

w.e. f. Dec 2019

Bachelor of Technology (B.Tech) in Computer Science & Engineering: 6th Semester Scheme

Sr. No.	Course No.	Course Category	Course Title	Teaching Schedule			Credits	Examination Marks			
				L	T	P		Internal	Theory	Practical	Total
1.	MA-10 / SAP-02/ HUM-14/ HUM-15/ HUM-16	General	Fuzzy Maths / SAP ABAP / Finance Management / HR Management / Research Methodology / *Swayam	2	1	-	3	40	60	-	100
2.	CS-30	Specialization	Cloud Computing	3	1	-	4	40	60	-	100
3.	CS-31	General	Big Data & Analytics	3	1	-	4	40	60	-	100
4.	CS-32	Specialization	Elective-I	3	-	-	3	40	60	-	100
5.	CS-33	Specialization	Elective-II	3	-	-	3	40	60	-	100
6.	CS-34	Specialization	Elective-III	3	-	-	3	40	60	-	100
7.	CS-35	General	Big Data & Analytics Lab	-	-	2	2	60	-	40	100
8.	CS-36	Specialization	Elective-I Lab	-	-	2	2	60	-	40	100
9.	CS-37	Specialization	Elective-III Lab	-	-	2	2	60	-	40	100
10.	CS-38	Core	Project-II	-	-	4	4	60	-	40	100
Total				17	3	10	30	480	360	160	1000

***One Course -3 credit through Swayam**

*Swayam means subject that cover under self study/learning mode via online study material

Elective-I, II, III

Course No.	Course Title
Elective-I	
CS-32 (a)	Mobile Application Development
CS-32 (b)	Advanced Java Programming
CS-32 (c)	Computer Graphics
CS-32 (d)	Internetworking Technologies
Elective-II	
CS-33 (a)	Cryptography & Network Security
CS-33 (b)	Wireless & Mobile Communication
CS-33 (c)	Adhoc Networks
CS-33 (d)	Robotic Process Automation Design & Development
Elective-III	
CS-34 (a)	Microprocessor & Interfacing
CS-34 (b)	Software Testing
CS-34 (c)	Advanced Python Programming
CS-34 (d)	Advanced Web Technology

Course No.	Course Title
Elective-I Lab	
CS-36 (a)	Mobile Application Development Lab
CS-36 (b)	Advanced Java Programming Lab
CS-36 (c)	Computer Graphics Lab
CS-36 (d)	Internetworking Technologies Lab
Elective-III Lab	
CS-37 (a)	Microprocessor & Interfacing Lab
CS-37 (b)	Software Testing Lab
CS-37 (c)	Advanced Python Programming Lab
CS-37 (d)	Advanced Web Technology Lab

**B. Tech. (6thSem) Computer Science &Engineering
CS-30 (Cloud Computing)**

L	T	P	Continuous evaluation	40
3	1	-	End semester exam	60
			Total marks	100
			Credits	4.0

Course Objectives:

1. To acquire knowledge about Cloud computing and its characteristics.
2. To learn how to identify various Cloud services.
3. To learn various Cloud delivery models.
4. To learn about Cloud security and Multi-Cloud management systems.
5. To learn about future directions of cloud computing.

Unit:-1

Overview of Cloud Computing- Brief history and evolution, History of Cloud Computing, Evolution of Cloud Computing, Traditional Vs. cloud Computing, Why Cloud Computing, Cloud Service Models (IaaS, PaaS & SaaS), Cloud Deployment Models (Public, Private, Hybrid and Community Cloud), Benefits and Challenges of Cloud Computing.

Working with Private Cloud- Basics of Virtualization, Virtualization technologies, Server Virtualization, VM Migration techniques, Role of Virtualization in Cloud Computing, Business cases for the need of Cloud Computing environment, Private Cloud Definition, Characteristics of Private Cloud, Private Cloud Deployment Models, Private Cloud Vendors, Private Cloud Building Blocks namely Physical Layer, Virtualization Layer, Cloud Management Layer, Challenges to private Cloud, Virtual Private Cloud, Implementing Private Cloud (one out of CloudStack, OpenStack, Eucalyptus, IBM or Microsoft).

Unit:-2

Working with Public Clouds- What is Public Cloud, Why Public Cloud, When to opt for Public Cloud, Public Cloud Service Models, and Public Cloud Players, Infrastructure as a Service Offerings, IaaS Vendors, PaaS Offerings, PaaS vendors, Software as a Service, Implementing Public Cloud (one out of AWS, Windows Azure, IBM or Rackspace).

Unit:-3

Overview of Cloud Security- Explain the security concerns in Traditional IT, Introduce challenges in Cloud Computing in terms of Application Security and Network security, Security reference Model, Abuse and Nefarious Use of Cloud Computing, Insecure Interfaces and APIs, Malicious Insiders, Shared Technology Issues, Data loss or Leakage, account or Service Hijacking, Unknown Risk Profile, Introduce the different vendors offering Cloud Security for Public and private clouds.

Overview of Multi-Cloud Management Systems- Explain concept of multi-cloud management, Challenges in managing heterogeneous clouds, benefits and advantages of multi-cloud management systems, Implementing Multi-Cloud Management System (i.e. RightScale Cloud Management System).

Unit:-4

Business Clouds- Cloud Computing in Business, Various Biz Clouds focused on industry domains (Retail, Banking and Financial sector, Life Sciences, Social Networking, Telecom, Education), Cloud Enablers (Business Intelligence on cloud, Big Data Analytics on cloud).

Future directions in Cloud Computing- Future technology trends in Cloud Computing with a focus on Cloud service models, deployment models, cloud applications and cloud security, Migration paths for cloud, Selection criteria for cloud deployment, Current issues in cloud computing leading to future research directions.

Course Outcomes:

- i) Understanding the systems, protocols and mechanisms to support cloud computing.
- ii) Develop applications for cloud computing.
- iii) Understanding the hardware necessary for cloud computing.
- iv) Define cloud computing and related concepts.
- v) Understand the key dimensions of the challenges of Cloud Computing.
- vi) Understand the assessment of the economics, financial, and technological implications for selecting cloud computing for an organization.
- vii) Describe the benefits of cloud computing.

Instructions for paper setter: All Questions are compulsory. The Question paper is divided in to four sections A, B, C and D. Section A is compulsory and comprises of 12 questions of one mark each, 3 from each unit. The questions shall be asked in such a manner that there are no direct answers including one word answer, fill in the blanks or multiple choice questions. Section B comprises of 4 questions of 2 marks each, one from each unit. Section C Comprises of 4 questions of 4 marks each, one from each unit. Section D Comprises of 4 questions of 6 marks each, one from each unit. There is no overall choice, however internal choice may be provided in section C and D, if paper setter so desires.

