

**CVM UNIVERSITY**  
**M.Sc. (Information Technology)**  
**Semester – I**  
**Syllabus with Effective from: 2021-2022**  
**First Semester**

<b>Subject Code</b>	<b>Subject Title</b>
101410101	Software Engineering
101410102	Advanced Java
101410103	ASP.NET Using C#
101410104	Practical based on Advanced Java
101410105	Practical based on ASP.NET Using C#
101410106	Comprehensive Viva-Voce
101410107 <b>Or</b> 101410108	Elective Subject

**Elective Subjects:**

101410107 Artificial Intelligence

101410108 Network Security & Cryptography

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**Paper Code: 101410101**  
**Paper Title: Software Engineering**

**(Total Marks: 100)**

**Unit 1:**

**Introduction:** Introduction to Software Engineering, Defining Software, Changing Nature of Software, Attributes of a Good Software, Software Development Life Cycle, Software Process, Software Myths, Current Trends in Software Engineering, Web Engineering, Reengineering

**Software Process Models:** Waterfall Model, Prototyping Model, Iterative Model, Time Boxing Model and Spiral Model, Introduction to Basic Concepts of Agile Software Development

**Unit 2:**

**Software Project Management:** Responsibilities of a Software Project Manager, Project Planning, Metrics or Project Size Estimation, Project Estimation Techniques, Empirical Estimation Techniques, COCOMO Model, An Analytical Technique, Staffing Level Estimation, Scheduling, Organization and Team Structures, Staffing, Risk Management, Software Configuration Management

**Requirements Analysis and Specification:** Requirements Gathering and Analysis, Software Requirements Specification, Formal System Specification, Axiomatic Specification, Algebraic Specification

**Unit 3:**

**Software Design:** Design Concepts and Design Principal, Cohesion and Coupling, Layered Arrangement of Modules, Approaches to Software Design, Function-Oriented Software Design (Overview), User Interface Design (Characteristics of A Good User Interface, Basic Concepts, Types of User Interfaces)

**Object Oriented Analysis & Design Tool – UML:** UML Overview, Class Diagram, Activity Diagram, Sequence and Collaboration Diagram, State Chart Diagram, Use Case Diagram

**Unit 4:**

**Software Coding & Testing:** Coding, Code Review, Software Documentation, Testing, Unit Testing, Debugging, Program Analysis Tools, Integration Testing.

**Software Maintenance:** Characteristics of Software Maintenance, Software Reverse Engineering, Software Maintenance Process Models, Estimation of Maintenance Cost

**Reference Books:**

1. Jalote Pankaj : Integrated Approach to Software Engineering, 3rd Edition, Narosa Publishing House, 2005 (ISBN 978-81-7319-702-4).
2. Roger Pressman , Software Engineering, A Practitioners Approach, McGraw Hill Publication
3. Ivar Jacobson, Object Oriented Software Engineering A use case Approach , Pearson
4. Rajib Mall : Fundamentals of Software Engineering, 2 nd Edition, Prentice-Hall of India, 2006 (ISBN-81-203-2445-5).
5. James A Senn : Analysis and Design of Information Systems McGraw Hill Intl. Std. Edn, 1985
6. C Lliu: Elements of Descrete Mathematics – TMH
7. Swapan Kumar chakraborty and Bikash Kanti Sarkar: Discrete Mathematics – OXFORD Higher Education.
8. Ian Sommerville : Software Engineering, 6th edition, Pearson Education, 2001, (ISBN 81 7808-497-X).

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**Paper Code: 101410102**  
**Paper Title: Advanced Java**

**(Total Marks: 100)**

**Unit 1:**

**Multithreading:** Life Cycle of a Thread, Creating Thread and Running it, Creating Multiple Threads, Waiting for Threads, Thread Group, Thread Priorities, Synchronization

**Introduction to J2EE Technology:** Introduction to J2EE Platform, J2EE Architecture, Introduction to J2EE APIs

**Java Database Connectivity (JDBC):** JDBC Overview & Architecture, Introduction to JDBC, JDBC Architecture, Database Connectivity using JDBC

**Unit 2:**

**Servlets:** Introduction to Java Servlet, Servlet Interface and the Servlet Life Cycle, Handling HTTP Get and Post Requests, Session Tracking, Cookies

