NOTIFICATION

No. 139 /2021 Date : 2 /12/2021

Subject :- Implementation of new syllabi of Semester III & IV of M.C.A. (Two Years Semester Pattern Course) (C.B.C.S.) as per A.I.C.T.E. Guidelines from the session 2021-2022 & onwards.

It is notified for general information of all concerned that the authorities of the University have accepted to implement the new syllabi of **Semester III & IV of M.C.A. (Two Years Semester Pattern Course)** (C.B.C.S.) as per A.I.C.T.E. Guidelines to be implemented from the academic session 2021-2022 and onwards in phase wise manner as per **Appendix – A** :

Sd/-
Dr.T.R.Deshmukh)
Registrar
Sant Gadge Baba Amravati University

Appendix – A

SEMESTER III & IV OF M.C.A. (TWO YEARS SEMESTER PATTERN COURSE) [C.B.C.S.]

SEMESTER III

Course Code **MCA20301**

Course Name **Data Analytics**

Credits **04**

Course Outcomes : On completion of the course, the students will be able to

1. Understand the basics of data analytics
2. Demonstrate basics of python programming
3. Analyze and visualize data using different libraries of python.
4. Describe R programming basics and identify the data objects in R.
5. Analyze and summarize data using statistical methods of R

Units	Contents	Total Hrs
I	**Introduction of Data Analytics and Data Analysis:** The difference between Data Analytics and Data Analysis.The different types of data analysis. The key steps in a data analysis process. Big Data Processing Architectures. The role of Data Engineers, Data Analysts, Data Scientists and Business Analysts. **A modern data ecosystem:** The different components of a modern data ecosystem. The role of Business Intelligence Analysts in this ecosystem. The role, responsibilities, and skillsets required to be a Data Analyst. Hypothesis and Null Hypothesis.	8
II	**Basics of Python Programming:**Variables, strings, functions, loops, and conditions in Python. The nuances of collection, lists, sets, dictionaries, conditions and branching. **Data in Python:**Objects and classes in Python including reading and writing files, loading, working, and saving data with Pandas.	8
III	**Python Libraries-I:**How to interpret data in Python using multi-dimensional arrays in NumPy, Manipulation of DataFrames in pandas. Implementation and examples on above topics. **SciPy and Scikit**:Use of SciPy library of mathematical routines, and execution of machine learning using Scikit-Learn. Implementation and examples on above topics.	8
IV	**Python Libraries-II**Scrapy Python Library for large scale web scrapping. Implementation and examples on above topics. **Data visualization:**Data visualization libraries in Python; including Matplotlib, Seaborn, Plotly and Folium. Implementation and examples on above topics.	8

V	**R Programming Basics:** Introduction of R, Environment Setup, Data Types, Variables, Operators, Decision Making, Loops, Functions, Strings, Vectors, Lists, Matrices, Arrays, Factors. Implementation and examples on above topics. **R Programming Data associates:** Data Frames, Packages, Data, Reshaping, Data Interfaces, CSV Files, Excel Files, Binary Files, XML Files, JSON Files, Web Data, Database. Implementation and examples on above topics.	8
VI	**Visualization and** Charts & Graphs, Pie Charts, Bar Charts, Boxplots, Histograms, Line Graphs, and Scatterplots. Implementation and examples on above topics. **Statistical analysis using R:** Mean, Median & Mode, Linear Regression, Multiple Regression, Logistic Regression, Normal Distribution, Binomial Distribution, Poisson Regression, Time Series Analysis, Decision Tree, Random Forest. Implementation and examples on above topics.	8

Text Books :

1: A General Introduction to Data Analytics by João Moreira, Andre Carvalho, TomÃ¡s Horvath, Publisher- Wiley.
2: Python: The Complete Reference by Martin C. Brown, Publisher Mc Graw Hill
3: The Python 3 Standard Library by Example | First Edition | by Hellmann Doug, By Pearson
4: Python for data analytics by Wes McKinney- Oreilly
5: A. Ohri, "R for Business Analytics", Springer, 2012

Reference Books :

1: Neal Krawetz, ―Introduction to Network Security‖, Thomson Learning, Boston, 2007.
2: Bruce Schneier, ―Applied Cryptography, John Wiley & Sons, New York, 2004. 2: Data Science & Analytics 1St Edition 2018 by VK Jain, Khanna Publishing House.
3: A Handbook of Statistical Analyses Using R, By Brian S. Everitt, TorstenHothorn · 2006, Publisher- Chapman R Hall/CRC.
4: Python Standard Library By Fredrik Lundh · 2001, Publisher- Oreilly
5: Modern Python Standard Library, Cookbook by Alessandro Molina, Publisher Packt.

Course Code **MCA20302**

Course Name **Cloud Computing**

Credits **04**

Course Outcomes: On completion of the course, the students will be able to

1. Understand the core concepts of the cloud computing and its benefits along with its various models and services in cloud computing.
2. Use various types of Virtualization techniques using its open-source tools.
3. Explain various types of cloud file systems.
4. Simulate cloud computing environments.
5. Outline various stages of SLA life cycle.
6. Identify various security threats and issues in cloud environments.

Units	Contents	Total Hrs
I	**Introduction to Cloud Computing** Introduction, Defining Cloud Computing, Understanding Cloud Architecture, Benefits of Cloud Computing SOA, Web services, Web 2.0, Mashups, Grid computing, Utility computing, Hardware virtualization, Essentials of Cloud characteristics, Challenges, Cloud economics, Role of Networks in Cloud Computing: Cloud types and service models, Primary Cloud Service models, Cloud Services brokerage, Primary cloud deployment models, cloud computing reference model, The greenfield and brownfield deployment options.	8
II	**Virtualization** Introduction, Understanding Abstraction & Virtualization Technologies, Virtualization, Types of Virtualization, Characteristics of Virtualized environments, Taxonomy of Virtualization techniques, Pros and Cons of Virtualization, Technology examples: Xen, KVM, Vmware, Microsoft Hyper-V, Load Balancing & Virtualization, Understanding Hypervisors, Defining Baseline and metrics, Baseline measurements, System metrics, Load testing, Resource ceilings, Servers and instance types, Network Capacity, Scaling.	8