Text Books/Reference Books:

1. Raj Kumar Buyya, James Broberg, Andrezei M. Goscinski, "Cloud Computing: Principles and paradigms".
2. Michael Miller, "Cloud Computing", 2008.
3. Judith Hurwitz, Robin Bllor, Marcia Kaufman, Fern Halper, "Cloud Computing for dummies", 2009.
4. Anthony T. Velte, Toby J. Velte and Robert Elsenpeter, "Cloud Computing: A Practical Approach", McGraw Hill.
5. Borko Furht, Armando Escalante (Editors), "Handbook of Cloud Computing", Springer, 2010.
6. Rittinghouse, John, W, "Cloud Computing: Implementation, management and security".
7. Barrie Sosinsky, "Cloud Computing Bible", Wiley, 2011.
8. Rhoton, John, "Cloud Computing Architected: Solution Design Handbook".
9. Krutz, Ronald L.: Vines, Russell Dean, "Cloud Security, a Comprehensive Guide to Secure Cloud Computing".

CS-31 (Big Data and Analytics)

L	T	P	Continuous evaluation	40
3	1	-	End semester exam	60
			Total marks	100
			Credits	4.0

Course Objectives:

1. To acquire knowledge about Big Data and its characteristics.
2. To learn about Hadoop & its installation.
3. To acquire knowledge about data streaming process.
4. To learn how Map Reduce can be used for parallel programming.
5. To learn about various data processing tools such as PIG, Hive, Hbase & Sqoop.

Unit:-1

Big Data- Introduction to Big Data Platform, Challenges of Conventional Systems, Data Types (Structured, Semi-Structured and Unstructured), Traditional BI vs Big Data Environment, Big Data (Descriptive, Predictive and Prescriptive), Big Data Technology Landscape (SQL, NoSQL, NoSQL Databases, New SQL), CAP Theorem, Hadoop installation (standalone modes and fully distributed mode).

Unit:-2

Hadoop- Introduction, key advantages of Apache Hadoop, Hadoop vs. RDBMS, Hadoop Architecture, Hadoop components, HDFS Design and goals, anatomy of file read and write in HDFS, Replica placement strategy, Working with HDFS Commands, Hadoop file system interfaces, Hadoop 1.0 vs Hadoop 2.0, Hadoop Echo System.

Data Streaming- Data streaming, Data Flow, Models, Flumes (Features, Architecture).

Unit:-3

Map Reduce- Anatomy of a Map Reduce Job Run, Failures, Job Scheduling, Shuffle and Sort, Task Execution, Map Reduce Types and Formats, Map Reduce Features, SQL vs. Map Reduce, Stream Data Model and Architecture.

Unit:-4

PIG- Introduction, Execution Modes of Pig, Comparison of Pig with Databases, Grunt, Pig Latin, User Defined Functions, Data Processing operators. Hive- Hive Shell, Hive Services, Hive Metastore, Comparison with Traditional Databases, HiveQL, Tables, Querying Data and User Defined Functions. Hbase- HBasics, Concepts, Clients, Example, Zookeeper, Hbase vs. RDBMS. Big SQL. Sqoop- Sqoop Architecture, Installation, connectors & drivers, importing and exporting data from HDFS, HIVE, Hbase.

Course Outcomes:

- i) Able to understand operational database, warehousing and multidimensional need of data base to meet industrial needs.
- ii) Able to identify and understand the components of warehousing.
- iii) Able to identify and understand the data extraction and transformation techniques.
- iv) Able to identify and understand the Business analysis, query tools and application, OLAP etc.
- v) Able to explain about data mining, decision tree, neural networks and clustering.

Instructions for paper setter: All Questions are compulsory. The Question paper is divided in to four sections A, B, C and D. Section A is compulsory and comprises of 12 questions of one mark each, 3 from each unit. The questions shall be asked in such a manner that there are no direct answers including one word answer, fill in the blanks or multiple choice questions. Section B comprises of 4 questions of 2 marks each, one from each unit. Section C Comprises of 4 questions of 4 marks each, one from each unit. Section D Comprises of 4 questions of 6 marks each, one from each unit. There is no overall choice, however internal choice may be provided in section C and D, if paper setter so desires.

Text Books/Reference Books:

1. Tom White, "Hadoop: The Definitive Guide", 3rd ed., O'reilly Media, 2012.
2. Chris Eaton, Dirk DeRoos, Tom Deutsch, George Lapis, Paul Zikopoulos, "Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data", McGraw-Hill Publishing, 2012.
3. Bill Franks, "Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics", John Wiley.
4. Glenn J. Myatt, "Making Sense of Data", John Wiley & Sons.
5. Pete Warden, "Big Data Glossary", O'Reilly, 2011.

CS-32 (a) (Mobile Application Development)

L	T	P	Continuous evaluation	40
3	-	-	End semester exam	60
			Total marks	100
			Credits	3.0

Course Objectives:

1. To learn about the differences between Android and other mobile development environments.
2. To understand the rapid prototyping techniques to design and develop sophisticated mobile interfaces.
3. To understand how Android applications work, their life cycle, manifest, Intents, and using external resources.
4. To design and develop useful Android applications with compelling user interfaces by using, extending, and creating your own layouts and Views and using Menus.

Unit:-1

Getting started with Mobility- Mobility landscape, Introduction to mobile devices and mobile platforms, Mobile app development, Overview of Android platform, Setting up the mobile app development environment along with an emulators, A case study on Mobile app development.

Unit:-2

Building blocks of mobile apps- App user interface designing- Mobile UI resources (Layout, UI elements, Draw-able, Menu), Activity-states and life cycle, Interaction amongst activities.

App functionality beyond user interface- Threads, Async task, Services (states and life cycle), Notifications, Broadcast receivers, Telephony and SMS APIs.

Native data handling- on device file I/O, shared preferences, Mobile database such as SQLite, and enterprise data access (via internet/intranet).

Unit:-3

Sprucing up mobile apps- Graphics and animations- custom views, Canvas, Animation APIs, Multimedia- audio/video playback and record, Location awareness and native hardware access (Sensors such as accelerometer and gyroscope).

Unit:-4

Testing Mobile Apps- Debugging mobile application, White box testing, black box testing and test automation of mobile apps using JUnit for android, Robotium and MonkeyTalk.

