

**Deccan Education Society's
FERGUSSON COLLEGE (AUTONOMOUS),
PUNE**

Syllabus

for

S. Y. M. Sc. (Computer Applications)

[Pattern 2019]

(M.Sc. Semester-III and Semester-IV)

From Academic Year

2020-21

Deccan Education Society's
Fergusson College (Autonomous), Pune

S. Y. M.Sc. (Computer Applications) (Pattern 2019)

From academic year 2020-21

Particulars	Name of Paper	Paper Code	Title of Paper	No. of Credits
S.Y. M.Sc. Semester III	Theory Core Paper – 7	CSA5301	Advanced Java	4
	Theory Core Paper - 8	CSA5302	Software Engineering and UML	4
	Theory Departmental Elective Paper - 7	CSA5303	Advanced Web Technologies	4
	Theory Departmental Elective Paper - 8	CSA5304	Mobile Technology	4
	Theory MOOC Elective Paper – 3	CSA5305	MOOC – III	4
	Theory General Elective Paper – 3	CSA5306	Programming in C++ (General Elective – III)	4
	Theory Departmental Elective Paper - 9	CSA5307	Full Stack	4
	Theory Departmental Elective Paper - 10	CSA5308	Internet of Things	4
	Theory MOOC Elective Paper – 4	CSA5309	MOOC - IV	4
	Theory General Elective Paper – 4	CSA5310	Data Structures (General Elective – IV)	4
	Practical Core Paper-5	CSA5311	Computer Applications Practical – IV (Lab Based on Advanced Java)	4
	Practical Core Paper-6	CSA5312	Project	4
S.Y. M.Sc. Semester IV	Practical Core Paper-7	CSA5401	Industrial Training/Institutional Project	8

S.Y. M.Sc. Semester III
Theory Core Paper -7 (CSA 5301): Advanced Java

[Credits-4]

Course Outcomes

At the end of this course, students will be able to

- CO1** Understand basic understanding of concepts of database connectivity
- CO2** Understand and can use various readymade collections and data structure
- CO3** Implement the basics of data communication, networking concepts and socket programming.
- CO4** Implement the web-based applications on the basis of MVC framework.
- CO5** Understand of concepts of Java Beans.
- CO6** Understand how mails are send through java and could design such application

Unit	Details	Lectures
I	Database Programming 1.1 The design of JDBC 1.2 JDBC configuration 1.3 Types of drivers 1.4 Executing SQL statements 1.5 Query execution 1.6 Batch execution 1.7 Scrollable and updatable result sets 1.8 Rowset, Metadata, transactions. (Databases: MySQL/ SQL Server/ PostgreSQL/Oracle/MS- Access)	[10]
II	Collections 2.1 Collections 2.2 Introduction to the Collection framework (Interfaces, Implementation and algorithms) 2.3 Interfaces 2.4 Collection classes: Set, List, Queue and Map 2.5 Set: HashSet, TreeSet, and LinkedHashSet 2.6 Interfaces such as Lists, Set, Vectors, Stack, LinkedList, Comparator, Iterator, Enumerators, Hash table 2.7 Working with Maps: Map Interface and Map Classes	[6]
III	Networking 3.1 The java.net package 3.2 Connection oriented transmission – Stream Socket Class 3.3 Internet Addressing 3.4 Inet Address 3.5 Factory methods 3.6 Instance methods 3.7 TCP/IP client socket 3.8 TCP/IP Server sockets 3.9 Creating a Socket to a remote host on a port (creating TCP client and server) 3.10 URL, URL Connection 3.11 Datagrams 3.12 Developing small application with sockets	[7]

IV	Servlets 4.1 Introduction to Servlet (HTTP Servlet) 4.2 Life Cycle of servlet 4.3 GenericServlet Class 4.4 Handling get and post request(HTTP) 4.5 Data handling using Servlet 4.6 Creating cookies 4.7 Session tracking using HTTP servlet 4.8 Servlet – JDBC 4.9 Security Issues	[10]
V	Web development using JSP 5.1 Introduction to JSP 5.2 JSP Architecture 5.3 JSP Directives 5.4 JSP scripting elements 5.5 Default objects in JSP 5.6 JSP Actions 5.7 JSP with Database 5.8 Error handling in JSP 5.9 Session tracking techniques in JSP 5.10 Introduction to custom tags	[8]
VI	Java Mail API and JMS 7.1 Introduction 7.2 Sending Email 7.3 Receiving Email 7.4 Sending Attachment 7.5 Receiving Attachment 7.6 Sending HTML 7.7 Forwarding Email 7.8 Deleting Email 7.9 JMS introduction 7.10 JMS messaging domain 7.11 JMS programming model 7.12 JMS sender / receiver application	[7]

