REGULATIONS AND SYLLABUS

of

Master of Technology

in

Cyber Forensics and Information Security

(w.e.f. 2019-20 admitted batch)
M.Tech. in Cyber Forensics and Information Security (CFIS)

REGULATIONS

(w.e.f. 2019-20 admitted batch)

1. ADMISSION
   Admission into M.Tech. in Cyber Forensics and Information Security program of GITAM (Deemed to be University) is governed by GITAM admission regulations.

2. ELIGIBILITY CRITERIA
   21 A pass in B.E./B.Tech./AMIE in any branch of Engineering or its equivalent or MCA/M.Sc.
   22 Admissions into M.Tech. will be based on the following:
      (i) Score obtained in GAT (PG), if conducted.
      (ii) Performance in Qualifying Examination /Interview.
      (iii) Candidates with valid GATE scores will be exempted from appearing for GAT (PG).
   23 The actual weightage to be given to the above items will be decided by the authorities at the time of admissions.

3. CHOICE BASED CREDIT SYSTEM
   31 Choice Based Credit System (CBCS) was introduced with effect from 2015-16 admitted batch and revised with effect from academic year 2019-20 in order to promote:
      • Student centered Learning
      • Activity based learning
      • Students to learn courses of their choice
      • Cafeteria approach
   32 Learning objectives and outcomes are outlined for each course to enable a student to know what he/she will be able to do at the end of the program.

4. STRUCTURE OF THE PROGRAM
   41 The Program Consists of
      i) Core Courses (compulsory) which give exposure to a student in core subjects related area.
      ii) Program Electives.
      iii) Open Electives
      iv) Mandatory and Audit Courses
   42 Each course is assigned a certain number of credits depending upon the number of contact hours (lectures/tutorials/practical) per week.
   43 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.
   44 The curriculum of the four semesters M.Tech. program is designed to have a total of 68 credits for the award of M.Tech. degree
5. **MEDIUM OF INSTRUCTION**

The medium of instruction (including examinations and project reports) shall be English.

6. **REGISTRATION**

Every student has to register for the courses in each semester at the time specified in the academic calendar.

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 semester-end 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 65% 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 a minimum of 40% in any theory course in the two components (ref. 8.1) put together to be declared to have passed the course, subject to the condition that the student must have secured a minimum of 24 marks out of 60 marks (i.e. 40%) in the theory component at the semester-end examination.

8.3 Practical/ Project Work/ 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.

8.4 Audit courses are assessed through continuous evaluation for satisfactory or not satisfactory only. No credits will be assigned.

**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>
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<tbody>
<tr>
<td>1</td>
<td>Theory Courses</td>
<td>40</td>
<td>Continuous Evaluation</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>60</td>
<td>Semester-end Examination</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>100</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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.
<table>
<thead>
<tr>
<th></th>
<th>Course</th>
<th>Marks</th>
<th>Evaluation</th>
<th>Details</th>
</tr>
</thead>
</table>
| 2 | Practical Courses            | 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.  
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 | Technical Seminar (II Semester) | 100   | Continuous          | Through five periodic seminars of 20 marks each |
| 4 | Project Work (III Semester) | 100   | Continuous          | i) Forty (40) marks for periodic assessment 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*. |
| 5 | Project Work (IV Semester) | 50    | Continuous          | i) Twenty (20) marks for periodic assessment 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*.  
iii) Fifteen (15) marks for interim report presentation and viva-voce. |
|   | Total                         | 100   | Semester-end        | Fifty (50) marks for final project report and viva-voce examination assessed by external examiners. |

* Marks awarded by external examiners.
Audit courses are assessed for PASS or FAIL only. No credits will be assigned to these courses. If a student secures a minimum of 40 out of 100 marks during continuous evaluation, he/she will be declared PASS, else FAIL. PASS grade is necessary to be eligible to get the degree

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

9. **PROVISION FOR ANSWER BOOK VERIFICATION AND CHALLENGE EVALUATION**

9.1 If a student is not satisfied with his/her grade, the student can apply for answer book verification on payment of prescribed fee for each course within one week after announcement of results.

9.2 After verification, if a student is not satisfied with revaluation marks/grade, he/she can apply for challenge valuation within one week after announcement of answer book verification result or two weeks after the announcement of results, which will be valued by two examiners i.e., one Internal and one External examiner in the presence of the student on payment of prescribed fee. The challenge valuation fee will be returned, if the student is successful in the appeal by securing a better grade.

10. **SUPPLEMENTARY AND SPECIAL EXAMINATIONS**

10.1 The odd semester supplementary examinations will be conducted after conducting regular even semester examinations during April/May.

10.2 The even semester supplementary examinations will be conducted after conducting regular odd semester examinations during October/November.

10.3 A student who has secured ‘F’ Grade in Project work shall have to improve his/her work and reappear for viva-voce after satisfactory completion of work approved by panel of examiners.

10.4 A student who has completed period of study and has “F” grade in final semester courses is eligible to appear for special examination.

11. **MASSIVE OPEN ONLINE COURSES (MOOCs)**

Greater flexibility to choose variety of courses is provided through Massive Open Online Courses (MOOCs) during the period of study. Students without any backlog courses up to first semester are permitted to register for MOOCs in second semester up to a maximum of 6 credits from program elective / open elective/audit courses. However the Departmental Committee (DC) of the respective campuses has to approve the courses under MOOCs. The grade equivalency will be decided by the respective Board of Studies (BoS).
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 and 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 5.0f or 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:

\[
\text{GPA} = \frac{\sum [C \times G]}{\sum C}
\]

Where,  
- \( C \) = number of credits for the course,
- \( G \) = grade points obtained by the student in the course.

13.2 The Cumulative Grade Point Average (CGPA), is calculated using the above formula considering the grades obtained in all the courses, in all the semesters up to that particular semester.

