



Vishwavidyanilaya Karyasoudha  
Crawford Hall, Mysuru- 570 005  
Dated: 12.07.2019.

No.AC.2(S)/785/2019-20

**NOTIFICATION**

**Sub:** Minor modifications to FCBCS & Earning Credits of M.C.A. course from the Academic Year 2019-20.

**Ref:** 1. Decision of Board of Studies in Computer Science (PG) meeting held on 15.12.2018.  
2. Decision of the Faculty of Science & Technology Meeting held on 01.04.2019.  
3. Decision of the Academic Council meeting held on 07.06.2019.

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The Board of Studies in Computer Science (PG) which met on 15.12.2018 has recommended to make minor modifications to FCBCS and revise the Earning Credits for the syllabus of MCA course from the Academic Year 2019-20.

The Faculty of Science and Technology and Academic Council meeting held on 01.04.2019 and 07.06.2019 respectively have approved the above said proposal and the same is hereby notified.

The modified earning credits of M.C.A. course is annexed. The contents may be downloaded **from the University Website i.e., [www.uni-mysore.ac.in](http://www.uni-mysore.ac.in)**.

Draft approved by the Registrar


Sd/-  
**Deputy Registrar (Academic),**

**To:**

1. The Registrar (Evaluation), University of Mysore, Mysore.
2. The Dean, Faculty of Science & Technology, DOS in Zoology, Manasagangotri, Mysore.
3. The Chairperson, BOS in Computer Science, DOS in Computer Science, Manasagangotri, Mysore.
4. The Chairperson, Department of Studies in Computer Science, Manasagangotri, Mysore.
5. The Director, College Development Council, Moulya Bhavan, Manasagangotri, Mysore.
6. The Deputy/Assistant Registrar/Superintendent, AB and EB, UOM, Mysore.
7. The P.A. to the Vice-Chancellor/Registrar/Registrar (Evaluation), UOM, Mysore.
8. Office file.

**Minor Changes in Flexible Choice Based Credit System (FCBS)  
and Continuous Assessment Grading Pattern (CAGP)  
for MCA Course with effect from 2019-2020**

Section of Regulations	Existing	Proposed Change	Remarks
Title of the Course	Master of Computer Applications (MCA)	No Change	---
Duration of the Course	Three years duration extended over six semesters. A student is allowed a maximum of six years to become eligible for the award of MCA degree, failing which he/she shall have to register once again as a fresh candidate.	No Change	---
Eligibility for Admission	As per the regulations of the University of Mysore	No Change	---
Course Structure	Proposed to adopt L:T:P model as per the FCBCS and CAGP of the University.	No Change	---
Evaluation	As stated in FCBCS regulations of University of Mysore.	No Change	---
Project Evaluation	As stated in FCBCS regulations of University of Mysore.	No Change	---
Earning Credits	Since, it is a 3 year degree programme; students have to earn a minimum of 112 credits to get MCA degree with 60 credits in Hard Core, a minimum of 40 in Soft Core, and a minimum of 4 credits and a maximum of 12 credits in Open Elective subjects.	Since, it is a 3 year degree programme; students have to earn a minimum of 112 credits to get MCA degree with 52 credits in Hard Core, a minimum of 48 in Soft Core, and a minimum of 4 credits and a maximum of 12 credits in Open Elective subjects.	Number of Hard-core and Soft-core subjects to be studied have been changed

  
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## List of Hardcore Subjects

Sl. No.	Course Title	Credit Pattern	Total Credits
1.	Fundamental of Data Structures	3:0:1	4
2.	Object-Oriented Programming with C++	3:0:1	4
3.	Real Time Operating Systems	3:1:0	4
4.	Database Management Systems	3:0:1	4
5.	Advanced Software Engineering	3:1:0	4
6.	Embedded Systems	3:1:0	4
7.	Analysis and Design of Algorithms	3:0:1	4
8.	Java Programming	2:0:2	4
9.	Data Communication and Networks	3:1:0	4
10.	Big Data Analytics	3:0:1	4
11.	Dissertation Work	2:2:8	12