III	**Storage in Cloud** Storage system architecture, Big data, Virtualize data center(VDC) architecture, VDC Environment, server, storage, networking, Virtual Machine Components and Process of converting physical to VMs, Block and file level storage virtualization, Virtual Provisioning, VLAN, VSAN and befits, Network traffic management techniques in VDC, Cloud file systems: GFS and HDFS, BigTable, HBase and Dynamo. Features and comparisons among GFS, HDFS.	8
IV	**Cloud computing platforms & Standards** Infrastructure as Service, best-of breed cloud infrastructure components, cloud ready converged infrastructure, Anatomy of Cloud infrastructure, Distributed management of virtual infrastructure, scheduling techniques, SLA Commitment, Google Web Services, Amazon Web Services, Microsoft Cloud services. Cloud Computing Standards Objectives, Best Practices and Standards, Practical Issues- Interoperability, Portability, Integration, Security, Standards Organizations and Groups.	8
V	**Cloud monitoring and management** Introduction and architecture for federated cloud computing, Performance prediction for HPC on Cloud. SLA management: Types of SLA, Life cycle of SLA, service catalog, cloud portal and its functions, cloud interface standards, system integration and work-flow modeling, cloud service life-cycle phases: service planning, service creation, service operation, and service termination Control layer, its functions and benefits,element and unified manager, software defined approach and techniques for managing IT resources.	8
VI	**Security in Cloud Computing** Introduction, Global Risk and Compliance aspects in cloud environments and key security terminologies, Data security risk, Cloud computing and identity, Digital identity and access management, Content level security, Securing the Cloud, Securing Data, Establishing Identity and Presence. Cloud Applications, Research trend in Cloud Computing, Fog Computing, Open Source and Commercial Clouds, Cloud Simulator.	8

Text Books :

1. Barrie Sosinsky,"Cloud Computing", Wiley India.
2. Dr. Kumar Saurabh,"Cloud Computing", Wiley Publication.
3. RajkumarBuyya, "Mastering Cloud Computing", Tata McGraw Hill.

Reference Books :

1. Greg Schulr,"Cloud and virtual data storage networking", CRC Press.
2. Anthony T. Velte, "Cloud Computing, A Practical Approach", TATA Mc Graw Hill
3. Pachghare V. K.,"Cloud Computing", PHI Learning
4. Kailash Jayaswal, "Cloud computing", Black Book, Dreamtech Press.

Course Code **MCA20303**

Course Name **Web Technology**

Credits **04**

Course Outcomes : On completion of the course, the students will be able to

1. Understand the concepts of different web technologies.
2. Use various types of scripting and markup languages like HTML5, CSS3.
3. Understand how to work in UI/UX design.
4. Illustrate Angular environments.
5. Describe Type Script, Object Oriented features.

Units	Contents	Total Hrs
I	HTML5 and XHTML– Introduction & Basics, Layout, Editors, Heading, Paragraph, Links, Images, Mapping Image, Lists, Text Formatting, Attributes, Iframes, Class Attribute, Id Attributes, style attribute, Color Styles and HSL, Spell Check, Quotations, Geolocation, Drag and Drop, URL Encoding, File Paths, Tables, Audio Tag, Video Tag, Comments, Doctypes, Design Form, Canvas Basics, SVG-Basics, Charsets.	8
II	CSS 3 : CSS3 Introduction, Positioning Elements, Centering Elements, Background, Borders, Links, Fonts, Text Formatting, Height and Width, Overflow, Combinators, flex-wrap property, Pagination, Types of CSS (Cascading Style Sheet), Opacity / Transparency, Advance CSS layout with flexbox, Display property, align-content property, 2D Transforms, empty-cells Property, Units, Gradients, DropDowns, Margins and Padding, Box model, Animations, Counters, Colors, 3D Transforms, Multiple Columns, Attribute Selector, resize Property, align-self Property, word-break Property, Shadow Effect.	8

III	ANGULAR 8 : Introduction to Angular Framework, History & Overview, Environment Setup, Angular CLI, Installing Angular CLI, NPM commands & json, Bootstrapping Angular App, Components, AppModule, Project Setup, Editor Environments, Building Angular App, Directory Structure, Angular Fundamentals, Building Blocks, MetaData Component Basics Templates setup, Creating Components using CLI, Nesting Components, Data Binding – Property & Event Binding, String Interpolation, Style binding, Two-way data binding, Input Properties, Output Properties, Passing Event Data, New features added in Angular11.	8
IV	Introduction to Typescript, Setup and installation, IDE support, Scoping using let and const Keywords (ES6), Template Literals (ES6), Rest and Spread Parameters (ES6), Destructuring (ES6), Introduction to Types: Type inference, Type Annotations, Number, Boolean, String, Array, Tuple, Enum, Any Void, Null and Undefined, Never, Introduction to Functions: Using types in functions,Function as types, Optional and default parameters, Arrow functions.	8
V	Introduction to Classes: Inheritance, Access modifiers, Getters and setters, Read-only & static, Introduction to Interfaces, Optional properties and methods, Strict structural contract, Extending interface, Implementing interface, Introduction to Modules, Import / Export, Default, Decorators.	8
VI	Angular CLI : Anatomy of the project, Setting up a workspace, Updating Angular apps using ng update, Adding support for external libraries using ng add, Directives, Pipes, Routing, Services, Angular Forms, Debugging Angular apps, Working with Augury, Using the Angular Language Service with Microsoft VS Code.	8

Text Book :

HTML 5 Black Book, Covers CSS3, JavaScript, XML, XHTML,AJAX, PHP and jQuery, 2nd Edition 2016

Reference Book :

Angular 11: by Example 2021 by John & MichaelKocer

Useful Links : 1. https://angular.io/

Course Code **MCA20304**

Course Name **Elective 2 - i) Animation & Movie Making**

Credits **04**

Course Outcomes: On completion of the course, the students will be able to

1. Familiarize the students with various approaches, methods and techniques of Animation Technology.
2. Develop competencies and skills needed for becoming an effective Animator.
3. Exploring different approaches in computer animation.
4. Enable students to manage Animation Projects from its Conceptual Stage to the final product creation.
5. Develop expertise in life-drawing and related techniques.
6. Apply Audio and Video Production Techniques to an Animation Project.