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>
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<tbody>
<tr>
<td>First Class with Distinction</td>
<td>( \geq 8.0^* )</td>
</tr>
<tr>
<td>First Class</td>
<td>( \geq 6.5 )</td>
</tr>
<tr>
<td>Second Class</td>
<td>( \geq 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 the 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 project works.
   b) Successfully acquired the minimum required credits as specified in the curriculum corresponding to the branch of his/her study within the stipulated period.
   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**

   Notwithstanding 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 Cyber Forensics and Information Security  
Effective from academic year 2019-20 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>19ECS701</td>
<td>Advanced Data Structures</td>
<td>PC</td>
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<td>19ECS705</td>
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Total Credits: 21

Semester II

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<td>PC</td>
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<td>3</td>
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<td>7</td>
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<td>PC</td>
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<td>8</td>
<td>19ECS792</td>
<td>Technical Seminar</td>
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Total Credits: 21

Semester III

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<td>PW</td>
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Total Credits: 13

Semester IV

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<th>P</th>
<th>C</th>
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<tbody>
<tr>
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<td>Project Work II</td>
<td>PW</td>
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Total Credits: 13

Number of Credits

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<tr>
<td>1</td>
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<td>19ECS753</td>
<td>Data Warehousing and Data Mining</td>
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Programme Elective II

<table>
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<tr>
<th>S.no.</th>
<th>Course Code</th>
<th>Course Title</th>
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<tbody>
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<td>19ECS757</td>
<td>Malware Analysis and Reverse Engineering</td>
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<td>19ECS761</td>
<td>Data Encryption and Compression</td>
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Programme Elective III

<table>
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<th>S.no.</th>
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<th>Course Title</th>
<th>Category</th>
<th>L</th>
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<th>C</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>19ECS760</td>
<td>Steganography and Digital Watermarking</td>
<td>PE</td>
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<tr>
<td>2</td>
<td>19ECS762</td>
<td>Information Theory and Coding</td>
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Programme Elective IV

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<th>S.no.</th>
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<th>Course Title</th>
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<tbody>
<tr>
<td>1</td>
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Programme Elective V

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<th>Course Title</th>
<th>Category</th>
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<tbody>
<tr>
<td>1</td>
<td>19ECS768</td>
<td>Security Assessment and Risk Analysis</td>
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<td>2</td>
<td>19ECS770</td>
<td>Web Search and Information Retrieval</td>
<td>PE</td>
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<td>19ECS772</td>
<td>Data Security and Access Control</td>
<td>PE</td>
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## AUDIT COURSE I and II

<table>
<thead>
<tr>
<th>S. No</th>
<th>Course Code</th>
<th>Course Name</th>
<th>Category</th>
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## OPEN ELECTIVE

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This course provides an overall idea of designing, implementing, and performing various operations like search, insert, delete etc., operations on the complex data structures. As a part of string matching techniques and text data compression algorithms were also considered.

Course Objectives:
- Learn to choose appropriate data structures, understand the ADT/libraries, and use it to design algorithms for a specific problem.
- Understand the necessary mathematical abstraction to solve problems.
- Familiarize with advanced paradigms and data structure used to solve algorithmic problems.
- Analyze efficiency and proof of correctness of various algorithms.

Unit I
Dictionaries: Definition, Dictionary Abstract Data Type, Implementation of Dictionaries.
Learning Outcomes
After completion of this unit the student will be able to
- define adt, understand hashing (L1)
- design and implement a hash function with the above collision resolution techniques (L6)

Unit II
Learning Outcomes
After completion of this unit, the student will be able to
- create and perform operations like insert, delete and search operations on skipped lists (L6)
- differentiate between singly linked list/doubly linked list and skip list with respect to space complexity and time complexity to perform search, insert and delete operations. (L2)

Unit III
Learning Outcomes
After completion of this unit, the student will be able to
- organize data in a hierarchy form / non linear way (L4)
- perform search, insert and delete operations in the above data structures. (L4)

Unit IV
Learning Outcomes
After completion of this unit, the student will be able to
- perform various string handling and string matching algorithms mainly considering similarity and identity in to account. (L6)
- understand various text data compression techniques (L2)

Unit V
Computational Geometry: One Dimensional Range Searching, Two Dimensional Range Searching,
constructing a Priority Search Tree, Searching a Priority Search Tree, Priority Range Trees, Quad trees, k-D Trees.

**Learning Outcomes**
After completion of this unit, the student will be able to
- distinguish between one dimensional range search and two dimensional range search (L2)
- understand the database management query concepts in this domain (L2)

**TextBook(s):**

**Course Outcomes:**
After completion of this course, the student will be able to
- understand the implementation of symbol table using hashing techniques.(L2)
- develop and analyze algorithms for red-black trees, b-trees and splay trees.(L3)
- develop algorithms for text processing applications.(L5)
- identify suitable data structures and develop algorithms for computational geometry problems. (L4)
The course is concentrated on the study and development of algorithms for solving practical problems efficiently, and the theoretical analysis of their behavior. It involves algorithm design techniques, methods for analyzing the performance of corresponding algorithms and improving their efficiency, and to provide performance guarantees.

Course Objectives:
- Introduce the advanced methods of designing and analyzing algorithms.
- Identify an appropriate algorithm and implement it for a specific problem.
- Understand different classes of problems concerning their computation difficulties.
- Solve problems using dynamic programming, network flow algorithms, graph algorithms and approximation algorithms.
- Analyze recent developments in the area of algorithmic design.

Unit I                                                                                                                        6 L
Sorting: Review of various sorting algorithms, topological sorting
Graph: Definitions and Elementary Algorithms: Shortest path by BFS, shortest path in edge weighted case (Dijkstra's), depth-first search and computation of strongly connected components, emphasis on correctness proof of the algorithm and time/space analysis.

Learning Outcomes
After completion of this unit the student will be able to
- describe different sorting algorithms and their time complexity(L2)
- apply various graph traversal algorithms to find shortest paths(L3)
- outline the difference between BFS and DFS algorithms(L4)
- review the correctness of algorithm time and space analysis(L2)

Unit II                                                                                                                           8 L
Matroids: Introduction to greedy paradigm, algorithm to compute a maximum weight maximal independent set. Application to MST.
Graph Matching: Algorithm to compute maximum matching. Characterization of maximum matching by augmenting paths, Edmond's Blossom algorithm to compute augmenting path.

Learning Outcomes
After completion of this unit the student will be able to
- calculate the maximum matching in graph related problems(L3)
- compute algorithms for maximum weight and maximal independent set. (L3)
- apply MST for real world problems(L3)
- discover augmenting paths in graphs using various algorithms(L3)

Unit III                                                                                                                          9 L
Matrix Computations: Strassen's algorithm and introduction to divide and conquer paradigm, inverse of a triangular matrix.