Taking apps to Market- Versioning, signing and packaging mobile apps, Distributing apps on mobile market place.

Course Outcomes:

- i) Learn and understand the terminology related to mobile application development.
- ii) Understand how Android applications work, their life cycle, manifest, Intents, and using external resources.
- iii) Able to explain the differences between Android and other mobile development environments.
- iv) Able to utilize the power of background services, threads, and notifications.
- v) Able to use Android's communication APIs for SMS, telephony, network management, and internet resources (HTTP).
- vi) Able to build the Android applications.
- vii) Able to secure, tune, package, and deploy Android applications.

Instructions for paper setter: All Questions are compulsory. The Question paper is divided in to four sections A, B, C and D. Section A is compulsory and comprises of 12 questions of one mark each, 3 from each unit. The questions shall be asked in such a manner that there are no direct answers including one word answer, fill in the blanks or multiple choice questions. Section B comprises of 4 questions of 2 marks each, one from each unit. Section C Comprises of 4 questions of 4 marks each, one from each unit. Section D Comprises of 4 questions of 6 marks each, one from each unit. There is no overall choice, however internal choice may be provided in section C and D, if paper setter so desires.

Text Books/Reference Books:

1. Anubhav Pradhan and Anil V. Deshpande, "Composing Mobile Apps: Learn, Explore, Apply Using Android", Wiley India.
2. Valentino Lee and Heather Schneider, "Mobile Applications: Architecture, Design, and Development", Hewlett-Packard Professional Books, 2004.
3. Barry Burd, "Android Application Development All-in-one for Dummies", Wiley, 1st Edition.
4. Carmen Delessio and Lauren Darcey, "Teach Yourself Android application Development in 24 Hours", SAMS Publication.

CS-32 (b) (Advanced Java Programming)

L	T	P
3	-	-

Continuous evaluation	40
End semester exam	60
Total marks	100
Credits	3.0

Course Objectives:

1. To learn about networking concepts in Java.
2. To understand the use of Java Servlets.
3. To understand how Java Server Pages are designed.
4. To acquire knowledge about Remote Method Invocation, AJAX & Spring.

Unit:-1

Networking in Java- Networking fundamentals, Client/Server model, Internet addresses, Sockets, networking classes and interfaces using java.net package, TCP/IP and datagram programming, HTTP protocol and URLs.

Collection Framework- ArrayList, LinkedList, Stack, Queue (PriorityQueue), Map (HashMaps), Sets (HashSet).

Unit:-2

Java Servlets- WWW, HTML Basics, HTTP, CGI, Life cycle of a Servlet, ServletConfig, ServletContext, Reading Servlet parameters, HttpServlet, HttpServletRequest, HttpServletResponse, HttpSession, Handling HTTP request and response, Cookies, Session Tracking, Servlet Listener, Servlet Filters.

Unit:-3

Java Server Pages- Implicit Objects, JSP Directives, scripting elements, Extracting fields and values, attributes, Sessions in JSP, Cookies, JSP UseBean, Java Standard Tag Library, Expression Language, Custom Tag, Introduction to MVC Pattern.

Unit:-4

Remote Method Invocation (RMI)- What is RMI, Object Serialization, RMI layer model, Skelton, Stub, java.rmi packages (Remote interface, Naming, RMISecurityManager, RemoteException), java.rmi.registry package (Registry interface, LocateRegistry), java.rmi.server package (RemoteObject, RemoteServer), Parameter passing of non-remote and remote objects, cloning remote objects.

Introduction to AJAX & Spring- Introduction to AJAX (AJAX Components and Advantages), Introduction to Spring (Spring Modules, Spring Applications, Advantages).

Course Outcomes:

- i) To write programs using object-based programming techniques including classes, objects and inheritance.
- ii) To use basic graphical user interface (GUI) components including buttons, text fields, user-defined methods and process strings.
- iii) To learn and use the concept of multi-threading, JDBC, Servlet, RMI and Beans.
- iv) To use advance Java programming related concepts in development of various projects/fields.

Instructions for paper setter: All Questions are compulsory. The Question paper is divided in to four sections A, B, C and D. Section A is compulsory and comprises of 12 questions of one mark each, 3 from each unit. The questions shall be asked in such a manner that there are no direct answers including one word answer, fill in the blanks or multiple choice questions. Section B comprises of 4 questions of 2 marks each, one from each unit. Section C Comprises of 4 questions of 4 marks each, one from each unit. Section D Comprises of 4 questions of 6 marks each, one from each unit. There is no overall choice, however internal choice may be provided in section C and D, if paper setter so desires.

Text Books/Reference Books:

1. H.M. Deitel, P.J. Deitel, "Java How to Program", 6th edition Pearson Education, New Delhi
2. Cay S. Horstmann, Gray Cornell, "Core Java 2 Volume II-Advanced Features", Sun Microsystems Press, Pearson Education, New Delhi.
3. Bryan Basham, Kathy Sierra, Bert Bates, "Head First Servlets and JSP".
4. Herbert Schildt, "Java: The Complete Referenc", 7th Edition, Tata McGraw Hill Publication, Delhi.

CS-32 (c) (Computer Graphics)

L	T	P	Continuous evaluation	40
3	-	-	End semester exam	60
			Total marks	100
			Credits	3.0

Course Objectives:

1. To learn about computer graphics fundamentals and its applications.
2. To understand the use of 2 dimensional viewing techniques.
3. To understand 3-D viewing techniques and raster graphics.
4. To acquire knowledge about 3-D curves, hidden surface removal techniques.

Unit:-1

Introduction to Computer Graphics- Computer Graphics Applications, Computer Graphics hardware and software, Two dimensional Graphics primitives, Points and Lines, Point plotting Techniques (Coordinate system, Increment method), Line drawing algorithm (DDA), Bresenham's circle drawing algorithm using polar coordinates, Midpoint circle drawing algorithms, Filled area algorithm (Scan line, Polygon filling algorithms, Boundary filled algorithms).

Point & Positioning Devices- Light pen, Mouse, Tablet, Input technique, Positioning technique and character recognition.

Unit:-2

Two Dimensional Viewing- Viewing pipeline, Window to view port transformation, Window to view port Mapping.

Clipping- Point & line clipping algorithm, 4 bit code algorithm, Cohen-Sutherland line clipping algorithms, Liang-Barsky line clipping algorithms, Polygon clipping (Sutherland-Hodgeland Polygon clipping algorithm), Curve clipping, Text clipping.

Unit:-3

Three Dimensional Viewing- Viewing pipeline, viewing coordinates, Projection (Parallel, perspective).