## List of Soft-core Subjects

Sl. No.	Course Title	Credit Pattern	Total Credits
1.	Essential Mathematics/ Accountancy and Financial Management	3:1:0	4
2.	Computer Fundamentals and Organization	3:1:0	4
3.	C Programming	3:0:1	4
4.	Computer Graphics	2:1:1	4
5.	Theory of languages and Automata	3:1:0	4
6.	Numerical Techniques	3:0:1	4
7.	Operation Research	3:1:0	4
8.	Web Programming	2:0:2	4
9.	.Net with C#	2:1:1	4
10.	System Analysis and Design	3:1:0	4

  
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11.	Probability and Statistics	3:1:0	4
12.	Mobile Communication	3:1:0	4
13.	E-commerce and E-governance	3:1:0	4
14.	Linux Programming	2:1:1	4
15.	Information Retrieval	2:1:1	4
16.	Image Processing	3:0:1	4
17.	Graph Theory	3:1:0	4
18.	Cryptography and Network Security	3:1:0	4
19.	Distributed Computing	3:1:0	4
20.	Pattern Recognition	3:0:1	4
21.	Artificial Intelligence	3:1:0	4
22.	Data Mining and Data Warehousing	2:1:1	4
23.	Data Clustering	2:1:1	4
24.	Machine Learning	2:1:1	4
25.	Fuzzy Sets and Theory	3:1:0	4
26.	Computational Mathematics	3:1:0	4
27.	Compiler Construction	2:1:1	4
28.	Communication Skills and Professional Management	3:1:0	4
29.	Simulation and Modeling	2:1:1	4
30.	Python Programming	2:0:2	4
31.	Mobile Application Design and Development	3:0:1	4
32.	Enterprise Resource Planning	3:1:0	4
33.	Network and Information Security	3:1:0	4
34.	Cloud Computing	3:1:0	4
35.	Internet of Things	2:1:1	4
36.	Software Project Management	3:1:0	4

  
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## Note:

**For Lateral Entry:** The candidates who have admitted to MCA through lateral entry directly to 2<sup>nd</sup> year (III semester) they have to earn 76 credits instead of 112, out of which 36 credits are from Hard core, a minimum of 32 credits from soft core and a minimum of 4 credits and a maximum of 8 credits in open elective.

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# REAL TIME OPERATING SYSTEMS

## Introduction to OS and RTOS

Architecture of OS (Monolithic, Microkernel, Layered, Exo-kernel and Hybrid kernel structures), Operating system objectives and functions, Virtual Computers, Interaction of O. S. & hardware architecture, Evolution of operating systems, Batch, multi programming, Multitasking, Multiuser, parallel, distributed & real –time O.S.

## Process Management of OS/RTOS

Uniprocessor Scheduling: Types of scheduling, scheduling algorithms: FCFS, SJF, Priority, Round Robin, UNIX Multi-level feedback queue scheduling, Thread Scheduling, Multiprocessor Scheduling concept, Real Time Scheduling concepts.

## Process Synchronization

Concurrency: Principles of Concurrency, Mutual Exclusion H/W Support, software approaches, Semaphores and Mutex, Message Passing, Monitors, Classical Problems of Synchronization: Readers-Writers Problem, Producer Consumer Problem, Dining Philosopher problem, Deadlock: Principles of deadlock, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, An Integrated Deadlock Strategies.

## Memory and I/O Management:

Memory Management requirements, Memory partitioning: Fixed, dynamic, partitioning, Buddy System Memory allocation Strategies (First Fit, Best Fit, Worst Fit, Next Fit), Fragmentation, Swapping, Segmentation, Paging, Virtual Memory, Demand paging, Page Replacement Policies (FIFO, LRU, Optimal, clock) ,Thrashing, Working Set Model.

I/O Management and Disk Scheduling: I/O Devices, Organization of I/O functions, Operating System Design issues, I/O Buffering, Disk Scheduling (FCFS, SCAN, C-SCAN, SSTF), Disk Caches.

## RTOS Application Domains

Comparison and study of RTOS: Vxworks and  $\mu$ COS – Case studies: RTOS for Image Processing – Embedded RTOS for voice over IP – RTOS for fault Tolerant Applications – RTOS for Control Systems.