Learning Outcomes
After completion of this unit the student will be able to
- solve network flow problems using network flow algorithms(L3)
- implement divide and conquer paradigm for matrix multiplication(L3)
- analyze how efficiency can be achieved by matrix computation algorithms(L4)
Unit IV  
**Learning Outcomes:**
After completion of this unit the student will be able to
- practice more examples on dynamic programming (L3)
- determine shortest paths in a graph using dynamic programming (L5)
- assess various representations of data (L5)
- develop algorithms for interpolation problems (L6)

Unit V  
Linear Programming: Geometry of the feasibility region and Simplex algorithm  
NP-completeness: Examples, proof of NP-hardness and NP-completeness. One or more of the following topics based on time and interest. Approximation algorithms, Randomized Algorithms, Interior Point Method.  
**Learning Outcomes**
After completion of this unit, the student will be able to
- explain linear programming concepts (L2)
- examine NP-hardness and NP-completeness problems (L4)
- illustrate approximation algorithms (L4)
- analyze randomized algorithms (L4)

**Text Book(s):**

**Course Outcomes:**
After completion of the course, students would be able to:
- analyze the complexity/performance of different algorithms. (L4)
- determine appropriate algorithm that is suitable for solving a particular set of problems. (L3)
- explain more complex algorithms and proofs in written form (L3)
- categorize different problems in various classes according to their complexity. (L4)
- design and analyze techniques for algorithms and ways to approach NP-complete problems (L6)
- apply techniques to solve new problems that may arise in various applications (L3)
The emphasis of the course is on the application of the number theory in the design of cryptographic algorithms. The course will start with the notion of time complexity and with several elementary number theoretic algorithms. Putting them together we will see how we can design several cryptographic algorithms. As a part of cryptanalysis we will study several attacks on these algorithms as well as their remedies. We will also study recent developments in elliptic curve cryptography and the use digital signatures and its variations for authentication.

Course Objectives:

- This course purpose is to introduce the arithmetic topics, both ancient and very modern, which have been at the centre of interest in applications, especially in cryptography.
- For this reason, we take an algorithmic approach, emphasizing estimates of the efficiency of the techniques that arise from the theory.
- Enable the student to learn basic knowledge in cryptographic various algorithms.
- Demonstrate the handling of variety of threats during transmission of information over network and also how to overcome it.
- Train the student to convert algorithm logic into any programming language code.

Unit I

Topics in elementary number theory: O and \(\Omega\) notations, time estimates for doing arithmetic, divisibility and the Euclidean algorithm. Congruence’s: Definitions and properties, linear congruencies, residue classes, Euler’s phi function, Fermat’s Little Theorem, Chinese Remainder Theorem, Applications to factoring, finite fields, quadratic residues and Reciprocity: Quadratic residues, Legendre symbol, Jacobi symbol.

Learning Outcomes:

After completion of this unit, the student will be able to

- Identify how number theory is related to and used in cryptography. (L3)
- Learn basic Algebra and Discrete Mathematics. (L1)
- Know to find the greatest common divisor of two numbers (which is an incredibly important problem by itself), but its extended version also gives an efficient way to solve Diophantine equations and compute modular inverses. (L1)
- Understand the Chinese remainder theorem which gives a unique solution to simultaneous linear congruence’s with co-prime moduli. (L2)

Unit II


Learning Outcomes:

After completion of this unit, the student will be able to

- Learn the environment that led to the development of the Data Encryption Standard (DES). (L1)
- Identifying, describing, and explaining the purpose of each stage of the DES algorithm. (L3)
- Explaining why the input and output permutation in DES do not improve the security. (L2)
- Enumerating the weaknesses of the DES algorithm. (L1)
- Comparing and contrasting the protection provided by 3DES as compared to 2DES. (L2)
- Defining what a Feistel structure is and why it is important to the design of encryption techniques. (L1)
Unit III


Learning Outcomes:

After completion of this unit, the student will be able to

• defining key expressions and terminology including multiplicative inverse, relatively prime, and the totient function. (L1)
• describing the steps required to perform the rsa (rivest, shamir, and adleman) encryption algorithm. (L2)
• performing the rsa algorithm on a given number by hand. (L3)
• using the RSA algorithm to encrypt and decrypt data. (L3)
• describing a key exchange algorithm or protocol (e.g. Diffie Hellman). (L2)
• design and implement a new unbreakable cryptosystem. (L6)
• blend the existing cryptographic algorithms with the existing communication protocols. (L6)
• analyze and application of cryptography for secures ecommerce and other secret transactions. (L4)

Unit IV

Primality and Factoring: Pseudo primes, the rho (γ) method, Format factorization and factor bases, the continued fraction method, the quadratic seive method.

Learning Outcomes:

After completion of this unit, the student will be able to

• understand the concept of way to attack RSA would be to try to factor the public modulus. (L2)
• apply the Modern Algorithms: Quadratic Sieve, Number field Sieve. (L3)
• learn Complexity of Trial Division. (L1)

Unit V

Number Theory and Algebraic Geometry: Elliptic curves, basic facts, elliptic curve cryptosystems, elliptic curve primality test – elliptic curve factorization.

Learning Outcomes:

After completion of this unit, the student will be able to

• identify the approach to public-key cryptography is based on the algebraic structure of elliptic curves over finite fields. (L3)
• learn examples of elliptic curves over the field of real numbers. (L1)
• learn about the elliptic curve discrete logarithm problem, which is the cornerstone of much of present-day elliptic curve cryptography. (L1)

Text Book(s):

Course Outcomes:

After completion of this course, the student will be able to.

- find the greatest common divisor of two numbers (which is an incredibly important problem by itself), but its extended version also gives an efficient way to solve Diophantine equations and compute modular inverses. (L1)
- identifying, describing, and explaining the purpose of each stage of the DES algorithm. (L3)
- analyze and application of cryptography for secures ecommerce and other secret transactions. (L4)
- apply the Modern Algorithms: Quadratic Sieve, Number field Sieve. (L3)
- the approach to public-key cryptography is based on the algebraic structure of elliptic curves over finite fields. (L6)
This course introduces the student to the fundamentals of research, research process, technical writing and intellectual property rights. Students will be able to use this knowledge to gain interest in their subject area and pursue their career in research.