Books

1. Cay S. Horstmann, Gary Cornell, Core Java Volume-II-Advanced Features, Eighth Edition, Prentice Hall, Sun Microsystems Press, 2007.
2. Ivan Bayross, Commercial web development using java 2.0, BPB, 2007.
3. Steven Horlzner , Java 2 programming black books, 2006.
4. Herbert Schildt (5th edition), Complete reference Java, 2002.
5. Jason Hunter, Java servlet Programming, O'Reilly 2001.

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1. <https://www.edureka.co/blog/advanced-java-tutorial>
2. <https://www.javatpoint.com/java>
3. <https://www.tutorialspoint.com/java>
4. <https://www.studytonight.com/java>
5. <https://www.w3schools.com/java>

S.Y. M.Sc. Semester III**Theory Core Paper -8 (CSA 5302): Software Engineering and UML****[Credits-4]****Course Outcomes**

At the end of this course, students will be able to

- CO1** Understand various models used for Software development.
CO2 Learn and Understand about requirement engineering
CO3 Implement the object-oriented programming with the help of UML diagrams.
CO4 Learn about various agile process models.

Unit	Details	Lectures
I	Introduction to Software development 1.1 Overview of Software Development with SSAD 1.2 System Development Life Cycle, different types of users and their roles 1.3 Models for System Development: Waterfall Model, Spiral Model, Prototyping Model, RAD Model, Unified Process Model	[6]
II	Requirement Engineering 2.1 Types of Requirements: Functional and Non-functional 2.2 Four Phases of Requirement Engineering 2.3 Software requirement Specification (SRS): Structure and contents of SRS, IEEE standard format for SRS	[5]
III	Use-case Driven Object-oriented Analysis 3.1 Introduction to UML 3.2 Requirement Analysis - Use-case Diagram, Identify Actors, Identify Use cases, Develop use-case Model 3.3 Basic Structural Modeling: Class Diagram and Object diagram Advanced Structural Modeling: Associations and links, Aggregation, Composition and containment, Inheritance, Sub Types and IS-A hierarchy Package Diagram	[10]
IV	Basic Behavioral Modeling 4.1 Interaction Diagram 4.2 Sequence Diagram 4.3 Activity Diagram 4.4 Collaboration Diagram 4.5 State Chart Diagram 4.6 State Transition Diagram	[15]
V	Architectural Modeling 5.1 Component Diagram 5.2 Deployment Diagram	[6]
VI	Current Trends in Software Engineering 6.1 Introduction to Web Engineering 6.2 Agile Process	[6]

	6.3 Agile Process Models: Extreme Programming (XP), Adaptive Software Development (ASD), Dynamic Systems Development Method (DSDM) : Scrum, Crystal Feature Driven Development (FDD)	
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Books-

1. Ali Bahrami, Object Oriented System Development - McGRAW-HILL International Edition, 2017.
2. UML in Nutshell, O'reilly Publication, 2015.
3. Roger Pressman, Software Engineering (6th edition), 2009.
4. Grady Booch, James Rumbaugh, Ivar Jacobson, The Unified Modeling Language user guide, 2005.
5. James Rumbaugh, Michael Blaha, Object Oriented Modeling and Design with UML 2004.
6. Tom Pender, UML 2 Bible, 2002.
7. Ivan Jacobson, Object-Oriented Software Engineering: A Use Case Driven Approach 1992

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1. https://www.tutorialspoint.com/software_engineering
2. <https://www.javatpoint.com/software-engineering-tutorial>
3. <https://www.edx.org/course/uml-class-diagrams-for-software-engineering>
4. <https://www.tutorialspoint.com/uml>
5. <https://www.smartdraw.com/uml-diagram>

S.Y. M.Sc. Semester III**Departmental Elective Paper - 7 (CSA5303): Advanced Web Technologies****[Credits-4]****Course Outcomes**

At the end of this course, students will be able to

- CO1** Acquire the knowledge about concepts of XML DOM.
CO2 Get familiarity with the implementation of AJAX concepts.
CO3 Acquire the knowledge about concepts of JSON.
CO4 Learn about concepts of Framework like Drupal.

