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| **Course Title/ Code** | **Progressive Web App (CSH401B) T & P** |
| **Course Type:** | Elective (Departmental) |
| **Course Nature:** | Hard |
| **L-T-P-O Structure** | (3-0-2-0) |
| **Objectives** | Students would be able to develop progressive web applications. |

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| **Syllabus** | **Sections** | **Weightage** |
| A | 25% |
| B | 25% |
| C | 25% |
| D | 25% |
| **TOTAL** | **100%** |

**Section-A**

**Introduction to Progressive Web App Architectures:** Components, PWA Architecture pattern, Migrating existing site to PWA, Application Shell, Create and build App shell.

**Service Worker:** Introduction, Service worker lifecycle, Events in service worker.

**Lighthouse:** PWA Analysis Tool, running Lighthouse as Chrome extension and command line.

**Section-B**

**Offline application:** Why and How, **Promises:** Introduction, using promise, states of promise, Use promise, and Promise chains. **Fetch API:** Making a request, Reading the response object, Custom request, Cross-origin request. **Caching:** Cache API in the service worker, serving files from the cache.

**Section-C**

**IndexedDB:** Introduction, Opening database, working with object stores and with data, fetch all data, using database versioning. **Live data:** Storing data with IndexedDB and storing assests in the cache interface. **Gulp tool:** set up gulp, creating tasks and automation. Automate creation of service worker with sw-precache and sw-toolbox.

**Section-D**

**Push Notification:** Introduction and terminology, Notification API, Push API, Web Push Protocol. **Payment Request API:** Introduction, how and using payment request API. **Google Analytics:** adding analytics to site, dashboard, Analytics and service worker, Offline analytics.

**LIST OF EXPERIMENTS:**

1. Lab: Scripting the Service Worker
2. Lab: Auditing with Lighthouse
3. Lab: Responsive Design and Images
4. Lab: Promises
5. Lab: Fetch API
6. Lab: Caching Files with Service Worker
7. Lab: IndexedDB
8. Lab: Gulp setup
9. Lab: Integrating Web Push
10. Lab: Integrating Analytics
11. Lab: E-commerce project

**Text Books:**

1. Beginning Progressive Web App Development: Creating a Native App Experience on the Web by Dennis Sheppard, Apress.

2. <https://developers.google.com/web/progressive-web-apps/>

3. Progressive Web Apps ILT – Concepts by Developed by Google Developer Training

**Reference Book:**

1. Building Progressive Web Apps: Bringing the Power of Native to the Browser, By Tal Ater, O’Reilly.

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| **Course Title/ Code** | **BIG DATA(CSH402B) T & P** |
| **Course Type:** | ELECTIVE (Departmental) |
| **Course Nature:** | HARD |
| **L-T-P-O Structure** | 3-0-2-0 |
| **Objectives** | Student will be able to do Big Data Programming and Analytics using Hadoop. |

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| **Syllabus** | **Sections** | **Weightage** |
| A | 25% |
| B | 25% |
| C | 25% |
| D | 25% |
| **TOTAL** | **100%** |

**Section-A**

**Introductory Concepts (Digital Data and Big Data)**: Digital Data Basics,Types of Digital Data (Structured, Semi-Structured, Unstructured), Introduction to Big Data, Why Big Data? Dimensions of Big Data, Challenges with Big Data, Big Data Stack,ScalingProblems.Big data processing tools(AWS).

**Hadoop overview:**

Brief history of Hadoop, Hadoop 1.0 vs. Hadoop 2.0,Hadoop Components, High level architecture of Hadoop,HadoopStreaming,Hadoop Compression.

**Section-B**

**Big data programming using Hadoop:** Hadoop Distributed File System: Architecture, Daemons related to HDFS, working with HDFS command,Special features of Hadoop, Introduction to functional programming, How Map Reduce Works, Mapreduce on YARN, Map Reduce Joins, Map Reduce Work Flows. HDFS and Hadoop Ecosystem.

**Section C**

**Big Data Analytics :** Analytics 1.0, Analytics 2.0, Analytics 3.0,Traditional BI vs. Big Data Environment ,Big Data technology Landscape,NoSQLDatabases,NoSQL Vs. RDBMS, New SQL.

**Section-D**

**Frameworks:** APACHE HIVE:History of HIVE,HIVE architecture,Hive Primitive Data Types and Collection Types,Hive File Formats ,Hive Query Language – Statements,DDL  DML , Fundamentals of APACHE PIG & HBASE ,Business Intelligence on Hadoop.