Course Objectives

- To familiarize the meaning, objectives and sources of research
- To acquaint the student with the importance and methods of literature review/research ethics
- To impart the knowledge of technical writing for preparing reports, presentations, research proposals, conference/journal publications
- To introduce the terminology and process of obtaining intellectual property rights
- To expose the intricacies in the process of obtaining patent rights

Unit I

Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem. Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations

Learning Outcomes

- define the meaning of a research problem (L1)
- list the different sources of research problem (L2)
- enumerate the different criteria of good research and list the different errors in selecting research problem (L2)
- contrast the different approaches of research (L3)
- compare the different methods for data collection and analysis (L5)

Unit II

Effective literature studies approaches, analysis Plagiarism, Research ethics

Learning Outcomes

- list and elaborate the different steps of the research process (L1)
- explain the importance of carrying out an effective literature review (L2)
- identify the research gaps from literature review (L5)
- describe the ethical principles to be following during research process and authorship (L2)
- define the terminology and list the methods to avoid being accused of plagiarism (L1)
- list the different types of research misconduct (L2)

Unit III

Effective technical writing, how to write report, Paper Developing a Research Proposal, Format of
research proposal, a presentation and assessment by a review committee

Learning Outcomes
After the completion of this unit, the student will be able to
- list the attributes, reasons and guidelines for effective technical writing (L1)
- contrast between conference paper, technical presentation and journal paper (L3)
- choose a particular research contribution for patenting or journal publication (L4)
- describe the terminology related to citation, citation index, h-index etc (L2)

Unit IV 5L

Learning Outcomes
After the completion of this unit, the student will be able to
- describe the codes and standards in building intellectual property rights(L2)
- list the subject, importance and requirements for of patentability(L1)
- explain the process of patenting and commercialization in academia(L2)
- enumerate the procedure for application preparation, filing and grant of Patents(L2)

Unit V 8L

Learning Outcomes
After the completion of this unit, the student will be able to
- explain the scope of patent rights(L2)
- describe the process for licensing and transfer of technology(L2)
- identify the sources of patent information and databases(L1)
- elaborate the administration of patent system(L2)
- describe the new developments in IPR in computer software, biological systems etc(L3)

Text Book(s):

References:
1. Develop programs for
   a. HeapSort
   b. MergeSort
   c. Quick sort by taking random element as pivot
   d. Selection

2. Program to perform insertion, deletion and search operations on the following:
   a. Single Linked List
   b. Doubly Linked List
   c. Circular Linked List

3. Implement the functions of a dictionary using Hashing.

4. Implement hash tables with linear probing and double hashing.
   Demonstration of inserting and deleting elements.

5. Skip list: Implementations and operations.

6. Develop a program to perform insertion, deletion and search operations on the following Trees
   a. Binary Search Tree
   b. B-Trees
   c. AVL Tree
   d. Red Black Trees

7. Implement the code for the following problems using Dynamic Programming:
   a. Matrix Chain Multiplication Problem.
   b. String matching algorithm.
1. Introduction to Python Libraries- Numpy, Pandas, Matplotlib, Scikit
2. Perform Data exploration and preprocessing in Python
3. Implement regularised Linear regression
4. Implement Naive Bayes classifier for dataset stored as CSV file.
5. Implement regularized logistic regression
6. Build models using different Ensembling techniques
7. Build models using Decision trees
8. Build model using SVM with different kernels
9. Implement K-NN algorithm to classify a dataset.
Machine Learning is the science of making machines think intelligently without being explicitly programmed. Machine learning is pervasive in everyday life today. This course is designed to enable students get in-depth understanding of different machine learning techniques including deep learning and reinforcement learning and apply them on real-life data.

Course Objectives:
- Understand the fundamental concepts of Supervised learning.
- Explore descriptive problem solving through unsupervised learning strategies.
- Acquire skills in developing as well as evaluating different machine learning models.
- Demonstrate the application of different deep learning methodologies.
- Gain an understanding of concepts like Reinforcement Learning and Active Learning.

Unit I
Supervised Learning (Regression/Classification): Basic methods: Distance-based methods, Nearest-Neighbors, Decision Trees, Naive Bayes, Linear models: Linear Regression, Logistic Regression, Support Vector Machines, Nonlinearity and Kernel Methods, Beyond Binary Classification: Multi-class

Learning Outcomes
After completion of this unit, the student will be able to:
- explain the concept of machine learning and their applications to different real world datasets. (L2)
- demonstrate the working of different supervised learning algorithms and assess their suitability to a given problem. (L3)
- extend a binary classification problem to solve a multi-class classification problem.(L3)

Unit II
Unsupervised Learning: Clustering: K-means, Dimensionality Reduction: PCA and kernel PCA, Generative Models (Gaussian Mixture Models and Hidden Markov Models)

Learning Outcomes
After completion of this unit, the student will be able to:
- demonstrate the working of different dimensionality reduction techniques on high-dimensional datasets (L3)
- illustrate the working of Generative Models mathematically. (L3)

Unit III
Evaluating Machine Learning algorithms, Model Selection, Ensemble Methods (Boosting, Bagging, Random Forests)

Learning Outcomes
After completion of this unit, the student will be able to:
- interpret ensemble models as a function of different weak classifiers. (L3)
- compare the performances of different classification models. (L4)

Unit IV
Modeling Sequence/Time-Series Data, Deep Learning (Deep generative models, Deep Boltzmann Machines, Deep auto-encoders, Applications of Deep Networks) and Feature Representation Learning

Learning Outcomes
After completion of this unit, the student will be able to:
- understand the methods for handling time series and sequence data. (L2)
• demonstrate the working of different deep learning approaches on complex data. (L3)

Unit V
Scalable Machine Learning (Online and Distributed Learning) Semi-supervised Learning, Active Learning, Reinforcement Learning, Inference in Graphical Models, Introduction to Bayesian Learning and Inference

Learning Outcomes
After completion of this unit, the student will be able to:
• apply reinforcement learning approach to applications like bioinformatics and personalized recommendation. (L3)
• analyses the working of Active Learning approach on complex data. (L4)

Text Book(s)
2. Trevor Hastie, Robert Tibshirani, Jerome Friedman, The Elements of Statistical Learning, Springer 2009
3. Jiawei Han, Micheline Kamber, Jian Pei , Data Mining: Concepts and Techniques, 3/e, Morgan Kaufmann, 2011.