## Reference Books:

1. Wayne Wolf, "*Computers as Components: Principles of Embedded Computing System Design.*" 2/e, Kindle Publishers, 2005.
2. Tanenbaum, "*Modern Operating Systems.*" 3/e, Pearson Edition, 2007.
3. Jean J Labrosse, "*Embedded Systems Building Blocks Complete and Ready-to-use Modules in C.*" 2/e, 1999.
4. C.M.Krishna and G.Shin, "*Real Time Systems.*" McGraw-Hill International Edition, 1997.



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## EMBEDDED SYSTEMS

**Introduction to Embedded Systems:** Introduction to Embedded Systems – The build process for embedded systems- Structural units in Embedded processor , selection of processor & memory devices- DMA – Memory management methods- Timer and Counting devices. Watchdog Timer, Real Time Clock, In circuit emulator, Target Hardware Debugging.

**Embedded Networking:** Embedded Networking: Introduction, I/O Device Ports & Buses– Serial Bus communication protocols – RS232 standard – RS422 – RS485 – CAN Bus -Serial Peripheral Interface (SPI) – Inter Integrated Circuits (I2C) –need for device drivers.

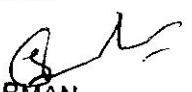
**Embedded Firmware Development Environment:** Embedded Product Development Life Cycle- objectives, different phases of EDLC, Modelling of EDLC: issues in Hardware-software Co-design. Data Flow Graph, state machine model, Sequential Program Model, concurrent Model, object oriented Model.

**RTOS Based Embedded System Design:** Introduction to basic concepts of RTOS- Task, process & threads, interrupt routines in RTOS, Multiprocessing and Multitasking, Preemptive and non preemptive scheduling, Task communication shared memory, message passing-, Inter process Communication – synchronization between processes-semaphores, Mailbox, pipes, priority inversion, priority inheritance, comparison of Real time Operating systems: Vx Works, µC/OS-II, RT Linux.

**Embedded System Application Development:** Case Study of Washing Machine- Automotive Application- Smart card System Application..

### Reference Books:

- Rajkamal, 'Embedded System-Architecture, Programming, Design', Mc Graw Hill, 2013.
- Peckol, "Embedded system Design", John Wiley & Sons, 2010
- Lyla B Das, "Embedded Systems-An Integrated Approach", Pearson, 2013.
- Shibu, K.V, "Introduction to Embedded Systems", Tata Mcgraw Hill, 2009.
- Elicia White, "Making Embedded Systems", O' Reilly Series, SPD, 2011.
- Han-Way Huang, "Embedded system Design Using C8051", Cengage Learning, 2009.
- Rajib Mall "Real-Time systems Theory and Practice" Pearson Education, 2007.

  
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## BIG DATA ANALYTICS

**Introduction to Big Data Analytics:** Big Data Overview, State of practice in analytics, Role of Data Scientists, Examples of Big Data Analytics, Data Analytics Lifecycle, Components of Hadoop, Analyzing Big data with Hadoop, Design of HDFS, Developing a Map reduce Application

**Map Reduce:** Distributed File System(DFS), Map Reduce, Algorithms using Map Reduce, Communication cost Model, Graph Model for Map Reduce Problem

**Hadoop Environment:** Setting up a Hadoop Cluster, Hadoop Configuration, Security in Hadoop, Administering Hadoop, Hadoop Benchmarks, Hadoop in the cloud.


**Big Data Analytics Methods using R:** Introduction to R-Attributes, R Graphical user interfaces, Data import and export, attribute and Data Types, Descriptive Statistics, Exploratory Data Analysis.

**Statistical methods for evaluation:** Hypothesis Testing, Difference of Means, Wilcoxon Rank-Sum Test, Type I and Type II errors, power and sample size, ANOVA

**Advanced Analytics - technologies and tools:** Analytics for unstructured data, The Hadoop ecosystem – pig – Hive- HBase- Mahout- NoSQL

## Reference Books

1. Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data by EMC Education Services, 2015, publishing.
2. Anand Raja Raman and Jeffrey David Ullman, Mining of Massive Datasets, 2012, Cambridge University Press.
3. Tom White, Hadoop: The Definitive Guide, 3rd Edition, O`Reilly Media

  
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## CLOUD COMPUTING

**Introduction:** Cloud models-Evolution of Cloud Computing –System Models for Distributed and Cloud Computing – NIST Cloud Computing Reference Architecture – On-demand Provisioning – Elasticity in Cloud – deployment models – service models-cloud service providers

**Virtualization:** Basics of Virtualization - Types of Virtualization - Implementation Levels of Virtualization, Virtualization Structures - Tools and Mechanisms – resource sharing and resource pooling Desktop Virtualization – Server Virtualization.