**Java Server Pages (JSP):** Introduction, Java Server Pages Overview, JSP Architecture & Life Cycle, JSP Directives, JSP Scripting Elements, JSP Action Elements, JSP Implicit Objects

**Unit 3:**

**The Spring Framework:** Introduction to The Spring Framework and Architecture, Beans (Definition, Scope, Lifestyle), Aspect- Oriented Spring, Spring MVC, Security, JDBC Framework

**Web Service:** Introduction About Restful Web Service

**Unit 4:**

**Enterprise Java Beans (EJB):** Introduction to Enterprise Java Beans, Enterprise Bean Architecture, Benefits of Enterprise Bean, Types of Enterprise Bean, Accessing Enterprise Beans, Enterprise Bean Application, Entity Beans, Session Beans, Message Driven Beans

**Reference Books:**

1. Java the complete reference, 8<sup>th</sup> edition by Herbert Schildt
2. Professional Java Server Programming by Subrahmanyam Allamaraju, Cedric Buest Wiley Publication
3. Bayross Ivan, Shah Sharanam, Bayross Cynthia and Shah Vaishali: Java Server Programming, 2nd Edition, Shroff Publishers and Distributors Pvt. Ltd., 2008
4. “Restful Java Web Services”, Jose Sandoval, Packt Publication
5. “Spring MVC Beginner’s Guide”, Amuthhan Ganeshan, Packt Publication
6. “Advanced Java 2 Platform HOW TO PROGRAM” by H. M.Deitel, P. J. Deitel, S. E. Santry – Prentice Hall Java the complete reference , 8th Edition by Herbert Schildt
7. Panda, Rahman and Lane : EJB 3 in Action, Dreamtech Press, 2010

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**Paper Code: 101410103**

**Paper Title: ASP.NET Using C#**

**(Total Marks: 100)**

**Unit 1:**

**Introduction to .NET Framework** - Architecture of .NET Framework – BCL (Base Class Library), CLR (Common Language Runtime), Etc. - .NET Languages – Introduction, Types of Applications Supported by .NET Technology - Managed Code, Compilation to Intermediate Language, Just-In-Time Compilation, Garbage Collection, Assemblies and the GAC

**Unit 2:**

C#.NET – Introduction and Features - General Structure of C#.NET Program - C#.NET – Basic Data Types, Variable, Constant, Type Conversion - Boxing and Unboxing - C#.NET – Statements (Conditional and Looping) – Types of Applications.

**Advance Features** - OOPS Concepts, Class and Object - Inheritance; Polymorphism – Overloading, Overriding, Etc., Class Types and Interface - Working with Strings, Arrays, Lists and Collections - Exception Handling

**Unit 3:**

**Introduction To ASP.NET And Programming In ASP.NET;** Web Server – Internet Information Server (IIS); Architecture Of ASP.NET; ASP.NET Page Lifecycle; ASP .NET Page Directives; Controls – HTML Controls And ASP.Net Server Controls ; Control Properties And Events ; PostBack ; Exception Handling ; Validation Controls ; Navigation Controls ; Login Controls; MasterPages  
**Web Application Management;** State Management; ViewState; Application; Session; Cookie; QueryString; Web.Config And Machine.Config ; Global.Asax ; Authentication Methods ; Caching

**Unit 4:**

**Database Programming with ADO.NET and Reports** - The ADO.NET architecture (connected and disconnected mode) - ADO.NET Data providers, Dataset, DataAdapter, DataReader - Working with Data Controls; Design time data binding; Runtime data binding; Working with Stored Procedures, Generating reports

**Reference Books:**

1. C# and the .NET Platform by Andrew Troelsen : APress
2. C# The Basics by Vijay Mukhi : BPB
3. C# Essentials by Ben Albabari : O'Reilly
4. Professional C# by Simon Robinson : Wrox
5. ASP.NET - A Beginner's guide by Dave Mercer : TMH
6. Professional ASP.NET : Wrox.
7. ASP.NET Programmer's Reference : Wrox
8. ADO.NET Programmer's Reference : Wrox.
9. Professional C# 2008 by Christian Nagel : Wrox
10. C# The Nuts & Bolts by Akash Sarat & Sonal Mukhi : BPB
11. C# Made Simple : BPB Publication
12. C# 3.0 Unleashed: With the .NET Framework 3.5 by Joseph Mayo : Sams

