UNIVERSITY OF MUMBAI

No. UG/108 2017-18

(2)

CIRCULAR:-

The Head of the University Departments of Computer Science , the Principals of the affiliated Colleges in Science and the Directors of recognized Science Institutions concerned are hereby informed that in continuation syllabi relating to Bachelor of Science degree Course passed by the Academic Council at its meeting held on 27/2/2013, **vide** item No. 4.50 and recommendations made by the Ad – hoc Board of Studies in Computer Science at its meeting held on 5/5/2017 has been accepted by the Academic Council at its meeting held on 11th May, 2017, **vide** item no. 4.211 and that in accordance therewith, the revised syllabus as per the (CBCS) for (Sem V & VI) of B.Sc programme in the Course of Computer Science, which is available on the University's website (www.mu.ac.in) and that the same has been brought into force with effect from the academic year 2017-18.

REGISTRAR

MUMBAI – 400 032

24th July, 2017

To,

The Head of the University Departments of Computer Science, the Principals of the affiliated Colleges in Science and the Directors of Recognized Institutions concerned.

A.C/4.211/11.05.2017

No. UG/108-A of 2017 MUMBAI-400 032 24th July, 2017

Copy forwarded with compliments for information to :-

1) The Co-ordinator, Faculty of Science,
2) The Offg. Director, Board of Examinations and Evaluation,
3) The Director of Board of Studies Development,
4) The Professor-cum-Director, Institute of Distance and Open Learning.
5) The Co-Ordinator, University Computerization Centre.

REGISTRAR

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UNIVERSITY OF MUMBAI

Syllabus for Sem V & VI
Program: B.Sc.
Course: Computer Science

(Credit Based Semester and Grading System with effect from the academic year **2017-2018**)

Preamble

In this era of Computerisation, Digitalization and Automation, there is barely any field of research or any industry left that is not benefitting from Computer Science or Information Technology. The Graduation course in Computer Science holds big importance in cultivating skilled professionals. The courses of third-year of B.Sc. (Computer Science) are therefore designed in a such way which will develop the students not only as a professional developer but also with the view of research oriented.

To enhance programming skills among students Programming holds key indispensable position in any curriculum of Computer Science. It is essential for the learners to know how to use Object Oriented paradigm. This is covered during course of Advanced Java in both fifth and sixth semesters. There is also one dedicated course for Mobile Development catering to modern day needs of Mobile platforms and applications.

Today's world is about connectivity and shared computing. A course in Data Communications and Networking is therefore very apt for the students who are gearing for professional world of applications. Along with these courses Web Computing courses gives enough idea about theories and fundamentals of building robust web interfaces.

T.Y.B.Sc. (Semester V and VI)
Computer Science Syllabus
(Credit Based Semester and Grading System)
To be implemented from academic year 2017-2018

SEMESTER V			
Course	**Topics**	**Credits**	**L / Week**
USCS501	Data Communication and Networking	2.5	4
USCS502	Advanced Java Programming– I	2.5	4
USCS503	Mobile Application Development	2.5	4
USCS504	Data Management using PL/SQL-I	2.5	4
USCSP501	Practical of USCS501 + USCS502	3	8
USCSP502	Practical of USCS503 + USCS504	3	8

SEMESTER VI			
Course	**Topics**	**Credits**	**L / Week**
USCS601	Advanced Networking & Security	2.5	4
USCS602	Advanced Java Programming – II	2.5	4
USCS603	Software Engineering and Testing	2.5	4
USCS604	Data Management using PL/SQL-II	2.5	4
USCSP601	Practical of USCS602 + USCS604	3	8
USCSP602	Practical of USCS601 + USCS603	3	8

SEMESTER V

THEORY

Course: **USCS501**	**TOPICS (Credits : 2.5 Lectures/Week: 04)** **Data Communication and Networking**	
Unit I	**Introduction** - Data Communication, Networks, Internet, Intranet, Protocols, OSI & TCP/IP Models, Addressing **Physical Layer** - Signals, Analog, Digital, Analog VS Digital, Transmission Impairment, Data Rate Limits, Performance **Digital Transmission** - Line Coding (Unipolar, Polar, Biphase), Block Coding(4B/5B Encoding), Analog to digital conversion, PCM, Transmission Modes, **Analog Transmission** - Digital to analog conversion(ASK,FSK,PSK, QAM), Analog to Analog conversion	**15L**
Unit II	**Multiplexing** - FDM, WDM, Synchronous TDM(time slots & frames, interleaving, data rate management), **Spread Spectrum** - FHSS, DSSS **Transmission Media** - Guided & Unguided **Switching** - Switching, Circuit-Switched Networks, Datagram networks, Concept of Virtual circuit networks, structure of circuit switch & packet switch, Concepts of DSL & ADSL	**15L**
Unit III	**Data Link Layer** -Error correction & detection, Types of errors, Detection VS Correction, Block Coding, Hamming Distance, Linear Block codes(single parity check, hamming codes), Cyclic codes, CRC Encoder & Decoder, CRC Polynomial & its degree, Checksum **Data Link Control & Protocols** - Framing, Flow & Error Control, Simplest, Stop-N-Wait, Stop-N-Wait ARQ, Go Back N ARQ, Selective Repeat ARQ, Piggybacking HDLC & PPP- HDLC Modes, HDLC Frames, PPP, PPP Transition states	**15L**
Unit IV	**Multiple Access** - Random(CSMA), Controlled(Reservation, Polling,	**15L**