Two Dimensional Geometric Transformations- Transformations, Translation, Scaling, Rotation, Other Transformations such as Reflection, shear, Homogenous Coordinate System.

Raster Graphics- Raster Graphics fundamental, Solid Area, Scan Conversion, Interactive Raster Graphics and Raster Graphics System.

Unit:-4

Representation of 3-D Curves and Surfaces- Curved lines and surfaces, Spline representations, interpolation and approximation splines, parametric continuity conditions.

Bezier curves and surfaces- Bezier curves, properties of Bezier curves, Bezier surfaces, B-spline curves and surfaces.

Hidden Surfaces Removal- Hidden surface elimination, Depth buffer algorithm, Scan line coherence algorithm, Priority algorithm.

Course Outcomes:

- i) Understand contemporary graphics principles and graphics hardware.
- ii) Understand and demonstrate geometrical transformations.
- iii) Understand and demonstrate 2D image processing techniques.
- iv) Understand and demonstrate 3D image processing techniques.
- v) Able to create interactive graphics applications in C using graphics application programming interfaces.

Instructions for paper setter: All Questions are compulsory. The Question paper is divided in to four sections A, B, C and D. Section A is compulsory and comprises of 12 questions of one mark each, 3 from each unit. The questions shall be asked in such a manner that there are no direct answers including one word answer, fill in the blanks or multiple choice questions. Section B comprises of 4 questions of 2 marks each, one from each unit. Section C Comprises of 4 questions of 4 marks each, one from each unit. Section D Comprises of 4 questions of 6 marks each, one from each unit. There is no overall choice, however internal choice may be provided in section C and D, if paper setter so desires.

Text Books/Reference Books:

1. Hern & Baker, "Computer Graphics", PHI, New Delhi.
2. Foley, Van Dam, Feiner and Hughes, "Computer Graphics Principles and Practice", Addison-Wesley Pub. Company.
3. Computer Graphics, Schaum's Outline Series, MGH Publications, New Delhi.
4. Rogers, "Principles of Computer Graphics", MGH Publications, New Delhi.
5. Yashwant Kanetkar, "Graphics Programming with C", BPB Publications, New Delhi.

CS-32 (d) (Internetworking Technologies)

L T P
3 - -

Continuous evaluation 40
End semester exam 60
Total marks 100
Credits 3.0

Course Objectives:

1. To learn about OSI model & IP protocols in detail.
2. To understand & learn the applicability of routing protocols.
3. To acquire practical knowledge about LAN & VLAN.
4. To acquire knowledge about WLAN.

Unit:-1

Open System Interconnection (OSI) reference model. IP Protocol- IPv4 Header Format, Convert IP addresses between decimal and binary, Default mask, subnet mask, Subnetting using Variable- Length Subnet Mask (VLSM) and Classless Inter Domain Routing (CIDR), IP Forwarding, IPv6.

Unit:-2

Introduction to Routing and Packet Forwarding, Static Routing, default static routes, Dynamic Routing Protocols, Distance Vector Routing Administrative distances, Network discovery, Routing table maintenance, Routing loops, RIP version 1, RIP version 2, EIGRP, Link State Routing Protocols (OSPF).

Unit:-3

LAN Architecture, Principle of Hierarchical Network Design, Functions of LAN Switches, IEEE802.3- Design Issues, CSMA/CD, Switching and its types. VLAN- Types of VLAN, VLAN Trunking (Operations and Trunking modes), Inter-VLAN Routing (implementation of Inter-VLAN routing using multilayer switch and router on a stick).

Unit:-4

Wireless LAN- Significance of WLAN, WLAN Architecture & Services, WLAN Infrastructure components, Wireless LAN Topologies WLAN Standards (IEEE 802.11). Introduction to WAN- PPP (Architecture, Frame Structure, Management of PPP session, PPP Authentication protocol). Frame Relay- Introduction, Virtual Circuits, Encapsulation, Topologies, Address Mapping.

Course Outcomes:

- i) Able to understand the concept of IP addressing i.e. CLSM and CIDR.
- ii) Configure and Test the working of routing protocol.
- iii) Understand the concept of VLAN and Inter-VLAN routing.
- iv) Ability to understand the concept of wireless network and WAN Standard.
- v) Install, operate and troubleshoot a small to medium size enterprise branch network with switching technologies.

Instructions for paper setter: All Questions are compulsory. The Question paper is divided in to four sections A, B, C and D. Section A is compulsory and comprises of 12 questions of one mark each, 3 from each unit. The questions shall be asked in such a manner that there are no direct answers including one word answer, fill in the blanks or multiple choice questions. Section B comprises of 4 questions of 2 marks each, one from each unit. Section C Comprises of 4 questions of 4 marks each, one from each unit. Section D Comprises of 4 questions of 6 marks each, one from each unit. There is no overall choice, however internal choice may be provided in section C and D, if paper setter so desires.

Text Books/Reference Books:

1. Rick Graziani, Allan Johnson, "Routing Protocols & Concept", Cisco Press, PEARSON Education.
2. Lewis, "LAN Switching and Wireless", Cisco Press, PEARSON Education.
3. Vachon Graziani, "Accessing the WAN", Cisco Press, PEARSON Education.

L	T	P	Continuous evaluation	40
3	-	-	End semester exam	60
			Total marks	100
			Credits	3.0

Course Objectives:

1. To understand basics of Cryptography and Network Security.
2. To know about various encryption techniques.
3. To study about message authentication and hash functions.
4. Identify types of firewall implementation suitable for differing security requirements.

Unit:-1

Introduction- Principal of Security, Basic Security Components, Security Threats.

Cryptography- Cryptosystem, Type of Cryptography, Cryptographic Principles, Substitution and Transposition Ciphers, Block Cipher, Cipher Block, Cipher Modes of Operation, Stream Cipher, Secret-Key Algorithms (DES, Breaking DES, AES), Public-Key Algorithms (RSA).

Unit:-2

Authentication Protocols- Digital Signatures, Message Digest, MD5, SHA , HMAC, PKI, KDC protocols, Diffie-Hellman Key Exchange, Needham Schroeder protocol, Passwords- Technology and Administration, Kerberos, PGP, S/MIME, IPsec, VPN.

Unit:-3

Operating System Security- Access Control, Security Models: Introduction to Discretionary v/s Mandatory Access Control, Bell-La-Padula model, Biba model, Chinese Wall model. Malicious Code- Malicious software and its types, Life cycle of a Computer Virus, Virus Countermeasures, TCP/IP Vulnerabilities, DoS and DDoS Attacks.