Unit	Details	Lectures
I	XML DOM 1.1 XML DOM 1.2 XML XSLT 1.3 XML XQuery 1.4 XML XLink 1.5 XML Validator 1.6 XML DTD 1.7 XML Schema 1.8 XML Server	[8]
II	AJAX 2.1 Introduction 2.2 AJAX from User's Perspective 2.3 AJAX from Developer's Perspective 2.4 How AJAX works? 2.5 Applications of AJAX 2.6 AJAX web application model 2.7 Performing AJAX validation 2.8 Handling XML data using PHP and AJAX 2.9 Connecting database using PHP and AJAX	[9]
III	JSON 3.1 What is JSON 3.2 JSON Syntax 3.3 JSON DataTypes 3.4 JSON Objects 3.5 JSON Schema 3.6 JSON versus XML 3.7 JSON with PHP 3.8 JSON with AJAX	[9]
IV	PHP Framework 4.1 Introduction 4.2 Features, Applications 4.3 Essential concepts of Drupal 4.4 User Interface 4.5 Storing and Retrieving Data 4.6 Essential APIs	[12]

V	Web Services 5.1 Introduction 5.2 Characteristics of web services 5.3 Web services – Architecture 5.4 Web services - Components: XML-RPC, SOAP, WSDL, UDDI 5.5 Web services – Security 5.6 Web services – Standards, 5.7 Application of web services using PHP 5.8	[10]
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Books-

1. Sai Srinivas Sriparsa, Javascript and JSON Essentials, ISBN: 9781783286034, packt publishing, 2013.
2. Rebecca M. Riordan, Head First Ajax (O'Reilly), 2008.
3. Sas Jacobs, Beginning XML with DOM and Ajax: From Novice to Professional Paperback, Apress, 2006.
4. Erban Cerami, Web services Essentials, O'Reilly, 2002.

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1. www.php.net.in
2. www.w3schools.com
3. www.wrox.com
4. www.tutorialspoint.com
5. <https://api.drupal.org>

S.Y. M.Sc. Semester III**Departmental Elective Paper - 8 (CSA5304): Mobile Technology****[Credits-4]****Course Outcomes**

At the end of this course, students will be able to

- CO1** Learn about the concepts and importance of wireless communication.
- CO2** Acquire the knowledge about medium access control layer, various physical properties.
- CO3** Understand various telecommunication systems and their working
- CO4** Learn about various wireless technologies like Bluetooth, WATM etc.
- CO5** Understand the role and behaviour of Network layer and Transport layer in Wireless technologies.
- CO6** Acquire the knowledge about various wireless applications.

Unit	Details	Lectures
I	Wireless communication 1.1 Introduction 1.2 Types of wireless communication 1.3 Need and Application of wireless Communication 1.4 Wireless Data Technologies Market for mobile	[3]
II	Wireless transmission 2.1 Frequency for radio transmission signal antennas 2.2 Signal propagation 2.3 Multiplexing Modulation 2.4 Spread and Cellular system	[4]
III	Medium Access Control 3.1 Specialized MAC: Hidden and Exposed terminals, Near and Far terminals 3.2 SDMA 3.3 FDMA 3.4 TDMA: Fixed TDM, Classical ALOHA, Slotted ALOHA Carrier Sense Multiple Access , CDMA	[8]
IV	Telecommunication Systems 4.1 Introduction to GSM 4.2 GSM Architecture 4.3 DECT systems, Architecture and protocols 4.4 Tetra frame structure 4.5 UMTS basic architecture and UTRA modes	[5]
V	Wireless LAN 5.1 Introduction 5.2 Infrared v/s Radio transmission 5.3 Infrastructure and ad-hoc network 5.4 IEEE 802.11 5.5 HIPERLAN 5.6 Bluetooth	[6]