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**Paper Code: 101410104**

**Paper Title: Practical based on Advanced Java**

**(Total Marks: 100)**

**[Based on Industrial demand department would decide the list of experiments]**

**Paper Code: 101410105**

**Paper Title: Practical based on ASP.NET Using C#**

**(Total Marks: 100)**

**[Based on Industrial demand department would decide the list of experiments]**

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**Paper Code: 101410107**  
**Paper Title: Artificial Intelligence**

**(Total Marks: 100)**

**Unit 1:**

**Introduction and Search Techniques:** The AI Problems, The Underlying Assumption, AI techniques, The Level of The Model, Criteria for Success, Defining the Problems, As A State Space Search, Production Systems, Production Characteristics, Production System Characteristics and Issues in the Design of Search Programs, Generate-And-Test, Hill Climbing, Best-First Search, Problem Reduction, Constraint Satisfaction, Means-Ends Analysis

**Unit 2:**

**Knowledge Representation & Reasoning:** Representations and Mappings, Approaches to Knowledge Representation, Representation Simple Facts in Logic, Representing Instance and Isa Relationships, Computable Functions and Predicates, Resolution, Procedural versus Declarative Knowledge, Logic Programming, Forward versus Backward Reasoning

**Symbolic Reasoning Under Uncertainty:** Introduction to Nonmonotonic Reasoning, Logics for Non-monotonic Reasoning.

**Probabilistic Reasoning:** Probability and Bays' Theorem, Certainty Factors and RuleBase Systems, Bayesian Networks, Dempster-Shafer Theory, Fuzzy Logic

**Unit 3:**

**Game Playing, Planning and Natural Language Processing: Overview,** MiniMax Search Procedure, Alpha-Beta Cut-offs, Refinements, Iterative deepening

**Planning:** The Blocks World, Components of a Planning System, Goal Stack Planning, Nonlinear Planning Using Constraint Posting, Hierarchical Planning, Reactive Systems

**Natural Language Processing:** Introduction, Syntactic Processing, Semantic Analysis, Discourse and Pragmatic Processing, Spell Checking

**Unit 4:**

**Connectionist Models:** Introduction to Hopfield Network, Learning in Neural Network, Application of Neural Networks, Recurrent Networks, Distributed Representations, Connectionist AI And Symbolic AI.

**Expert Systems:** Representing and Using Domain Knowledge, Expert System Shells, Explanation, Knowledge Acquisition.

**Genetic Algorithms:** A Peek into the Biological World, Genetic Algorithms (GAs), Significance of the Genetic Operators, Termination Parameters.

**Reference Books:**

1. Qiangfu ZHAO and Tatsuo Higuchi, Artificial Intelligence: from fundamentals to intelligent searches, Kyoritsu, 2017, ISBN:978-4-320-12419-6 (in Japanese).
2. Rich and Knight, Artificial Intelligence, Tata McGraw Hill Publishing Co. Ltd., 21st Indian Reprint, 2001
3. Akerkar RA and Sajja P S, Knowledge-Based Systems, Jones & Bartlett Publishers, Sudbury, MA, USA, 2009
4. Vijyalaxmi Pai and Rajasekaran, Neural Network, Fuzzy Logic and Genetic Algorithms, Prentice Hall of India, 2003
5. Introduction to Artificial Intelligence, Shinji Araya, KYORITSU SHUPPAN, ISBN4-320-12116-3 (in Japanese)
6. New Artificial Intelligence (Fundamental), Takashi Maeda and Fumio Aoki, Ohmsha, ISBN4-274-13179 (in Japanese)
7. Artificial Intelligence: a modern approach, S. Russell and P. Norvig, Prentice Hall, ISBN0-13-080302-2

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**Paper Code: 101410108**

**Paper Title: Network Security & Cryptography**

**(Total Marks: 100)**

**Unit 1:**

**Introduction:** Security trends, The OSI Security Architecture, Security Attacks, Security Services and Security Mechanisms, A model for Network security

**Classical Encryption Techniques:** Symmetric Cipher Modes, Substitute Techniques, Transposition Techniques, Rotor Machines, Stenography