	Token Passing), Channelization(FDMA, TDMA, CDMA) **Wired LAN -** LLC, MAC, Ethernet, Ethernet frame, Addressing, Concept of MBaseN Ethernet, Bridged, Switched, Full Duplex Ethernet, Concept of Fast & Gigabit Ethernet **Wireless LAN -** Introduction to WLAN(Architecture, Hidden, Exposed Station Problem), Introduction to Bluetooth & Architecture, Cellular telephony, Concept of 1G, 2G, 3G cellular telephony **Connecting Devices -** Repeaters, Hubs, Bridges, Spanning tree algorithm, Two & Three layer Switches, Routers, Gateways, Backbone networks, Concept of VLAN	

Text-book(s):

1) Data Communication & Networking (Forouzan), Tata McGraw-Hill Education
2) Computer Networks - Andrew Tanenbaum, PHI

Additional Reference(s):

1) Computer Network, Bhushan Trivedi, Oxford University Press
2) Computer Networks and Internets - Douglas Comer, Prentice Hall
3) Computer Networking, Kurose, Ross, Pearson

Course: **USCS502**	**TOPICS (Credits : 2.5 Lectures/Week: 04)** **Advanced Java Programming– I**	
Unit I	**Swing Components – I:** Introduction to JFC and Swing, Features of the Java Foundation Classes, Swing API Components, JComponent Class, Windows, Dialog Boxes, and Panels, Labels, Buttons, Check Boxes, Menus, Pane, JScrollPane, Desktop pane, Scrollbars, Lists and Combo Boxes, Text-Entry Components.	**15L**
Unit II	**Swing Components – II:** Toolbars, Implementing Action interface, Colors and File Choosers, Tables and Trees, Printing with 2D API and Java Print Service API. Schedules Tasks using JVM, Thread-safe variables, Communication between threads. **Event Handling:** The Delegation Event Model, Event classes (ActionEvent, FocusEvent, InputEvent, ItemEvent, KeyEvent,	**15L**

	MouseEvent, MouseWheelEvent, TextEvent, WindowEvent) and various listener interfaces (ActionListener, FocusListener, ItemListener, KeyListener, MouseListener, MouseMotionListener, MouseWheelListener, TextListener, WindowFocusListener, WindowListener)	
Unit III	**JDBC:** JDBC Introduction, JDBC Architecture, Types of JDBC Drivers, The Connectivity Model, The java.sql package, Navigating the ResultSet object's contents, Manipulating records of a ResultSet object through User Interface , The JDBC Exception classes, Database Connectivity, Data Manipulation (using Prepared Statements, Joins, Transactions, Stored Procedures), Data navigation.	**15L**
Unit IV	**Networking with JAVA:** Overview of Networking, Working with URL, Connecting to a Server, Implementing Servers, Serving multiple Clients, Sending E-Mail, Socket Programming, Internet Addresses, URL Connections. Accessing Network interface parameters, Posting Form Data, Cookies, Overview of Understanding the Sockets Direct Protocol. Introduction to distributed object system, Distributed Object Technologies, RMI for distributed computing, RMI Architecture, RMI Registry Service, Parameter Passing in Remote Methods, Creating RMI application, Steps involved in running the RMI application, Using RMI with Applets.	**15L**

Text book(s):

1) Joe Wigglesworth and Paula McMillan, Java Programming: Advanced Topics, Thomson Course Technology (SPD)
2) Cay S. Horstmann, Gary Cornell, Core Java™ 2: Volume II–Advanced Features Prentice Hall PTR
3) Herbert Schildt, Java2: The Complete Reference, Tata McGraw-Hill

Additional Reference(s):

1) The Java Tutorials of Sun Microsystems Inc.