**LIST OF EXPERIMENTS:**

1. To Install and set up of Hadoop  along with Start up and shut down process
2. Introduction to (Hadoop Distributed File System ) labs

* Loading data
* Viewing the cluster contents
* Getting data out of the cluster

1. To write basic map reduce program

* Driver code
* 3Mapper
* Reducer

1. To Creating Input and Output formats in Map Reduce Jobs

* Text Input format
* Key value input format
* Sequence file input format

1. To  implementing  Latin commands on pig/ How to use basic pig commands
2. Introduction to processing data with Hive

* Creating tables with Hive
* Managing hive table data location and lifetime
* Loading data into hive tables
* Partitioning the data
* Querying tables with Hive QL

**Text Books:**

1. Tom White “ Hadoop: The Definitive Guide” Third Edition, O’reilly Media, 2012.

*2.* Michael Berthold, David J. Hand, “Intelligent Data Analysis”, Springer, 2007.

3. Michael Minelli (Author), Michele Chambers (Author), AmbigaDhiraj (Author) , Big Data, Big Analytics: Emerging Business Intelligence   and  Analytic Trends for Today's Businesses,Wiley Publications,2013.

**Reference Book:**

1. Chris Eaton, Dirk DeRoos, Tom Deutsch, George Lapis, Paul Zikopoulos, “Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data”, McGraw Hill Publishing, 2012.
2. AnandRajaraman and Jeffrey David Ullman, “Mining of Massive Datasets”, Cambridge University Press, 2012.
3. Bill Franks, “Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics”, John Wiley &sons, 2012.
4. Glenn J. Myatt, “Making Sense of Data”, John Wiley & Sons, 2007.
5. Pete Warden, “Big Data Glossary”, O’Reilly, 2011.
6. Paul Zikopoulos , Dirk deRoos , Krishnan Parasuraman , Thomas Deutsch , James Giles , David Corrigan , Harness the Power of Big Data The IBM Big Data Platform, Tata McGraw Hill Publications, 2012.
7. Zikopoulos, Paul, Chris Eaton, Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data, Tata McGraw Hill Publications, 2011.

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| **Course Title/ Code** | **Image Processing(CSH403B) T & P** |
| **Course Type** | Elective (Departmental) |
| **Course Nature** | Hard |
| **L-T-P-O Structure** | (3-0-2-0) |

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| **Syllabus** | **Sections** | **Weightage** |
| A | 25% |
| B | 25% |
| C | 25% |
| D | 25% |
| **TOTAL** | **100%** |

**Section-A**

**Overview to Digital Image Processing**: The nature of Digital Image Processing and Applications, Fundamentals Steps in Image Processing, Elements of Digital Image Processing Systems.

**Image Sampling and Quantization:** Some basic relationships like Neighbors, Connectivity, Distance Measures between pixels, Linear and Non Linear Operations.

**Image Enhancement in the Spatial Domain:** Histogram Processing, Arithmetic and Logic operations, Smoothening and Sharpening Spatial Filters, Combining Spatial Enhancement Methods.

**Section-B**

**Filtering in the Frequency Domain:** Introduction to Fourier Transform and the frequency Domain, Smoothing and Sharpening Frequency Domain Filters.

**Image Restoration:** Introduction and types of Image Degradation, Noise Modeling- Noise Category base on distribution, correlation, source and nature. Image Restoration in the presence of Noise Only- Mean Filters, Order Static Filters.

**Image Restoration Techniques:** Unconstrained, Constrains, iterative and Blind image Restoration Methods.

**Section-C**

**Image Compression:** fundamentals of compression, coding redundancy, Lossy and lossless compression algorithms, Spatial and temporal redundancy, Image compression models. Some basic compression methods**.**

**Image Segmentation:** Detection of Discontinuities, Edge and boundary detection, Types of Edge detector, Region Oriented and Motion based segmentation.

**Section-D**

**Image Representation and Description:** Introduction, Boundary Representation & Descriptors, Component Labeling & regional descriptors, Introduction to Morphological operators with examples.

**Object Recognition**: Patterns and Pattern Classes, Decision-Theoretic Methods, Structural Methods.

**Text Books:**

1. Rafael C. Gonzalez & Richard E. Woods, “Digital Image Processing”, 3rd edition, Pearson, 2008.
2. S. Sridhar, “Digital Image processing”, 2nd edition, Oxford 2016.
3. A.K. Jain, “Fundamental of Digital Image Processing”, PHI, 1989.