**Unit 2:**

**Block Cipher and Data Encryption Standards:** Block Cipher Principles, Data Encryption Standards, the Strength of DES, Differential and Linear Crypt Analysis, Block Cipher Design Principles

**Advanced Encryption Standards:** Evaluation Criteria for AES, the AES Cipher. MORE ON SYMMETRIC CIPHERS: Multiple Encryption, Triple DES, Block Cipher Modes of Operation, Stream Cipher and RC4

**Unit 3:**

**Public Key Cryptography and RSA:** Principles Public key crypto Systems, Diffie Hellman Key Exchange, the RSA algorithm, Key Management, Elliptic Curve Arithmetic, Elliptic Curve Cryptography

**Message Authentication and Hash Functions:** Authentication Requirement, Authentication Function, Message Authentication Code, Hash Function, Security of Hash Function and MACs

**Hash and MAC Algorithm:** Secure Hash Algorithm, Whirlpool, HMAC, CMAC

**Digital Signature:** Digital Signature, Authentication Protocol, Digital Signature Standard

**Unit 4:**

**Email Security:** Pretty Good Privacy (PGP) and S/MIME

**IP Security:** Overview, IP Security Architecture, Authentication Header, Encapsulating Security Payload, Combining Security Associations and Key Management

**Web Security:** Requirements, Secure Socket Layer (SSL) and Transport Layer Security (TLS), Secure Electronic Transaction (SET), Intruders, Viruses and related threats

**Firewall:** Firewall Design principles, Trusted Systems

**Reference Books:**

1. William Stallings (2006), Cryptography and Network Security: Principles and Practice, 4th edition, Pearson Education, India.
2. William Stallings (2000), Network Security Essentials (Applications and Standards), Pearson Education, India.
3. Charlie Kaufman (2002), Network Security: Private Communication in a Public World, 2nd edition, Prentice Hall of India, New Delhi.
4. Atul Kahate (2008), Cryptography and Network Security, 2nd edition, Tata Mc Grawhill, India.
5. Robert Bragg, Mark Rhodes (2004), Network Security: The complete reference, Tata Mc Grawhill, India.

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**Semester – II**  
**Syllabus with Effective from: 2020-2021**

**Second Semester**

<b>Subject Code</b>	<b>Subject Title</b>
101410201	Internet of Things (IOT)
101410202	Application Development using Advanced .NET
101410203	Data Science Using Python and R
101410204	Practical based on Application Development using Advanced .NET
101410205	Practical based on Data Science Using Python and R
101410206	Comprehensive Viva-Voce
101410207 <b>or</b> 101410208	Elective Subjects

**Elective Subjects:**

101410207	Cloud Computing
101410208	Digital Image Processing

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**Paper Code: 101410201**

**Paper Title: Internet of Things (IOT)**

**(Total Marks: 100)**

**Unit 1:**

**Introduction of IOT:** Introduction Of IOT; Introduction-Definition & Characteristics Of IoT , Physical Design Of IoT- Things In IoT; Introduction Of IOT Reference Architecture and IOT Reference Model; IOT Application Fields ; Threads And Security Issues With IOT System

**Unit 2:**

**IOT hardware platforms of IOT end devices:** Sensing devices and smart IOT end points: Sensors, sensor devices and Input devices, Actuators; Introduction of Embedded system and its role in IOT; Embedded system microcontroller architecture; Introduction IOT system educational Hardware development platforms: Arduino and Raspberry Pi; Introduction of Raspberry Pi hardware Peripherals

**Unit 3:**

**IOT communication Protocols and information theory :** RF energy and theoretical range; Short range communication used in IOT: Non-IP based and IP based WPAN (Wireless personal area network) and its protocols; Long rang communication(LPWAN) used in IOT and its protocols; IOT edge to cloud protocols, Cloud service models; Introduction of Data management system for IOT

**Unit 4:**

**Domain Specific IoTs :**Home Automation: Smart Lighting, Smart Appliances, Intrusion Detection, Smoke/Gas Detectors, Cities-Smart Parking, Smart Lighting, Smart Roads, Structural Health Monitoring, Surveillance, Emergency Response, Environment-Weather Monitoring, Air Pollution Monitoring, Noise Pollution Monitoring, Forest Fire Detection , River Floods Detection , Retail-Inventory Management , Smart Payments , Smart Vending Machines , Logistics-Route Generation & Scheduling , Shipment Monitoring , Remote Vehicle Diagnostics, Agriculture-Smart Irrigation ,Green House Control ,Industry - Machine Diagnosis & Prognosis Indoor Air Quality Monitoring ,Health & Lifestyle -Health & Fitness Monitoring, Wearable Electronics IoT