Course: USCS503	TOPICS (Credits : 2.5 Lectures/Week:04) Mobile Application Development	
Unit I	**Introduction to Mobile Application Development** **Introduction to Mobile Computing** - Definition and general overview of Mobile and Cell Phone Technologies - CDMA, GSM, 3G, 4G, Types of mobile computing devices - PDA, Pagers, Mobiles, etc. **History of mobile platforms** - J2ME, BB, Android, Windows Mobile, Windows Phone, etc. **The Android Platform:** Introduction to the Android platform, Architecture, Android components, Development Tools – SDK, ADB, Gradle, etc. Installing Android Studio IDE, and developing first app **Activities and Lifecycle, Fragments and Intents** - Working with Activities-creating activity, starting activity, managing life cycle of activity, applying themes and styles, displaying dialog in activity; Using Intents-exploring intent objects, resolution, filters passing data using objects in intents; Fragments, Intent Object to Invoke Built-in Application	**15L**
Unit II	**UI Design**: Display Orientation, Views and ViewGroups, Layouts, Action Bars and Navigation Drawers, Android Layout Managers - LinearLayout, RelativeLayout, ScrollView, TableLayout, FrameLayout, Action Bar, Working with Views- TextView, EditText View, Button View, RadioButton View, CheckBox View, ImageButton View, ToggleButton View, RatingBar View **UI Events:** Understanding Android Events, Using the android:onClick Resource, Event Listeners and Callback Methods, Event Handling, The Event Listener and Callback Method, Intercepting Touch Events, Implementing Common Gesture Detection **Data binding in applications** - Introduction to data binding in Android, What is an Adapter?, Adapter Views - ListView Class, Spinner, Gallery View, AutoTextCompleteView, GridView **Displaying Pictures and Menus with Views** - Working with Image Views, Designing Context Menu for Image View, Embedding Web Browser in an	**15L**

	Activity using WebView, Notifying the User **Data Persistence** - The Data Storage Options, Internal Storage, External Storage, Using the SQLite Database - CRUD, Working with Content Providers	
Unit III	**Networking in Android**: Accessing the network, Permission to access the network, Checking Network Availability, Sending Email, consuming web services using HTTP **Location-Based Services** - Displaying Maps, Getting Location Data, monitoring a Location, Google Maps API, Using the Geocoder. **Using Multimedia** — Audio, Video, and the Camera Playing audio and video, recording audio and video, Using Camera for Taking Pictures, Using Media Player **Telephony and SMS:** Handling Telephony, Handling SMS, Sending SMS Using Intent	**15L**
Unit IV	**Working with Bluetooth and Wi-Fi** - BluetoothAdapter and Managing Wi-Fi connectivity using WifiManager **Threads and Thread Handlers** - Introduction to Threads, Worker threads - asyncTask, interprocess communication and Services **Working with Graphics and Animation**: Working with Graphics, Using the Drawable Object, Using the ShapeDrawable Object, Concept of Hardware Acceleration, Working with Animations **Advanced Development** - Cloud to Device Messaging using Google Firebase Cloud Messaging, Publishing the App, Best Practices for Performance	**15L**

Text book(s):

1) Professional Android™ 4 Application Development, Reto Meier, John Wiley & Sons, Inc. 2012.
2) Android Application Development, Black Book, Pradeep Kothari, Kogent Learning Solutions, DreamTech Press
3) Google Android Developers - https://developer.android.com/index.html

Additional Reference(s):

1) Expert Android Studio, Murat Yenar, Onur Dundar, Wrox

2) Android Studio Cookbook, Mike van Drongelen, PACKT Publication
3) Android Programming for Beginners by John Horton (Author), PACKT Publication
4) Hello, Android: Introducing Google's Mobile Development Platform, Third Edition, Ed

Course: **USCS504**	**TOPICS (Credits : 2.5 Lectures/Week: 04)** **Data Management using PL/SQL-I**	
Unit I	**Fundamentals of PL SQL** Introduction to SQL Developer, Introduction to PL/SQL, PL/SQL Overview, Benefits of PL/SQL, Subprograms, Overview of the Types of PL/SQL blocks, Create a Simple Anonymous Block, Generate Output from a PL/SQL Block **SQL Identifiers** List the different Types of Identifiers in a PL/SQL subprogram, Usage of the Declarative Section to define Identifiers, Use variables to store data, Identify Scalar Data Types, The %TYPE Attribute, Bind Variables, Sequences in PL/SQL Expressions **Write Executable Statements** Describe Basic PL/SQL Block Syntax Guidelines, Comment Code, Deployment of SQL Functions in PL/SQL, Nested Blocks, Identify the Operators in PL/SQL.	**15L**
Unit II	**Conversion Functions**: implicit and explicit data type conversion, Describe the TO_CHAR, TO_NUMBER, and TO_DATE conversion functions, Nesting multiple functions **Control Structures:** Conditional processing Using IF Statements, Conditional processing Using CASE Statements, Use simple Loop Statement, Use While Loop Statement, Use For Loop Statement, Describe the Continue Statement **Composite Data Types** Use PL/SQL Records, The %ROWTYPE Attribute, Insert and Update with PL/SQL Records, Associative Arrays (INDEX BY Tables), Examine INDEX BY Table Methods, Use INDEX BY Table of Records	**15L**