Units	Contents	Total Hrs
I	**Introduction to Animation:** History of Animation, Introduction to Animation, Terms used in Animation, Types of Animation, Basic Principles of Animation, Animator's Drawing Tools.	8
II	**Creating Animations:** Explore An Animation program, Create a New Animation, Insert Content in a Frame, Add and Delete Frames and Keyframes, Create Frame-by-Frame Animation, Preview an Animation, Create Motion and Path Animation, Use Layers, Copy and Move a Frame or Frame Series, View multiple Frames, Test a Movie.	8
III	**Enhancing Animations:** Recoding a sound File, Edit a Sound File, Import and Add Sound in Animations, Add and Animate Text, Insert Buttons in Animation, Use Action Scripts.	8
IV	**Publishing an Animation:** Analyze a Movie File, Optimize a Movie, Publish a Movie, Publish a Movie for web Delivery, Publish a Movie to Animated or Static Graphics, Publish a Movie to an Executable, Publish a Movie to Quick Time.	8

V	**Working with Video :**Set Up to Video Project, Capture Video from an External Source, Import Video Sources from other Digital Media, Create and Preview a Video, Edit Video.	8
VI	**Enhancing Video:** Add Effects, Add Transitions, Add Titles, Add Audio **Publishing Video:** Publish to a Movie File, Publish to a DVD or VCD, Publish to a Digital Videotape, Publish to an Analog Videotape, Publish a Signal Frame of the Video as a Still Image.	8

Reference Books :

1. The Complete Animation course by Chris Patmore, By – Barons Educational Series (New York).
2. Multimedia and Web Technology, Edition: Second, 2007 by Ramesh Bangia, Firewall Media
3. Multimedia Basics by Weixel, Fulton, Barksdale, Morse, Morse, Thomoson Course Technology.
4. The Complete Reference Macromedia Flash MX by Brain Underdahl, Tata McGRAW Hill.

Course Code **MCA20304**

Course Name **Elective 2 - ii) Cyber Security & Digital Forensic**

Credits **04**

Course Outcomes : On completion of the course, the students will be able to

1. Understand the concepts and foundations of Cyber Security
2. Identify security risks
3.Apply preventive steps
4. Investigate Cyber Crime and analysis of evidences
5. Acquire knowledge of Digital Forensics

Units	Contents	Total Hrs
I	Cyber security concepts, Cyber security Strategy, Current Laws Involving Cyber security, International Comprehensive Cyber security Strategy, Cyber security Policy and Strategy Emerging Challenges, Cyber security, Need of Cyber security Malwares: Viruses, Trojans, and Attacks, Development of Computer Viruses	8
II	Threat Landscape, Attack Classification, Threat Attacks ,Botnets and Cyber Crime Applications , Different types of crimes, Deep Web , Vulnerabilities, Risk Assessment, and Risk Management, Random Stochastic Models ,issues of Time and Sequence , Attack Graphs , Cyber security vulnerabilities, Constraint and Simulations, Optimization and Risk.	8
III	Cyber Threat Spectrum—Cyberspace Attacks and Weapons, Cyber Threat Capability and Cyber Tools, Cyber Digital Arsenal , Rationale of Cyberspace Infrastructure Attacks Framework for Improving Critical Infrastructure Cyber security.	8
IV	Basics of Critical Infrastructure Protection ,Design and Utility of Infrastructures, Evolution of Infrastructures, Impact of Infrastructures on Society ,Random Nature of Faults, Failures, and Engineering Resilience, Fault Intolerance and Fault Tolerance, Fail-Safe.	8
V	Management Methods and Standards, Economic Impact on Regulation and Duties to Protect ,Legal Requirements and Regulations Critical Infrastructure Protection Strategies and Operations ,Physical Security ,Personnel Security, Operational Security Information Warfare Theory and Application Cost of Cyber security Contemporary Cost of Cyber Crime, Cyber security Insurance New Cyber security Models, Future Generations for Cyber security, Transformational Challenges	8
VI	Digital Forensics: Introduction of digital forensics, Need for digital forensics, Forensic process, Investigation, Digital evidence collection, Application, limitations, Legal considerations, Digital evidence, investigation tools.	8

Books :

1. Cyber Security - Edited By Thomas A Johnson CRC Press.
2. CYBER SECURITY By Dr. Krishan Kumar Goyal, Prof Amit Garg
3. The NICE Cyber Security Framework: Cyber Security Intelligence and Analytics by IzzatAlsmadi
4. Computer Forensics and Digital Investigation with EnCase Forensic v7 By Suzanne Widup
5. Digital Forensics for Network, Internet and Cloud computing By Cunt P Garrison

Course Code **MCA20304**

Course Name **Elective 2 - iii) Block Chain Technology**

Credits **04**

Course Outcomes : On completion of the course, the students will be able to

1. Understand how blockchain systems (mainly Bitcoin and Ethereum) work.

2. Describe secured interaction between blockchain.

3. Design, build, and deploy smart contracts and distributed applications

4. Integrate ideas from blockchain technology into their own projects.

Units	Contents	Total Hrs
I	**Basics:** Distributed Database, Two General Problem, Byzantine General problem and Fault Tolerance, Hadoop Distributed File System, Distributed Hash Table, ASIC resistance, Turing Complete.	8
II	**Cryptography :**Hash functions, Puzzle friendly Hash, Collison resistant hash Digital Signature - ECDSA, public key crypto, verifiable random functions, Memory Hard Algorithm, Zero Knowledge Proof.	8
III	**Blockchain:** Introduction, Advantage over 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.	8
IV	**Distributed Consensus:** Nakamoto consensus, Proof of Work, Proof of Stake, Proof of Burn, Difficulty Level, Sybil Attack, Energy utilization and alternate.	8
V	**Cryptocurrency:** History, Distributed Ledger, Bitcoin protocols - Mining strategy and rewards, Ethereum - Construction, DAO, Smart Contract, GHOST, Vulnerability, Attacks, Sidechain, Namecoin	8
VI	**Cryptocurrency Regulation:** Stakeholders, Roots of Bit coin, Legal Aspects-Crypto currency Exchange, Black Market and Global Economy. Applications: Internet of Things, Medical Record Management System, Domain Name Service and future of Blockchain.	8

Text Book :

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

Reference Books :

1. Antonopoulos, Mastering Bitcoin: Unlocking Digital Cryptocurrencies
2. Satoshi Nakamoto, Bitcoin: A Peer-to-Peer Electronic Cash System
3. DR. Gavin Wood, "ETHEREUM: A Secure Decentralized Transaction Ledger,"Yellow paper.2014.
4. Nicola Atzei, Massimo Bartoletti, and TizianaCimoli, A survey of attacks on Ethereum smart contracts
5. Josh Thompson, 'Blockchain: The Blockchain for Beginnings, Guild to Blockchain Technology and Blockchain Programming', Create Space Independent Publishing Platform, 2017

Course Code **MCA20305**

Course Name **Elective 3- i) Software Testing**

Credits **04**

Course Outcomes : On completion of the course, the students will be able to

1. Describe fundamentals of testing

2. Explain the role of testing in SDLC

3. Discriminate among static and dynamic testing

4. Understand the test management mechanisms.

5.Design and develop the best test strategies in accordance to the development model.

