REGULATIONS AND SYLLABUS
of
Master of Technology
in
Software Engineering
(w.e.f 2017-18 admitted batch)
VISION
To become a global leader in higher education.

MISSION
To impart futuristic and comprehensive education of global standards with a high sense of discipline and social relevance in a serene and invigorating environment.
REGULATIONS & SYLLABUS
OF
M.Tech. in Software Engineering
(w.e.f 2017-18 admitted batch)

GITAM Committed to Excellence
M.Tech.in Software Engineering
REGULATIONS
(w.e.f. 2017-18 admitted batch)

1. ADMISSION
1.1 Admission into M.Tech. in SE program of GITAM is governed by GITAM admission regulations.

2. ELIGIBILITY CRITERIA
2.1 • First class or equivalent grade in the qualifying examination from recognized university with a minimum of 60% aggregate marks and rank obtained in GAT (PGT).
• B.E./B.Tech./AMIE in CSE / IT / ECE / EEE / EI / CSIT or its equivalent.

2.2 Admissions into M.Tech. will be based on the following:
(i) Score obtained in GAT (PG), if conducted.
(ii) Performance in Qualifying Examination / Interview.

2.3 The actual weightage to be given to the above items will be decided by the authorities before the commencement of the academic year. Candidates with valid GATE score shall be exempted from appearing for GAT (PG).

3. CHOICE BASED CREDIT SYSTEM
3.1 Choice Based Credit System (CBCS) is introduced with effect from the admitted Batch of 2015-16 based on UGC guidelines in order to promote:
• Student Centered Learning
• Cafeteria approach
• Students to learn courses of their choice
• Learning at their own pace
• Inter-disciplinary learning

3.2 Learning goals/ objectives and outcomes are specified leading to what a student should be able to do at the end of the program.

4. STRUCTURE OF THE PROGRAM
4.1 The Program Consists of
i) Core Courses (compulsory) which give general exposure to a Student in SE and subject related area.
ii) Programme Electives.
iii) Interdisciplinary Electives.
4.2 Each course is assigned a certain number of credits depending upon the number of contact hours (lectures/tutorials/practical) per week.

4.3 In general, credits are assigned to the courses based on the following contact hours per week per semester:
- One credit for each Lecture / Tutorial hour per week.
- One credit for two hours of Practicals per week.
- Two credits for three (or more) hours of Practicals per week.

5. MEDIUM OF INSTRUCTION
The medium of instruction (including examinations and project reports) shall be English.

6. REGISTRATION
Every student has to register himself/herself for each semester individually at the time specified by the Institute / University.

7. ATTENDANCE REQUIREMENTS
7.1 A student whose attendance is less than 75% in all the courses put together in any semester will not be permitted to attend the end-semester examination and he/she will not be allowed to register for subsequent semester of study. He/she has to repeat the semester along with his / her juniors.

7.2 However, the Vice Chancellor on the recommendation of the Principal / Director of the Institute/School may condone the shortage of attendance to the students whose attendance is between 66% and 74% on genuine grounds and on payment of prescribed fee.

8. EVALUATION
8.1 The assessment of the student’s performance in a Theory course shall be based on two components: Continuous Evaluation (40 marks) and Semester-end examination (60 marks).

8.2 A student has to secure an aggregate of 40% in the course in the two components put together to be declared to have passed the course, subject to the condition that the candidate must have secured a minimum of 24 marks (i.e. 40%) in the theory component at the semester-end examination.

8.3 Practical/ Project Work/ Industrial Training/ Viva voce/ Seminar etc. course are completely assessed under Continuous Evaluation for a maximum of 100 marks, and a student has to obtain a minimum of 40% to secure Pass Grade. Details of Assessment Procedure are furnished below in Table 1.
## Table 1: Assessment Procedure

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Component of Assessment</th>
<th>Marks Allotted</th>
<th>Type of Assessment</th>
<th>Scheme of Evaluation</th>
</tr>
</thead>
</table>
| 1     | Theory                  | 40             | Continuous         | i) Thirty (30) marks for mid Semester examinations. Three mid examinations shall be conducted for 15 marks each; performance in best two shall be taken into consideration.  
       |                         |                | Evaluation         | ii) Ten (10) marks for Quizzes, Assignments and Presentations.  
       |                         | 60             | Semester-end       | Sixty (60) marks for Semester-end examinations |
|       |                         |                | Examination        |                      |
|       |                         | Total          | 100                |                      |
| 2     | Practicals              | 100            | Continuous         | i) Fifty (50) marks for regularity and performance, records and oral presentations in the laboratory. Weightage for each component shall be announced at the beginning of the Semester.  
       |                         |                | Evaluation         | ii) Ten (10) marks for case studies.  
       |                         |                |                    | iii) Forty (40) marks for two tests of 20 marks each (one at the mid-term and the other towards the end of the Semester) conducted by the concerned lab Teacher. |
| 3     | Project work (III Semester ) | 100         | Continuous         | i) Forty (40) marks for periodic evaluation on originality, innovation, sincerity and progress of the work, assessed by the Project Supervisor.  
       |                         |                | Evaluation         | ii) Thirty (30) marks for mid-term evaluation for defending the Project, before a panel of examiners.  
       |                         |                |                    | iii) Thirty (30) marks for final Report presentation and Viva-voce, by a panel of examiners |
| 4     | Project work (IV Semester) | 50           | Continuous         | i) Twenty (20) marks for Periodic evaluation on originality innovation, sincerity and progress of the work, assessed by the Project Supervisor.  
       |                         |                | Evaluation         | ii) Fifteen (15) marks for mid-term evaluation for defending the Project, before a panel of examiners*. |
### Marks Distribution