Unit III	**Exception Handling** Understand Exceptions, Handle Exceptions with PL/SQL, Trap Predefined Oracle Server Errors, Trap Non-Predefined Oracle Server Errors, Trap User-Defined Exceptions, Propagate Exceptions, RAISE_APPLICATION_ERROR Procedure **Stored Procedures and Functions** Understand Stored Procedures and Functions, Differentiate between anonymous blocks and subprograms, Create a Simple Procedures, Create a Simple Procedure with IN parameter, Create a Simple Function, Execute a Simple Procedure, Execute a Simple Function. **Invoke SELECT Statements in PL/SQL to Retrieve data:** Data Manipulation in the Server Using PL/SQL, SQL Cursor concept, Usage of SQL Cursor Attributes to Obtain Feedback on DML, Save and Discard Transactions.	**15L**
Unit IV	**Explicit Cursors** What are Explicit Cursors?, Declare the Cursor, Open the Cursor, Fetch data from the Cursor, Close the Cursor, Cursor FOR loop, Explicit Cursor Attributes, FOR UPDATE Clause and WHERE CURRENT Clause **Collections** Index-by tables or Associative array, Nested table, Variable-size array or Varray Strings, Date and Time functions, arrays	**15L**

Text book(s):

1) Oracle SQL and Pl/SQL, Joel Murach
2) PL/SQL Language Reference 11g, , Sheila Moore, E. Belden,

Additional Reference(s):

1) Ivan Bayross, “SQL,PL/SQL -The Programming language of Oracle”, B.P.B. Publications
2) Michael Abbey, Michael J. Corey, Ian Abramson, Oracle 8i – A Beginner’s Guide, Tata McGraw-Hill.
3) Martin Gruber, “Understanding SQL”, B.P.B. Publications.
4) George Koch and Kevin Loney ,ORACLE “The Complete Reference”, Tata McGraw Hill,New Delhi
5) https://docs.oracle.com

Suggested List of Practical – SEMESTER V

Course:	**(Credits : 03 Practical/Week: 08)**	
USCSP501	**USCS501+ USCS502**	

Data Communication and Networking

1. Study of URL, InetAddress and its members
2. Study of URLConnection & to read the contents.
3. Study of URLConnection & to write to it.
4. Study of Connection-less approach using datagram-approach
5. Study of connection-oriented approach using ServerSocket
6. Creating server process using ServerSocket
7. Sending Email through Java
8. Designing RMI Application

Advanced JAVA Programming-I

1. Using Basic Swing Controls
2. Using JScrollPane, JTabbedPane, JDesktopPane
3. Using Common Dialog Boxes
4. Using JTable and JTree
5. Creating Table in database
6. Inserting data in tables & Displaying data
7. Using ResultSetMetaData
8. Using Prepared Statements

Course: USCSP502	(Credits : 03 Practical/Week: 08) USCS503+ USCS504	

Mobile Application Development

1. Design an application representing a simple calculator.
2. Develop an application for working with Menus and Screen Navigation
3. Develop an application for working with Notifications
4. Develop an application demonstrating Internal Storage to store private data on the device memory.
5. Design a simple to-do list application using SQLite
6. Develop an application for connecting to the internet and sending email.
7. Develop an application for working with graphics and animation.
8. Develop an application for working with device camera.
9. Develop an application for working with location based services.
10. Using Worker thread write Android code for a click listener that downloads an image from a separate thread and displays it in an ImageView.