VI	Wireless ATM 6.1 WATM services 6.2 Location Reference model function radio access layer handover Location management 6.3 Addressing 6.4 Mobile QoS 6.5 Access point control protocol	[6]
VII	Mobile Network Layer 7.1 Introduction 7.2 Mobile IP: IP Packet Delivery, Agent Discovery, Agent Advertisement, Registration 7.3 Mobile Ad-hoc Networks 7.4 DHCP	[5]
VIII	Mobile Transport Layer 8.1 TCP 8.2 Fast and selective retransmission and recovery 8.3 Transaction oriented TCP	[3]
IX	Support for Mobility 9.1 File systems 9.2 World Wide Web 9.3 Wireless Application Protocol with example Applications	[3]
X	Wireless Telephony Applications 10.1 Overview of the WTA Architecture 10.2 The WTA client Framework 10.3 The WTA Server and security 10.4 Design considerations 10.5 Application Creation Toolbox	[5]

Books-

1. Jachan Schiller, Mobile Communications, ISBN: 9788131724262 , Pearson Education, 2003.
2. Sandeep Sighat Jari Alvinen and group, The Wireless Application Protocol, Addison Wesley, 2001.
3. Pater T. Davis Carig R. Mc.Guffin, Wireless Local Area Networks, McGraw-Hill, 1995.

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1. <https://er.yuvayana.org/wireless-telephony-objective-features-and-application>
2. <https://www.getkisi.com/blog/media-access-control>
3. https://www.tutorialspoint.com/wireless_communication

S.Y. M.Sc. Semester III**Theory General Elective Paper – 3 (CSA5306): Programming in C++****[Credits-4]****Course Outcomes**

At the end of this course, students will be able to

- CO1** Understand the concept of object-oriented programming. Have a strong understanding of features of object-oriented programming.
- CO2** Understand the basic concept of variable, operators, keywords, control structures, arrays etc.
- CO3** Understand the use of functions, memory allocation and de-allocation using constructors and destructor.
- CO4** Understanding the concept of Polymorphism and Inheritance.
- CO5** Choose various classes for the effective use of file handling operations.

Unit	Details	Lectures
I	Object oriented concepts 1.1 Introduction 1.2 Procedure Oriented Programming versus Object Oriented Programming 1.3 Features, advantages and Applications of OOPS	[3]
II	Introduction to C++ 2.1 Data types, new operators and keywords, using namespace concept 2.2 Simple C++ Program 2.3 Introduction to Reference variables 2.4 Usage of 'this' pointer 2.5 Classes and Objects 2.6 Access Specifiers 2.7 Defining Data members and Member functions 2.8 Array of objects	[7]
III	Functions in C++ 3.1 Call by reference, Return by reference 3.2 Function overloading and default arguments 3.3 Inline function 3.4 Static class members 3.5 Friend Concept – Function, Class	[7]
IV	Constructors and destructor 4.1 Introduction 4.2 Types of constructors 4.3 Memory allocation (new and delete) 4.4 Destructor	[5]
V	Operator overloading 5.1 Definition 5.2 Overloading Unary and Binary operators 5.3 Overloading using friend function 5.4 Type casting and Type conversion	[8]

VI	Inheritance 6.1 Definition, Types of inheritance with examples 6.2 Constructors and destructor in derived classes 6.3 Virtual base classes, Virtual functions and Pure virtual function 6.4 Abstract base classes	[10]
VII	Working with files 7.1 File operations – Text files, Binary files 7.2 File stream class and methods 7.3 File updation with random access 7.4 Overloading insertion and extraction operator	[8]

Books-

1. Yashwant Kanitkar, Let us C++, BPB Publications, 2016.
2. E. Balagurusamy, Object Oriented Programming with C++, Tata McGraw Hill Publishing Company Limited, 2011.
3. Herbert Schildt, The Complete Reference C++, The McGraw-Hill Companies, 2010.
4. Harimohan Pandey, Trouble free C++, ANE Books, 2009.
5. Robert Lafore, Object Oriented Programming with C++ , Sams Publishing, 2001.
6. K R Venugopal, T Ravishankar, Rajkumar Buyya, Mastering C++, Tata McGraw Hill Publishing Company Limited, 1997

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2. www.cplusplus.com/doc/tutorial
3. <https://www.learncpp.com>
4. <https://www.w3schools.com/cpp>
5. <https://www.javatpoint.com/cpp-tutorial>