6. Understand how to test the s/w for object-oriented designs

Units	Contents	Total Hrs
I	**Fundamentals of Testing**: Human and errors, Testing and Debugging, Software Quality, Requirement Behavior and Correctness, Fundamentals of Test Process, Psychology of Testing, General Principles of Testing, Test Metrics	8
II	Role of Testing in SDLC: Review of software development models (Waterfall Models, Spiral Model, W Model, V Model) Agile Methodology and Its Impact on testing, Test Levels (Unit, Component, Module, Integration, System, Acceptance, Generic)	8
III	**Approaches to Testing - Static Testing** Structured Group Examinations Static Analysis Control flow & Data flow, Determining Metrics .**Dynamic Testing**: Black Box Testing Equivalence Class Partitioning, Boundary Value Analysis, State Transition Test, Cause Effect Graphing and Decision Table Technique and Used Case Testing and Advanced black box techniques White Box Testing Statement Coverage, Branch Coverage, Test of Conditions, Path Coverage, Advanced White Box Techniques, Instrumentation and Tool Support Gray Box Testing, Intuitive and Experience Based Testing.	8
IV	**Test Management** : Test Organization Test teams, tasks and Qualifications Test Planning Quality Assurance Plan, Test Plan, Prioritization Plan, Test Exit Criteria Cost and economy Aspects Test Strategies Preventive versus Reactive Approach, Analytical versus heuristic Approach Test Activity Management, Incident Management, Configuration Management Test Progress Monitoring and Control Specialized Testing: Performance, Load, Stress & Security Testing	8
V	**Testing Tools** : Automation of Test Execution, Requirement tracker, High Level Review Types of test Tools Tools for test management and Control, Test Specification, Static Testing, Dynamic Testing, Non functional testing Selection and Introduction of Test Tools Tool Selection and Introduction, Cost Effectiveness of Tool Introduction	8
VI	Testing Object Oriented Software Introduction to OO testing concepts, Differences in OO testing. Issues in Object Oriented Testing, Class Testing, GUI Testing, Object Oriented Integration and System Testing	8

Text Books:

1. Software Testing techniques – BarisBeizer, 2nd edition, Dreamtech.
2. Software Testing Tools – Dr.K.V.K.K.Prasad, Dreamtech.

Reference Books :

1. Software Testing Foundations, Andreas Spillner, Tilo Linz, Hans Schaefer, Shoff Publishers and Distributors
2. Foundations of Software Testing, by Aditya P. Mathur – Pearson Education custom edition 2000.
3. The ART of Software Testing, by GlenfordJ. Myers, Wiley India, Second Edition
4. Software Testing: Principles and Practices, by Srinivasan D and Gopalswamy R, PearsonEd, 2006.
5. Software Testing & Quality Assurance Theory &PracticeByKshirasagarNaik&PriyadarshiTripathi, Wiley Student Edition.
6. Software Quality Assurance Principles & Practice, by Nina S. Godbole, Narosa.
7. Stephan H.Kan, Metric and Model in Software Quality Engineering, Addison Wesley, 1995.
8. Roger S. Pressman, Software Engineering – A Practitioners Approach, Fifth Edition ,McGraw Hill, 2001
9. Advanced Software Testing, Vol. 2, Rex Black, SPD.

Course Code **MCA20305**

Course Name **Elective 3- ii) Mobile Application Development**

Credits **04**

Course Outcomes : On completion of the course, the students will be able to

1. Identify various concepts of mobile programming that make it unique from programming for other platforms.

2. Critique mobile applications on their design pros and cons.

3. Utilize rapid prototyping techniques to design and develop sophisticated mobile interfaces.

4. Program mobile applications for the Android operating system that use basic and advanced phone features.

5. Deploy applications to the Android marketplace for distribution.

Units	Contents	Total Hrs
I	Introduction to Mobile A brief history of Mobile, The Mobile Ecosystem, Why Mobile?, Types of Mobile Applications, Mobile Information Architecture, Mobile Design, Mobile 2.0, Mobile Web development, Small Computing Device Requirements. J2ME: Overview The World of Java, Inside J2ME, J2ME Architecture, MIDlet Programming, J2ME Wireless Toolkit, Hello World J2ME Style, Multiple MIDlets in a MIDlet Suite.	8
II	Introduction to Android: History of Android, Introduction to Android, Operating Systems, Android Development Tools, Android Architecture.	8
III	Development Tools: Installing and using Eclipse with ADT plug-in, Installing Virtual machine for Android sandwich/Jelly bean (Emulator), configuring the installed tools, creating a android project – Hello Word, run on emulator, Deploy it on USB-connected Android device.	8
IV	User Interface Architecture: Application context, intents, Activity life cycle, multiple screen sizes. User Interface Design: Form widgets, Text Fields, Layouts, Button control, toggle buttons, Spinners(Combo boxes),Images, Menu, Dialog.	8
V	Testing Android applications, Publishing Android application, Using Android preferences, Managing Application resources in a hierarchy, working with different types of resources. Understanding of SQLite database, connecting with the database.	8
VI	Publishing and Distributing Android Applications : The Android Software Development Process, Assessing Project Risks, Writing Essential Project Documentation, Deploying Mobile Applications, Designing and Developing, Bulletproof Android Applications.	8

Text Books :

1. J2ME: The Complete Reference, James Keogh, Tata McGraw Hill
2. Android application development for java programmers. By James C. Sheusi. Publisher: Cengage Learning, 2013.
3. Lauren Darcey and Shane Conder, - Android Wireless Application Development‖, Pearson Edn, 2nd edn. (2011)

Reference Books :

1) Reto Meier, "Professional Android 2 Application Development", Wiley India Pvt Ltd
2) Mark L Murphy, "Beginning Android", Wiley India Pvt Ltd
3) Android Application Development All in one for Dummies by Barry Burd, Edition: I