Data Management using PL/SQL-I

1. Writing Anonymous PL/SQL Block with basic programming construct by including following:
   a. Sequential Statements b. unconstrained loop
2. Writing PL/SQL Blocks with basic programming constructs by including following:
   a. CONSTANT
   b. NOT NULL
   c. DEFAULT
   d. %TYPE and % ROWTYPE Attribute.
3. Writing PL/SQL Blocks with basic programming constructs by including following conversion functions: TO_CHAR, TO_NUMBER, and TO_DATE, blocks on strings, date and time functions, and arrays.
4. Writing PL/SQL Blocks with basic programming constructs by including following:
   a. If...then...Else, IF...ELSIF...ELSE... END IF
   b. Case statement

5. Writing PL/SQL Blocks with basic programming constructs for following Iterative Structure:
    a. While-loop Statements b. For-loop Statements.
6. Writing Exception Handling with PL/SQL.
    a. Exception Types (implicitly raised, Explicitly raised)
    b. Trapping Exceptions (WHEN exception1, WHEN OTHERS)
    c. Predefined Exception
    - NO_DATA_FOUND
    - TOO_MANY_ROWS
    - INVALID_CURSOR
    - ZERO_DIVIDE
    - DUP_VAL_ON_INDEX
7. Writing Procedures in PL/SQL Block (IN, OUT, INOUT, DEFAULT keywords).
    a. Create an empty procedure, replace a procedure and call procedure
    b. Create a stored procedure and call it
    c. Define procedure to insert data
    d. A forward declaration of procedure
8. Writing Functions in PL/SQL Block.
    a. Define and call a function
    b. Define and use function in select clause,
    c. Call function in dbms_output.put_line
    d. Recursive function
    e. Count Employee from a function and return value back
    f. Call function and store the return value to a variable
9. Writing PL/SQL Block for
    a. Declare and use Association Array b. Varray c. Nested Tables
10. Writing PL/SQL Block for Cursors
    a. Cursor attributes:%ROWCOUNT,%FOUND,%NOTFOUND,%ISOPEN
    b. Cursor with sub queries
    c. Combination of PL/SQL, cursor and for loop
    d. Parameterized cursors, Cursor Variables

SEMESTER VI

THEORY

Course: **USCS601**	**TOPICS (Credits : 2.5 Lectures/Week: 04)** **Advanced Networking & Security**	
Unit I	**Network Layer** -Logical addressing, IPv4 Addresses, Classful & Classless addresses, NAT, IPv6 Addressing, **Network layer protocol** - Internetworking, IPv4, IPv4 protocol packet format, IPv6 Protocol & Packet format, IPv4 VS IPv6, Transition from IPv4 to IPv6, Address Resolution protocols(ARP, RARP), BOOTP, DHCP, **Routing Protocols** - Delivery, forwarding, routing, types of routing, routing tables, Unicast Routing, Unicast Routing protocols, RIP, Concepts of OSPF, BGP & Multicast Routing	**15L**
Unit II	**Transport Layer -** Process to process delivery, UDP, TCP **Congestion Control & Quality of Service**- Data traffic, Congestion, Congestion Control(Open Loop, Closed Loop & Congestion control in TCP), QoS and Flow Characteristics **Application Layer** - DNS, Remote Logging(Telnet), SMTP, FTP, WWW, HTTP	**15L**
Unit III	System and network security**:** Introduction to system and network security, security attacks, security services and mechanisms. **Malicious software and Internet Security:** viruses and related threats, virus countermeasures, denial of service attacks, *Hacking*, Security policies and plan, Strategies for a secure network. **Firewall and Intrusion Detection:** Firewalls and their types, DMZ, Limitations of firewalls, Intruders, Intrusion detection (Host based, Networked, Distributed), IDS.	**15L**
Unit IV	**Cryptography**: Traditional and Modern Symmetric-Key Ciphers, DES and AES, Asymmetric -Key Cryptography, RSA and ELGAMAL cryptosystems. Message Digest, Digital Signature, Key Management **Network Security:** Security at Application Layer (E-MAIL, PGP and S/MIME), Security at Transport Layer (SSL and TLS), Security at	**15L**

	Network Layer (IPSec).	

Text book(s):

1) Data Communication & Networking (Forouzan) , Tata McGraw-Hill Education
2) Cryptography & Network Security, Behrouz A. Forouzan, Tata McGraw-Hill,
3) Network security essentials-applications and standards, William Stallings, Third Edition, Pearson Education

Additional Reference(s):

1) Computer Networks and Internets - Douglas Comer, Prentice Hall
2) Computer Networks - Andrew Tanenbaum, Prentice Hall
3) Computer Network, Bhushan Trivedi, Oxford University Press