Course Outcomes:
After successful completion of the course, the student will be able to
• relate knowledge about application of machine learning techniques to real world problems. (L3)
• apply deep learning methodologies to applications such as image recognition, video tagging etc. (L3)
• generate suitable unsupervised learning approaches to descriptive machine learning models. (L4)
• utilize supervised learning approaches to perform predictive modeling of data. (L3)
• assess different machine learning algorithms based on performance evaluation measures. (L5)
Due to the advent of technology, internet, and advanced applications like social media, huge amounts of digital data have been accumulated in data centers/Cloud Databases, which has led to a situation "we are drowning in data but starving from knowledge". To make use of this various data mining functionalities like Association Analysis, Classification, Clustering, Outlier Analysis, and Web mining are used to find golden nuggets which are useful for decision making processes.

Data warehousing (DW) is an integral part of the knowledge discovery process, where DW plays a vital role. DW is an integration of multiple heterogeneous data repositories under a unified schema at a single site. The students will acquire knowledge in Data modeling, design, architecture, Data warehouse implementation, and further development of data cube technology.

Course Objectives

This course will introduce the concepts, techniques, design, and applications of data mining and data warehousing. It will enable the students to understand and implement classical algorithms in data mining. They will learn how to analyze the data, identify the problems, and choose the relevant algorithms to apply. Then, they will be able to assess the strengths and weaknesses of the algorithms and analyze their behavior on real datasets.

- Understand the importance of Data Mining and its applications
- Introduce various types of data and pre-processing techniques
- Learn various multi-dimensional data models and OLAP Processing
- Study concepts of Association Analysis
- Learn various Classification methods
- Learn basics of cluster analysis

Unit I 7L
Introduction to Data Warehousing; Data Mining: Mining frequent patterns, association and correlations; Sequential Pattern Mining concepts, primitives, scalable methods.

Learning outcomes

- Understand the basic concepts of data mining (L2)
- Learn the KDD process (L2)
- Learn different data mining tasks (L2)
- Understand the use of frequent patterns in business analysis (L2)
- Implement Apriori algorithm and FP-Growth algorithm (L3)

Unit II 7L
Classification and prediction; Cluster Analysis – Types of Data in Cluster Analysis, Partitioning methods, Hierarchical Methods, Transactional Patterns, and other temporal based frequent patterns.

Learning outcomes

- Understand various types of data sets and attributes (L2)
- Apply different statistical techniques on different types of attributes to find the similarities and dissimilarities (L3)
- Learn different data preprocessing techniques and apply them on data sets (L2)
- Learn the basics of data warehousing and different OLAP operations (L2)

Unit III 9L
Mining Time series Data, Periodicity Analysis for time related sequence data, Trend analysis and Similarity search in Time-series analysis.

**Learning outcomes**
After completion of this unit, student will be able to
- Learn Categories of Time-Series Movements (L2)
- Find the Trend Discovery in Time-Series (L1)
- Know about Similarity Search in Time-Series Analysis (L2)

**Unit IV**
9L
Mining Data Streams, Methodologies for stream data processing and stream data systems, frequent pattern mining in stream data, Sequential Pattern Mining in Data Streams, Classification of dynamic data streams, Class Imbalance Problem; Graph Mining; Social Network Analysis.

**Learning outcomes**
After completion of this unit, student will be able to
- Know about stream data processing and stream data systems (L2)
- Apply Sequential Pattern Mining in Data Streams (L3)
- Understand the Class Imbalance Problem (L2)
- Analyse Graph Mining and Social Network Analysis (L4)

**Unit V**
10L
Web Mining, Mining the web page layout structure, mining web link structure, mining multimedia data on the web, Automatic classification of web documents and web usage mining; Distributed Data Mining.

**Learning outcomes**
After completion of this unit, student will be able to
- Understand the Taxonomy of Web mining (L2)
- Work with Automatic classification of web documents (L4)
- Learn about Web usage mining (L2)

**Textbook(s):**
1. Jiawei Han and M Kamber, Data Mining Concepts and Techniques, 2/e, Elsevier Publishers, 2011.

**Course Outcomes**
At the end of this course, student will be able to
- understand the functionality of various data warehousing and data mining components: (L2)
- understand various OLAP operations: (L2)
- understand the strengths and limitations of various data mining models: (L2)
- implement the data mining algorithms with different datasets: (L3)
- compare various approaches of data mining implementations: (L2)
- identify and apply appropriate data mining technique to solve a problem: (L3)
This course is designed to enable the student to gain insights on the wide array of threats and attacks that can possibly bring down a computer system or even a network as a whole. They will be familiarized with all possible intrusions that occur in a network and various counter attacking mechanisms to stand our ground against the attackers and cyber threats.

Course Objectives:
- Familiarize the student with the basics of cyber threats and attacks.
- Enable the student to learn and develop intrusion detection taxonomies and frameworks.
- Explain with the features and constructs of system anomalies, vulnerabilities.
- Demonstrate the handling of various counter attack mechanisms such as attack trees, alerts, security techniques.

Unit I
The state of threats against computers, and networked systems - Overview of computer security solutions and why they fail - Vulnerability assessment, firewalls, VPN’s - Overview of Intrusion Detection and Intrusion Prevention - Network and Host-based IDS

Learning Outcomes:
After completion of this unit the student will be able to
- analyze various threats against the systems. (L4)
- study different kinds of intrusions and detection frameworks. (L2)

Unit II

Learning Outcomes:
After completion of this unit the student will be able to
- classify the attacks based on their nature. (L2)
- segregate the cyber attackers according to their mode of attack. (L3)

Unit III
A General IDS model and taxonomy, Signature-based Solutions, Snort, Snort rules, Evaluation of IDS, Cost sensitive IDS

Learning Outcomes:
After completion of this unit the student will be able to
- study and analyze various IDS models and their relevant features, Rule set, costs. (L4)

Unit IV
Anomaly Detection Systems and Algorithms - Network Behavior Based Anomaly Detectors (rate based) - Host-based Anomaly Detectors - Software Vulnerabilities - State transition, Immunology, Payload Anomaly Detection

Learning Outcomes:
After completion of this unit the student will be able to
- compare and contrast various intrusion detection algorithms. (L2)
- study different anomaly detectors - vulnerabilities, states, software payloads. (L3)

Unit V
Attack trees and Correlation of alerts - Autopsy of Worms and Botnets - Malware detection -
Obfuscation, polymorphism - Document vectors.
Email/IM security issues - Viruses/Spam-From signatures to thumbprints to zero- day detection - Insider Threat issues-Taxonomy-Masquerade and Impersonation- Traitors, Decoys and Deception- Future: Collaborative Security.