**Reference Books:**

1. Bernd Jahne, “Digital Image Processing”, 5th Ed., Springer, 2002.
2. William K Pratt, “Digital Image Processing: Piks Inside”, John Wiley & Sons, 2001.
3. Lavanya Sharma, “Object Detection with Background Subtraction”, LAP LAMBERT Academic Publishing, SIA OmniScriptum Publishing, 2018.

**List of Experiments (Using MATLAB or ImageJ Tools):**

1. Convert an RGB image of size 256X256 pixel’s into greyscale and binary image.
2. Implement the spatial image enhancement functions on a bitmap image –Mirroring (Inversion).
3. Implement the spatial image enhancement functions on a bitmap image –Rotation (Clockwise).
4. Implement (a) Gaussian Low Pass Filter (b) Butterworth High Pass Filter (c) Gradient and Laplacian filters
5. Implement (a) Harmonic Mean Filter (b) Yp- Mean Filter (c) Median Filter.
6. Implement Smoothing and Sharpening of an eight bit color image
7. Implement (a)Wavelet transformation Algorithm (b) Graham's Scan Algorithm
8. Implement (a) Edge Detection using Canny, Prewitt, and Sobel operators
9. Display an image size of 512X512  and its histogram
10. Perform shrinking and cropping of an image
11. Perform blurring and de-blurring operation on an image( 256X256).
12. Removal of Poisson, Salt and Pepper noise.
13. Implement a function for image segmentation using second order derivative.
14. Implement a function for image morphology using Morphological tools such as dilation, erosion and imfill operators.
15. Implement a function for Image Restoration Model for representing the color and methods of processing the color plane.
16. Implement a code to detect contour of an input image of size 512X512.

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| **Course Title/ Code** | **Cloud Computing (CSH404B) T & P** |
| **Course Type:** | Elective (Departmental) |
| **Course Nature:** | Hard |
| **L-T-P-O Structure** | (3-0-2-0) |
| **Objectives** | Students will be able to learn the concepts, techniques and implementation of clouds. |

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| **Syllabus** | **Sections** | **Weightage** |
| A | 25% |
| B | 25% |
| C | 25% |
| D | 25% |
| **TOTAL** | **100%** |

**Section-A**

**Overview of Cloud Computing:** Brief history and evolution - History of Cloud Computing, Evolution of Cloud Computing, Traditional vs. Cloud Computing. Why Cloud Computing, Cloud service models (IaaS, PaaS&SaaS). Cloud deployment models (Public, Private, Hybrid and Community Cloud), Benefits and Challenges of Cloud Computing.

**Working with Private Cloud:** Basics of virtualization, Virtualization technologies, Server virtualization, VM migration techniques, Role of virtualization in Cloud Computing. Business cases for the need of Cloud computing environment, Private Cloud Definition, Characteristics of Private Cloud, Private Cloud deployment models, Private Cloud Vendors, Private Cloud Building blocks

namely Physical Layer, Virtualization Layer, Cloud Management  Layer, Challenges to private Cloud, Virtual Private Cloud. Implementing private cloud (one out of CloudStack, OpenStack, Eucalyptus, IBM or Microsoft)

**Section-B**

**Working with Public Clouds:** Public Cloud, Public Cloud Service Models, and Public Cloud Players. Infrastructure as a Service Offerings,

IaaSVendors,  PaaS  offerings,  PaaS  vendors,  Software  as  a  Service. Implementing public cloud (one out of AWS, Windows Azure, IBM or Rackspace).

**Application Development:** Service creation environments to develop cloud based applications. Development environments for service development; Amazon, Azure, Google App.

**Section-C**

**Cloud Services Management:** Reliability, availability and security of services deployed from the cloud. Performance and scalability of services, tools and technologies used to manage cloud services deployment; Cloud Economics: Cloud Computing infrastructures available for implementing cloud based services.

**Cloud Infrastructure:** Architectural Design of Compute and Storage Clouds - Layered Cloud Architecture Development –Design Challenges.  Inter Cloud Resource Management System – Resource Provisioning and platform Deployment- Global Exchange of Cloud Resources.