Course Code **MCA20305**

Course Name **Elective 3- iii) Internet of Things**

Credits **04**

Course Outcomes : At the end of the course, the students will be able to

1. Identify the use of IoT from a global context.

2. Design application using IoT.

3. Analyze the IoT enabling Technologies

4. Determine the real world problems and challenges in IoT .

Units	Contents	Total Hrs
I	**IoT Architecture** – State of the Art Introduction, State of the art, Architecture Reference Model, Introduction, Reference model and architecture, IoT reference model, IoT Reference Architecture, Introduction, Functional view, Information view, Deployment and operational view, Other relevant architectural views.	8
II	**IoT Enabling Technologies** - Wireless Sensor Networks ,Cloud Computing, Big Data Analytics, Communication Protocols, Embedded Systems.	8
III	**Real-World Design Constraints**- Introduction, Technical design Constraints– hardware, Data representation and visualization, Interaction and remote control.	8
IV	**Open – Source Prototyping Platforms for IoT-** Basic Arduino Programming Extended Arduino Libraries, Arduino – Based Internet Communication, Raspberry PI, Sensors and Interfacing.	8
V	**Data Management,** Business Process in IoT, IoT Analytics, Creative Thinking Techniques, Modification, Combination Scenarios, Decentralized and Interoperable,Approaches, Object - Information Distribution, Architecture, Object Naming Service(ONS), Service Oriented Architecture, Network of Information.	8

VI	**Domain specific** Home Automation - Smart Lighting, Smart Appliances, Intrusion Detection, Smoke/Gas Detectors Energy-Smart Grids, Renewable Energy Systems ,Prognostics Health &Lifestyle - Health & Fitness Monitoring ,Wearable Electronics ,Agriculture - Smart Irrigation, Green House Control ,Retail- Inventory Management, Smart Payments ,Smart Vending Machines, Cities -Smart Parking, Smart Lighting ,Smart Roads ,Structural HealthMonitoring,Surveillance,Emergency Response.	8

Reference Books :

1) From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence, Jan Holler VlasiosTsiatsis Catherine Mulligan Stefan Aves & Stamatis Karnouskos David Boyle.
2) VijayMadisetti and ArshdeepBahga, "Internet of Things (A Hands-on-Approach)", 1 stEd., VPT, 2014.
3) Getting Started with the Internet of Things by Cuno P fister.
4) The Internet of Things: Connecting Objects by HakimaChaouchi.
5) FrancisdaCosta, "Rethinking the Internet of Things: A Scalable Approach to Connecting Everything", 1st Edition ,Apress Publications, 2013.

Course Code **MCA20305**

Course Name **Elective 3- iv) Soft Computing**

Credits **04**

Course Outcomes : On successful completion of the course, students will be able to:

1. Describe soft computing concepts and techniques
2. Apply fuzzy logic and neural network to solve various engineering problems
3. Apply genetic algorithms in problem solving.
4. Evaluate and compare solutions by various soft computing approaches for a given problem.

Units	Contents	Total Hrs
I	**Introduction to Soft Computing and Neural Networks:** Evolution of Computing: Soft Computing Constituents, From Conventional AI to Computational Intelligence: Machine Learning Basics.	8
II	**Fuzzy Sets and Logic:** Fuzzy Sets, Operations on Fuzzy Sets, Fuzzy Relations, Membership Functions: Fuzzy Rules and Fuzzy Reasoning, Fuzzy Inference Systems, Fuzzy Expert Systems, Fuzzy Decision Making.	8
III	**Models of Neural Networks:** Machine Learning Using Neural Network, Adaptive Networks, Feed forward Networks, Supervised Learning Neural Networks, Radial Basis Function Networks: Reinforcement Learning, Unsupervised Learning Neural Networks, Adaptive Resonance architectures, Advance in Neural networks.	8
IV	**Genetic Algorithms:** Introduction to Genetic Algorithms (GA), Applications of GA in Machine Learning: Machine Learning Approach to Knowledge Acquisition.	8
V	**Application of Soft Computing**: Introduction to MATLAB / Python, Arrays and array operations, Functions and Files, Study of neural network toolbox and fuzzy logic toolbox, Simple implementation of Artificial Neural Network and Fuzzy Logic.	8
VI	**Recent Trends and Techniques:** Recent Trends in deep learning, various classifiers, neural networks and genetic algorithm. Implementation of recently proposed soft computing techniques.	8

Reference Books :

1. Sivanandam, Deepa, " Principles of Soft Computing", Wiley
2. Jang J.S.R, Sun C.T. and Mizutani E, "Neuro-Fuzzy and Soft computing", Prentice Hall.
3. George J. Klir and Bo Yuan, Fuzzy Sets and Fuzzy Logic: theory and Applications, Prentice Hall, 1995.

Course Code **MCA20307**

Course Name **Lab 7 Data Analytics using Python/R language**

Credits **1**

Course Outcomes : On completion of the course, the students will be able to

1. Understand the basics of data analytics
2. Demonstrate basics of python programming
3. Analyze and visualize data using different libraries of python.
4. Describe R programming basics and identify the data objects in R.
5. Analyze and summarize data using statistical methods of R

Contents	Total Hrs
1. Write a program to demonstrate basic data type in python. 2. Write a program to demonstrate list and tuple in python using For& while loops. 3. Write a Python program to demonstrate use Dictionary& relatedfunctions. 4. Write a Python program to demonstrate working of classes and objects Python Libraries. 5. Write a Python program to read and write data from a file& perform various operations like copy, save. 6. Using a Numpy module create an array and check the following: a. Type of array b. Axes of array c. Shape of array d. Type of elements in array. 7. Write a Pandas program to check the number of rows and columns and drop those row if 'any' values are missing in a row of sampleDataFrame. 8. Demonstrate the use of data visualization libraries like matplotlib, seaborn, pandas & folium using a sample DataFrame. 9. Reading different types of data sets (.txt, .csv) from web and disk and writing in file in specific disk location&find subset of dataset by using subset (), aggregate () functions on iris dataset.	30

Course Code **MCA20308**
Course Name **Lab 8 Web Technology**
Credits **1**

Course Outcomes : On completion of the course, the students will be able to

Develop web applications using advanced web technologies i.e HTML5, CSS3, ANGULAR.