**Learning Outcomes:**
After completion of this unit the student will be able to
- build various counter attack mechanisms such as Attack trees, alerts (L3)
- deploy the security protocols that are future proof against insider threats, deception, impersonating and study various future collaborative. (L6)

**Text Book(s)**

**Course Outcomes:**
After completion of this course the student will be able to
- analyze various threats, intrusions and detection frameworks pertaining to the cyber space(L4)
- develop taxonomy of attacks based on their nature. (L3)
- analyze various IDS models and their relevant features (L4)
- compare and contrast various intrusion detection algorithms, anomaly detectors-vulnerabilities, states, software payloads (L2)
- build various counter attack mechanisms such as Attack trees, and deploy various security protocols. (L3)
The course will provide an overview of malware research, intelligence gathering related to malware, and provide basic skills required to analyze and disassemble malicious programs. Students will explore the tools required to analysis and do reverse engineering of malicious code, learn malware Forensics techniques, how malware functions, and will perform live analysis and reverse engineering exercises.

Course Objectives:

- Learn fundamentals and Classification of Malware
- Introduce Tools and Techniques of malware analysis
- Enable to Identify malware through behavioural and Code analysis
- Describe Malware Forensics

Unit I


Dynamic Analysis Tools: Process Monitor, Regshot, Handle Diff, Analysis Automation Tools: Virtual Box, VM Ware, Python, Other Analysis Tools

Learning Outcomes:

- understand knowledge of methodology, technology and application of malware analysis and reverse engineering (L2)
- identify malware through behavioral and Code analysis (L3)

Unit II

Malware Forensics: Using TSK for Network and Host Discoveries, Using Microsoft Offline API to Registry Discoveries, Identifying Packers using PEiD, Registry Forensics with Reg Ripper Plugins, Bypassing Poison Ivy’s Locked Files, Bypassing Conficker’s File System ACL Restrictions, Detecting Rogue PKI Certificates.

Learning Outcomes:

- gain Knowledge on Malware Forensics (L3)
- know regarding Plugins and PKI Certificate (L3)
Unit III

Learning Outcomes:
After completion of this unit, the student will be able to
- understand Malware Kernel Debugging(L2)
- apply Win Dbg Commands and Controls(L3)

Unit IV
MemoryForensicsandVolatility:MemoryDumpingwithMoonSolsWindowsMemoryToolkit,Accessing VM Memory Files Overview of Volatility, Investigating Processes in Memory Dumps, Code Injection and Extraction, Detecting and Capturing Suspicious Loaded DLLs, Finding Artifacts in Process Memory, Identifying Injected Code with Malfind and YARA

Learning Outcomes:
After completion of this unit, the student will be able to
- understand Memory Forensics and Volatility (L2)
- find artifacts in Process Memory(L1)

Unit V

Learning Outcomes:
After completion of this unit, the student will be able to
- understand DNS Server and Reverse IP Process(L2)

Text Book(s)

Course Outcomes:
After completion of this course, the student will be able to
- apply malware analysis methodology and technology (L3)
- implement advanced static and dynamic malware analysis(L3)
- make use of Memory Forensics and Volatility (L3)
- find Artifacts in Process Memory Identify known anti-reverse engineering techniques(L1)
- apply DNS Server Process and Reverse IP Process(L3)
The course is designed to enable the student master an ethical hacking methodology that can be used in a penetration testing or ethical hacking situation. This course provides a fundamental look at offensive security concepts and techniques using a virtual install of Kali Linux and three different target victims, Windows XP, Server 2008 and Linux (Metasploitable2). This course delivers in-demand ethical hacking skills.

Course Objectives:
• Familiarize the student with the steps involved ethical hacking.
• Enable the student to perform vulnerability analysis.
• Explain the student how to perform the malware analysis.
• Demonstrate how to perform static analysis using IDA Pro
• Train the student with metasploit and kali linux

Unit I 9L
Introduction to Ethical Disclosure: Ethics of Ethical Hacking, Ethical Hacking and the legal system, Proper and Ethical Disclosure

Learning Outcomes:
After completion of this unit, the student will be able to.
• describe the ethics of ethical hacking(L1)
• understand the legal system of ethical hacking(L2)
• report ethical disclosure. (L1)

Unit II 9L

Learning Outcomes:
After completion of this unit, the student will be able to.
• practice exploiting using Metasploit(L6).
• implement reverse shells using Metasploit(L3).
• use Backtrack Linux (Kali Linux) (L3).

Unit III 9L

Learning Outcomes:
After completion of this unit, the student will be able to.
• explain passive vulnerability analysis (L2).
• experiment advanced static analysis using IDA Pro(L3).
• explain advanced reverse engineering (L2).

Unit IV 9L
Client-side browser exploits: Exploiting Windows Access Control Model for Local Elevation Privilege, Intelligent Fuzzing with Sulley, From Vulnerability to Exploit.

Learning Outcomes:
After completion of this unit, the student will be able to
• apply windows access control model for privilege escalation (L3).
• make use of Intelligent Fuzzing with sully(L3).
• investigate the vulnerabilities and exploit them(L4).

Unit V 6L
Malware Analysis: Collecting Malware and Initial Analysis, Hacking Malware. Case study of vulnerability of cloud platforms and mobile platforms & devices.

Learning Outcomes:
After completion of this unit, the student will be able to.
• analyze the malware (L4).
• categorize the malware(L4).
• practice vulnerability analysis on cloud and mobile platforms(L3).

Text Book(s)
2. Jon Erickson, Hacking: The Art of Exploitation, SPD

Course Outcomes:
After completion of this course, the student will be able to
• implement reverse shells using Metasploit (L4)
• experiment advanced static analysis using IDA Pro (L3)
• apply windows access control model for privilegeescalation. (L3)
• make use of Intelligent Fuzzing with sully. (L3)
• analyze the malware.(L4)
The emphasis of the course is processing of encryption and compression in the design of cryptographic algorithms. The course will start with encryption is the process of encoding messages or information in such a way that only authorized parties can read it. And compression, source coding, or bit-rate reduction involves encoding information using fewer bits than the original representation. As a part of cryptanalysis we will study several attacks on these algorithms as well as their remedies. We will also study recent developments in Entropy encoding and differential encoding techniques.