S.Y. M.Sc. Semester III**Theory Departmental Elective Paper - 9(CSA5307): Full Stack****[Credits-4]****Course Outcomes**

At the end of this course, students will be able to

- CO1** Develop the skills to build accessible, usable and attractive User Interfaces for your web applications.
- CO2** To make the user interaction as very simple and most efficient

Unit	Details	Lectures
I	HTML 5 1.1 Understanding Basic Tags / Elements and Attributes 1.2 Working with Basic Tags and Font Formatting Tags 1.3 Understanding Block Level Tags, Inline Tags & Empty Tags 1.4 Heading Tags, Paragraph Tags & Multiple Columns 1.5 Adding Basic Styles using HTML Attributes and CSS Styles 1.6 Inserting Images & Image Attributes 1.7 Working with Links & Link Attributes / Link States	[8]
II	CSS 3 2.1 History of CSS 2.2 Browser Support 2.3 HTML5Selectors and Pseudo Classes 2.4 Fonts and Text Effects, Colours, Gradients, Background 2.5 Images, and Masks, Borders and Box Effects, Transitions, Transforms, and Animations 2.6 Layout: Columns and Flexible Box, Vendor Prefixes 2.7 Embedding Media	[7]
III	JavaScript 3.1 Introduction 3.2 Role as Client Scripting Language 3.3 Variables, Loops & Control Statements 3.4 Arrays / Array Sorting Methods 3.5 Creating Functions / Working with JavaScript Inbuilt Functions 3.6 Scope	[5]
IV	Databases and Web Storage 4.1 NoSQL 4.2 Database Connectivity 4.3 In-memory data stores 4.4 Web storage	[8]
V	HTTP & REST 5.1 What is REST? 5.2 RESTful API	[5]

VI	Bootstrap 6.1 Introduction 6.2 Grid 6.3 Components 6.4 Plugins	[8]
VII	jQuery 7.1 Introduction 7.2 jQuery Syntax 7.3 jQuery Selectors 7.4 jQuery Events 7.5 jQuery Effects 7.6 jQuery HTML 7.7 jQuery Traversing 7.8 jQuery AJAX	[7]

Books-

1. Beginning JQuery By Jack Franklin (APress), 2017.
2. Bootstrap by Jake Spurlock (O'Reilly), 2013.
3. Head First HTML5 Programming, Building Web Apps with JavaScript By Eric Freeman, Elisabeth Robson (O'Reilly), 2011.
4. Beginning JavaScript By Jeremy McPeak and Paul Wilton(Wrox), 2009.
5. Head First Ajax By Rebecca M. Riordan (O'Reilly), 2008

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2. https://www.tutorialspoint.com/the_full_stack_web.../index.asp
3. https://www.w3schools.com/html/html5_intro.asp
4. <https://jquery.com/>
5. <https://getbootstrap.com/>

S.Y. M.Sc. Semester III**Theory Departmental Elective Paper -10 (CSA 5308): Internet of Things****[Credits-4]****Course Outcomes**

At the end of this course, students will be able to

- CO1** Understand basic concepts of Internet of Things (IoT).
- CO2** Gain the knowledge about Fundamental IoT Mechanisms and Key Technologies
- CO3** Acquire the knowledge about RFID Technology, WSN Architecture.
- CO4** Learn about various identity management modules.
- CO5** Study about implementation of Security, Privacy and Governance in IoT.
- CO6** Learn about various business modules of IoT.

Unit	Details	Lectures
I	Introduction 1.1 What is the Internet of Things? 1.2 History of IoT 1.3 About IoT 1.4 Overview and Motivations 1.5 Examples of Applications 1.6 Internet of Things Definitions and Frameworks: IoT Definitions, IoT Architecture, General Observations, ITU-T Views, Working Definition, IoT Frameworks, Basic Nodal Capabilities	[8]
II	Fundamental IoT Mechanisms and Key Technologies 2.1 Identification of IoT Objects and Services 2.2 Structural aspects of IoT 2.3 Environment Characteristics 2.4 Traffic Characteristics: Scalability, Interoperability, Security and Privacy 2.5 Open Architecture 2.6 Key IoT Technologies 2.7 Device Intelligence 2.8 Communication Capabilities 2.9 Mobility Support 2.10 Device Power 2.11 Sensor Technology 2.12 RFID Technology 2.13 Satellite Technology	[8]
III	Radio Frequency Identification Technology (RFID) 3.13 Introduction 3.14 Principle of RFID 3.15 Components of an RFID system 3.16 Issues: EPC Global Architecture Framework: EPCIS & ONS, Design issues, Technological challenges, Security Challenges 3.17 IP for IoT 3.18 Web of Things 3.19 Wireless Sensor Networks 3.20 History and context	[8]