<table>
<thead>
<tr>
<th>Category</th>
<th>Marks</th>
<th>Assessment Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>iii) Fifteen (15) marks for interim Report presentation and Viva-voce.</td>
<td>50</td>
<td></td>
</tr>
<tr>
<td>Fifty (50) marks for final Report presentation and Viva-voce assessed by external examiners.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>5 Technical Seminar</td>
<td>100</td>
<td>Continuous Evaluation</td>
</tr>
<tr>
<td>6 Comprehensive Viva-voce (II Semester)</td>
<td>100</td>
<td>Continuous Evaluation</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Through five periodic Viva-voce exams for 20 marks each, conducted by a panel of examiners. The course content for Viva exams shall be announced at the beginning of the Semester.</td>
</tr>
</tbody>
</table>

*Panel of Examiners shall be appointed by the concerned Head of the Department*

### REAPPEARANCE

9.1 A student who has secured ‘F’ grade in a Theory course shall have to reappear at the subsequent Semester end examination held for that course.

9.2 A student who has secured ‘F’ grade in a Practical course shall have to attend Special Instruction Classes held during summer.

9.3 A student who has secured ‘F’ Grade in Project work / Industrial Training etc shall have to improve his/her report and reappear for Viva – voce at the time of Special Examination to be conducted in the summer vacation.

### SPECIAL EXAMINATION

10.1 A student who has completed his/her period of study and still has “F” grade in a maximum of three theory courses is eligible to appear for Special Examination normally held during summer vacation.

### BETTERMENT OF GRADES

11. A student who has secured only a Pass or Second class and desires to improve his/her Class can appear for Betterment Examinations only in Theory courses of any Semester of his/her choice, conducted in Summer Vacation along with the Special Examinations. Betterment of Grades is permitted ‘only once’ immediately after completion of the program of study.
12. **GRADING SYSTEM**

12.1 Based on the student performance during a given semester, a final letter grade will be awarded at the end of the semester in each course. The letter grades and the corresponding grade points are as given in Table 2.

<table>
<thead>
<tr>
<th>Sl.No.</th>
<th>Grade</th>
<th>Grade Points</th>
<th>Absolute Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>O (outstanding)</td>
<td>10</td>
<td>90 and above</td>
</tr>
<tr>
<td>2</td>
<td>A+ (Excellent)</td>
<td>9</td>
<td>80 to 89</td>
</tr>
<tr>
<td>3</td>
<td>A (Very Good)</td>
<td>8</td>
<td>70 to 79</td>
</tr>
<tr>
<td>4</td>
<td>B+ (Good)</td>
<td>7</td>
<td>60 to 69</td>
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<tr>
<td>5</td>
<td>B (Above Average)</td>
<td>6</td>
<td>50 to 59</td>
</tr>
<tr>
<td>6</td>
<td>C (Average)</td>
<td>5</td>
<td>45 to 49</td>
</tr>
<tr>
<td>7</td>
<td>P (Pass)</td>
<td>4</td>
<td>40 to 44</td>
</tr>
<tr>
<td>8</td>
<td>F (Fail)</td>
<td>0</td>
<td>Less than 40</td>
</tr>
<tr>
<td>9</td>
<td>Ab. (Absent)</td>
<td>0</td>
<td>-</td>
</tr>
</tbody>
</table>

12.2 A student who earns a minimum of 4 grade points (P grade) in a course is declared to have successfully completed the course, and is deemed to have earned the credits assigned to that course, subject to securing a GPA of 5 for a Pass in the semester.

13. **GRADE POINT AVERAGE**

13.1 A Grade Point Average (GPA) for the semester will be calculated according to the formula:

\[
GPA = \frac{\sum_i C_i G_i}{\sum_i G_i}
\]

Where

- \(C_i\) = number of credits obtained for the ith course
- \(G_i\) = number of credits obtained for the ith course

13.2 To arrive at Cumulative Grade Point Average (CGPA), a similar formula is used considering the student’s performance in all the courses taken, in all the semesters up to the particular point of time.

13.3 CGPA required for classification of class after the successful completion of the program is shown in Table 3.
### Table 3: CGPA required for award of Class

<table>
<thead>
<tr>
<th>Class</th>
<th>CGPA Required</th>
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<tbody>
<tr>
<td>First Class with Distinction</td>
<td>&gt; 8.0*</td>
</tr>
<tr>
<td>First Class</td>
<td>&gt; 6.5</td>
</tr>
<tr>
<td>Second Class</td>
<td>&gt; 5.5</td>
</tr>
<tr>
<td>Pass Class</td>
<td>&gt; 5.0</td>
</tr>
</tbody>
</table>

* In addition to the required CGPA of 8.0 or more, the student must have necessarily passed all the courses of every semester in first attempt.

### 14. ELIGIBILITY FOR AWARD OF THE M.Tech. DEGREE

14.1 Duration of the program: A student is ordinarily expected to complete the M.Tech. program in four semesters of two years. However a student may complete the program in not more than four years including study period.

14.2 However the above regulation may be relaxed by the Vice Chancellor in individual cases for cogent and sufficient reasons.