**Reference Books:**

1. Vijay Madiseti and Arshdeep Bahga, “Internet of Things (A Hands-on-Approach)”, 1 st Edition, VPT, 2014
2. Cuno Pfister, Getting Started with the Internet of Things, O’Reilly Media, 2011, ISBN: 978-1-4493-9357-1
3. Internet of Things architecture and Design Principles, Raj Kamal, McGrawhill Education private limited, 2017
4. Learning Internet of Things, Peter Waher, / Packt Publishing Limited, 2015
5. Internet of Things: Technologies and Applications for a New Age of Intelligence, Vlasios Tsiatsis, Stamatis Karnouskos and Jan Holler, Academic Press, 2018
6. Raspberry Pi Cookbook, Simon Monk,, O’Reilly Publishing Limited, 2014
7. The Internet of Things, Olivier Hersent, David Boswarthick, Omar Elloumi, Wiley, 2018
8. Designing the Internet of Things, Adrian McEwen & Hakim Cassimally, Wiley, 2018
9. The Internet of Things, Hakima Chaouchi, Wiley, 2017

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**Paper Code: 101410202**

**Paper Title: Application Development using Advanced .NET**

**(Total Marks: 100)**

**Unit 1:**

**Advanced Features of ASP.NET:** Introduction to Web Architecture; Overview of ASP.NET; ASP.NET State Management; Membership Functionality; Globalization and Localization; AJAX; Client Side and Server Side AJAX; AJAX Toolkit; Hosting Web Application in IIS

**Unit 2:**

**ASP.NET MVC:** MVC Architectural Pattern ; URL Routing Engine ; Routing Configuration ; Wiring Controller, Model, and View ; Data Access and Modeling ; TempData, ViewBag and ViewData ; Unit Testing and ASP.NET MVC

**Unit 3:**

**ASP.NET CORE:** Introduction to ASP.NET Core ; Working with OpenID and OAuth Login ; Asynchronous Programming ; Multiple Environments and Development Mode ;Working with WebSockets and SignalR ; Self hosting of Web Applications ; Dependency Injection ; Action Filters ; Security and Identity ; Working with SQL and No-SQL Data Storage Types

**Unit 4:**

**AngularJS with .NET:** Single-page Application Framework ; Angular CLI ; Model-View-Controller Architecture ; Two Way Data Binding ; Directives, Pipes, Components, Scope Inheritance, Method Chaining, Templates, Services, Forms and Validation ;Animation and Routing ; Calling API, Using Third Party API ; Web-Sockets, Use of UI Frameworks Plug-ins

**Reference Books:**

1. Pro ASP.NET 4.5 in C# by Adam Freeman, APress, 2013
2. Mastering ASP.NET Core 2.0 by Ricardo Peres, Packt Publishing Limited, 2017
3. Professional ASP.NET MVC 5 by Jon Galloway, Wrox, 2014
4. Beginning ASP.NET 4.5: in C# and VB by Imar Spaanjaars, Wiley, 2014
5. Beginning Node.js by Basarat Syed, Apress, 2014
6. ASP.NET Core 2 Fundamentals by Onur Gumus and Mugilan T. S. Ragupathi, Packt Publishing Ltd, 2018
7. Learning ASP.NET Core MVC Programming by Mugilan T. S. Ragupathi, Packt Publishing Ltd, 2016
8. ASP.NET Core Essentials by Shahed Chowdhuri, Packt Publishing Ltd, 2016
9. Enterprise Application Architecture with .NET Core by Ganesan Senthilvel, Ovais Mehboob Ahmed Khan, Habib Ahmed Qureshi, Packt Publishing Ltd, 2017
10. ASP.NET Core 2 and Angular 5 by Valerio De Sanctis, Packt Publishing Ltd, 2017
11. ASP.NET MVC with Entity Framework and CSS by Lee Naylor, Apress, 2016
12. Pro ASP.NET Core MVC by Adam Freeman, Springer, 2016
13. Node.js, MongoDB and Angular Web Development: The definitive guide to using the MEAN stack to build web applications – Brad Dayley and Brendan Dayley-Second Edition- Kindle Edition