Contents	Total Hrs
1. Create a webpage which shows student's general information in a tabular format using table tag. 2. Create a registration form using HTML5 input tag. 3. Create a HTML5 page which shows video using video tag. 4. Write a HTML5 program to create a circle with canvas tag. 5. Create a college 5 page college website using HTML5. 6. Create a web page with red background andopacity 0.5 with the help of internal CSS. 7. Show simple animation webpage using CSS3 8. Write a program to add 10 elements in array in type script. 9. Write a program to concatenate two strings in type script. 10. Write a program to show data in Upper case and Lower case using Pipe in angular 11. Create a registration form with component in Angular. 12. Write a program to create a calculator in Angular. 13. Design a Login Form using Angular Materials/Bootstrap.	30

Course Code **MCA20309**

Course Name **Lab 9 Elective 2 - i) Animation & Movie Making**

Credits **1**

Course Outcomes : On completion of the course, the students will be able to

1. Create on videos using flash
2. Create on movies using action script

Contents	Total Hrs
1. Write, test and debug small applications using Basic Flash concepts using shapes, colors, text and images.	30
2. Write, test and debug small applications with flash layers.	
3. Write, test and debug small applications with Scenes and Frame Labels.	
4. Write, test and debug small applications with flash symbols and instances.	
5. Write, test and debug small applications with flash animation.	
6. Write, test and debug small applications with simple action script.	
7. Write, test and debug small applications of movie using action script.	
8. Write, test and debug small applications of movie using timeline action script.	
9. Write, test and debug small applications with flash & publish it using flash.	

Course Code **MCA20309**

Course Name **Lab 9 Elective 2 - ii) Cyber Security & Digital Forensic**

Credits **1**

Course Outcomes: On completion of the course, the students will be able to

Apply the concepts of Cyber Security to real world problems

Contents	Total Hrs
The following list of can be used as guidelines for basic understanding but the scope of the laboratory should not be limited to this list. Aim of the list to inform about minimum expected outcomes.	30
1. Case study on cyber attack/crime	
2. Study and implementation of cyber tools.	
3. Identification of Virus infected file	
4. Vulnerability Analysis in Web Application	
5. Perform Port Scanning using Nmap	
6. Perform Data Hiding Technique using OpenStego	
7. Case Study on current cyber security laws in india	
8. Case study on digital evidence collection	
9. Generation of reports by using digital forensic investigation tools	

Course Code **MCA20309**

Course Name **Lab 9 Elective 2 - iii) Block Chain Technology**

Credits **1**

Course Outcomes : On completion of the course, the students will be able to

1. Write basic Hadoop commands
2. Implement the Hash Table
3. Create simple Blockchain

4. Use Geth to implement Ethereum
5. Prepare Case Studies on Blockchain Applications
6. Study Smart Contract Construction

Contents	Total Hrs
Lab Work – 1) To Study Basic Hadoop Commands 2) To study and implement Hash Table using Hash functions 3) Create a Simple Blockchain in any suitable programming language **Using JavaScript Perform following** 4) Creating a Blockchain 5) Implementing Proof of Work 6) Miner rewards & transactions 7) Signing transactions **Use Geth to Implement Private Ethereum Block Chain** 8) Creation of private Blockchain 9) Creation of Account 10) Mining using geth 11) Create Case study of Block Chain being used in illegal activities in real world 12) Write a smart contract in solidity to store and get "Hello World".	30

Course Code **MCA20310**

Course Name **LAB 10 ELECTIVE 3 - I) SOFTWARE TESTING**

Credits **1**

Course Outcomes: On completion of the course, the students will be able to

1. Describe fundamentals of testing
2. Discriminate among static and dynamic testing
3. Understand the test management mechanisms.
4. Design and develop the best test strategies in accordance to the development model.

Contents	Total Hrs
1. How many bugs can you find on buggy windows calculator? 2. How many bugs can you find on buggy Calendar? 3. How many bugs can you find on Weather Forecast screen? 4. How many bugs can you detect on Google accounts page? 5. How many test scenarios can you derive for ATM Feature based on Design Spec? 6. How many test scenarios can you derive for ATM Feature based on Use Case? 7. What Test Data conditions could you derive for the Test Scenarios identified before? 8. Would you be able to prepare a Test case you derive for a Test Scenario identified before? 9. What Test Scenarios can be derived for this feature based on Agile User Stories? 10. How many defects can you uncover for this Currency Converter App? 11. What Xpaths can you find for Search Engine (Dynamic Application)? 12. How do you automate a test case using Selenium WebDriver and Java? 13. How do you automate a test case using Selenium WebDriver, Java and JUnit? 14. Can you Prepare Cucumber BDD Steps Definition for feature? 15. Light Search Engine (Sorting) - Test Application	30

Course Code **MCA20310**

Course Name **Lab 10 Elective 3 - ii) Mobile Application Development**

Credits **1**

Course Outcomes : On completion of the course, the students will be able to

Design and Develop Mobile Application using Android Studio Development tool.

Contents **Total Hrs**

The following list of can be used as guidelines for basic understanding but the scope of the laboratory should not be limited to this list. Aim of the list is to inform about minimum expected outcomes 30

1. Add two Edit Text. When a number is entered in Edit Text 1, the square of that number should be displayed in Edit Text 2.

2. Add an Edit Text and a button. When the button is clicked, the text inputted in Edit Text should be retrieved and displayed back to the user

3. Add two EditText and a button. When the button is clicked, the text inputted in Edit Text 1 should be retrieved and displayed in EditText2.

4. Program a calculator

5. Create a Unit convertor for height

6. Create a Unit convertor for height and weight in the same application. Selection of height/weight can be done using a spinner.

7. Add a spinner. When the spinner is selected, there should be three options (e.g., android, java, testing). When you click on each option, it should go to another page containing some other components. Each of these pages should have a "back" button, which on pressing will take you back to the page with the spinner.

8. Create applications to include Action Bar, Menus, Dialogs and Notifications.

9. Create a user login form and registration form. First time users have to register through the registration form and the details should be stored in the database. Then they can login using the login page.

10. Create a camera application, where you can click a picture and then save it as the wallpaper.

11. Create a media player which plays an mp3 song.

12. Create a media recorder which will record the sound.

Course Code **MCA20310**
Course Name **Lab 10 Elective 3 - iii) Internet of Things**
Credits **1**
Course Outcomes : On completion of the course, the students will be able to
Design and Develop IoT based application

Contents

The following list of can be used as guidelines for basic understanding but the scope of the laboratory should not be limited to this list. Aim of the list to inform about expected outcomes.