Course: **USCS602**	**TOPICS (Credits : 2.5 Lectures/Week: 04)** **Advanced Java Programming-II**	
Unit I	**Servlet:** What Is a Servlet? The Example Servlets, Servlet Life Cycle, Sharing Information, Initializing a Servlet, Writing Service Methods, Filtering Requests and Responses, Invoking Other Web Resources, Accessing the Web Context, Maintaining Client State, Finalizing a Servlet.	**15L**
Unit II	**JSP:** What Is a JSP Page?, The Example JSP Pages, The Life Cycle of a JSP Page, Creating Static Content, Creating Dynamic Content, Unified Expression Language, JavaBeans Components, JavaBeans Concepts, Using NetBeans GUI Builder Writing a Simple Bean, Properties: Simple Properties, Using Custom tags, Reusing content in JSP Pages, Transferring Control to Another Web Component, Including an Applet.	**15L**
Unit III	**EJB:** Introduction to EJB, Benefits of EJB, Types of EJB, Session Bean: State Management Modes; Message-Driven Bean, Differences between Session Beans and Message-Driven Beans, The Contents of an	**15L**

	Enterprise Bean, Naming Conventions for Enterprise Beans, The Life Cycles of Enterprise Beans, The Life Cycle of a Stateful Session Bean, The Life Cycle of a Stateless Session Bean, The Life Cycle of a Message-Driven Bean	
Unit IV	**Web Service:** Defining Client Access with Interfaces: Remote Access, Local Access, Local Interfaces and Container-Managed Relationships, Deciding on Remote or Local Access, Web Service Clients, Method Parameters and Access. Building Web Services with JAX-WS: Setting the Port, Creating a Simple Web Service and Client with JAX-WS.	**15L**

Text book(s):

1) Joe Wigglesworth and Paula McMillan, Java Programming: Advanced Topics, Thomson Course Technology (SPD)
2) Eric Jendrock, Jennifer Ball, D Carson and others, The Java EE 5 Tutorial, Pearson Education
3) Bryan Basham, Kathy Sierra, Bert Bates, Head First Servlets and JSP, O'reilly (SPD)

Additional Reference(s):

1) Cay S. Horstmann, Gary Cornell, Core Java™ 2: Volume II–Advanced Features Prentice Hall PTR, 2001
2) Ivan Bayross, Web Enabled Commercial Applications Development Using Java 2, BPB Publications
3) The Java Tutorials of Sun Microsystems Inc.

Course: **USCS603**	**TOPICS (Credits : 2.5 Lectures/Week: 04)** **Software Engineering and Testing**	
Unit I	**Introduction to Software Engineering:** Introduction to Software, Types of Software , Classes of Software, Introduction to Software Engineering, Software Components, Software Characteristics, Software Crisis, Software Myths, Software Applications, Software-Engineering Processes, Evolution of Software,	**15L**

	Comparison of Software Engineering and Related Fields, Some Terminologies, Programs Versus Software Products **Software-Development Life-Cycle Models** Software-Development Life-Cycle, Waterfall Model, Prototyping Model, Spiral Model, Evolutionary Development Model, Iterative-Enhancement Model, RAD Model, Comparison of Various Process, Models	
Unit II	**Introduction to Software Requirements Specifications** Requirement Engineering, Process of Requirements Engineering, Information Modeling, Data-Flow Diagrams, Decision Tables, SRS Document, IEEE Standards for SRS Documents, SRS Validation, Components of SRS, Characteristics of SRS, Entity-Relationship Diagram **Software Reliability and Quality Assurance** Verification and Validation, Software Quality Assurance, Software Quality, (insert 6 sigma, Intro Agile Development) Capability Maturity Model (SEI-CMM), International Standard Organization (ISO), Comparison of ISO-9000 Certification and the SEI-CMM, Reliability Issues, Reliability Metrics, Reliability Growth Modeling, Reliability Assessment	**15L**
Unit III	**System Design:** System/Software Design, Architectural Design, Low-Level Design Coupling and Cohesion, Functional-Oriented Versus The Object-Oriented Approach, Design Specifications, Verification for Design, Monitoring and Control for Design **Software Measurement and Metrics:** Software Metrics, Halstead's Software Science, Function-Point Based Measures, Cyclomatic Complexity **Software Testing :** Introduction to Testing, Testing Principles, Testing Objectives, Test Oracles, Levels of Testing, White-Box	**15L**

	Testing/Structural Testing, Functional/Black-Box Testing, Test Plan, Test-Case Design	
Unit IV	**Software-Testing Strategies:** Static-Testing Strategies, Debugging, Error, Fault, and Failure **Computer-Aided Software Engineering:** CASE and its Scope, Levels, Architecture of CASE Environment, Building Blocks, Support in Software Life-Cycle, Objectives, CASE Repository, Characteristics of CASE Tools, CASE Classification, Categories of CASE Tools, Advantages, Disadvantages of Case Tools, Reverse Software, Engineering, Software Re-Engineering **Coding:** Information Hiding, Programming Style, Internal Documentation, Monitoring and Control for Coding, Structured Programming, Fourth-Generation Techniques	**15L**