**Future directions in Cloud**

**Computing:** Future  technology  trends  in  Cloud  Computing  with  a  focus  on  Cloud  service  models,

deployment models,  cloud  applications, and cloud  security.  Migration paths for cloud, Selection criteria for cloud deployment.Current issues in cloud computing leading to future research directions.

**Section-D**

**Business Clouds:** Cloud Computing in Business, Various Biz Clouds focused on industry domains (Retail, Banking and Financial sector, Life Sciences, Social networking, Telecom, Education). Cloud Enablers (Business Intelligence on cloud, Big Data Analytics on Cloud)

**Programming Cloud IT Model**:  Parallel and Distributed Programming Paradigms, Twister and Iterative MapReduce, Hadoop Library from Apache- Mapping Applications – Programming Support of Google App Engine, Cloud Software Environments – including Eucalyptus, Open Nebula, OpenStack, Aneka and Cloud Sim.

**LIST OF EXPERIMENTS:**

1. Creation of EC2 Instance on Amazon.
2. Implementation of Load Balancing.
3. Deployment of various services on Amazon.
4. Design, development and implementation of a given business application.
5. Management of one application using multi-cloud management.

**Text Books:**

1. A Practical Approach Cloud Computing:  By Anthony T Velte, Toby J Velte, Robert C Elsenpeter.
2. Distributed and Cloud Computing: From Parallel Processing to the Internet of Things, *Kai Hwang, Jack Dongarra and Geoffrey Fox*, Morgan Kaufmann, 2011.

**Reference Book:**

1. Cloud computing: Implementation, management and security By Rittinghouse, John, W.
2. Cloud Computing Bible, By Barrie Sosinsky, Wiley, 2011.
3. Cloud Computing Architected: Solution Design Handbook by Rhoton, John.
4. Cloud Security, A comprehensive Guide to Secure Cloud Com puting by Krutz, Ronald L.; Vines, Russell Dean
5. Cloud Computing:  Principles and paradigms By Raj Kumar Buyya, James Broberg, AndrezeiM.Goscinski, 2011

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| **Course Title/ Code** | **Software Testing(CSH405B)T&P** |
| **Course Type:** | Domain Elective (Departmental) |
| **Course Nature:** | Hard |
| **L-T-P-O Structure** | (3-0-2-0) |
| **Objectives** | Student will be able to implement software testing skills to test any given software based on the requirements specification. |

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| **Syllabus** | **Sections** | **Weightage** |
| A | 25% |
| B | 25% |
| C | 25% |
| D | 25% |
| **TOTAL** | **100%** |

**Section-A**

**INTRODUCTION:** Software Testing Techniques, software testing fundamentals: objectives, principles, testability; Test case design, V Model.

**CODE TUNING TECHNIQUES:** Use of Correct Data Type, Ordering statements in switch, Stop testing in a loop when result is known, Minimizing array references, Jamming and Un-switching of Loops, Minimizing Computations in loop.

**FUNCTIONAL TESTING TECHNIQUES: BLACK BOX TESTING:** Exploratory Testing, Logic Coverage: Interface Testing, Boundary Value Analysis, Robustness Testing, Worst Case Testing, Equivalence Class Testing.

**Section-B**

**FUNCTIONAL/STRUCTURAL TESTING TECHNIQUES**: Decision Table based Testing, Cause Effect Graphing Technique, and White box testing, Basis Path Testing, DD Paths and Cyclomatic Complexity.

**STRUCTURAL TESTING TECHNIQUES: WHITE BOX TESTING**: Graph Matrices, Data Flow Testing, Mutation Testing, Unit Testing, Integration Testing.

**REDUCING THE NUMBER OF TEST CASES:**  Regression Testing, Regression Test Process, Selection of Regression Tests, Prioritization Guidelines, Slice based testing.

**Section-C**

**OBJECT ORIENTED TESTING**: Issues in OO Testing, Class Testing: Random Testing, Class Testing: Partition based Testing, Object Oriented Integration and System Testing, System Testing.

**DEBUGGING AND DEFECT TRACKING REPORT**: Debugging Techniques, Debugging through Code Inspection, Debugging using Logs, Debugging using IDE, Creating Defect Tracking Reports.