	3.21 WSN Architecture: The node, Connecting nodes, Networking Nodes, Securing Communication, WSN specific IoT applications challenges: Security, QoS, Configuration, Various integration approaches, Data link layer protocols, Routing protocols and infrastructure Establishment	
IV	Resource Management in Internet of Things 4.1 Clustering 4.2 Software Agents 4.3 Clustering Principles in an Internet of Things Architecture 4.4 Design Guidelines 4.5 Software Agents for Object Representation 4.6 Data Synchronization 4.7 Identity portrayal 4.8 Identity management 4.9 Various identity management models: Local, Network, Federated and global web identity, User-centric identity management, Device centric identity management, Hybrid-identity management, Identity and trust	[8]
V	Internet of Things Privacy, Security and Governance 5.1 Vulnerabilities of IoT 5.2 Security requirements 5.3 Threat analysis 5.4 Use cases and misuse cases 5.5 IoT security tomography and layered attacker model 5.6 Identity establishment 5.7 Access control 5.8 Message integrity 5.9 Non-repudiation and availability 5.10 Security model for IoT	[8]
VI	Business Models for Internet of Things 6.1 Business Models and Business Model Innovation 6.2 Value Creation in the Internet of Things 6.3 Business Model Scenarios for the Internet of Things 6.4 Internet of Things Applications: Smart Metering Advanced Metering Infrastructure, e-Health Body Area Networks, City Automation, Automotive Applications, Home Automation, Smart Cards	[8]

Books:

1. Arshdeep Bahga, Vijay Madiseti, "Internet of Things –A hands-on approach", Universities Press, 2015.
2. Parikshit N. Mahalle & Poonam N. Railkar, "Identity Management for Internet of Things", River Publishers, ISBN: 978-87-93102-90-3 (Hard Copy), 978-87-93102-91-0 (ebook), 2015.
3. Daniel Minoli, "Building the Internet of Things with IPv6 and MIPv6: The Evolving World of M2M Communications", ISBN: 978-1-118-47347-4, Willy Publications, 2013.

4. Daniel Kellmerit, Daniel Obodovski, “The Silent Intelligence: The Internet of Things”,. Publisher: Lightning Source Inc; 1 edition (15 April 2014). ISBN-10: 0989973700, ISBN-13: 978-0989973700, 2013.
5. Olivier Hersent, David Boswarthick, Omar Elloumi, The Internet of Things: Key Applications and Protocols, ISBN: 978-1-119-99435-0, 2nd Edition, Willy Publications, 2012.
6. Bernd Scholz-Reiter, Florian Michahelles, “Architecting the Internet of Things”, ISBN 978-3-642-19156-5 e-ISBN 978-3-642-19157-2, Springer, 2011.
7. HakimaChaouchi, “The Internet of Things Connecting Objects to the Web” ISBN : 978-1-84821-140-7, Willy Publications, 2010.

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1. <https://www.ibm.com/blogs/internet-of-things/what-is-the-iot>
2. <https://www.businessinsider.com/internet-of-things-definition>

S.Y. M.Sc. Semester III
Theory General Elective Paper -4 (CSA 5310): Data Structures

[Credits-4]

Course Outcomes

At the end of this course, students will be able to

- CO1** Understand basics of algorithms and their complexities.
- CO2** Acquire the knowledge of Abstract Data Type (ADT)
- CO3** Familiarity with the concepts of linear data structures.
- CO4** Learn the concepts of non-linear data structures.
- CO5** Understand the basic implementation of linear and non-linear data structures using Python programming language.
- CO6** Understand the application areas of implementing linear and non-linear data structures.