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**Paper Code: 101410203**

**Paper Title: Data Science Using Python and R**

**(Total Marks: 100)**

**Unit 1:**

**Introduction to Data Science:** Introduction and Methodology, Data Science Tasks, Description, Estimation, Basic ML Algorithms (Classification, Clustering, Prediction, Association), Applications of Data Science, Technologies for visualization, Data Science toolkit, Types of data

**Unit 2:**

**Python for Data Science:** Python Environment Setup and Essentials, Mathematical Computing with Python (NumPy), Scientific computing with Python (Scipy), Data Manipulation with Pandas, Data Visualization in Python using matplotlib

**Unit 3:**

**R Programming for Data Science:** Basics of R programming, Essentials of R programming, Exploratory Data Analysis, Data Manipulation, Data Visualization in R

**Unit 4:**

**Data Preparation Using Python and R:** The Problem Understanding Phase, Data Preparation Phase, Adding an Index Field Using R and Python, Changing Misleading Field Values, Re-expression of Categorical Data as Numeric, Standardizing the Numeric Fields, Identifying Outliers

**Reference Books:**

1. Mark Lutz, "Learning Python", 4th Edition, O'Reilly, 2009
2. Wes McKinney, "Python for Data Analysis", O'Reilly, 2013
3. Robert I. Kabacoff, "R in Action: Data Analysis and Graphics with R", Manning, 2011
4. Field Cady, "The Data Science Handbook", Wiley Publication ISBN-13: 978-1119092940
5. Jake VanderPlas, 'Python Data Science Handbook ESSENTIAL TOOLS FOR WORKING WITH DATA', O'REILLY ISBN:978-1-491-91205-8
6. Rachel Schutt and Cathy O'Neil, Doing Data Science, O'REILLY
7. Wes McKinney, Python for Data Analysis Data Wrangling with Pandas, NumPy, and IPython, 2nd Edition, O'REILLY

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**Paper Code: 101410204**

**Paper Title: Practical based on Application Development using Advanced .NET**

**(Total Marks: 100)**

**[Based on Industrial demand department would decide the list of experiments]**

**Paper Code: 101410205**

**Paper Title: Practical based on Data Science Using Python and R**

**(Total Marks: 100)**

**[Based on Industrial demand department would decide the list of experiments]**

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**Semester – II**  
**Syllabus with Effective from: 2021-2022**

**Paper Code: 101410207**

**Paper Title: Cloud Computing**

**(Total Marks: 100)**

**Unit 1:**

Introduction to Cloud Computing; Characteristics of Cloud Computing; Cloud Service Models - Infrastructure as a Service, Platform as a Service, Software as a Service and Anything as a Service; Cloud Deployment Models - Private Cloud, Community Cloud, Public Cloud and Hybrid Cloud ; Difference Between Traditional Computing and Cloud Computing ; Virtualization; Need of Virtualization; Types of Virtualization ; Virtualization in Cloud Computing

**Unit 2:**

Cloud Infrastructure and Architectures; Cloud Computing Stack ; Composability ; Infrastructure ; Platforms ; Virtual Applications ; Communication Protocols ; Applications; Cloud Data Center Architecture 2.3 Conceptual View of Networking in Cloud Computing; Cloud Data Storage (Overview of SAN, DFS, etc.) ; Computing Cluster in Cloud ;Service Level Agreement and Cloud Pricing Model ; Cloud Security Concepts; Industrial Platforms and New Developments: Amazon Web Services, Google App Engine, Microsoft Azure

**Unit 3:**

Service Offerings by Cloud Providers; Introduction to Amazon Cloud Services ;EC2 – Elastic Cloud Compute ;Elastic Container Service ; Elastic Kubernetes Service ; Lambda – Serverless Computing ; VPC – Virtual Private Cloud ; S3 – Simple Storage Service ; EBS – Elastic Block Storage ; RDS – Relational Database Service ; ; Introduction to Microsoft Azure ; Service Fabric ; AKS – Azure Kubernetes Service ; Container Instances ; Azure SQL ; Azure DevOps ;Security Center ; Azure IoT Hub ; Traffic Manager ; Cognitive Services ; Introduction to Google Cloud Services ; Google App Engine ; Google Compute Engine ; Google Kubernetes Engine ; Cloud ; Cloud SQL