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

**Programming Model:** Parallel and Distributed Programming Paradigms - Map Reduce, Twister and Iterative Map Reduce – Hadoop Library from Apache – Mapping Applications - Programming Support.

**Security in the Cloud:** Security Overview – Cloud Security Challenges – Access control mechanisms – Security Governance – Risk Management – Security Monitoring – Security Architecture Design – Virtual Machine Security.

**Enterprise Cloud-Based High Performance Computing (HPC):** Overview of High Performance Computing (HPC) on Cloud-Enterprises HPC applications (high-performance grid computing, high-performance big data computing/analytics, high performance reasoning)-HPC Cloud vendor solutions: compute grids (Windows HPC, Hadoop, Platform Symphony ,Gridgain), data grids (Oracle coherence, IBM Object grid, Cassandra, HBase, Memcached, IIPChardware (GPGPU, SSD, Infiniband, Non-blocking switches)

**Setting up own Cloud:** Cloud setup-How to build private cloud using open source tools-Understanding various cloud plugins-Setting up your own cloud environment-Autoprovisioning-Custom images-Integrating tools like Nagio-Integration of Public and Private cloud.

## Reference Books

1. Kai Hwang, Geoffrey C Fox, Jack G Dongarra, Distributed and Cloud Computing, From
2. Parallel Processing to the Internet of Things, 2012, 1st Edition, Morgan Kaufmann Publishers.
3. Katarina Stanoevska-Slabeva, Thomas Wozniak, Santi Ristol, Grid and Cloud Computing – A Business Perspective on Technology and Applications, 2010, Springer.
4. John W.Rittinghouse and James F.Ransome, Cloud Computing: Implementation, Management, and Security”, 2010, CRC Press.
5. Toby Velte, Anthony Velte, Robert Elsenpeter, Cloud Computing, A Practical Approach, 2009, TMH.
6. George Reese, Cloud Application Architectures: Building Applications and Infrastructure in the Cloud O'Reilly, 2009.

# MOBILE APPLICATION DESIGN AND DEVELOPMENT

**Mobile application development:** A brief history of mobile, Mobile ecosystem. Designing for context. Developing a Mobile Strategy, Mobile Information Architecture, Mobile Design. Types of mobile application

**Technologies:** HTML5-elements, form, graphics, media. CSS3-2Dtransforms, 3Dtransforms, transitions, animations, images. Javascript-forms, objects, error handling, validations, JQuery- selectors, effects, traversing, Ajax

**Android programming:** Android toolkit, Java for android, components of an Android Application.

**Android software development:** Eclipse Concepts and Terminology, Eclipse Views and Perspectives, Eclipse and Android, Effective java for Android.


**Android Framework:** Building a View, Fragments and Multiplatform Support. Handling and Persisting Data.

**Android UID principles:** Designing powerful user interfaces, handling advanced user input, designing accessible applications.

**Drawing, Animations and Graphics programming:** Developing 2D graphics applications, working with animations developing Android 3D graphics applications, using Android NDK.

## Reference Books

1. Zigurd Mednieks, Laird Dornin, G. Blake Meike, and Masumi Nakamura, Programming Android, 2011, 1st Edition, O'Reilly Media.
2. Jonathan Stark, Building iPhone Apps with HTML, CSS and JavaScript, 2011, 1st Edition, O'Reilly Media.
3. Brian fling, Mobile Design and Development, 2009,1st Edition, O'Reilly Media.
4. Paul Deitel, Harvey Deitel, Abbey Deitel, Michael Morgana, Android for Programmers An App-Driven Approach, 2012, 2nd Edition, Deitel Developer Series, Pearson Education.

  
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# NETWORK AND INFORMATION SECURITY

**Introduction:** Threats, vulnerabilities, controls. Confidentiality, integrity, availability. Attackers and attack types.