Unit:-4

Firewall- Types of Firewall, Design Principal of Firewall, Firewall Limitation, DMZ. Intrusion Detection System (IDS)- IDS Models, IDS Architecture. Internet Security- Secure Socket Layer (SSL), Secure Electronic Transaction (SET), 3-D secure protocol.

Course Outcomes:

1. Able to explain the need for network security.
2. Able to compare and contrast symmetric and asymmetric encryption systems and their vulnerability to attack, and explain the characteristics of hybrid systems.
3. Able to explain the role of third-party agents in the provision of authentication services.
4. Identify types of firewall implementation suitable for differing security requirements.

Instructions for paper setter: All Questions are compulsory. The Question paper is divided in to four sections A, B, C and D. Section A is compulsory and comprises of 12 questions of one mark each, 3 from each unit. The questions shall be asked in such a manner that there are no direct answers including one word answer, fill in the blanks or multiple choice questions. Section B comprises of 4 questions of 2 marks each, one from each unit. Section C Comprises of 4 questions of 4 marks each, one from each unit. Section D Comprises of 4 questions of 6 marks each, one from each unit. There is no overall choice, however internal choice may be provided in section C and D, if paper setter so desires.

Text/Reference Books:

1. Sean Convery, "Network Security Architectures", Cisco Press, 2004.
2. William Stallng, "Cryptography and Network Security", Pearson Education.
3. Charels P. Pfleeger, "Security in Computing", Prentice Hall.
4. Jeff Crume, "Inside Internet Security", Addison Wesley.
5. Richard H. Baker, "Network security", Mcgraw Hill International, 1996.
6. B. Schneier, "Applied Cryptography", John Wiley, New York, 1996.
7. C. Kaufman, "Network security", Prentice Hall International, 1998.

L	T	P	Continuous evaluation	40
3	-	-	End semester exam	60
			Total marks	100
			Credits	3.0

Course Objectives:

1. To make students familiar with fundamentals of mobile communication systems.
2. To choose system (TDMA/FDMA/CDMA) according to the complexity, installation cost, speed of transmission, channel properties etc.
3. To enable the student to synthesis and analyze wireless and mobile cellular communication systems.
4. To provide the student with an understanding of diversity reception techniques.

Unit:-1

Radio Propagation Characteristics, Models for Path loss, Shadowing & Multipath fading-delay spread, Coherence bandwidth, Coherence Time, Doppler Spread Jake's Channel model.

Unit:-2

Digital Modulation for Mobile radio, Analysis under fading channel, diversity techniques and Rake demodulator, Introduction to Spread Spectrum Communication Multiple Access Techniques used in Mobile Wireless Communications (FDMA/TDMA/CDMA).

Unit:-3

The Cellular concept, Frequency Reuse basic theory of hexagonal cell layout, spectrum efficiency, FDM/TDM, Cellular System, channel allocation schemes, Handover Analysis, cellular CDMA, Soft capacity, Erlang capacity comparison.

Unit:-4

Wireless standards-GSM, IS-95, UMTS-IMT-2000, Signaling, Call Control, Mobility Management and location Tracing.

Course Outcomes:

- i) Ability to acquire solid knowledge on radio propagation and channel interference.
- ii) Understand the concept of cellular architecture, channel allocation methods and handoff techniques for seem-less connectivity
- iii) Understand various approaches for better utilization of frequency spectrum.
- iv) Ability to understand 2G and 3G technologies.

Instructions for paper setter: All Questions are compulsory. The Question paper is divided in to four sections A, B, C and D. Section A is compulsory and comprises of 12 questions of one mark each, 3 from each unit. The questions shall be asked in such a manner that there are no direct answers including one word answer, fill in the blanks or multiple choice questions. Section B comprises of 4 questions of 2 marks each, one from each unit. Section C Comprises of 4 questions of 4 marks each, one from each unit. Section D Comprises of 4 questions of 6 marks each, one from each unit. There is no overall choice, however internal choice may be provided in section C and D, if paper setter so desires.

Text/Reference Books:

1. Theodore S. Reppaport, "Wireless Communications Principles and Practice", IEEE Press, Prentice Hall.
2. William C.Y. Lec, "Mobile Cellular Telecommunications, Analog and Digital Systems", Mc-Graw Hill Inc.
3. Kamilo Feher, "Wireless Digital Communications, Modernization & Spread Spectrum Applications", PHI, New Delhi.
4. Wireless Information Networks by Kaveh Pahlavan and Allen H. Levesque, Wiley Series, John Wiley and Sons Inc.

L	T	P	Continuous evaluation	40
3	-	-	End semester exam	60
			Total marks	100
			Credits	3.0

Course Objectives:

1. Describe the basic principles of mobile ad hoc networks (MANETs) and MANET routing protocols.
2. To provide knowledge of routing mechanisms and the three classes of approaches: proactive, on-demand and hybrid.
3. To provide knowledge of clustering mechanisms and the different schemes that have been employed.
4. To acquire knowledge of the 802.11 Wireless Lan (WiFi) and Bluetooth standards.

Unit-1: Fundamentals

Fundamentals of Wireless Communication Technology, The Electromagnetic Spectrum, Radio Propagation Mechanisms, Characteristics of the Wireless Channel, IEEE 802.11a-b Standard, Origin of Adhoc Packet Radio Networks, Technical Challenges, Architecture of PRNETs, Components of Packet Radios, Adhoc Wireless Networks, What is an Adhoc Network? Heterogeneity in Mobile Devices, Wireless Sensor Networks, Traffic Profiles, Types of Adhoc Mobile Communications, Types of Mobile Host Movements, Challenges Facing Adhoc Mobile Networks, Adhoc wireless Internet.

Unit-2: Adhoc Routing Protocols

Introduction, Issues in Designing a Routing Protocol for Adhoc Wireless Networks, Classifications of Routing Protocols, Table-Driven Routing Protocols, Destination Sequenced Distance Vector (DSDV), Wireless Routing Protocol (WRP), Cluster Switch Gateway Routing (CSGR), Source-Initiated On-Demand Approaches, Adhoc On-Demand Distance Vector Routing (AODV), Dynamic Source Routing (DSR), Temporally Ordered Routing Algorithm (TORA), Signal Stability Routing (SSR), Location-Aided Routing (LAR), Power-Aware Routing (PAR), Zone Routing Protocol (ZRP).