1. Study of Raspberry-Pi, Beagle board, Arduino and other micro controller .
2. Study of different operating systems for Raspberry-Pi /Beagle board. Understanding the process of OS installation on Raspberry-Pi /Beagle board. **Total Hrs**
3. Study of Connectivity and configuration of Raspberry-Pi /Beagle board circuit with basic peripherals, LEDS. Understanding GPIO and its use in program.
4. Understanding the connectivity of Raspberry-Pi /Beagle board circuit with temperature sensor. Write an application to read the environment temperature. If temperature crosses a threshold value, the application indicated user using LEDSs.
5. Understanding the connectivity of Raspberry-Pi /Beagle board circuit with IR sensor.
6. Write an application to detect obstacle and notify user using LEDs.

7. Understanding and connectivity of Raspberry-Pi /Beagle board with camera. Write an application to capture and store the image. 30

8. Understanding and connectivity of Raspberry-Pi /Beagle board with a Zigbee module. Write a network application for communication between two devices using Zigbee .

9. Write an application using Raspberry-Pi /Beagle board to control the operation of stepper motor.

10. Write an application using Raspberry-Pi /Beagle board to control the operation of a hardware simulated traffic signal.

11. Write a server application to be deployed on Raspberry-Pi /Beagle board. Write client applications to get services from the server application .

12. Create a small dashboard application to be deployed on cloud. Different publisher devices can publish their information and interested application can subscribe.

Course Code **MCA20310**

Course Name **Lab 10 Elective 3 - iv) Soft Computing**

Credits **1**

Course Outcomes : On successful completion of the course, students will be able to:

1. Describe soft computing concepts and techniques
2. Apply fuzzy logic and neural network to solve various engineering problems.
3. Apply genetic algorithms in problem solving.
4. Evaluate and compare solutions by various soft computing approaches for a given problem

Contents	Total Hrs
1. Implement basic logic gate by considering Boolean value.	30
2. Implement Union, Intersection, Complement and Difference operations on fuzzy sets.	
3. Perform Max-Min Composition on any two fuzzy relations.	
4. Implementation of simple neural network.	
5. Implementation of Single layer Perceptron Learning Algorithm.	
6. Implementation of Simple Genetic Application	
7. Write a program to implement artificial neural network with or without back propagation algorithm.	
8. Implement any classification algorithm by applying Fuzzy concept	
9. Study of ANFIS Architecture to understand Hybrid System.	
10. Study of research paper on Soft Computing	

SEMESTER : IV

Course Code **MCA20401**

Course Name **Industry Project and Internship/Start-up**

Credits **18**

Details	Total Hrs
Guidelines : 1. Students may opt either Industrial Project or Internship or Start-up. 2. Industrial Project: It is a software development project assigned by any registered industry/organization to the student. Student may complete the project at industry/organization or from home. Student shall submit the completion/implementation certificate issued by the Industry/organization. Students should take prior approval from the institute in this regard. 3. Internship: In the internship, students shall apply direct/through institute to the Industry/Organization for internship or take use of'Intershala', an initiative of AICTE. The internship is placement of students in the industry/organization for which they are entitled to receive stipend. Students shall submit the appointment letter at the start of the internship and completion certificate at the end of the session well before the final examination. 4. Start-up: Students may undertake startup activity which is recognized by the Institute. Institute shall incubate the start-up using the system available at institute level and assign a mentor/guide to the student. The necessary support may be extended to the students for this activity. Students shall submit their proposal well in advance to the institute and Institute should grant its approval through available mechanism at Institute level. The registration of start-up and business proposal shall be the essential documents for this activity. Activity shall be evaluated on thebasis of its profit ratio. 5. In all the three above activities, students need to submit complete Project Report to the Institute well before thefinal examination.	06 Months

Course Code **MCA20402**

Course Name **Seminar**

Credits **6**

Details

Guidelines :
1. Institute shall assign mentor/guide to each student.
2. Student shall submit synopsis approved by the mentor/guide.
3. Institute shall approve the seminar topic.
4. Students shall prepare seminar report and presentation with the help of guide and submit seminar report andpresentation approved by the guide well in advance to conduct final presentation/examination.
5. Students may take seminar topic based on new technology, case study, success story of start-up he/she hasundertaken in the 'Industrial Project/Internship/Start-up activity.

Course Code **MCA20403**

Course Name **Online Subject - i) Management Information System**

Credits **02**

Prerequisite Basic Knowledge of managerial functions and organization

Course Outcomes : On completion of the course, the students will be able to

1. Describe various organization structures, behaviors and its influence on MIS Design
2. Create reports for various subsystem in an organization based on their functionality and interrelationship
3. Explain the planning models and relevance of each in current scenario at various levels of management.
4. Analyze the decision making requirements to create an appropriate decision support system.

Unit	Contents	Duration
I	**Introduction** An introduction to Information systems, Information systems in organization and their capabilities, Foundation concepts: Business Applications, development and Management, Role and process of management, Functions of a manager, Methods of Management, Types of Information Systems, Transaction Processing system, Management Reporting system, Decision Support system, Executive Information system, Office information system, Professional information system ,Expert Systems	8
II	**Competing with Information Technology** Systems Definition, Effectiveness and efficiency, Various Models, Control in systems (Feedback and Feed forward control), Organization Model, Strategic Planning Model, Management Control Model **IS Planning** Types of planning, Traditional Strategy making, Assumptions in traditional planning, Various Planning approaches: Traditional and Current scenario **Functional subsystem** Marketing and Sales, Finance and Accounting, Production, Human Resources, Logistics and Inventory, Research and development	8
III	**Decision Support Systems** Overview, Capabilities of DSS, DSS models: Scenario generation, Goal Seeking, DSS Components/ Architecture, DSS Classification, Building DSS **Expert Systems** Capabilities of ES, Architecture, Applications to Information Systems, Development and Maintenance of ES, Benefits and Limitations	8

Text Books :

1. Davis, Gordon B., and Margrethe H. Olson. Management information systems: conceptual foundations, structure, and development. McGraw-Hill, Inc., 1984.
2. Barbara McNurlin et al, IS Management in practice, Pearson Education, 5th edition
3. Zwass, Vladimir. Foundations of information systems. Irwin/McGraw Hill, 1997.
4.