**Authentication, Access Control and:** Authentication. Identification Versus Authentication, Authentication Based on biometrics, Authentication Based on Tokens, Federated Identity management, Multifactor Authentication, Secure Authentication, Implementing Access Control, Procedure-Oriented Access Control, Role-Based Access Control.

**Cryptography:** Problems Addressed by Encryption Terminology, DES: The Data Encryption Standard, AES: Advanced Encryption System, Public Key Cryptography, Trust Certificates: Trustable Identities and Public Keys, Digital Signatures.

**Browser Attacks:** Browser Attack Types, How Browser Attacks Succeed: Failed Identification and Authentication, Web Attacks Targeting Users False or Misleading Content, Malicious Web Content Protecting Against Malicious Web Pages, Foiling Data Attacks, Email Attacks.

**Cyber Security:** Cyber Security Fundamentals – Attacker techniques and motivation – Malicious Code – Defence and Analysis Techniques – Memory Forensics – Honeypots – Malicious code Naming – Automated code analysis systems – Intrusion Detection System.

**Replication:** Self-Replicating Malicious Code .Evading Detection and Elevating Privileges, Persistent Software Techniques, Rootkits, Spyware, Virtual Machine Detection.

**Cloud Security:** Cloud Computing Concepts, Service Models, Deployment Models, Moving to the Cloud, Risk Analysis Cloud Provider Assessment, Switching Cloud Providers, Cloud Security Tools and Techniques Data Protection in the Cloud, Cloud Application Security, Cloud Identity Management.

## Reference Books

1. Charles P. Fleeger, Security in Computing, 2011, 5th edition, Prentice Hall, New Delhi.
2. P.W.Singer and Allan Friedman, Cyber security and cyber war what everyone needs to Know, 2014, 1st edition, Oxford university press,USA.
3. Taylor Sutton Finch Alexander, Information Security Management Principles, 2012, 2nd edition BCS Learning and development Limited, United Kingdom.



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# INTERNET OF THINGS

**Introduction to IoT:** Definition and Characteristics, Physical Design of IoT, Logical Design of IoT, IoT Enabling Technologies.

**M2M and IoT:** Introduction to M2M, Difference between IoT and M2M, SDN and NFV for IoT.

**IoT Protocols:** IEEE 802.15.4, BACNet Protocol, Modbus, KNX, Zigbee Architecture, 6LoWPAN, RPL

**Developing Internet of Things:** IoT Platforms Design Methodology, Python packages of Interest for IoT, IoT Physical Devices and Endpoints

**IoT and Cloud:** IoT Physical Servers and Cloud Offerings, IoT Tools: Chef, Puppet

**Data Analytics for IoT:** Big Data Platforms for the IoT, Hadoop Map Reduce for Batch Data Analysis, Apache Oozie Workflows for IoT Data Analysis, In-Memory Analytics using Apache Spark, Apache Storm for Real Time Data Analysis, Sustainability Data and Analytics in Cloud based M2M Systems, Fog Computing: A Platform for IoT and Analytics

**Domain Specific IoTs:** Home Automation, Cities, Environment, Energy, Retail, Logistics, Agriculture, Industry, Health and Lifestyle, Virtual Reality Internet Advertising, Intelligent Transportation Systems, Health Information System: Genomics Driven Wellness Tracking and Management System (Go-WELL)

## Reference Books

1. Arshdeep Bahga, Vijay Madisetti, Internet of Things: A Hands-on Approach, 2015, 1st Edition, Universities Press.
2. Olivier Hersent, David Boswarthick, Omar Elloumi, The Internet of Things – Key applications and Protocols, 2012, Wiley Publication.
3. Honbo Zhou, The Internet of Things in the Cloud: A Middleware Perspective, 2012, CRC Press.
4. Dieter Uckelmann; Mark Harrison; Florian Michahelles Architecting the Internet of Things, 2011, Springer.



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## ENTERPRISE RESOURCE PLANNING

**Introduction to Enterprise Resource Planning:** Introduction, Benefits of ERP, Business Process Reengineering, Data Warehousing, Data Mining, Supply Chain Management.

**Reasons for the Growth of ERP:** Reasons for the Growth of ERP, Scenario and Justification of ERP in India, Evaluation of ERP, Various Modules of ERP, and Advantages of ERP.