Unit-3: Multicasting in Adhoc Networks

Introduction, Issues in Designing a Multicast Routing Protocol, Operation of Multicast Routing Protocols, An Architecture Reference Model for Multicast Routing Protocols, Classifications of Multicast Routing Protocols, Tree-Based Multicast Routing Protocols, Mesh-Based Multicast Routing Protocols, Summary of Tree and Mesh based Protocols, Energy-Efficient Multicasting, Multicasting with Quality of Service Guarantees, Application-Dependent Multicast Routing, Comparisons of Multicast Routing Protocols.

Unit-4: Transport Layer Security Protocol

Introduction, Issues in Designing a Transport Layer Protocol for Adhoc Wireless Networks, Design Goals of a Transport Layer Protocol for Adhoc Wireless Networks, Classification of Transport Layer Solutions, TCP over Adhoc Wireless Networks, Other Transport Layer Protocols for Adhoc Wireless Networks, Security in Adhoc Wireless Networks, Network Security Requirements, Issues and Challenges in Security Provisioning, Network Security Attacks, Key Management, Secure Routing in Adhoc wireless networks.

Course Outcomes:

- i) Help students to identify the major issues associated with Adhoc networks.
- ii) Able to explain the challenges in designing routing and transport protocols for wireless Adhoc/sensor networks.
- iii) Able to perform designing, operation and classification of multicast routing protocols in of Adhoc network.
- iv) Able to understand Network Security attacks, Key management and secure routing in Adhoc network.

Instructions for paper setter: All Questions are compulsory. The Question paper is divided in to four sections A, B, C and D. Section A is compulsory and comprises of 12 questions of one mark each, 3 from each unit. The questions shall be asked in such a manner that there are no direct answers including one word answer, fill in the blanks or multiple choice questions. Section B comprises of 4 questions of 2 marks each, one from each unit. Section C Comprises of 4 questions of 4 marks each, one from each unit. Section D Comprises of 4 questions of 6 marks each, one from each unit. There is no overall choice, however internal choice may be provided in section C and D, if paper setter so desires.

Text/Reference Books:

1. C. Siva Ram Murthy and B. S. Manoj, "Adhoc Wireless Networks Architectures and Protocols", PHI.
2. C. K. Toh, "Adhoc Mobile Wireless Networks Protocols and Systems", PHI.
3. Charles E. Perkins, "Ad Hoc Networking", Addison Wesley.

**B. Tech. (6th Sem) Computer Science & Engineering
CS-33 (d) (Robotic Process Automation Design & Development)**

L	T	P	Continuous evaluation	40
3	-	-	End semester exam	60
			Total marks	100
			Credits	3.0

Course Objectives:

1. To understand Basic Programming concepts and the underlying logic/structure.
2. To describe RPA, where it can be applied and how it's implemented.
3. To describe the different types of variables, Control Flow and data manipulation techniques.
4. To Understand Image, Text and Data Tables Automation.
5. To describe automation to Email and various types of Exceptions and strategies to handle.

Unit-1: Programming Basics & Recap

Programming Concepts Basics- Understanding the application, Basic Web Concepts, Protocols, Email Clients.

Data Structures- Data Tables, Algorithms, Software Processes, Software Design, Scripting, .Net Framework, .Net Fundamentals, XML, Control structures and functions, XML, HTML, CSS, Variables & Arguments.

Unit-2: RPA Concepts

RPA Basics, History of Automation, What is RPA, RPA vs Automation, Processes & Flowcharts, Programming Constructs in RPA, What Processes can be Automated, Types of Bots, Workloads which can be automated, RPA Advanced Concepts, Standardization of processes, RPA Development methodologies, Difference from SDLC, Robotic control flow architecture, RPA business case, RPA Team, Process Design Document/Solution Design Document, Industries best suited for RPA, Risks & Challenges with RPA, RPA and emerging ecosystem.

Unit-3: RPA Tool Introduction & Basics

Introduction to RPA Tool, The User Interface, Variables, Managing Variables, Naming Best Practices, The Variables Panel, Generic Value Variables, Text Variables, True or False Variables, Number Variables, Array Variables, Date and Time Variables, Data Table Variables, Managing Arguments, Naming Best Practices, The Arguments Panel, Using Arguments, About Imported Namespaces, Importing New Namespaces, Control Flow, Control Flow Introduction, If Else Statements, Loops, Advanced Control Flow, Sequences, Flowcharts, About Control Flow, Control Flow Activities, The Assign Activity, The Delay Activity, The Do While Activity, The If Activity, The Switch Activity, The While Activity, The For Each Activity, The Break Activity, Data Manipulation, Data Manipulation Introduction, Scalar variables, collections and Tables, Text Manipulation, Data Manipulation, Gathering and Assembling Data.

Unit-4: Advanced Automation Concepts & Techniques

Recording and Advanced UI Interaction, Recording Introduction, Basic and Desktop Recording, Web Recording, Input/Output Methods, Screen Scraping, Data Scraping, Scraping advanced techniques, Selectors, Selectors, Defining and Assessing Selectors, Customization, Debugging, Dynamic Selectors, Partial Selectors, RPA Challenge, Image, Text & Advanced Citrix Automation, Introduction to Image & Text Automation, Image based automation, Keyboard based automation, Information Retrieval, Advanced Citrix Automation challenges, Best Practices, Using tab for Images, Starting Apps, Excel Data Tables & PDF, Data Tables in RPA, Excel and Data Table basics, Data Manipulation in excel, Extracting Data from PDF, Extracting a single piece of data, Anchors, Using anchors in PDF. Email Automation, Incoming Email automation, Sending Email automation, Debugging and Exception Handling, Debugging Tools, Strategies for solving issues, Catching errors.

Course Outcomes:

- i) Understand Basic Programming concepts and the underlying logic/structure.
- ii) Describe RPA, where it can be applied and how its implemented.
- iii) Describe the different types of variables, Control Flow and data manipulation techniques.
- iv) Identify and understand Image, Text and Data Tables Automation.
- v) Describe automation to Email and various types of Exceptions and strategies to handle.

Instructions for paper setter: All Questions are compulsory. The Question paper is divided in to four sections A, B, C and D. Section A is compulsory and comprises of 12 questions of one mark each, 3 from each unit. The questions shall be asked in such a manner that there are no direct answers including one word answer, fill in the blanks or multiple choice questions. Section B comprises of 4 questions of 2 marks each, one from each unit. Section C Comprises of 4 questions of 4 marks each, one from each unit. Section D Comprises of 4 questions of 6 marks each, one from each unit. There is no overall choice, however internal choice may be provided in section C and D, if paper setter so desires.