**Unit 4:**

Cloud Delivery Model Considerations: Cloud Delivery Models: The Cloud Provider Perspective, Cloud Delivery Models: The Cloud Consumer Perspective, Cost Metrics and Pricing Models: Business Cost Metrics, Cloud Usage Cost Metrics, Cost Management Considerations, Service Quality Metrics and SLAs: Service Quality Metrics, SLA Guidelines

**Reference Books:**

1. Cloud Computing and Virtualization by Dac-Nhuong Le, Raghvendra Kumar, Gia Nhu Nguyen, Jyotir Moy Chatterjee, WILEY, 2018
2. Cloud Computing : A Practical Approach by Anthony Velte, Toby Velte, Robert Elsenpeter, Mc Graw Hill, 2017
3. Cloud Computing – Black Book by Kailash Jayaswal, Jagannath kallakurchi, Donald Houde, Deven Shah, Dreamtech Press, 2014
4. Architecting The Cloud by Michael Kavis, WILEY, 2014
5. Learning AWS by Aurobindo Sarkar, Amit Shah, Packt Publication, 2015
6. Google Cloud Platform Cookbook by LegorieRajan, Packt Publication, 2018
7. Building Your Next Big Thing with Google Cloud Platform by S.P.T. Krishnan, Jose L. Ugia Gonzalez, Apress, 2015
8. Microsoft Azure Fundamentals by Jim Cheshire, Pearson, 2019

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**Paper Code: 101410208**

**Paper Title: Digital Image Processing**

**(Total Marks: 100)**

**Unit 1:**

**Digital image Digital Image Fundamentals:** Digital Image Processing, Origins of Digital Image Processing, Fields using Digital Image Processing, Fundamental Steps in Digital Image Processing, Components of an Image Processing System, Understanding Pixel, Overview of Coordinate System, Accessing and Manipulating Pixels, Elements of Visual Perception, Light and the Electromagnetic Spectrum, Overview of Image Sensing and Acquisition, Image Sampling and Quantization, Basic Relationship between Pixels, Introduction to Mathematical Tools used in Digital Image Processing–Array Operations, Matrix Operations, Image representation – Gray scale and Color images, Image sampling and quantization

**Unit 2:**

**Image enhancement**

**Spatial domain:** Basics of Intensity Transformation and Spatial Filtering, Basic Intensity Transformation Functions, Histogram Processing, Fundamentals of Spatial Filtering, Smoothing Spatial Filters, Sharpening Spatial Filters

**Filtering in the Frequency Domain:** Preliminary Concepts, Extension to functions of two variables, Image Smoothing, Image Sharpening, Homomorphic filtering

**Unit 3:**

**Image Restoration and Reconstruction:** Reasons for image degradation, Model of image degradation/restoration process, Noise probability density functions, Image restoration using spatial filtering (Mean filters, Order statistic filters and adaptive filters), Inverse Filtering, MMSE (Wiener) Filtering, Noise Models, Noise Reduction, Inverse Filtering, MMSE (Wiener) Filtering.

**Unit 4:**

**Image Segmentation**

Edge based segmentation, Region based segmentation, Region split and merge techniques, Region growing by pixel aggregation, optimal thresholding

**Morphological Image Processing:** Erosion, Dilation, Opening, Closing, Basic Morphological Algorithms: hole filling, connected components, thinning, skeletons

**Reference Books:**

1. Digital Image Processing by Rafael C. Gonzalez and Richard E. Woods, Pearson Education, Third Edition
2. Fundamentals of Digital Image Processing: Practical Approach with examples in MATLAB by Chris Solomon and Toby Breckon, Wiley-Blackwell
3. Digital Image Processing by S Sridhar, Oxford University Press
4. “Digital Image Processing using MATLAB”, Rafael C Gonzalez, Richard E Woods, Steven Eddins, Tata McGraw-Hill Publications
5. “Digital Image Processing”, William K. Pratt, Wiley Publications