Course Objectives:
- The objective of this course is to introduce to the students the fundamentals of data compression, data encryption and data security.
- Students will be able to distinguish among various types of Data Compression and Encryption techniques/algorithms for text, images.
- Enable the student to learn basic knowledge in cryptographic various algorithms.
- Demonstrate the handling of variety of threats during transmission of information over network and also how to overcome it.
- Describe and apply various techniques for text compression and also evaluate performance of the coding techniques.

Unit I 6L

Learning Outcomes:
- After completion of this unit the student will be able to
  - learn why network need security and its approaches. (L1)
  - learn to protect a computer system from security threats and also ethical issues related to computer and network security. (L1)
  - finding differentiates between substitution and transposition techniques and also different types of cryptography. (L2)

Unit II 9L

Learning Outcomes:
- After completion of this unit the student will be able to
  - learn the environment that led to the development of the Data Encryption Standard (DES). (L6)
  - identifying, describing, and explaining the purpose of each stage of the DES algorithm. (L3)
  - enumerating the weaknesses of the DES algorithm. (L4)
  - finding methods that provide the goals of integrity, authentication and non-repudiation. (L1)

Public Key Cryptography and Message Authentication: Approaches to Message Authentication, SHA-1, MD5, Public-Key Cryptography Principles, RSA, Digital, Signatures, KeyManagement.

Learning Outcomes:
After completion of this unit the student will be able to
• learn the requirement in a public key cryptography is a secure algorithm. (L1)
• know the MD5 sum collection in the presence of witnesses. (L1)
• practices and procedures to be followed in carrying out technical and administrative aspects of key management, both automated and manual. (L3)

Unit IV 7L
Introduction: Need for data compression, Fundamental concept of data compression & coding, Communication model, Compression ratio, Requirements of data compression, Classification.
Methods of Data Compression: Data compression - Loss less &Lossy.

Learning Outcomes:
After completion of this unit the student will be able to
• describe and apply various techniques for text compression and also evaluate performance of the coding techniques. (L2)
• define and classify compression and also explain its performance parameters. (L1)

Unit V 11L
Entropy encoding: Repetitive character encoding, Run length encoding, Zero/Blank encoding.
Statistical encoding: Huffman, Arithmetic & Lempel-Ziv coding; Source encoding - Vector quantization (Simple vector quantization & with error term).

Learning Outcomes:
After completion of this unit the student will be able to
• understand need for text compression, types of redundancies and their model to apply coding. (L2)
• examine the given situation to choose the appropriate compression technique by evaluating the performance. (L4)
• conclude on encoded outputs using entropy technique with given the different probability sets. (L5)
• draw and explain different image compression standards. (L2)

Text Book(s)
2. Nelson, The Data Compression Book, BPB.
3. Atul Kahate, Cryptography & Network Security, TMH

**Course Outcomes:**
After completion of this course, the students would be able to
- provide security of the data over the network. (L4)
- do research in the emerging areas of cryptography and network security. (L6)
- implement various networking protocols. (L3)
- protect any network from the threats in the world. (L5)
The goal of this course is to provide an up-to-date survey of developments in computer security. Central problems that confront security designers and security administrators include defining the threats to computer and network systems, evaluating the relative risks of these threats, and developing cost-effective and user-friendly countermeasures.

Course Objectives

- Deep understanding of various basic principles and examines their application in specific areas of computer security.
- Demonstrates various issues relating to authentication and access control.
- Design approaches to meet specific computer security requirements.
- An understanding of the current status and future direction of technology in information security.

Unit I

Case Study: Readings, Intrusion and intrusion detection by John McHugh.

Learning Outcomes:

After Completion of this unit the student will be able to

- describe the key security requirements of confidentiality, integrity, and availability. (L2)
- understand the types of security threats and attacks that must be dealt with different categories of computer and network assets. (L2)
- distinguish among various types of intruder behavior patterns. (L2)
- understand the basic principles of and requirements for intrusion detection and prevention systems. (L2)
- describe the purpose of honey pots. (L2)

Unit II

Applications: Kerberos, X.509, PKI, Federated Identity Management.

Learning Outcomes:

After Completion of this unit the student will be able to

- discuss the four general means of authenticating a user’s identity. (L6)
- present an overview of token-based user authentication and issues involved and the approaches for remote user authentication. (L5)
- explain how access control fits into the broader context that includes authentication, authorization, and audit. (L2)
- describe the Principle concepts of UNIX file access control model and role-based access control. (L2)
- summarize the basic operation of Kerberos. (L2)
compare the functionality of Kerberos version 4 and version 5 and function of X.509 certificates. (L2)

Unit III

Learning Outcomes:
After Completion of this unit the student will be able to
• explain the basic operation of symmetric block encryption algorithms. (L2)
• compare and contrast block encryption and stream encryption. (L4)
• discuss the use of secure hash functions for message authentication. (L6)
• describe the structure and function of DES and AES. (L2)
• distinguish among the major block cipher modes of operation. (L4)
• discuss the issues involved in key distribution. (L2)

Unit IV

Learning Outcomes:
After Completion of this unit the student will be able to
• understand the functionality of S/MIME and the security threats it addresses. (L2)
• explain the key components of SSL. (L5)
• discuss the use of HTTPS. (L6)
• understand the operation of SHA-1 and SHA-2. (L2)
• present an overview of the use of HMAC for message authentication. (L2)
• describe the RSA algorithm and Diffie-Hellman algorithm. (L2)

Unit V

Learning Outcomes:
After Completion of this unit the student will be able to
• describe three broad mechanisms malware uses to propagate. (L2)
• understand the basic operation of viruses, worms, and Trojans. (L2)
• describe four broad categories of malware payloads. (L4)
• understand the different threats posed by bots, spyware, and root kits. (L2)
• describe some malware countermeasure elements. (L4)
• describe three locations for malware detection mechanisms. (L4)
Text Book(s)


Course Outcomes:

After completion of this course, the student will be able to
• distinguish among various types of intruder behavior patterns (L4)
• describe the key security requirements of confidentiality, integrity, and availability (L1)
• explain how access control fits into the broader context that includes authentication, authorization, and audit (L5)
• describe the structure and function of DES and AES. (L2)
• describe four broad categories of malware payloads. (L4)
The following programs should be implemented preferably on platform Windows/Unix using C language (for 1-5) and other standard utilities available with UNIX systems (for 6-15) :

1. Implement the encryption and decryption of 8-bit data using Simplified DES Algorithm (created by Prof. Edward Schaefer) in C

2. Write a program to break the above DES coding

3. Implement Linear Congruential Algorithm to generate 5 pseudo-random numbers in C

4. Implement Rabin-Miller Primality Testing Algorithm in C

5. Implement the Euclid Algorithm to generate the GCD of an array of 10 integers in C

6. a) Implement RSA algorithm for encryption and decryption in C
    b) In an RSA System, the public key of a given user is e=31, n=3599. Write a program to find private key of the User.