Text book(s):

1) Software Engineering, A Practitioner's Approach, Roger S, Pressman.
2) Software Engineering, Ian Sommerville, Pearson Education

Additional Reference(s):

1) Software Engineering Fundamentals, Behforooz, Hudson, Oxford University Press
2) Fundamentals of Software Engineering, Fourth Edition, Rajib Mall, PHI
3) Software Engineering-Principles and Practices, Jain, Oxford University Press
4) Software Engineering: Principles and Practices, Hans Van Vliet, John Wiley & Sons
5) Software Engineering Concepts, Richard Fairley, McGraw-Hill Companies

Course: **USCS604**	**TOPICS (Credits : 2.5 Lectures/Week: 04)** **Data Management using PL/SQL-II**	
Unit I	**Decomposition:** Functional dependency, Closure of a set of functional dependency, Lossless-Join decomposition, Multi valued dependency and fourth normal form, Join dependency, Fifth normal form.	**15L**

	Concurrency Control: Concept of a transaction, ACID properties, Serial and serializable schedules, Conflict and View serializabilty, Precedence graphs and test for conflict seralizability.	
Unit II	**Enforcing Serializability by locks:** Concept of locks, the locking scheduler, Two phase Locking, upgrading and down grading locks, Concept of deadlocks, Concurrency control by time stamps, The Thomos Write rule. **Crash Recovery:** ARIES algorithm. The log based recovery, recovery related structures like transaction and dirty page table, Write-ahead log protocol, check points, recovery from a system crash, Redo and Undo phases.	**15L**
Unit III	**Packages:** Advantages of Packages, Components of a Package, Develop a Package, Visibility of a Package's components, Package Specification and Body, Package Constructs, PL/SQL Source Code Using the Data Dictionary **Dynamic SQL**: Execution Flow of SQL, Cursor Variables, Dynamically executing a PL/SQL Block, Configure Native Dynamic SQL to Compile PL/SQL Code, DBMS_SQL Package, Implement DBMS_SQL with a Parameterized DML Statement	**15L**
Unit IV	**Triggers:** Concepts of Triggers, Trigger Event Types and Body, Business Application Scenarios, Create Trigger, Insert Trigger and Delete Trigger Statement, Statement Level Triggers Versus Row Level Triggers, Create Instead of and Disabled Triggers, Managing Testing and Removing Triggers. **File Organization and Indexing:** Cluster, Primary and secondary indexing, Index data structure: hash and Tree based indexing, Comparison of file organization: cost model, Heap files, sorted files, clustered files. Creating, dropping and maintaining indexes.	**15L**

Text book(s):

1) Ramakrishnam, Gehrke, "Database Management Systems", McGraw- Hill.
2) Ivan Bayross, "SQL,PL/SQL -The Programming language of Oracle", B.P.B. Publications
3) Michael Abbey, Michael J. Corey, Ian Abramson, Oracle 8i – A Beginner's Guide, TataMcGraw-Hill.

Additional Reference(s):

1) Joel Murach, Murach's MySQL, Mike Murach & Associates

2) Elsmasri and Navathe, “Fundamentals of Database Systems”, Pearson Education.
3) Peter Rob and Coronel, “Database Systems, Design, Implementation and Management”, Thomson Learning
4) ORACLE “The Complete Reference”, Tata McGraw Hill, New Delhi
5) C. J. Date, Longman, “Introduction to database Systems”, Pearson Education. George Koch and Kevin Loney

Suggested List of Practical – SEMESTER VI

Course: USCSP601	**(Credits : 03 Practical/Week: 08) USCS602+USCS604**	

Advanced JAVA Programming-II

1. Simple Server-Side Programming using Servlets
2. Advance Server-Side Programming using Servlets
3. Simple Server-side programming using JSP
4. Advance Server-side programming using JSP
5. Developing Simple Enterprise Java Beans
6. Developing Advance Enterprise Java Beans
7. Developing Simple Web services in Java
8. Developing Advance Web services in Java

Data Management using PL/SQL-II

1. Study of transactions and locks.
2. Creating and Handling Deadlock situation.
3. Packages 1:
   a. Working with oracle supplied packages like DBMS_OUTPUT , etc
   b. Forward Declaration of packages
4. Packages 2:
   a. Create and invoke a package that contains private and public constructs.
   b. Implement Package Functions in SQL
5. Data Dictionary: View PL/SQL Source Code Using the Data Dictionary.