Unit	Details	Lectures
I	Introduction to data structures 1.1 Concept 1.2 Data type, Data object, ADT 1.3 Need of Data Structure 1.4 Types of Data Structures	[2]
II	Algorithm analysis 2.1 Algorithm – definition, characteristics 2.2 Space complexity, time complexity 2.3 Asymptotic notation (Big O)	[3]
III	Linear data structures 3.1 Introduction to Arrays - array representation 3.2 Sorting algorithms with efficiency - Bubble sort, Insertion sort, Merge sort, Quick sort 3.3 Searching techniques –Linear Search, Binary search	[7]
IV	Linked List 4.1 Introduction to Linked List 4.2 Implementation of Linked List – Static & Dynamic representation 4.3 Types of Linked List 4.4 Operations on Linked List - create, display, insert, delete, reverse, search, sort, concatenate and merge 4.5 Applications of Linked List – polynomial manipulation	[8]
V	Stacks 5.1 Introduction 5.2 Representation- Static & Dynamic 5.3 Operations 5.4 Application - infix to postfix, infix to prefix, postfix evaluation 5.5 Simulating recursion using stack	[7]

VI	Queues 6.1 Introduction 6.2 Representation - Static & Dynamic 6.3 Operations 6.4 Circular queue, priority queue (with implementation) 6.5 Concept of doubly ended queue	[7]
VII	Trees 7.1 Concept & Terminologies 7.2 Binary tree, binary search tree 7.3 Representation – Static and Dynamic 7.4 Operations on BST – create, Insert, delete, traversals (preorder, inorder, postorder), counting leaf, non-leaf & total nodes, non-recursive inorder traversal 7.5 Application - Heap sort 7.6 Height balanced tree- AVL trees- Rotations, AVL tree examples	[7]
VIII	Graphs 8.1 Concept & terminologies 8.2 Graph Representation – Adjacency matrix, Adjacency list, Adjacency Multilist 8.3 Traversals – BFS and DFS 8.4 Applications – AOV network – topological sort, AOE network – critical path	[7]

Books:

1. Benjamin Baka, Dr. Basant Agarwal, Hands-On Data Structures and Algorithms with Python, Packt Publishing, 2018.
2. Gilberg & Forouzan, Data Structures: A Pseudo-code approach with C, Thomson Learning, 2004.
3. Horowitz Sahani, Fundamentals of Data Structures, Galgotia Publications, 2001.
4. Ten Baum, Data Structures using C & C++, Prentice-Hall International, 1998.
5. Jean-Paul Tremblay & Paul G. Sorenson, An Introduction to Data Structures with Applications, Tata McGraw Hill, 1984.

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2. https://www.tutorialspoint.com/data_structures.../data_structures_basics.htm
3. <https://www.edureka.co/blog/data-structures-in-python/>
4. https://www.tutorialspoint.com/python/python_data_structure.htm

S.Y. M.Sc. Semester III
Practical Core Paper -5 (CSA 5311): Lab based on Advanced Java

[Credits-4]

Course Outcomes

At the end of this course, students will be able to

- CO1** Implement simple application to learn DDL with different databases.
- CO2** Implement an DML with different database
- CO3** Learn the use of various collection classes and their application
- CO4** Design an application to understand the servlet
- CO5** Have a connectivity between servlet and database
- CO6** Web development using JSP
- CO7** Implement an application to send mail

Unit	Details
I	JDBC and Database for DDL
II	JDBC and Database for DML
III	Collections
IV	Networking - stream
V	Networking - TCP
VI	Servlets
VII	JSP
VIII	JSP and Database
IX	Sending email
X	Case Study

Books:

1. Cay S. Horstmann, Gary Cornell, Core Java Volume-II-Advanced Features, Eighth Edition, Prentice Hall, Sun Microsystems Press, 2007.
2. Ivan Bayross, Commercial web development using java 2.0, BPB, 2007.
3. Steven Horlzner , Java 2 programming black books, 2006.
4. Herbert Schildt(5th edition), Complete reference Java, 2002.
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4. <https://www.studytonight.com/java>
5. <https://www.w3schools.com/java>

S.Y. M.Sc. Semester III
Practical Core Paper - 6 (CSA 5312): Project

[Credits-4]

Course Outcomes

At the end of this course, students will be able to

- CO1** Understand different software development lifecycle and different approaches to solve the problem of a project.
- CO2** Understand the difference between literature writing and technical writing and importance of different UML diagrams of the concerned problem.

