4
Enterprise architecture (EA) principles and purpose; modeling approaches for EA definition and communication; key enterprise architecture approaches, standards, and frameworks; best practice for development of enterprise architecture, analysis of alternative models for enterprise architectures; best practice approaches and models for documenting enterprise architectures; evaluation of alternative enterprise architecture approaches, identification and evaluation of gaps and opportunities in different enterprise architecture models and processes; models of different aspects of the enterprise architecture processes and artifacts, and architectures at different levels, including conceptual and technical.

Cloud Computing: The internet as a platform, Software as a service and cloud computing, cloud computing platforms, Cloud Technologies – Web Services – SOAP- AJAX, Virtualization and cloud, Multi-tenant Software, Data in the cloud and cloud file systems. Big Data: Map Reduce, Hadoop

TEXT BOOKS / REFERENCES:
5. Tom White, “Hadoop: The Definitive Guide”, O’Reilly Media

CS625 NEGOTIATED STUDIES 0-0-2-2

Note: This course is intended to be a self study course. Each student can select an area of self study in consultation with the Faculty, collect and study basic and recent research articles (project reports, review articles, published articles in journals and book chapters.) on the topic. It can also involve semester long case study or mini projects involving programming, implementation, testing performance analysis etc. in different application specific contexts. Students will be required to make two in-class presentations and prepare a review article, possibly of publishable quality The Seminars and article will be evaluated for grading purpose. The evaluation will be done by a panel of (at least) two Faculty members.

EN600 TECHNICAL WRITING P/F

Technical terms, Definitions - extended definitions; grammar checks: error detection, punctuation, spelling and number rules; tone and style; pre-writing techniques; online and offline library resources; citing references; plagiarism; graphical representation; documentation styles; instruction manuals; information brochures; research papers, proposals & reports (dissertation, project reports etc.), oral presentations.

TEXT BOOKS/REFERENCES:

IT701 DESIGN OF INTERNET APPLICATIONS 3-0-0-3

HTML5 - Basic html tags and its usage, what is new in HTML5, Media elements, Input types, Semantic elements, LocalStorage, SessionStorage, Cookies CSS3 - Different selectors. Different type of styling methods, JavaScript - Basic JavaScript functionalities and regular expressions. JQuery - How to download and use JQuery library. Server side programming - Introduction to server side programming and advantages of Node.js, Asynchronous and non-blocking IO, Node.js HTTP Server and TCP Server, NPM, How to create a simple HTTP server, Web framework with express, what is a framework and how to use a framework. Examples with Express module. Socket programming - Introduction to Socket programming, socket Emit, Broadcast and On methods, Node.js database communication, Create a basic mySql table and retrieve data from that using node.js mySql module. Ajax calls - Different Ajax call methods, Communicate with database using Ajax, JSON/XML formats, Share data in various formats. Advantages of JSON data format.

Introduction on android development, How to create a native android project, Managing Android SDKs, Remember/restore data while changing activity, Manage access permissions, Login; DB connectivity; Web service, Importing Libraries. Activity, UI components, Intent - Implicit and Explicit intent, Device debugging, Tutorial: Create a sample android app which includes implicit and explicit intents, Fetch Device details and Account details, Local storage (Shared preference, SQL Lite), Tutorial: Create an app which gets all the device and account details and stores these details in a SQL Lite table. Online storage, Connect to web services, Tutorial: Create an app which checks for validity of username and password with a remote database and stores the credentials in Shared preference. Notifications and toast, Menu, Handling phone buttons (Back, Options, Power), Broadcast receiver (Booting, Call, Net connection, Battery power), Sensors

Client server architecture, two tier, three tier, and n tier Architecture, Internet System Architecture – How an E-Mail Works, YouTube architecture, Video Streaming techniques, Implement a prototype of YouTube.


TEXTBOOKS / REFERENCES:

**IT702 MOBILE NETWORKS 3-0-0-0**


**TEXTBOOKS / REFERENCES:**

**IT703 COLLABORATIVE APPLICATIONS ON THE INTERNET 3-0-0-0**

Pedagogy of collaborative mobile and web applications: Collaborative learning, Computer-supported collaborative learning, The objective and motivation of Social collaborative environment, Major collaborative applications, Psychology behind collaborative environment, Collaborative elements, Instructional designing strategies for collaborative applications, how to work autonomously within a collaborative environment. Assessments for collaborative experiences.
Collaborative Mobile and Web applications: A-VIEW, Blackboard. Google services, Google play store, Google map, Facebook.