a. User Tables

b. All tables

c. DBA Tables

6. Dynamic SQL: Use of DBMS_SQL package to write Dynamic SQL

   a. function and procedure of package (OPEN_CURSOR, PARSE, BIND_VARIABLE, EXECUTE, FETCH_ROWS, CLOSE_CURSOR)

   b. Using the EXECUTE IMMEDIATE Statement

7. Dynamic SQL: Implementing DBMS_SQL with a Parameterized DML Statement
8. Trigger: Creating and working with

   a. Insert/Update/Delete Trigger

   b. Before/After Trigger

   c. Working with statement Level Trigger and Row Level Trigger.

   d. Remove Trigger

9. Indexes: Creating, dropping, and maintaining indexes on tables for the given column.

USCSP602	**(Credits: 03, Practical/Week: 08)** **USCS601+USCS603**	

Project Documentation

1. **Acknowledgement**
2. **Preliminary Investigation** - Organizational Overview, Description of System, Limitations of present system, Proposed system and its adv. [For web project, URL can be mentioned], Feasibility Study, Stakeholders, Technologies used, Gantt Chart
3. **System Analysis** - Fact Finding Techniques (Questionnaire, Sample Reports, Forms...), Prototypes(if any), Event Table, Use Case Diagram, Scenarios & Use Case Description, ERD, Activity Diagram, Class diagram, Object Diagram, Sequence diagram/Collaboration Diagram, State diagram
4. **System Design** - Converting ERD to Tables, Design Class diagram[with UI classes, Persistent classes etc…], Component Diagram, Package Diagram, Deployment Diagram
5. **System Coding**- Menu Tree / Sitemap, List of tables with attributes and constraints, Design Patterns used (if any), Program Descr[Programs /Classes and their responsibilities in brief]

with Naming Conventions, Validations, Test Cases, Test Data and Test Results [Write test cases for all important programs], Screen Layouts & Report Layouts, Program Listing[for dummy project]

6. **System Implementation / Uploading**
7. **Future Enhancements**
8. References and Bibliography

Note – Project documentation will carry 50 marks. They will be distributed as follows –

1. Preliminary Investigation – 10 marks
2. System Analysis – 10 marks
3. System Design – 10 marks
4. System Coding & Implementation – 20 marks

Project Development

1. Faculties should arrange project demos for SY students at the end of the year or just at the beginning of TY. The demos can be of some good students of previous TY batches or it can be a project developed by faculties themselves.
2. SY students should be encouraged to start finding projects in the vacation. Faculties may take one or two introductory sessions for SY students before the vacation which will help students to work on preliminary investigation phase during vacation.
3. It can be Stand Alone, Multi-user or Web Based. Projects can be done in **any technology** and should have data stored in **DBMS**.
4. Each student shall do the project **individually**, though a project with the same topic name could be done by more than one student.
5. A project guide should be assigned to students. He/she will assign a schedule for each phase of the project and hand it over to students. The guides should oversee the project progress on a weekly/fortnightly basis. The guides should control iteration if any non-linear technique is used for project development.

   Sample phases can be as follows – Preliminary investigation, System Analysis, System Design, Coding, Implementation, Project Report Submission
6. College can arrange few sessions by experienced industry people on project management/best

practices/technologies etc.

7. After the completion of phase/projects, demos can be planned in front of faculties/clients/students.
8. **Projects should have at least following:**
    a. Good content management, presentation & meaningful images
    b. Data Entry with Validations
    c. Suitable navigation scheme(menus/toolbars/tabs/links etc)
    d. Record Manipulation(add, update, delete, display, search ,sort)
    e. Transactions / Sessions /Reports / Feedback/Registration whichever applicable
    f. Login accounts(Admin & User) with separate functionalities for administrators and users
9. A certificate should be added in the project report which should contain the following information –
    a. The fact that the student has successfully completed the project as per the syllabus and that it forms a part of the requirements for completing the BSc degree in computer science of University of Mumbai.
    b. The name of the student and the project guide
    c. The academic year in which the project is done
    d. Date of submission,
    e. Signature of the project guide and the head of the department with date along with the department stamp,
    f. Space for signature of the university examiner and date on which the project is evaluated.
10. Project should be evaluated by External Examiner as follows (Project Quality $\rightarrow$ 20 marks, Working of Project $\rightarrow$ 20 marks, Student's Presentation $\rightarrow$10 marks)

Note:

i. **Evaluating "Project Quality"**: It involves overall modules included in the project, whether it was sufficiently large enough, whether validations were done for data entry, variety of reports etc.

ii. **Evaluating "Working of the Project"**: It involves error-free execution of the project.

iii. **Evaluating Student's Presentation:** Marks can be given based on the presentation skills of a student. A student can prepare a power point presentation for the project.