Unit	Details
I	Selection of Problem Statement
II	Collection of Synopsis
III	Design the problem solution
IV	Implementation of design and refinement if needed
V	Working Progress Report – I
VI	Working Progress Report – II
VII	Working Progress Report – III
VIII	Final report writing and presentation

Books:

1. Object Oriented System Development - Ali Bahrami McGRAW-HILL International Edition, 2017.
2. UML in Nutshell, O'reilly Publication, 2015.
3. Software Engineering by Roger Pressman (6th edition), 2009.
4. The Unified Modeling Language user guide by Grady Booch, James Rumbaugh, Ivar Jacobson, 2005.
5. Object Oriented Modeling and Design with UML by James Rumbaugh, Michael Blaha, 2004.
6. UML 2 Bible by Tom Pender, 2002.
7. Object-Oriented Software Engineering: A Use Case Driven Approach by Ivan Jacobson, 1992.

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2. <https://www.javatpoint.com/software-engineering-tutorial>
3. <https://www.edx.org/course/uml-class-diagrams-for-software-engineering>
4. <https://www.tutorialspoint.com/uml>
5. <https://www.smartdraw.com/uml-diagram>

S.Y. M.Sc. Semester IV
Practical Core Paper -7 (CSA 5401): Industrial Training/Institutional Project
[Credits-8]

Course Outcomes

At the end of this course, students will be able to

- CO1** Get an insight into the actual work culture of the I.T. Industry.
- CO2** Aware of the skills and technologies needed to work in the I.T. industry.
- CO3** Understand Organizational structure of the company.

The necessary details for Industrial Training course are as follows:

A student can complete Industrial Training Project (ITP) in any I.T. industry / academic institute / with a research project of a teacher / an expert funded by any funding agency for a minimum period of three months.

1. There will be a teacher coordinator for a group of 10 students. A teacher coordinator is responsible to:

- Maintain a weekly status / progress report of the student.
- Keep in touch with the reporting authorities from industry for each student.
- Help the students to solve their difficulties.
- Arrange the meeting and presentations as per requirement.
- Guide each student for preparing final project report.
- Keep complete documentation record for each student separately.
- Internal assessment of each student for 50 marks.

The workload for this teacher coordinator is proposed as four hours per week.

The workload for a teacher coordinator who is guiding 3 students doing their ITP in Fergusson College (Autonomous) Pune (no mentor from industry) is proposed as four hours per week.

2. Guidelines for submitting the final project report:

The student must include the project completion certificate issued by the respective industry/research institute/educational institute in the report. A student will submit two hard bound copies and one CD: Student Copy, Department copy, Controller of Examinations copy of the work carried out during ITP (CD to be given by students).

3. Scheme of Assessment:➤ **Continuous Internal Assessment**

Evaluation for internal 50 Marks will be done by the Internal Teacher Coordinator.

Description	Marks
Weekly Reports (Minimum 12)	30
Final Project Report writing	10
Presentation Demo	10

➤ **End Semester Assessment**

Evaluation for external 50 Marks will be done by a panel of three consisting of One Industrial Expert, One Academic Expert (External from other college) and One Internal Examiner.

Each examiner is expected to assess each student for 50 marks independently and average of the three scores is to be considered as the final ESE score (out of 50).

Description	Marks
Knowledge and Execution of the System	15
Final Project Report	15
Presentation	10
Viva	10

The internal examiner(s) will be responsible for submitting the total marks out of 100 to examination section.

The final grade (to be printed on the mark list) is to be calculated on the basis of UGC 10 point scale.

Marks	Grade	Grade Point
90 – 100	O: Outstanding	10
80-89	A+ : Excellent	9
70-79	A: Very Good	8
65-69	B+ : Good	7
60 – 64	B: Above Average	6
55-59	C+ : Average	5
50 -54	C: Below Average	4
45-49	D : Satisfactory	3
40-44	E:Pass	2
0 -39	F : Fail	0
	Absent	0

Note: - A student who has obtained Grade F will have to carry out this project once again for a complete semester (minimum three months).