Designing interactive and collaborative environments, Characteristics and classification of collaborative tools, Technological challenges to the research and development of collaborative environments. Identify the main types of services supporting online collaboration like: cloud computing, mobile technology. Identify the main types of tools supporting online collaboration like: common productivity applications, social media, online calendars, online meetings, online learning environments. Identify key characteristics of online collaborative tools like: multiple users, real time, global reach, concurrent access.

Mobile: Connect to the Internet securely using wireless mobile technology. Add, edit, remove a calendar event. Share pictures, videos using options like: e-mail, messaging, social media, Bluetooth. Understand the purpose of synchronizing content. Synchronize mobile devices with mail, calendar, other devices.

Pedagogy of Collaborative serious Game: Introduction to Serious Games and Virtual Simulations: Overview of games and simulations for learning, Rationale for game-based learning, Basic terms and concepts; definitions and game genres
Learning, Instruction, and Assessment with Games: Game attributes and learning outcomes, Models of game-based learning, Learning theories and games, Pedagogical approaches for learning with serious games, Principles for designing instructionally effective games, Assessment of learning with serious games
Collaborative Serious Games: Theoretical background on collaborative learning, Collaboration and serious games

Collaborative Serious Games- AI for games: Introduction to simulation- virtual simulations and serious games - basic terms/concepts- how computer simulations and games differ from analog simulations. Games for Learning and Game Based Learning: how do we design games that create rigorous learning of academic material.

HTML5 Gaming: Introduction to Canvas rendering, SVG and WebGL, Atlases, Map rendering, Basic Input, handling events, The entity hierarchy, Box2D, and using external libraries, Adding sound, Asynchronous Loading.

Hands-on: Create a collaborative whiteboard using node.js, use Imaginea-matisse (https://github.com/Imaginea/matisse) as open source code and make it collaborative. Create simple android collaboration application which will share message and files.

TEXTBOOKS/REFERENCES:
3. Patricia Comeaux, " Communication and Collaboration in the Online Classroom - Examples
and Applications”, Anker Publishing Company, 2002

IT704 = SEMANTIC WEB = 3-0-0-3


TEXTBOOKS/REFERENCES:

IT705 = IMAGE RECOGNITION = 3-0-0-3

Hands-on: Hand on session in Image deformation and geometric transformations, special noise filters. Hand on session in Erosion, Dilation, Opening, Closing and Hit-or-Miss Transform.

Light, Brightness adaption and discrimination, Pixels, coordinate conventions, Imaging Geometry,
Perspective Projection, Spatial Domain Filtering, sampling and quantization.
Spatial Domain Filtering: Intensity transformations, contrast stretching, histogram equalization, Correlation and convolution, Smoothing filters, sharpening filters, gradient and Laplacian. Filtering in the Frequency domain: Hotelling Transform, Fourier Transforms and properties, FFT (Decimation in Frequency and Decimation in Time Techniques), Convolution, Correlation, 2-D sampling, Discrete Cosine Transform, Frequency domain filtering.
Morphological Image Processing: Basics, SE, Erosion, Dilation, Opening, Closing, Hit-or-Miss Transform, Boundary Detection, Hole filling, Connected components, convex hull, thinning, thickening, skeletons, pruning, Geodesic Dilation, Erosion, Reconstruction by dilation and erosion.
Image Segmentation: Boundary detection based techniques, Point, line detection, Edge detection, Edge linking, local processing, regional processing, Hough transform, Thresholding, Iterative Thresholding, Otsu's method, Moving averages, Multivariable Thresholding, Region-based segmentation, Watershed algorithm, Use of motion in segmentation.