14.3 A student shall be eligible for award of the M.Tech. Degree if he / she fulfills all the following conditions.

   a) Registered and successfully completed all the courses and projects.

   b) Successfully acquired the minimum required credits as specified in the curriculum corresponding to the branch of his/her study within the stipulated time.

   c) Has no dues to the Institute, hostels, Libraries, NCC / NSS etc, and

   d) No disciplinary action is pending against him / her.

### 15. DISCRETIONARY POWER

Not withstanding anything contained in the above sections, the Vice Chancellor may review all exceptional cases, and give his decision, which will be final and binding.
M.Tech. in Software Engineering
Department of Computer Science and Engineering
Effective from academic year 2017-2018 admitted batch

Semester I

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Course Code</th>
<th>Course Title</th>
<th>Category</th>
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<th>T</th>
<th>P</th>
<th>C</th>
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<tbody>
<tr>
<td>1</td>
<td>ECS701</td>
<td>Advanced Data Structures and Algorithms</td>
<td>CE</td>
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Semester II

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<tr>
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<td>CE</td>
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<td>2</td>
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|        |             |                                            |          |   |   |   | 27 |
### Semester III

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<th>C</th>
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<td>Project Work-I</td>
<td>PP(PW)</td>
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<tr>
<td>2</td>
<td>ECS893</td>
<td>Comprehensive Viva Voce</td>
<td>CE</td>
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### Semester IV

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### Number of Credits:

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<th>II</th>
<th>III</th>
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### Interdisciplinary Elective-I

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### Interdisciplinary Elective-II

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<thead>
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<th>P</th>
<th>C</th>
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<tbody>
<tr>
<td>1</td>
<td>ECS749</td>
<td>Internet of Things</td>
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## PROGRAMME ELECTIVES

### Program Elective - I

<table>
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<th>Course Title</th>
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### Program Elective - II

<table>
<thead>
<tr>
<th>S. No.</th>
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<th>Course Title</th>
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<th>C</th>
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<tbody>
<tr>
<td>1</td>
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<td>Software Verification and Validation</td>
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<td>2</td>
<td>ECS757</td>
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### Program Elective - III

<table>
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<tr>
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<th>Course Title</th>
<th>Category</th>
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<tr>
<td>1</td>
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<td>2</td>
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<td>Component Based Software Development</td>
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<td>Object Oriented Software Engineering</td>
<td>PE(PE)</td>
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### Program Elective - IV

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<td>1</td>
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<td>Software Project Management</td>
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<td>ECS762</td>
<td>Business Intelligence</td>
<td>PE(PE)</td>
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ECS 701: ADVANCED DATA STRUCTURES AND ALGORITHMS

Module I 12 hrs

Module II 10 hrs
Introduction to Graphs, Graph Traversal. Introduction to Trees and Tree Traversals, Binary Search Trees, AVL Trees, B-Trees, Priority Queues.

Module III 10 hrs

Module IV 10 hrs
Dynamic Programming: General Method, Matrix Chain Multiplication, Longest Common Subsequence, Reliability Design, Traveling Sales Person Problem. Back Tracking: General Method, 8 Queens Problem, Hamiltonian Cycle, Graph Coloring Problem.

Module V 10 hrs
Text Book(s)
2. Sartaj Sahni, Data Structures, Algorithms and Applications in C++, 2/e, Universities Press.

References
4. Michel T. Goddrich, Roberto Tamassia, Algorithm Design, John Weily and Sons
ECS702: ADVANCED COMPUTER NETWORKS

Module I 10 hrs

Module II 10 hrs
Direct Link Networks - Reliable Transmission - Stop-and-Wait, Sliding Window, Concurrent Logical Channels; Ethernet (802.3) - Physical Properties, Access Protocol, Experience with Ethernet; Rings - Token Ring Media Access Control, Token Ring Maintenance, FDDI, Resilient Packet Ring (802.17); Wireless - Bluetooth (802.15.1), Wi-Fi (802.11), WiMAX (802.16), Cell Phone Technologies; Sensor Networks; Packet Switching - Switching and Forwarding, Datagrams, Virtual Circuit Switching, Source Routing; Bridges and LAN Switches - Learning Bridges, Spanning Tree Algorithm, Broadcast and Multicast, Limitations of Bridges.

Module III 10 hrs
Internetworking - Simple Internetworking (IP) - What Is an Internetwork? Service Model, Global Addresses, Datagram Forwarding in IP, Address Translation (ARP), Host Configuration (DHCP), Error Reporting (ICMP), Virtual Networks and Tunnels; Routing - Network as a Graph, Distance Vector (RIP), Link State (OSPF), Metrics, Routing for Mobile Hosts; Subnetting - Classless Routing (CIDR), Inter-domain Routing (BGP), Routing Areas, IP Version 6 (IPv6); Multiprotocol Label Switching - Destination-Based Forwarding, Explicit Routing, Virtual Private Networks and Tunnels; Deployment of IPv6.

Module IV 12 hrs
End-to-End Protocols - Simple Demultiplexer (UDP); Reliable Byte Stream (TCP) - End-to-End Issues, Segment Format, Connection Establishment and Termination, Sliding Window Revisited, Triggering Transmission, Adaptive Retransmission, Record Boundaries, TCP

Module V 10 hrs
Applications - Traditional Applications - Electronic Mail (SMTP, MIME, IMAP), World Wide Web (HTTP), Name Service (DNS), Network Management (SNMP); Web Services - Custom Application Protocols (WSDL, SOAP), A Generic Application Protocol (REST), Multimedia Applications, Session Control and Call Control (SDP, SIP, H.323), Resource Allocation for Multimedia Applications; Overlay Networks - Routing Overlays, Peer-to-Peer Networks (Gnutella, BitTorrent), Content Distribution Networks.

Text Book(s)
1. Larry L. Peterson, Bruce S. Davie, Computer Networks, A Systems Approach, 4/e, Morgan Kaufmann.
2. D. Bertsekas, R. Gallager, Data Networks, PHI.

References
2. J. Walrand, P. Varaiya, High Performance Communication Networks, Morgan Kaufmann
6. Darren L Spohn, Data Network Design, TMH.
Module I

Module II

Module III

Module IV
Module V 10 hrs

Text Book

References
Module I
Introduction to Data Mining: What is Data Mining, Motivating Challenges, The origins of Data Mining, Data Mining Tasks. Data: Types of Data, Data quality, Data Preprocessing, Measures of Similarity and Dissimilarity

Module II
Data Warehouse and OLAP Technology for Data Mining: What is a Data Warehouse? Multi-Dimensional Data Model, Data Warehouse Architecture, Data Warehouse Implementation, Development of Data Cube Technology, Data Warehousing to Data Mining.

Module III

Module IV
Association Analysis: Basic Concepts and Algorithms, Problem Definition, Frequent Itemset Generation, Compact Representation of Frequent Itemsets, Alternative Methods for generating Frequent Itemsets, Evaluation of Association Patterns

Module V

Text Book(s)
1. Tan, Steinbach, Vipin Kumar, Introduction to Data Mining, Pearson Education, 2006
2. Jiawei Han and Micheline Kamber, Data Mining Concepts and Techniques, Morgan Kaufman Publications.

References
1. Margaret H Dunhan, Data Mining Introductory and Advanced Topics, Pearson Education.
2. Ian H. Witten Eibe Frank, Data Mining, Morgan Kaufman Publications.
Module I 12 hrs

Module II 10 hrs
Software Requirements: Functional and non-functional requirements, User requirements, System requirements, Interface specification, the software requirements document. Requirements engineering process: Feasibility Studies, Requirements elicitation and analysis, Requirements validation, Requirements management.

Module III 10 hrs

Module IV 10 hrs
Testing Strategies: A strategic approach to software testing, test strategies for conventional software, Black-Box and White-Box testing, Validation testing, System testing, Product metrics: Software Quality, Metrics for Analysis Model, Metrics for Design Model, Metrics for source code, Metrics for testing, Metrics for maintenance.

Module V 10 hrs
Plans for testing: Snooping for information, coping with complexity through teaming, testing plan focus areas, Testing for recoverability, Planning for troubles. Preparing for the tests: Software Reuse, Developing good test programs, Data corruption, Tools, Test Execution, Testing with a
virtual computer, Simulation and Prototypes, Managing the Test, Customer’s role in testing

Text Book(s)

References
Module I

Module II

Module III

Module IV

Module V
Putnam estimation model, algorithmic models, cost estimation tools: Desirable features of requirements management tools, some requirements management tools available, rational pro, desirable features in software estimation tools, some software estimation tools.

Text Book(s)

References
2. Ian Graham, Requirements Engineering and Rapid Development, Addision-Wesley, 1998
1. Program to perform insertion, deletion and search operations on the following:

2. Develop programs to demonstrate at least 3 applications of Stacks.

3. Develop a program to demonstrate the concept of double ended queue.

4. Program to represent a graph by using Adjacency Matrix and Adjacency List representation for the given set of Vertices and Edges. Traverse it by using Breadth First Search and Depth First Search Techniques.

5. Develop a program to perform insertion, deletion and search operations on the following Trees
   a. Binary Search Tree  b. AVL Tree

6. Develop programs for
   a) Heap Sort  b) Merge Sort  c) Quick sort by taking random element as pivot  d) Selection

7. Implement the code for the following problems by using Greedy Method:
   a. Finding Minimum Cost Spanning Tree by using Kruskal's Algorithm.
   b. Single Source Shortest Path Problem.

8. Implement the code for the following problems using Dynamic Programming:
   a. Matrix Chain Multiplication Problem.
   b. String Editing.
   c. Traveling Salesman Problem

9. Implement code for the following problems by using Back-Tracking:
   a. Hamiltonian Cycle  b. 8 Queens Problem

10. Implement code for Traveling Salesperson Problem by using Least-Cost Branch-and-Bound
1. Write a program to
   a. Print the IP address of www.yahoo.com
   b. Print the URL of 205.163.22.104
   c. Print all the addresses of www.apple.com
   d. Print the IP address of the local machine
   e. Print the hostname of the local machine
2. Write a program to Identify the well known ports on a Remote System
   By trying to listen to the various well known ports by opening client
   connections. If the exception does not occur then the remote port is
   active else the remote port is inactive.
3. Given a URL, write a program to print the parts of URL.
4. Write a program to display the socket's port and IP address.
5. Write a program to send & Receive data from Datagram Packet
6. Write a program for Multicast Sniffer
7. Write a program for Multicast sender
8. Write a program for a Chat Application
   One-One: By opening socket connection and displaying what is written
   by one party to the other. Many-Many (Broadcast): Each client opens
   a socket connection to the chat server and writes to the socket.
   Whatever is written by one party can be seen by all other parties.
9. Write a program for the Data Retrieval from a Remote Database At
    the remote database a server listens for client connections. This server
    accepts SQL queries from the client, executes it on the database and
    sends the response to the client.
10. Write a program for the Mail Client POP Client: Gives the server
    name, user name and password retrieve the mails and allow
    manipulation of mail box using POP commands. SMTP Client: Gives
    the server name, send e-mail to the recipient using SMTP commands
11. Write a program for the Simulation of Telnet Provide a user interface to contact well-known ports, so that client-server interaction can be seen by the user.

12. Write a program for Simple file transfer between two systems by opening socket connection to our server on one system and sending a file from one system to another.

13. Write a program for the TFTP-Client To develop a TFTP client for file transfer. (Unix Network programming- Stevens)

14. Write a program for the HTTP-Server Develop a HTTP server to implement the following commands GET, POST, HEAD, DELETE. The server must handle multiple clients.

References
1. Java Network Programming, Harold Orielly
2. An Introduction to Computer Networking, Kenneth C. Mansfield Jr andJames Antonakos, Pearson Education Asia

Web Resource:
Problem Analysis and Project Planning
Thorough study of the problem
- Identify project scope, Objectives, infrastructure and describe requirement
analysis to each phase
Software Testing
Prepare test plan, perform
validation testing, coverage analysis, memory leaks, develop test case
hierarchy, Site check and site monitor.

Mini Project Examples:
1. Online feedback system
2. Quiz System
3. Online ticket reservation system
4. Remote computer monitoring
5. Student marks analysing system
6. Expert system to prescribe the medicines for the given symptoms
7. ATM system
8. Platform assignment system for the trains in a railway station
9. Stock maintenance

Software:
Case Tools: Rational Suite, Win runner, Empirix
Languages: C/C++/JDK 1.3, JSDK, UML
Front End: VB, VC++.
Back End: Oracle, MS-Access, SQL
1. Study of testing tools
2. Introduction to WinRunner
3. Recording test in analog and context sensitive mode
4. Synchronizing test
5. Checking GUI Objects
6. Checking Bitmap Objects
7. Creating data driven test
8. Maintaining test script
9. Project (Creating test report)
10. Developing test cases for a particular task
ECS742: INTRODUCTION TO BIG DATA ANALYTICS

Module I 10 hrs

Module II 11 hrs

Module III 11 hrs

Module IV 10 hrs

Module V 10 hrs
Data Privacy and Ethics: The Privacy Landscape, The Great Data Grab Isn't New, Preferences, Personalization, and Relationships, Rights and
Responsibility, Playing in a Global Sandbox, Conscientious and Conscious Responsibility, Privacy May Be the Wrong Focus Can Data Be Anonymized? Balancing for Counter intelligence.

Text Book(s)
1. Michael Minelli, Michele Chambers, Big Data, Big Analytics, Wiley Publications, 2013
2. Tom White, Hadoop: The Definitive Guide, 3/e, O'Reilly Publications. (MODULE -III)

References
2. Frank J. Ohlhorst, Big Data Analytics, 1/e, Wiley, 2012
Module I 9 hrs
Software Verification and Validation: Introduction, Verification, Method of Verification, Validation, Level of Validation, Principle of testing, context of testing in producing software, White Box testing, Definition, Static testing, Structural testing, Black box testing.

Module II 10 hrs
Integration Testing- Scenario Testing, Defect bash, System and acceptance testing, functional, non-functional testing, Performance testing methodology, tools & Process.

Module III 12 hrs
Regression Testing, Internationalization Testing-Introduction, Test Phases of Internationalization testing, Enabling testing, Locale Testing, Language testing, Localization testing, Ad-hoc testing- Overview, Buddy testing, Pair Testing, Exploratory Testing, Iterative testing Agile and Extreme Testing

Module IV 10 hrs
Testing Of Object-oriented systems: Introduction, Primer on object oriented software, Differences in OO testing. Usability And Accessibility Testing: what is usability testing, approach to usability, when to do usability testing, how to achieve usability, quality factors for usability, accessibility testing, tools for usability.

Module V 10 hrs
Test planning, Test Management, Test Process and reporting, Software Test Automation, Scope of Automation, Design and Architecture of automation, Process Model for Automation, Test matrices and measurement, Type of Metrics, Project Metrics, Productivity Metrics, Progress Metrics, Release Metrics

Text Book
1. Srinivasan D., Gopalswami R, Software testing, Pearson Education

References
1. M G Limaye, Software Testing, TMH.
2. Ian Sommerville, Software Engineering, Pearson Education.
Module I 10 hrs
Introduction: Agile Methods, Agile Manifesto, and Agile Modelling

Module II 10 hrs

Module III 10 hrs

Module IV 10 hrs

Module V 12 hrs

Text Book(s)
1. John hunt, Agile software construction, 1/e, Springer, 2005

References
## ECS748: CLOUD COMPUTING

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### Module I 10 hrs

### Module II 08 hrs
Cloud-Enabling Technology: Data Center Technology, Virtualization Technology, Web Technology, Multitenant Technology, Service Technology

### Module III 08 hrs

### Module IV 12 hrs

### Module V 12 hrs
Text Book

References
6. Ronald Krutz Russell Dean Vines, Cloud Security
ECS 749: INTERNET OF THINGS

Module I 10 hrs
Introduction: The Internet of Things, An Overview, the flavour of the internet of things, the internet of things, the technology of the internet of things, enchanted objects, who is making the internet of things, Design principles for connected devices: Calm and ambient technology, magic as metaphor, privacy, web thinking for connected devices, affordances.

Module II 10 hrs
Internet Principles: Internet communications, An overview (IP, TCP, the IP protocol suite (TCP/IP), UDP), IP addresses (DNS, Static IP Address assignment, dynamic IP address assignment, IPv6), MAC addresses, TCP and UDP ports, application layer protocols.

Module III 10 hrs
Prototyping: Thinking About Prototyping: Sketching, familiarity, costs versus ease of prototyping, prototypes and production, open source versus closed source, tapping into the community. Prototyping embedded devices: Electronics, embedded computing basics, developing on the arduino, raspberry pi beaglebone black, electric imp, mobile phone and tablets, plug computing, always on internet of things.

Module IV 10 hrs
Prototyping the Physical Design: Preparation, sketch, iterate and explore, non digital methods, laser cutting, 3D printing, CNC milling, repurposing/recycling. Techniques for Writing Embedded Code: Memory management, performance and battery life, libraries, debugging.

Module V 10 hrs
Prototype to Reality: Business Models, A short history of business models, the business model canvas, models, funding an internet of things startup, lean startups. Moving to manufacture: Designing kits, designing printed circuit boards, manufacturing printed circuit boards, mass producing the case and other fixtures, certification, costs, scaling up software.
Text Book
1. Adrian McEwen, Hakim Cassimally, Designing the Internet of Things, 1/e, Wiley publication, 2013

References
1. Charalampos Doukas, Building Internet of Things with the Arduino, Create space, 2002.
ECS751: SERVICE ORIENTED ARCHITECTURE

<table>
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<tr>
<th>Module</th>
<th>Duration</th>
<th>Details</th>
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<tr>
<td>I</td>
<td>8 hrs</td>
<td>Fundamentals of SOA: Introduction, defining SOA, evolution of SOA, service oriented enterprise, comparing SOA to client server and distributed internet architectures, basic SOA architecture concepts, key service characteristics, technical benefits, business benefits.</td>
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<tr>
<td>II</td>
<td>10 hrs</td>
<td>Combining SOA and Web Services: Web services, service descriptions, messaging with SOAP, message exchange patterns, web service platform, service contract, service level data model, service discovery, service level security, service level interaction patterns, atomic and composite services, service enabling legacy system, enterprise service bus pattern.</td>
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<td>III</td>
<td>10 hrs</td>
<td>Multi Channel Access and Web Services Composition: SOA for multi-channel access, business benefits, tiers, business process management, web service composition, BPEL, RESTFUL services, comparison of BPEL and RESTFUL services.</td>
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<tr>
<td>IV</td>
<td>10 hrs</td>
<td>Java Web Services: SOA support in J2EE, Java API for XML, based web services (JAX, WS), Java architecture for XML binding (JAXB), Java API for XML registries (JAXR), Java API for XML based RPC (JAX, RPC), web services interoperability, SOA support in .NET, ASP.NET web services, case studies, web services enhancements (WSE).</td>
</tr>
<tr>
<td>V</td>
<td>8 hrs</td>
<td>Web Services Security and Transaction: Meta datamanagement, advanced messaging, addressing, reliable messaging, policies, WS- policy, security, WS- security, notification and eventing, transaction management.</td>
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**Text Book(s)**

**References**
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**Module I 10 hrs**

**Module II 10 hrs**

**Module III 10 hrs**

**Module IV 12 hrs**

**Module V 10 hrs**
Text Book

References
Module I 10 hrs

Module II 10 hrs

Module III 12 hrs
Using styles and Patterns: Selection of Stakeholders, Classes of Stakeholders, Proxy Stakeholders, Stakeholder Groups, Stakeholder Responsibilities, Types of Models, Modeling Languages, Guidelines for Creating Effective Models, Agile Modeling Techniques.

Module IV 10 hrs
View Point Catalog: Functional Viewpoint, Information Viewpoint, Concurrency Viewpoint, Development Viewpoint, Deployment Viewpoint, Operational Viewpoint

Module V 8 hrs
Perspective Catalog: Security Perspective, Performance and Scalability Perspective, Evolution Perspective
Text Book

References
Module I 8 hrs

Module II 9 hrs

Module III 12 hrs

Module IV 10 hrs

Module V 8 hrs
Maintenance: Maintenance process - System documentation - program evolution dynamics - Maintenance costs - Maintainability measurement
Text Book(s)

References
ECS757: SOFTWARE METRICS

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Module I 8 hrs
Fundamentals of measurement - Measurements in Software Engineering
- Scope of Software metrics, Measurements theory - Goal based framework
- Software Measurement validation.

Module II 9 hrs
Empirical investigation, Planning experiments, Software metrics data
Collection, Analysis methods, statistical methods.

Module III 10 hrs
Measurement of internet product attributes - size and structure - External
product attributes - measurement of quality.

Module IV 9 hrs
Software quality metrics - Product quality - Process quality - metrics for
software maintenance - Case studies of Metrics program - Motorola
- Hp and IBM.

Module V 9 hrs
Management Metrics: Quality management models - Rayleigh Model -
Problem Tracking report (PTR) model - Reliability growth model - model
evaluation - Orthogonal classification.

Text Book(s)
1. Norman E.Fenton, Shari Lawrence P fleeger ,Software metrics, International
2. C Ravindranath Pandian, Software Metrics: A guide to planning,analysis and
   application, auberbach publication, 2003

References
1. Stephen H.Kan, Metric and models in software quality engineering, 2/e, AddisonWesley Professional.
3. Robert B.Grady, Practical Software Metrics for Project Management and
   Process Improvement, Prentice Hall
Module I
Introduction, The problem, Software assurance and software security, Threats to software security, Sources of software insecurity, the benefits of detecting software security defects early, managing secure software development. Defining properties of secure software

Module II
Requirements Engineering for Secure Software: The SQUARE process model: Identifying security requirements using the security quality requirements engineering (SQUARE) method, SQUARE sample outputs, Requirements elicitation, Requirements prioritization.

Module III

Module IV
Considerations for Secure Coding and Testing, Introduction, Code analysis, Coding practices, Software security testing, Security testing considerations throughout the SD.

Module V
Security metrics: Defining security metrics, Diagnosing problems and measuring technical security.
Text Book(s)

References
<table>
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<tr>
<td>Module III</td>
<td>9 hrs</td>
<td>Software Quality Infrastructure Components: Procedures and Work Instructions, Supporting Quality Devices, Staff Training, Instructing and Certification - Preventive and Corrective Actions, Configuration Management, Documentation and Quality Records Controls.</td>
</tr>
</tbody>
</table>
Text Book(s)

Reference
1. John W. Horch, Practical guide to software quality management, 2/e, Artech house
Module I 10 hrs

Module II 10 hrs

Module III 10 hrs

Module IV 12 hrs

Module V 10 hrs
Text Book(s)

References
3. S.A. Kelkar, Software Project Management: A Concise Study, PHI.
4. Hughes Cotterell, Software Project Management, 2/e, TMH.
5. Andrew Stellman and Jennifer Greene, Applied Software Product Management, O'Reilly Media, 2006
Module I 9 hrs
Introduction to Business intelligence: Effective and timely decisions, Data, information and knowledge, The role of mathematical models, Business intelligence architectures, Cycle of a business intelligence analysis, Enabling factors in business intelligence projects, Development of a business intelligence system, Ethics and business intelligence.

Module II 10 hrs
Decision support systems: Definition of system, Representation of the decision-making process, Rationality and problem solving, the decision-making process, Types of decisions, Approaches to the decision-making process, Evolution of information systems, Definition of decision support system, Development of a decision support system

Module III 9 hrs
Mathematical models for decision making: Structure of mathematical models, Development of a model, Classes of models. Data exploration: Univariate analysis, Graphical analysis of categorical attributes, Graphical analysis of numerical attributes, Measures of central tendency for numerical attributes, Measures of dispersion for numerical attributes, Measures of relative location for numerical attributes, Identification of outliers for numerical attributes, Measures of heterogeneity for categorical attributes, Analysis of the empirical density, Bivariate analysis, Graphical analysis, Measures of correlation for numerical attributes, Contingency tables for categorical attributes, Multivariate analysis, Graphical analysis, Measures of correlation for numerical attributes. Regression: Structure of regression models, Simple linear regression, Calculating the regression line, Multiple linear regression, Calculating the regression coefficients, Assumptions on the residuals, Treatment of categorical predictive attributes, Ridge regression, Generalized linear regression, Validation of regression models, Normality and independence of the residuals, Significance of the coefficients, Analysis of variance, Coefficient of determination, Coefficient of linear correlation, Multi-collinearity of the independent variables, Confidence and prediction limits.
Module IV
9 hrs
Time series Data in BI: Definition of time series, Index numbers, Evaluating time series models Distortion measures Dispersion measures, Tracking signal, Analysis of the components of time series Moving average, Decomposition of a time series, Exponential smoothing models, Simple exponential smoothing, Exponential smoothing with trend adjustment, Exponential smoothing with trend and seasonality, Simple adaptive exponential smoothing, Exponential smoothing with damped trend, Initial values for exponential smoothing models, Removal of trend and seasonality, Autoregressive models, Moving average models, Autoregressive moving average models, Autoregressive integrated moving average models, Identification of autoregressive models, Combination of predictive models, the forecasting process, Characteristics of the forecasting process, Selection of a forecasting method.

Module V
9 hrs
Business intelligence applications: Marketing models - Relational marketing, Motivations and objectives, An environment for relational marketing analysis, Lifetime value, The effect of latency in predictive models, Acquisition, Retention, Cross-selling and up-selling, Market basket analysis, Web mining, Sales force management, Decision processes in sales force management, Models for sales force management, Response functions, Sales territory design, Calls and product presentations planning, Business case studies, Retention in telecommunications, Acquisition in the automotive industry, Cross-selling in the retail industry.

Text Book
1. Carlo Vercellis, Business Intelligence, John Wiley & sons, 2009

References
EID762: DESIGN PATTERNS

L   T   P   C
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Module I 10 hrs
Introduction: History and Origin of Patterns, Design Patterns in MVC,
Describing Design Patterns, How Design Patterns Solve Design Problems,
Selecting a Design Pattern, Using a Design Pattern

Module II 10 hrs
Design Patterns-1: Creational, Abstract Factory-Builder, Factory Method,
Prototype-Singleton

Module III 10 hrs
Design Patterns-2: Structural Patterns: Adapter, Bridge, Composite
Decorator, Façade, Flyweight, Proxy

Module IV 10 hrs
Design Patterns-3: Behavioral Patterns, Chain of Responsibility,
Command-Interpreter, Iterator-Mediator, Memento, Observer, State,
Strategy, Template Method, Visitor

Module V 12 hrs
Advanced Patterns: Pattern Catalogs and Writing Patterns, Patterns and
Case Study: Designing a Document Editor Anti-Patterns - Case Studies
in UML and CORBA, Pattern Community.

Text Book(s)
1. Erich Gamma, Richard Helm, Ralph Johnson, John Vlissides, Design patterns:
   Elements of Reusable object-oriented software, Addison-Wesley, 1995.

References
1. Craig Larman, Applying UML and Patterns: An Introduction to object-oriented
2. Thomas J Mowbray and Raphael Malveau, CORBA and Design Patterns ,
3. William J Brown, Anti-Patterns: Refactoring Software, Architectures and
EID766: INFORMATION SECURITY AND CYBER LAWS

Module I 10 hrs

Module II 10 hrs
Symmetric key Ciphers: Block Cipher principles & Algorithms (DES, AES, Blowfish), Differential and Linear Cryptanalysis, Block cipher modes of operation, Stream ciphers, RC4, Location and placement of encryption function.

Module III 10 hrs

Module IV 10 hrs
Private ordering solutions, Regulation and Jurisdiction for global Cyber security, Copy Rights source of risks, Pirates, Internet Infringement, Fair Use, postings, criminal liability, First Amendments, Data Losing.

Module V 10 hrs

Text Book(s)

References
Module I 10 hrs
Introduction to PERL and Scripting Scripts and Programs, Origin of Scripting, Scripting Today, Characteristics of Scripting Languages, Web Scripting, and the universe of Scripting Languages. PERL- Names and Values, Variables, Scalar Expressions, Control Structures, arrays, list, hashes, strings, pattern and regular expressions, subroutines, advance perl- finer points of looping, pack and unpack, filesystem, eval, data structures, packages, modules, objects, interfacing to the operating system, Creating Internet ware applications, Dirty Hands Internet Programming, security Issues.

Module II 10 hrs
PHP Basics- Features, Embedding PHP Code in your Web pages, Outputting the data to the browser, Datatypes, Variables, Constants, expressions, string interpolation, control structures, Function, Creating a Function, Function Libraries, Arrays, strings and Regular Expressions.

Module III 9 hrs
Advanced PHP Programming- Php and Web Forms, Files, PHP Authentication and Methodologies -Hard Coded, File Based, Database Based, IP Based, Login Administration, Uploading Files with PHP, Sending Email using PHP, PHP Encryption Functions, the Mcrypt package, Building Web sites for the World - Translating Websites- Updating Web sites Scripts, Creating the Localization Repository, Translating Files, text, Generate Binary Files, Set the desired language within your scripts, Localizing Dates, Numbers and Times.

Module IV 10 hrs
TCL - Tk- TCL Structure, syntax, Variables and Data in TCL, Control Flow, Data Structures, input/output, procedures, strings, patterns, files, Advance TCL- eval, source, exec and up level commands, Name spaces, trapping errors, event driven programs, making applications internet aware, Nuts and Bolts Internet Programming, Security Issues, C Interface. Tk-Visual Tool Kits, Fundamental Concepts of Tk, Tk by example, Events and Binding, Perl-Tk.
Module V  
10 hrs

Text Book(s)
3. Jason Gilmore, Beginning PHP and MySQL, 3/e, Apress Publications (Dreamtech)

References
1. J.Lee, B.Ware, Open Source Web Development with LAMP using Linux, Apache, MySQL, Perl and PHP, (Addison Wesley) Pearson Education.
2. M.Lutz, Programming Python, SPD.
4. Bayross and S.Shah, PHP 5.1, I. The X Team, SPD.
5. Chun, Core Python Programming, Pearson Education.
Module -I
Network, Relations and Structure: The Social Networks Perspective, Network Data, Boundary Specification and Sampling, Types of Networks, Network Data, Measurement and Collection

Module -II
Mathematical Representations of Social Networks: Graph Theoretic Notation, Sociometric Notation, Algebraic Notation, Graphs, Directed Graphs, Signed Graphs, Signed Directed Graphs, Valued Graphs, Valued Directed Graphs, Multi Graphs, Hyper Graphs, Relations, Matrices, Properties

Module III
Structural and Locational Properties: Actor Centrality, Degree Centrality, Closeness Centrality, Betweenness Centrality, Information Centrality, Structural Balance, Clusterability, Generalizations of Clusterability, Transitivity

Module IV
Roles and Positions: Background, Structural Equivalence, Automorphic and Isomorphic Equivalence, Regular Equivalence, Types of Ties, Local Role Equivalence, Ego Algebras

Module V
Dyadic and Triadic Methods, The Dyad Census, The Example and Its Dyad Census, An Index for Mutuality, Simple Distributions on Digraphs, Conditional Uniform Distributions, The Triad Census, The Example and Its Triad Census, Mean and Variance of a Triad Census
Text Book(s)

References
2. David Knoke and Song Yang, Social Network Analysis, SAGE Publications, 2ndEdn.
3. Robert A. Hanneman and Mark Riddle, Introduction to Social Networks.