Text/Reference Books:

1. Alok Mani Tripathi, "Learning Robotic Process Automation", Packt Publishing.

2. Frank Casale, Rebecca Dilla, Heidi Jaynes, Lauren Livingston, "Introduction to Robotic Process Automation: a Primer, Institute of Robotic Process Automation".
3. Richard Murdoch, "Robotic Process Automation: Guide To Building Software Robots, Automate Repetitive Tasks & Become An RPA Consultant".
4. Srikanth Merianda, "Robotic Process Automation Tools, Process Automation and their benefits: Understanding RPA and Intelligent Automation".
5. <https://www.uipath.com/rpa/robotic-process-automation>.

L	T	P	Continuous evaluation	40
3	-	-	End semester exam	60
			Total marks	100
			Credits	3.0

Course Objectives:

1. To provide extensive knowledge of microprocessor based systems.
2. To develop an in-depth understanding of the operation of microprocessors and microcontrollers, machine language programming & interfacing techniques
3. To study 8086 microprocessor.
4. To study various input output interfaces.

Unit:-1

THE 8085 Processor- Introduction to 8085 microprocessor, Architecture, instruction set, interrupt structure, assembly language programming. Memory Interfacing- Semiconductor memory and its types- Static and dynamic RAM, ROM, EPROM, EEROM and NOVRAM, Interfacing memory, Interfacing SRAM, DRAM, EPROM etc. Timing of RAM and ROM signals.

Unit:-2

THE 8086 Microprocessor Architecture- Architecture, Block diagram of 8086, details of sub-blocks such as EU, BIU, memory segmentation and physical address computations, program relocation, addressing modes, instruction formats, pin diagram and description of various signals. Instruction set of 8086- Instruction execution timing, assembler instruction format, data transfer instructions, arithmetic instructions, branch instructions, looping instructions, Nap and HLT instructions, flag manipulation instructions, logical instructions, shift and rotate instructions, directives and operators, programming examples.

Unit:-3

Interfacing Device 8255 PPI chip- Architecture, control words, modes and examples, Interfacing D/A and A/D converters, 8253, 8251, 8279.

Unit:-4

DMA- Introduction to DMA process, 8237 DMA controller. Interrupt and Timer- 8259 Programmable interrupt controller, Programmable interval timer chips.

Course Outcomes:

- i) Able to understand the architecture & instruction set of 8085.
- ii) Able to understand the architecture of 8086 & its instruction set.
- iii) Able to understand various interfacing devices.
- iv) Describe the basic idea about the data transfer schemes and its applications.

Instructions for paper setter: All Questions are compulsory. The Question paper is divided in to four sections A, B, C and D. Section A is compulsory and comprises of 12 questions of one mark each, 3 from each unit. The questions shall be asked in such a manner that there are no direct answers including one word answer, fill in the blanks or multiple choice questions. Section B comprises of 4 questions of 2 marks each, one from each unit. Section C Comprises of 4 questions of 4 marks each, one from each unit. Section D Comprises of 4 questions of 6 marks each, one from each unit. There is no overall choice, however internal choice may be provided in section C and D, if paper setter so desires.

Text/Reference Books:

1. Ramesh S Gaonkar, "Microprocessor Architecture, Programming & Applications with 8085", Wiley Eastern Ltd.
2. Hall, "Microprocessors and interfacing", TMH.
3. Brey, "The Intel Microprocessors 8086- Pentium processor", PHI.
4. Triebel & Singh, "The 8088 & 8086 Microprocessors-Programming, interfacing, Hardware & Applications", PHI.

L	T	P	Continuous evaluation	40
3	-	-	End semester exam	60
			Total marks	100
			Credits	3.0

Course Objectives:

1. To study fundamental concepts in software testing.
2. To discuss various software testing issues and solutions in software unit test.
3. To expose the advanced software testing topics.
4. To gain software testing experience by applying software testing knowledge.

Unit:-1

Introduction- Terminology, design for testability, objectives, principles, purpose of testing. Testing Limitations- Theoretical foundations, impracticality of testing all data, impracticality of testing all paths, No absolute proof of correctness. Role of V&V in Software Evolution- Types of Products, requirements, specifications, designs, implementations, changes, V&V objectives, correctness, consistency, necessity, sufficiency, performance.

Unit:-2

Testing Techniques and Strategies- Software technical reviews, Software testing, Levels of testing (module, integration, system, regression), Testing techniques and their applicability- Functional testing and analysis, structural testing and analysis, error-oriented testing and analysis, hybrid approaches, integration strategies, transaction flow analysis, stress analysis, failure analysis, concurrency analysis, performance analysis.

Unit:-3

Flow Graphs and Path Testing- Path Testing Basics, Path Predicates, Application of Path Testing. Transaction Flow Testing- Generalizations, Transaction Flows, Transaction-Flow testing techniques, Implementation Comments. Data Flow Testing- Basics, Data flow model, Data flow testing strategies, Applications.

Unit:-4

Software Testing and Regular Expression- Path products, path sums, Loops, Reduction procedure, Applications, Approximate number of paths, The mean processing time of any routine, Regular expression and Flow-anomaly detection, Formal language and its use for software testing.

Course Outcomes:

- i) Apply software testing skills and engineering methods.
- ii) Design and conduct a software test case for a software testing project.
- iii) Test how the software reacts under repeated execution of the same operations.
- iv) Identify the needs of software test automation and define and develop a test tool to support test automation.

Instructions for paper setter: All Questions are compulsory. The Question paper is divided in to four sections A, B, C and D. Section A is compulsory and comprises of 12 questions of one mark each, 3 from each unit. The questions shall be asked in such a manner that there are no direct answers including one word answer, fill in the blanks or multiple choice questions. Section B comprises of 4 questions of 2 marks each, one from each unit. Section C Comprises of 4 questions of 4 marks each, one from each unit. Section D Comprises of 4 questions of 6 marks each, one from each unit. There is no overall choice, however internal choice may be provided in section C and D, if paper setter so desires.

Text/Reference Books:

1. Boris Beizer, John Wiley & Dreamtech, "Software Testing Techniques".
2. William Perry, "Effective Methods for Software Testing", John Wiley & Sons, Inc.
3. Aditya P. Mathur, "Foundations of Software Testing", Pearson Education.
4. Glenford J. Myers, "The Art of Software Testing", Wiley India Pvt. Ltd.