**TEST MANAGEMENT**: Test Planning, Test Management, Test Automation, Testing Tools, Static vs. Dynamic Testing Tools.

**Section-D**

**TEST AUTOMATION USING SELENIUM: INTRODUCTION:**  Why Selenium? , Selenium Vs other tools (HP etc), Selenium Components, Selenium RC vs Web driver, Selenium Core, Selenium IDE, Remote Control (Selenium1), Web driver (Selenium2), Grid,  Locators & types, Test Automation, Getting started with Selenium IDE, Useful Tools for Writing Test Cases Firefox Add-ons,  Basic Html Theory.

**TEST AUTOMATION USING SELENIUM: RECORDING TESTS**: Selenium Commands – SELENESE, Pattern Matching, Element Locators, Selenium RC Overview, Install and Run Selenium RC,  Recording and Playing Back Test Cases, Test Case Verification, Working with Test Suites, Test Case HTML Reports.

**TEST AUTOMATION USING SELENIUM: RECORDING TESTS**: The Eclipse IDE, Running a Test Using the JUnit Export from Selenium-IDE, Running a Test Using the TestNG Export from Selenium-IDE, Data Driven Testing using TestNG.

**Text Books:**

1. William Perry, “Effective Methods for Software Testing”, John Wiley & Sons, New York, 1995.
2. Louise Tamres, “Software Testing”, Pearson Education Asia, 2002.
3. CemKaner, Jack Falk, Nguyen Quoc, “Testing Computer Software”, Second Edition, Van Nostrand Reinhold, New York, 1993.
4. David Burns, “SELENIUM 2 TESTING TOOLS : BEGINNER'S GUIDE”, Packt Publishing.

**Reference Books:**

1. K.K. Aggarwal&Yogesh Singh, “Software Engineering”, 2nd Ed., New Age International Publishers, New Delhi, 2005.
2. Boris Beizer, “Software Testing Techniques”, Second Volume, Second Edition, Van Nostrand Reinhold, New York, 1990.
3. AdityaGarg, “A Practitoner's Guide To Test Automation Using Selenium”, 1st Edition, McGraw Hill Education (India) Private Limited.

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| **Course Title/ Code** | **Blockchain Technology(CSH423B)T&P** |
| **Course Type:** | **Domain Elective** |
| **Course Nature:** | Hard |
| **L-T-P-O Structure** | (3-0-2-0) |
| **Objectives** | Students will be familiar with blockchain and cryptocurrency concepts. Also, they can build their application using the learned concepts. |

**Section-A**

**Basics:** Distributed Database, Two General Problem, Byzantine General problem and Fault Tolerance. Cryptography: Hash function, Digital Signature, Zero Knowledge Proof.

**Blockchain**: Introduction, Advantage over a conventional distributed database, Blockchain Network, Mining Mechanism, Distributed Consensus, Merkle Patricia Tree, Gas Limit, Transactions and Fee, Anonymity, Reward, Chain Policy, Life of Blockchain application, Soft & Hard Fork, Private and Public blockchain.

**Section-B**

**Distributed Consensus**: Nakamoto consensus, Proof of Work, Proof of Stake, Proof of Burn, difficulty Level, Sybil Attack, Energy utilization, and alternate.

**Cryptocurrency**: History, Distributed Ledger, Bitcoin protocols - Mining strategy and rewards

**Section-C**

**Ethereum** - Construction, DAO, Smart Contract, GHOST, Vulnerability, Attacks, Sidechain, Namecoin.

**Cryptocurrency Regulation**: Stakeholders, Roots of Bitcoin, Legal Aspects - Cryptocurrency Exchange, Black Market, and Global Economy.

**Section-D**

**Blockchain Applications**: Internet of Things, Medical Record Management System, Banking, Finance, copyrights, digital resources etc. and future of Blockchain.

**Lab:** Naive Blockchain construction, Solidity Programming, Working with Remix (Ethereum), Metamask Smart Contract Construction, Applications using Blockchain.

**TEXT BOOKS: NIL**

**REFERENCE BOOKS:**

·    Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller and Steven Goldfeder, Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction, Princeton University Press (July 19, 2016).

·    Wattenhofer, The Science of the Blockchain

·    Antonopoulos, Mastering Bitcoin: Unlocking Digital Cryptocurrencies

·    Satoshi Nakamoto, Bitcoin: A Peer-to-Peer Electronic Cash System

·    DR. Gavin Wood, ETHEREUM: A Secure Decentralized Transaction Ledger,"Yellow paper.2014.

·    Nicola Atzei, Massimo Bartoletti, and Tiziana Cimoli, A survey of attacks on Ethereum

smart contracts