Reference Books :

1. Laudon, Kenneth C., and Jane P. Laudon. "Management information systems: managing the digital firm." New Jersey 8 (2004).
2. W. S. Jawadekar, Management information Systems, Global Digital Enterprise Perspective, McGrawHill India, 5thed
3. James Obrien and George Maracus, Management information Systems McGrawHill India, 10thed,
4. Haag, Dawkins, Management information Systems for Information Age , McGrawHill India, 6thed

Course Code **MCA20403**

Course Name **Online Subject- ii) Entrepreneurship Development**

Credits **02**

Course Outcomes : On completion of the course, the students will be able to

1. Understand the systematic process to select and screen a business idea.
2. Identify business opportunities in chosen sector.
3. Sub-sector and plan and market and sell products / services.
4. Effectively manage small business enterprise

Unit	Contents	Total Hrs
I	**ENTREPRENEURIAL COMPETENCE** Entrepreneurship concept - Entrepreneurship as a Career - Entrepreneur - Personality Characteristics of Successful. Entrepreneur - Knowledge and Skills Required- or an entrepreneur. **ENTREPRENEURIAL ENVIRONMENT** Business Environment - Role of Family and Society - Entrepreneurship Development Training and Other Support Organizational Services - Central and State Government Industrial Policies and Regulations - International Business	8

II	**BUSINESS PLAN PREPARATION** Sources of Product for Business - Pre-feasibility Study - Criteria for Selection of Product - Ownership - Capital - Budgeting Project Profile Preparation - Matching Entrepreneur with the Project - Feasibility Report Preparation and Evaluation Criteria.	8
III	**LAUNCHING OF SMALL BUSINESS** Finance and Human Resource Mobilization Operations Planning - Market and Channel Selection- Growth Strategies - Product Launching. **MANAGEMENT OF SMALL BUSINESS** Monitoring and Evaluation of Business - Preventing Sickness and Rehabilitation of Business Units - Effective Management of small Business. **FINANCING THE ENTREPRENEURIAL BUSINESS** Funding & Start up and Entrepreneurship Councils in India, Arrangement of funds, Exercise on writing of project report, Entrepreneurial Financing and Risk. Appraisal of loans by financial institutions, Role of Commercial Banks in financing Business Entrepreneurs, Venture Capital.	8

Text Books :

1. Hisrich, 'Entrepreneurship', Tata McGraw Hill, New Delhi, 2001.
2. S.S.Khanka,'Entrepreneurial Development', S.Chand and Company Limited.

Reference Books :

1. Prasama Chandra, Projects - 'Planning, Analysis, SelecJion, Implementation and Reviews', TaJa McGraw-Hill.
2. P. C.Jain (ed.), 'Handbook for Nmv Entrepreneurs', EDII, Oxford University Press.

Course Code **MCA20403**

Course Name **Online Subject- iii) Enterprise Resource Planning**

Credits **02**

Course Outcomes :

At the end of the course student will be able to

1. Develop model for ERP for large projects
2. Develop model for E-commerce architecture for any application
3. Describe the advantages, strategic value, and organizational impact of utilizing an ERP system for the management of information across the functional areas of a business: sales and marketing, accounting and finance, human resource management, and supply chain
4. Demonstrate a working knowledge of how data and transactions are integrated in an ERP system to manage the sales order process, production process, and procurement process.
5. Evaluate organizational opportunities and challenges in the design system within a business scenario.
6. Use various platforms to implement the ERP

Unit	Details	Total Hrs
I	ERP Introduction, Benefits, Origin, Evolution and Structure: Conceptual Model of ERP, the Evolution of ERP, the Structure of ERP. Business Process Reengineering, Data ware Housing, Data Mining, Online Analytic Processing (OLAP), Product Life Cycle Management (PLM), LAP, Supply chain Management.	8
II	ERP Marketplace and Marketplace Dynamics: Market Overview, Marketplace Dynamics, the Changing ERP Market. ERP- Functional Modules: Introduction, Functional Modules of ERP Software, Integration of ERP, Supply chain and Customer Relationship Applications. ERP Implementation Basics, ERP Implementation Life Cycle, Role of SDLC/SSAD, Object Oriented Architecture, Consultants, Vendors and Employees.	8
III	ERP & E-Commerce, Future Directives- in ERP, ERP and Internet, Critical success and failure factors, Integrating ERP into organizational culture. Using ERP tool: ERP Softwares and tools, either SAP or ORACLE format to case study	8

Text Books :

1. Vinod Kumar Garg and Venkitakrishnan N K, "Enterprise Resource Planning Concepts and Practice", PHI.
2. Joseph A Brady, Ellen F Monk, Bret Wagner, "Concepts in Enterprise Resource Planning", Thompson Course Technology.

Reference Books :

1. Alexis Leon, "ERP Demystified", Tata McGraw Hill
2. Rahul V. Altekar "Enterprise Resource Planning", Tata McGraw Hill,
3. Vinod Kumar Garg and Venkitakrishnan N K, "Enterprise Resource Planning – A Concepts and Practice", PHI
4. Mary Summer, "Enterprise Resource Planning"- Pearson Education

Course Code **MCA20403**

Course Name **Online Subject- iv) Research Methodology**

Credits **2**

Course Outcomes : On completion of the course, the students will be able to

1. Explain fundamentals of Research Methodology

2. Analyze and classify different problem identification technique

3. Describe data analysis and data interpretation.

4. Use of different research techniques and tools.

Unit	Details	Total Hrs
I	Foundations of Research: Meaning, Objectives, Motivation, Utility. Concept of theory, empiricism, deductive and inductive theory. Characteristics of scientific method – Understanding the language of research – Concept, Construct, Definition, Variable. Research Process Problem Identification & Formulation – Research Question – Investigation Question – Measurement Issues – Hypothesis – Qualities of a good Hypothesis –Null Hypothesis & Alternative Hypothesis. Hypothesis Testing – Logic & Importance	8
II	Research Design: Concept and Importance in Research – Features of a good research design – Exploratory Research Design – concept, types and uses, Descriptive Research Designs – concept, types and uses. Experimental Design: Concept of Independent & Dependent variables Interpretation of Data and Paper Writing – Layout of a Research Paper, Journals in Computer Science, Impact factor of Journals, When and where to publish ? Ethical issues related to publishing, Plagiarism and Self-Plagiarism	8
III	Use of Encyclopaedias, Research Guides, Handbook etc., Academic Databases for Computer Science Discipline Use of tools / techniques for Research: methods to search required information effectively, Reference Management Software like Zotero/Mendeley, Software for paper formatting like LaTeX/MS Office, Software for detection of Plagiarism	8

Reference Books :

1. Business Research Methods – Donald Cooper & Pamela Schindler, TMGH, 9th edition
2. Business Research Methods – Alan Bryman & Emma Bell, Oxford University Press.
3. Research Methodology – C.R. Kothari

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