**Understanding ERP:** Overview of Enterprise, Integrated Management Information, Business Modeling, ERP for Small Businesses, ERP for Make to Order Companies.

**Business Process Mapping:** Business Process Mapping in ERP, ERP Implementation Process, Hardware Environment for ERP Implementation.

**ERP Implementation:** Precautions in ERP Implementation, ERP Post Implementation Options, Guidelines for ERP Implementation, Pre-evaluation Screening, Package Evaluation, Project Planning Phase, Gap Analysis, Hidden Cost, Vendors, Consultants, Human Resource, Re-Engineering, Configuration, Implementation, Team Training, Testing, Going Live and End User Training, Post Implementation.


**ERP and Related Technologies:** Business Process Re-engineering, Management Information System, Executive Information System (EIS), Decision Support Systems (DSS), Supply Chain Management.

**ERP Modules:** ERP Finance Module, Plant Maintenance, Quality Management, Materials Management Module.

**ERP and E-commerce:** Future Directives in ERP, ERP and Internet, Critical Factors Guiding Selection and Evaluation of ERP, Strategies for Successful ERP Implementation, Critical Success Factors in ERP Implementation, Failure Factors in ERP Implementation, Integrating ERP into Organization, ERP Software and Tools

## Reference Books

1. Concepts in Enterprise Resource Planning 4th Edition by Ellen Monk and Bret Wagner
2. Modern ERP: Select, Implement, and Use Today's Advanced Business Systems by Marianne Bradford
3. Enterprise Resource Planning: Concepts and Practice, Second Edition New Title Edition, Kindle Edition By Vinod Kumar and Venkitakrishnan, N. K. Garg



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## **PYTHON PROGRAMMING**

**Introduction:** History of Python. Need of Python Programming. Applications Basics of Python Programming Using the REPL(Shell), Running Python Scripts. Variables, Assignment, Keywords, Input-Output, Indentation.

**Types, Operators and Expressions:** Types – Integers, Strings, Booleans; Operators- Arithmetic Operators, Comparison (Relational) Operators, Assignment Operators, Logical Operators, Bitwise Operators, Membership Operators, Identity Operators, Expressions and order of evaluations Control Flow- if, if-elif-else, for, while break, continue, pass

**Data Structures Lists:** Operations, Slicing, Methods: Tuples, Sets, Dictionaries, Sequences, Comprehensions.


**Functions:** Defining Functions, Calling Functions, Passing Arguments, Keyword Arguments, Default Arguments, Variable-length arguments, Anonymous Functions, Fruitful Functions (Function Returning Values), Scope of the Variables in a Function- Global and Local Variables, Modules: Creating modules, import statement, from, Import statement, name spacing, Python packages, Introduction to PIP, Installing Packages via PIP, Using Python Packages

**Object-Oriented Programming OOP in Python:** Classes, 'self-variable', Methods, Constructor Method, Inheritance, Overriding Methods, Data hiding, Error, and Exceptions: Difference between an error and Exception, Handling Exception, try except for block, Raising Exceptions, User Defined Exceptions

**Brief Tour of the Standard Library:** Operating System Interface – String Pattern Matching, Mathematics, Internet Access, Dates and Times, Data Compression, Multithreading, GUI Programming, Turtle Graphics Testing: Why testing is required ?, Basic concepts of testing, Unit testing in Python, Writing Test cases, Running Tests.

### **Reference Books:**

1. Charles Dierbach, "Introduction to Computer Science Using Python", 1st Edition, Wiley India Pvt Ltd.
2. Mark Lutz, "Programming Python", 4th Edition, O'Reilly Media, 2011.
3. Wesley J Chun, "Core Python Applications Programming", 3rd Edition, Pearson Education India, 2015.
4. Roberto Tamassia, Michael H Goldwasser, Michael T Goodrich, "Data Structures and Algorithms in Python", 1<sup>st</sup> Edition, Wiley India Pvt Ltd, 2016.
5. Reema Thareja, "Python Programming using problem solving approach", Oxford university press, 2017.
6. Python Programming: A Modern Approach, Vamsi Kurama, Pearson
7. Learning Python, Mark Lutz, Orielly
8. Introduction to Python, Kenneth A. Lambert, Cengage.

  
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