TEXT BOOKS / REFERENCES:
Applications on Big Data Using Pig and Hive – Data processing operators in Pig – Hive services – Hive QL – Querying Data in Hive – fundamentals of H Base and Zoo Keeper – IBM Info Sphere Big Insights and Streams. Visualizations – Visual data analysis techniques, interaction techniques; Systems and applications

TEXTBOOKS / REFERENCES:


IT707 PSYCHOLOGY OF USER EXPERIENCE 3-0-0-3


Learning Psychology: Information Processing; Cognitive theories; Constructivism: Social
constructivism; Cognitive Constructivism; Social Cognitive Theory; Distributed Cognition; Situated Learning; Theory of Multimedia Learning; Meta cognition, Self-Regulation; Theories of Motivation; Learner Self-Efficacy; Intelligence: Different approaches to intelligence; Modern theories of intelligence – Gardener’s multiple intelligence, Sternberg’s successful intelligence and PASS Model of intelligence; Creativity and its dimensions; Learner Diversity: Cognitive Styles; Learning Styles; Cross-cultural Issues in Education; Taxonomies in Education.

UI Design for Internet users: Interaction – interaction models, ergonomics, social and organization context. Basics of Design, design rules and principles; Representations using tools like OOP, OOM, UML etc.; HCI and Software process; HCI and implementation. Evaluation methods - usability, functionality, quantitative evaluations;

UX: User Stories, Sketching the User Experience, Graphical Environments, Telemetry plans, UX in the Cloud.

Hands-on: Prototype a sample application using Balsamiq and InvisionApp, that will be translated to responsive web page(s) utilizing HTML5, CSS-3 and Bootstrap.

TEXTBOOKS/REFERENCES:

IT708 MACHINE LEARNING 3-0-0-3

Introduction: Machine learning: Types of machine learning, Supervised learning, Unsupervised learning, Some basic concepts in machine learning, Review of probability, Computational Learning theory.


Directed graphical models (Bayes nets), Conditional independence, Inference, Learning Learning from complete data, Learning with missing and/or latent variables, Conditional independence properties of DGMs, d-separation and the Baye’s Ball algorithm (global Markov properties), Influence (decision) diagrams, Mixture models and EM algorithm, Latent Linear models, Kernels, Adaptive basis function models, Clustering, Graphical model structure learning.

TEXTBOOKS / REFERENCES:

IT709 TECHNOLOGY ENHANCED LEARNING 3-0-0 3

Learning: Different views of learning; Pedagogical principles and methodologies for effective teaching-learning; Internet based learning.


Instructional Systems Design (ISD): Origin; ADDIE components of ISD; Models of ISD; Learning theories and ISD.

Different kinds of technology-supported learning: video-based instruction; games and simulations for learning; computer-supported collaborative learning, problem-based learning environments, open and distance learning, open education resources, tutored-video instruction, interactive video-conferencing; Use of technology in formal and informal contexts; Use of social networks for learning.

Framework for Educational Technology: Issues Related to Technology; Pedagogy; Policy, Capacity Building, and Implementation; Technological Pedagogical Content Knowledge;

Current Programs and Projects in Technology-enhanced learning: National and Global;

Universal Design for Learning: Principles; Strategies for Diverse Student Needs; Emerging research areas in technology-enhanced learning.

Blended MOOC approach in Learning. Various learning activities; Alternatives to Pure E-Learning: Blended, Embedded, etc. Synchronous and Asynchronous Learning, Building Learning Architectures.

Knowledge Management, Digital Libraries and Repositories, Learning Content Management System, Courseware Development, Digital Libraries for Learning, Future Classrooms, Infrastructure of Education environments: basics of sound systems, mixers, mikes. Understanding Acoustics; Basics of Videography: lighting, and designing backgrounds; Setting up Networks and basic system administration; Teacher training for studio: movement, gestures, and camera awareness.

Web Based Learning; Interactive Whiteboard technologies (Blackboard, WebCT, etc.); Computer-Mediated Communication (CMC) Tools. Predictive analytics; automated intervention and adaptive analytics; Development of "intelligent curriculum" Personalization of learning based on intelligent curriculum.
Hands on Session: Web portal design and creation, Streaming Technologies: Red5, WebRTC. Social media integration using APIs: Facebook, Google and Wikipedia.

TEXTBOOKS / REFERENCES:


IT710 CONTENT BASED IMAGE AND VIDEO RETRIEVAL 3-0-0-3


TEXTBOOKS/REFERENCES: