GANDHI INSTITUTE OF TECHNOLOGY AND MANAGEMENT (GITAM)
(Deemed to be University) (Estd. u/s 3 of the UGC Act, 1956)
VISAKHAPATNAM HYDERABAD BENGALURU

NAAC accredited with ‘A+’ Grade

REGULATIONS & SYLLABUS OF
M.Tech. in
Computer Science & Technology
(w.e.f 2017-18 admitted batch)

GITAM Committed to Excellence
M.Tech.in Computer Science & Technology
REGULATIONS
(w.e.f. 2017-18 admitted batch)

1. ADMISSION
1.1 Admission into M.Tech. in CST 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 any branch of engineering 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 CST 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>
<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>
<tbody>
<tr>
<td>1</td>
<td>Theory</td>
<td>40</td>
<td>Continuous</td>
<td>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. ii) Ten (10) marks for Quizzes, Assignments and Presentations. Sixty (60) marks for Semester-end examinations</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Evaluation</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>60</td>
<td>Semester-end</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Examination</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Total 100</td>
</tr>
<tr>
<td>2</td>
<td>Practicals</td>
<td>100</td>
<td>Continuous</td>
<td>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. 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.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Evaluation</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Project work (III Semester)</td>
<td>100</td>
<td>Continuous</td>
<td>i) Forty (40) marks for periodic evaluation on originality, innovation, sincerity and progress of the work, assessed by the Project Supervisor. 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</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Evaluation</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Project work (IV Semester)</td>
<td>50</td>
<td>Continuous</td>
<td>i) Twenty (20) marks for Periodic evaluation on originality innovation, sincerity and progress of the work, assessed by the Project Supervisor. ii) Fifteen (15) marks for mid-term evaluation for defending the Project, before a panel of examiners*</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Evaluation</td>
<td></td>
</tr>
</tbody>
</table>
iii) Fifteen (15) marks for interim Report presentation and Viva-voce. Fifty (50) marks for final Report presentation and Viva-voce assessed by external examiners.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th>Semester-end Examination</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>100</td>
<td>Continuous Evaluation</td>
<td>100</td>
</tr>
</tbody>
</table>

5 Technical Seminar

6 Comprehensive Viva-voce (II Semester) 100 Continuous Evaluation

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.

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

9. **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.

10. **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.

11. **BETTERMENT OF GRADES**

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 2: Grades & Grade Points

<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>
</tr>
<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:

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

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>
</tr>
</thead>
<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 Computer Science & Technology (CST)
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>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>ECS701</td>
<td>Advanced Data Structures and Algorithms</td>
<td>CE</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>2</td>
<td>ECS703</td>
<td>Advanced Operating Systems</td>
<td>CE</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>3</td>
<td>ECS705</td>
<td>Data Mining and Data Warehousing</td>
<td>CE</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>4</td>
<td>ECS7XX</td>
<td>Program Elective-I</td>
<td>PE</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>5</td>
<td>ECS7XX</td>
<td>Program Elective-II</td>
<td>PE</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>6</td>
<td>EID7XX</td>
<td>Interdisciplinary Elective-I</td>
<td>IDE</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>7</td>
<td>ECS721</td>
<td>Advanced Data Structures and Algorithms Lab</td>
<td>CE</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>8</td>
<td>ECS723</td>
<td>Data Analytics Lab</td>
<td>CE</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>2</td>
</tr>
</tbody>
</table>

### Semester II

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Course Code</th>
<th>Course Title</th>
<th>Category</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>ECS702</td>
<td>Advanced Computer Networks</td>
<td>CE</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>2</td>
<td>ECS704</td>
<td>Real Time Systems</td>
<td>CE</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>3</td>
<td>ECS706</td>
<td>Cryptography and Network Security</td>
<td>CE</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>4</td>
<td>ECS7XX</td>
<td>Program Elective -III</td>
<td>PE</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>5</td>
<td>ECS7XX</td>
<td>Program Elective -IV</td>
<td>PE</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>6</td>
<td>ECS7XX</td>
<td>Interdisciplinary Elective-II</td>
<td>IDE</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>7</td>
<td>ECS722</td>
<td>Advanced Computer Networks Lab</td>
<td>CE</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>8</td>
<td>ECS724</td>
<td>Programming with Scripting Languages: Python and R</td>
<td>CE</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>9</td>
<td>ECS792</td>
<td>Technical Seminar</td>
<td>CE</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>2</td>
</tr>
</tbody>
</table>
## Semester III

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Course Code</th>
<th>Course Title</th>
<th>Category</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>ECS891</td>
<td>Project Work-I</td>
<td>PW</td>
<td></td>
<td></td>
<td></td>
<td>8</td>
</tr>
<tr>
<td>2</td>
<td>ECS893</td>
<td>Comprehensive Viva Voce</td>
<td>CE</td>
<td></td>
<td></td>
<td></td>
<td>2</td>
</tr>
</tbody>
</table>

## Semester IV

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Course Code</th>
<th>Course Title</th>
<th>Category</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>ECS892</td>
<td>Project work-II</td>
<td>PW</td>
<td></td>
<td></td>
<td></td>
<td>14</td>
</tr>
</tbody>
</table>

## Number of Credits:

<table>
<thead>
<tr>
<th>Semester</th>
<th>I</th>
<th>II</th>
<th>III</th>
<th>IV</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Credits</td>
<td>25</td>
<td>27</td>
<td>10</td>
<td>14</td>
<td>76</td>
</tr>
</tbody>
</table>

## Interdisciplinary Elective - I

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Course Code</th>
<th>Course Title</th>
<th>Category</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>EID758</td>
<td>Statistics for Data Science</td>
<td>IDE</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>EID759</td>
<td>Open Source Software Development</td>
<td>IDE</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>3</td>
<td>EID760</td>
<td>Programming with R</td>
<td>IDE</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
</tbody>
</table>

## Interdisciplinary Elective - II

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Course Code</th>
<th>Course Title</th>
<th>Category</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>ECS762</td>
<td>Business Intelligence</td>
<td>IDE</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>EID762</td>
<td>Design Patterns</td>
<td>IDE</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>3</td>
<td>EID763</td>
<td>Multivariate Techniques for Data Analysis</td>
<td>IDE</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
</tbody>
</table>
### PROGRAMME ELECTIVES

#### Programme Elective-I

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Course Code</th>
<th>Course Title</th>
<th>Category</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>ECS741</td>
<td>Information Retrieval</td>
<td>PE</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>ECS743</td>
<td>Introduction to Embedded Systems</td>
<td>PE</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>3</td>
<td>ECS745</td>
<td>Parallel and Distributed Algorithms</td>
<td>PE</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
</tbody>
</table>

#### Programme Elective-II

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Course Code</th>
<th>Course Title</th>
<th>Category</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>ECS747</td>
<td>Agile Software Development</td>
<td>PE</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>ECS749</td>
<td>Internet of Things</td>
<td>PE</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>3</td>
<td>ECS751</td>
<td>Service Oriented Architecture</td>
<td>PE</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
</tbody>
</table>

#### Programme Elective-III

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Course Code</th>
<th>Course Title</th>
<th>Category</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>ECS742</td>
<td>Introduction to Big Data Analytics</td>
<td>PE</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>ECS744</td>
<td>Software Verification and Validation</td>
<td>PE</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>3</td>
<td>ECS746</td>
<td>Natural language Processing</td>
<td>PE</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
</tbody>
</table>

#### Programme Elective-IV

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Course Code</th>
<th>Course Title</th>
<th>Category</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>ECS748</td>
<td>Cloud Computing</td>
<td>PE</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>ECS750</td>
<td>Game Programming</td>
<td>PE</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>3</td>
<td>ECS752</td>
<td>Theory and Applications of Ontologies</td>
<td>PE</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
</tbody>
</table>
Module I

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

Module III

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

References

Web Resources
http://www.personal.kent.edu/~rmuhamma/Algorithms/algorithm.html
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,

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  

10hrs


Text Book


References

Module I
10 hrs
Introduction: what is real time, applications of real-time systems, a basic model of a real-time system, characteristics of real-time systems, safety and reliability, types of real-time tasks

Module II
10 hrs
Real-time task scheduling, types of real-time tasks and their characteristics, task scheduling, clock-driven scheduling, hybrid schedulers, event-driven scheduling, earliest deadline first (edf) scheduling

Module III
11 hrs
Handling resource sharing and dependencies among Real-time tasks: resource sharing among real-time tasks, priority inversion, priority inheritance protocol (pip), highest locker protocol (hlp), priority ceiling protocol (pcp), different types of priority inversions under pcp, important features of pcp

Module IV
11 hrs
Scheduling real-time tasks in Multiprocessor and Distributed Systems: multiprocessor task allocation, dynamic allocation of tasks, real-time communication: basic concepts, real-time communication in a Lan, soft real-time communication in a Lan, hard real-time communication in a Lan

Module V
10 hrs
Real-time Databases: basic database concepts, real-time databases, characteristics of temporal data, concurrency control in real-time databases, commercial real time operating systems: Time Services, features of RTOS, UNIX as a RTOS, windows as a RTOS

Text Book(s)

Reference
ECS705: DATA MINING AND DATA WAREHOUSING

L T P C
4 0 0 4

Module I

10 hrs
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 11 hrs 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

11 hrs

Module IV

11 hrs
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

09 hrs

Text Book(s)
1. Tan, Steinbach, Vipin Kumar, Introduction to Data Mining, Pearson Education, 2006
2. Jiawei Han, 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
10 hrs

Module II
11 hrs
Block Ciphers : Block Ciphers and the Data Encryption Standard: DES Algorithm, Differential and linear cryptanalysis, Triple DES. Block cipher design principles, Block cipher modes of operation, Advanced Encryption Standard, RC6

Module III
11 hrs

Module IV
10 hrs

Module V
10 hrs
Text Book

References
2. Behrouz A. Forouzan, Cryptography and Network Security, TMH
3. Atul Kahate, Cryptography and Network Security, 2/e, TMH
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 DatagramPacket

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 the 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
   and James Antonakos Pearson Education Asia

Web Resource:
Part-I: Fundamentals of Big Data Analysis Environment

Distributed and Parallel System Architecture and Configuration: Single and Multi node Hadoop cluster setup

MapReduce on Word Counting NoSQL

Machine learning and Reasoning with Mahout

Part II: Big data analysis for security

Deny of Service Attack Analysis

Tutorials and Hands-on Practice labs are available at:

https://sites.google.com/site/bigdatansalabware/

References:

Email scam

Security analysis
http://bigdatablog.emc.com/2013/01/30/rsa-security-analytics/
Reasoning Reference:

http://machinelearningbigdata.blogspot.com/
http://www.bigdatatraining.in/machine-learning-training/
http://www.slideshare.net/Cataldo/apache-mahout-tutorial-recommendation-2013

**Big data sets:**
http://www.ll.mit.edu/mission/communications/cyber/CSTcorpora/ideval/data/
1. Write a python script demonstrate all arithmetic operations.

2. Create a script which uses the function to read a string from the keyboard. Attempt to convert the string to a float using float(x) and also to an integer using int(x). Print out the resulting float and integer.

3. Write a python script, Convert the string to a list of words using the string split method and Sort the list into reverse alphabetical order using some of the list methods

4. Write a function that takes two integer arguments and prints out whether the first is divisible by the second.

5. Write a function which takes a string argument and returns a string which is the same as the argument except only the first occurrence of each letter is present. (Hint: apple ? aple and Mississippi ? Misp)

6. Write a function takes two lists of numbers of the same length, and returns a new list containing the sums of the corresponding elements of each.

7. Write a python script to demonstrate dictionary methods?

8. Write R Script to demonstrate Vector operations

9. Write R Script to demonstrate control statements on data frames

10. Write R Script to demonstrate Math functions

11. Write R Script to read data from file and write total number of characters into another file
Module I  
10 hrs  

Module II  
10 hrs  

Module III  
12 hrs  
Document & Term Clustering & User Search Techniques, Introduction, Thesaurus generation, Item clustering, Hierarchy of clusters. Search statements and binding, Similarity measures and ranking, Relevance feedback, Selective dissemination of information search, Weighted searches of Boolean systems, Searching the Internet and hypertext.

Module IV  
10 hrs  
Information Visualization & Text Search Algorithms, Introduction, Cognition and perception, Information visualization technologies. Introduction, Software text search algorithms, Hardware text search systems.

Module V  
10 hrs  
Information System Evaluation & Multimedia Information Retrieval, Introduction, Measures used in system evaluation, Measurement example - TREC results. Models and Languages: Data Modelling. Query Languages, Indexing and Searching
Text Book(s)

References
3. C. J. van Rijsbergen, Information Retrieval, (PDF Version)
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


Module II
10 hrs

Module III
9 hrs
Introduction to Real - Time Operating Systems: Tasks and Task States, Tasks and Data, Semaphores, and Shared Data; Message Queues, Mailboxes and Pipes, Timer Functions, Events, Memory Management, Interrupt Routines in an RTOS Environment

Module IV
10 hrs

Module V
9 hrs
Introduction to advanced architectures: ARM and SHARC, Processor and memory organization and Instruction level parallelism; Networked embedded systems: Bus protocols, I2C bus and CAN bus; Internet-Enabled Systems, Design Example-Elevator Controller.
Text Book(s)
1. Computers and Components, Wayne Wolf, Elseveir Publisher.
3. An Embedded Software Primer, David E. Simon, Pearson Education.

References
1. Embedding system building blocks, Labrosse, via CMP publishers.
2. Embedded Systems, Raj Kamal, TMH.
3. Micro Controllers, Ajay V Deshmukhi, TMH.
5. Microcontrollers, Raj Kamal, Pearson Education.
Module I  
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  
Integration Testing - Scenario Testing, Defect bash, System and acceptance testing, functional, non-functional testing, Performance testing methodology, tools & Process.

Module III  
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  
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  
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

Module II
Parallel Algorithm Design: The task/channel model, foster's design methodology: partitioning, communication, agglomeration, mapping, finding the maximum: partitioning, communication, agglomeration, mapping, analysis, adding data input: communication, analysis.

Module III
Introduction to distributed systems, what is distributed systems? hardware concepts, software concepts, design issues, communication in distributed systems layered protocols, ATM networks, the client-server model, remote procedure call, group communication.

Module IV
Process and processors in distributed system threads, system models, processors allocation, scheduling in distributed systems, fault tolerance, real time distributed system.

Module V
Distributed file systems, distributed file system design, distributed file system implementation, trends in distributed file system, distributed shared memory.
Text Book(s)

References
Module I

Module II
Morphology and Parts-of-Speech: Phonology, Computational Phonology, Words and Morphemes, Segmentation, Categorization and Lemmatisation, Word Form Recognition, Valency Agreement, Regular Expressions, Finite State Automata, Morphology, Morphological issues of Indian Languages, Transliteration.

Module III

Module IV

Module V
Text Book(s)

References
ECS747: AGILE SOFTWARE DEVELOPMENT

Module I
Introduction: Agile Methods, Agile Manifesto, and Agile Modelling

Module II

Module III

Module IV

Module V

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

References
Module I 10 hrs
Understanding Cloud Computing: Cloud Origins and Influences, Basic Concepts and Terminology, Goals and Benefits, Risks and Challenges

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
# ECS749: INTERNET OF THINGS

<table>
<thead>
<tr>
<th>Module I</th>
<th>10 hrs</th>
</tr>
</thead>
<tbody>
<tr>
<td>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.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Module II</th>
<th>10 hrs</th>
</tr>
</thead>
<tbody>
<tr>
<td>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.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Module III</th>
<th>10 hrs</th>
</tr>
</thead>
<tbody>
<tr>
<td>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.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Module IV</th>
<th>10 hrs</th>
</tr>
</thead>
<tbody>
<tr>
<td>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.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Module V</th>
<th>10 hrs</th>
</tr>
</thead>
<tbody>
<tr>
<td>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.</td>
<td></td>
</tr>
</tbody>
</table>
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.
Module I
10 hrs
Introduction to Game Programming, suitable languages for developing games and reasons, Animation framework, worms in windows and applets, full-screen worms.

Module II
9 hrs
Introduction to java imaging, image loading, visual effects, and animation. Loading and playing sounds, audio effects and synthesis, and Sprites.

Module III
10 hrs
Side-Scroller, Isometric Tile Game, 3-D check board and checkers, 3-D, loading and managing external models, lathe to make shapes, 3D- Sprites

Module IV
10 hrs
Networking basics, Network chat, networked two-person game, networked virtual environment.

Module V
9 hrs
Game production and project management, Game Industry roles and economics, the publisher-developer relationship, marketing.

Text Book(s)
1. Killer Game programming in Java by Andrew Davison, O'Reilly Publishers
2. Introduction to Game Development, by Steve Rabin, CENGAGE Technology

References
1. David Brackeen, Developing Games in Java
2. David M Bourg, Glenn Seemann AI for Game Developers, O'Reilly Publishers.

Web Resource
ECS751: SERVICE ORIENTED ARCHITECTURE

Module I  8 hrs
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.

Module II  10 hrs
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.

Module III  10 hrs
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.

Module IV  10 hrs
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).

Module V  8 hrs
Web Services Security and Transaction: Meta datamanagement, advanced messaging, addressing, reliable messaging, policies, WS- policy, security, WS- security, notification and eventing, transaction management.
Text Book(s)

References
Module I

Semi-structured Data and the XML framework: Need for semi-structured data, Relevance as a data model and in data integration, the XML framework, Document Type Definitions (DTDs), XML Schema, Storing and querying XML data, XPATH, XSLT, XQUERY languages. Limitations of the XML framework.

Module II

Theory behind Ontologies: Description Logics (DLs), the attributive language with complement (ALC), ALC with Negation (ALCN), Specific DLs - SROIQ, and SHIQ; Semantics of Description Logics; Inference in DLs, the tableaux algorithms.

Module III

Semantic Models and Knowledge Bases: Elements of Semantic Web Technology - Resource Description Framework (RDF); Ontology Frameworks - RDF Schema, Ontology Web Language (OWL); Ontology tools - Protégé; Query languages for semantic data - SPARQL language; Principles of Linked Data, Linked Data Cloud; Triple stores and indexing RDF data.

Module IV

Applications of Ontologies: Semantic search, ontologies for information integration, ontologies for question answering systems.

Module V

Programming assignments: Developing DTDs, Using XPATH 2.0, XQUERY and XSLT; Developing ontologies using OWL and Protégé, Querying using SPARQL, OWLAPI etc
Text Book(s)

Reference
ECS762: BUSINESS INTELLIGENCE

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
1. Elizabeth Vitt, Michael Luckevich, Business Intelligence: Making Better Decision, Microsoft Press, 2002
Module I

Introduction to probability, random experiment, event- definition, axiomatic approach to probability, addition law, Compound Law of probabilities, conditional probability, Bayes theorem - applications, concept of random variable (r.v) discrete and continuous random variables- examples, probability functions: mass function, density function and distribution functions, expected value of r.v, concept of moments and central moments- expected value of random variable: E(X), Variance of random variable, some popular distributions of random variables- Bernoulli, binomial distribution, Poisson distribution, Uniform, normal (Gaussian) distribution, exponential distribution, central limit theorem - applications.

Module II

Sampling: sample, populations, statistic, parameter, sampling distribution and standard error. Testing of hypothesis: Null hypothesis, critical regions, level of significance and power of the test. Large sample tests (Z-test): based on means, standard deviations, proportions, interval estimates, Small sample tests: t-test (single mean, two means paired t-test, test for population correlation coefficient ), ?2 - test for variance, goodness of fit, ?2 - test for attributes, Test of equality of variances (F-test), Analysis of variance (ANOVA), Post hoc tests.

Module III

Correlation, linear regression - simple linear regression, multiple linear regression- estimating the regression coefficients, assessing the accuracy of the coefficient estimates and model, other considerations in the regression model- qualitative predictors, potential problems. Logistic regression- the logistic model, estimating the regression coefficients, multiple logistic regression, logistic regression for >2 response classes, linear discriminant analysis- using bayes' theorem for classification, linear discriminant analysis for p=1, linear discriminant analysis for p>1, quadratic discriminant analysis, a comparison of classification methods.
Module IV

8 hrs

Resampling methods- cross validation, the validation set approach, leave one out cross validation, k-fold cross validation, bias variance trade off fork fold cross validation, cross validation on classification problems, the bootstrap.

Module V

10 hrs

Linear model selection and regularization- subset selection- best subset selection, stepwise selection, choosing the optimal model, shrinkage methods- ridge regression, the lasso, selecting the tuning parameter, dimension reduction methods- principal components regression, partial least squares, considerations in high dimensions- high-dimensional data, regression in high dimensions, interpreting results in high dimensions.

Text Book(s)

3. Gareth James, Daniela Witten, Trevor Hastie Robert Tibshirani, An Introduction to Statistical Learning with Applications in R, Springer

References

1. Joel Grus, Data Science from Scratch First Principles with Python, O'Reilly.
EID759: OPEN SOURCE SOFTWARE DEVELOPMENT

Module I 8 hrs
Introduction: Overview of open source software: what is software source code? the open source definition, need, applications, examples of OSD, compliant licenses, examples of open source software products, the open source software development process.
A History of open source software: The Berkeley software distribution, tex, the free software foundation, GNU unix, linux, apache.

Module II 8 hrs
Python Programming, Introduction: Features, using the python interpreter, an introduction to python, control statements, functions, input and output, reading and writing files.

Module III 8 hrs
Python Programming: Data structures, Modules, standard Modules, packages, errors and exceptions, handling exceptions, user defined exceptions.

Module IV 8 hrs
Python Programming: Classes, inheritance, generators, standard library (part I), command line arguments, string pattern matching, internet access, data compression.

Module V 8 hrs
Python Programming, Standard Library (Part II): Output formatting, templating, working with binary data record layouts, multithreading, logging

Text Book(s)

Reference
1. Mark Pilgrim, Dive into Python, http://www.diveintopython.net/

Web Resource
1. Python Tutorial: http://docs.python.org/tutorial/
EID760: PROGRAMMING WITH R

L T P C
3 0 0 3

Module I 10 hrs
Introduction to R programming, Introduction to Functions, Preview of Important R Data Structures, Vectors, Recycling, Common Vector Operations, Vectorized Operations, Filtering Matrices and Arrays

Module II 9 hrs
Lists, Creating Lists, General List Operations Accessing List Components and Values, Applying Functions to Lists, Recursive Lists, Data Frames, Creating Data Frames, Other Matrix-Like Operations, Merging Data Frames, Applying Functions to Data Frames, Factors and Tables, Factors and Levels, Common Functions Used with Factors, Working with Table, Table-Related Functions

Module III 10 hrs

Module IV 9 hrs
Math and Simulations in R, Math Functions, Functions for Statistical Distributions, Sorting, Linear Algebra Operations on Vectors and Matrices, Set Operations, Simulation Programming in R, Object-Oriented Programming, S3 Classes, S4 Classes, S3 Versus S4, Managing Your Objects

Module V 10 hrs
Input/Output, Accessing the Keyboard and Monitor, Reading and Writing Files, Accessing the Internet, String Manipulation, String-Manipulation
Functions, Regular Expressions, Use of String Utilities in the edtdbg Debugging Tool, Creating Graphs, Customizing Graphs, Saving Graphs to Files Creating Three-Dimensional Plots

Text Book
1. Norman Matloff, Art of R programming, Safari books online Publisher, Nostarch Press

References
1. Mark gardener, Beginning R: The Statistical Programming Language , Wrox publication
2. lary pace, Beginning R, Appress Publishers
3. Andrie De Vries and Joris Meys, R Programming for Dummies, 1/e, Wiley India Private Limited,
EID762: DESIGN PATTERNS

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
to object-oriented Analysis and Design and iterative development ,3/e,
Pearson, 2005.
2. Thomas J Mowbray and Raphael Malveau, CORBA and Design Patterns ,
3. William J Brown, Anti-Patterns: Refactoring Software, Architectures and
EID763: MULTIVARIATE TECHNIQUES FOR DATA ANALYSIS

L T P C
3 0 0 3

Module I 8 hrs
Introduction To Multivariate Analysis: Meaning of Multivariate Analysis, Measurements Scales - Metric measurement scales and Non-metric measurement scales, Classification of multivariate techniques (Dependence Techniques and Inter-dependence Techniques), Applications of Multivariate Techniques in different disciplines.

Module II 8 hrs
Factor Analysis: Meanings, Objectives and Assumptions, Designing a factor analysis, Deriving factors and assessing overall factors, Interpreting the factors and validation of factor analysis.

Module III 8 hrs
Cluster Analysis: Objectives and Assumptions, Research design in cluster analysis, Deriving clusters and assessing overall fit (Hierarchical methods, Non Hierarchical Methods and Combinations), Interpretation of clusters and validation of profiling of the clusters.

Module IV 8 hrs
Discriminant Analysis - concept, objective and applications. Procedure for conducting discriminant analysis. Stepwise discriminate analysis and Mahalanobis procedure. Logit model.

Module V 8 hrs

Text Book(s)

References
Chandrahhas ICT Bhavan - Institute of Technology, Visakhapatnam Campus

School of Technology, Hyderabad Campus

Sir Visvesvaraya Bhavan - GITAM School of Technology, Bengaluru Campus