M.M. (DEEMED TO BE UNIVERSITY) , MULLANA (AMBALA)

L	T	P	Continuous evaluation	60
-	-	2	End semester exam	40
			Total marks	100
			Credits	2.0

Course Objectives:

1. To acquire knowledge about Big Data and its characteristics.
2. To learn about Hadoop & its installation.
3. To learn about file streaming techniques.
4. To learn about various data processing tools such as PIG, Hive, Hbase & Sqoop.

List of Practical

Experimental work will be based upon the course Big Data & Analytics (CS-31).

Course Outcomes:

- i) Able to install Hadoop in single system as well as cluster.
- ii) Able to implement file streaming.
- iii) Able to upload /download data on Hadoop using HIVE & Sqoop.
- iv) Able to download data on Hadoop using PIG.
- v) Understand the benefit that Big data can offer to businesses & organizations.

B. Tech. (6thSem) Computer Science &Engineering
CS-36 (a) (Mobile Application & Development Lab)

L	T	P	Continuous evaluation	60
-	-	2	End semester exam	40
			Total marks	100
			Credits	2.0

Course Objectives:

1. To understand and use basic Android Programming.
2. To develop mobile apps for the modern world.
3. To use database concepts in terms of Mobile App Development.
4. To develop interactive and rich multimedia Applications.

List of Practical

Experimental work will be based upon the course Mobile Application and Development (CS-32 (a)).

Course Outcomes:

- i) To Apply and understand essential Android Programming concepts.
- ii) Able to develop various Android applications related to layouts & rich user interactive interfaces
- iii) Able to develop Android applications related to mobile related server-less database like SQLITE.
- iv) Able to distribute and publish Apps on Play store for real use.

B. Tech. (6thSem) Computer Science &Engineering
CS-36 (b) (Advance Java Programming Lab)

M.M. (DEEMED TO BE UNIVERSITY) , MULLANA (AMBALA)

L	T	P	Continuous evaluation	60
-	-	2	End semester exam	40
			Total marks	100
			Credits	2.0

Course Objectives:

1. To provide the ability to design console based Applications.
2. To develop enriched GUI based and web based applications.
3. To understand integrated development environment to create, debug and run multi-tier and enterprise-level applications.
4. To understand high level java concepts like multithreading, Database connectivity etc.

List of Practical

Experimental work will be based upon the course Advance Java Programming (CS-32 (b)).

Course Outcomes:

- i) Able to implement Graphical user interfaces.
- ii) Able to apply advanced Java concepts for development of real world and dynamic applications.
- iii) Able to develop client-server based applications.
- iv) Able to implement the concepts of networking, RMI, Swings etc.

**B. Tech. (6thSem) Computer Science &Engineering
CS-36 (c) (Computer Graphics Lab)**

L	T	P	Continuous evaluation	60
-	-	2	End semester exam	40
			Total marks	100
			Credits	2.0

Course Objectives:

1. To become familiar with building approach of graphics system components and algorithms related with them.
2. To understand the deep implementation of line, circle, polygon etc.
3. To understand 2-D and 3-D Graphics implementation.
4. To understand the concepts of image mapping and clipping.

List of Practical

Experimental work will be based upon the course Computer Graphics (CS-32 (c)).

Course Outcomes:

- i) Able to use and implement Computer graphics and its techniques.
- ii) Able to apply computer graphics in computer games, information visualization, and business applications.
- iii) Able to comprehend and analyze the fundamentals of animation.
- iv) Able to transform the shapes to fit them as per the picture definition.

**B. Tech. (6thSem) Computer Science &Engineering
CS-36 (d) (Internetworking Technologies Lab)**

M.M. (DEEMED TO BE UNIVERSITY) , MULLANA (AMBALA)

L	T	P	Continuous evaluation	60
-	-	2	End semester exam	40
			Total marks	100
			Credits	2.0

Course Objectives:

1. To use Layer-3 and Layer-2 address resolution methods.
2. To understand the working of routers.
3. To use data communication and data terminal equipment's
4. To understand and implement synchronous and asynchronous connections.

List of Practical

Experimental work will be based upon the course Internetworking technologies (CS-32 (d)).

Course Outcomes:

- i) Ability to use different networking concepts.
- ii) Able to understand the working of switch and routers etc.
- iii) Able to use data communication equipment properly

B. Tech. (6thSem) Computer Science &Engineering
CS-37 (a) (Microprocessor and Interfacing Lab)

L	T	P	Continuous evaluation	60
-	-	2	End semester exam	40
			Total marks	100
			Credits	2.0

Course Objectives:

1. To introduce students with the architecture and operation of typical microprocessor 8085.
2. To familiarize the students with the programming of 8085.
3. To familiarize the students with the programming of 8086.
4. To provides strong foundation for designing real world application using microprocessors

List of Practical

Experimental work will be based upon the course Microprocessor and Interfacing (CS-34 (a)).

Course Outcomes:

- i) Able to explain the internal architecture and working of any microprocessor.
- ii) Able to write and analyze assembly language programs.
- iii) Able to write programs to run on 8086 microprocessor based systems.
- iv) Evaluate assembly language programs and download the machine code that will provide solutions real-world control problems.

B. Tech. (6thSem) Computer Science &Engineering
CS-37 (b) (Software Testing Lab)

M.M. (DEEMED TO BE UNIVERSITY) , MULLANA (AMBALA)

L	T	P	Continuous evaluation	60
-	-	2	End semester exam	40
			Total marks	100
			Credits	2.0

Course Objectives:

1. To discuss various issues and solutions in software testing.
2. To describe strategies for generating system test cases.
3. To understand the essential characteristics of tool used for test automation.
4. To gain the techniques and skills on how to use modern software testing tools to support software testing projects.

List of Practical

Experimental work will be based upon the course Software Testing (CS-34 (b)).

Course Outcomes:

- i) Have an ability to apply software testing knowledge and engineering methods.
- ii) Have an ability to design and conduct a software test process for a software testing project.
- iii) Understands the Automation Testing Approach.
- iv) Have an ability to use software testing methods and modern software testing tools for their testing projects.

B. Tech. (6th Sem) Computer Science & Engineering
CS-38 (Project-II)

L	T	P	Continuous evaluation	60
-	-	4	End semester exam	40
			Total marks	100
			Credits	4.0

Course Objectives:

1. To learn about various phases of software development life cycle.
2. To learn about how to provide software solution for real life problems.
3. To learn about coding and testing of solutions.
4. To learn about report writing concepts.

The students are required to develop a project during semester and final evaluation will be entirely based upon his/her project work.

Course Outcomes:

- i) Able to identify software solution corresponding to real life problems.
- ii) Able to code software solution.
- iii) Able to test software solution.
- iv) Able to write reports.