7. Configure a mail agent to support Digital Certificates, send a mail and verify the correctness of this system using the configured parameters.

8. Configure SSH (Secure Shell) and send/receive a file on this connection to verify the correctness of this system using the configured parameters.


10. Implement encryption and decryption with openssl.

11. Implement Using IP TABLES on Linux and setting the filtering rules.

12. Implementation of proxy based security protocols in C or C++ with features like confidentiality, integrity and authentication
The following exercises have to be performed using various software tools/utilities mentioned Software Tools:

1. CyberCheck 4.0 – Academic Version
2. CyberCheckSuite
3. MobileCheck
4. Network SessionAnalyser
5. Win-LiFT
6. TrueImager
7. TrueTraveller
8. PhotoExaminer Ver1.1
9. CDRAnalyzer

Forensics Exercises:
I) Disk Forensics:
   1. Identify digital evidences
   2. Acquire the evidence
   3. Authenticate the evidence
   4. Preserve the evidence
   5. Analyze the evidence
   6. Report the findings

II) Network Forensics:
   - Intrusion detection
   - Logging (the best way to track down a hacker is to keep vast records of activity on a network with the help of an intrusion detectionsystem)
   - Correlating intrusion detection and logging

III) Device Forensics:
   1. PDA
   2. Mobilephone
   3. Digital Music
   4. Printer Forensics
   5. Scanner Forensics
Each student shall survey a technical topic related to a chosen specialization and prepare/submit a report in a specified format. It is advisable for students to choose a topic of interest to be continued as M.Tech Project in the 3rd & 4th Semester. The guidelines to carry out the research shall include the following:

1. Literature Review
2. Identification of Gap
3. Objectives and Expected Outcomes
4. Methodology / Innovative solution

Each student has to prepare a power point presentation on a selected technical topic with a novelty and get it evaluated by the faculty assigned for this purpose.
Information Hiding plays a very important role in providing of security to information and copyright protection. It consists of two parts: Digital Steganography and Digital Watermarking. Steganography is the art of information hiding in objects or images. It is a field with a rich heritage, and an area of rapid current development. Watermarking provides a copyright protection of video and audio products against multimedia pirates. Like probability theory, information and coding theory, signal processing procedures used for embedding of additional information into cover objects can be completely described by computer programs. Therefore, this course is especially useful for students specialized in computer science.

Course Objectives:
- To learn about steganography methods of hiding data
- To learn about steganography Algorithm and Techniques
- To learn about the watermarking models, applications and tools
- To learn about watermark security and authentication

Unit I

Learning Outcomes:
After completion of this unit, the student will be able to
- understand different type of data to provide security (L2)
- make use of different steganography methods of hiding data(L3)
- list of attackers and steganalysis(L4)

Unit II
Frameworks for secret communication: pure steganography, secret key, public key steganography), Steganography algorithms: Adaptive and Non-Adaptive.

Learning Outcomes:
After completion of this unit, the student will be able to
- understand public key steganography(L2)
- apply the steganography algorithm(L3)

Unit III

Learning Outcomes:
After completion of this unit, the student will be able to
- make use of different steganography techniques(L3)
• apply different tools(L3)

**Unit IV**

Detection and Distortion Techniques: LSB Embedding, LSB Steganalysis using primary sets, Texture based.

**Learning Outcomes:**

After completion of this unit, the student will be able to

• make use of different steganography techniques for embedding(L3)

**Unit V**


**Learning Outcomes:**

After completion of this unit, the student will be able to.

• compare Watermarking and steganography (L2)
• apply different techniques and tools of watermarking (L3)

**Text Book(s)**


**Course Outcomes:**

After completion of this course, the student will be able to

• understand different type of steganography methods of hiding data(L2)
• understand public key steganography and apply the steganography algorithm(L2)
• make use of different steganography techniques(L3)
• apply different tools(L3)
• make use of different steganography techniques for embedding(L3)
• apply different techniques and tools of watermarking (L3)
The course aims at introducing information theory and the practical aspects of data compression and error-control coding. The theoretical concepts are illustrated using practical examples related to the effective storage and transmission of digital and analog data. More broadly, the goal of the course is to introduce the basic techniques for reasoning under uncertainty as well as the computational and graphical tools which are broadly used in this area. In particular, Bayesian networks and decision trees will be introduced, as well as elements of automatic learning and data mining.

Course Objectives:
- To understand information theoretic behavior of a communication system.
- To understand various source coding techniques and their applications.
- To understand various channel coding techniques and their capability.
- To understand and apply principles of data communication and networking.

Unit I 7L
Information and entropy information measures, Shannon’s concept of Information, Channel coding, channel mutual information capacity (BW).
Learning Outcomes:
After completion of this unit the student will be able to
- understand the nature of information theory. (L2)
- analyze the results of shannon’s. (L4)
- explore the information measures (L1)
- understand the channel coding. (L2)

Unit II 8L
Theorem for discrete memory less channel, information capacity theorem, Error detecting and error correcting codes.
Learning Outcomes:
After completion of this unit the student will be able to
- construct efficient codes for data communication channels (L3)
- generalize the discrete concepts to continuous signals (L4)
- finding errors in communication channel (L5)
- process of correcting errors. (L5)

Unit III 7L
Types of codes: Block codes, Hamming and Lee metrics, description of linear block codes, parity check Codes, cyclic code, Masking techniques.
Learning Outcomes:
After completion of this unit the student will be able to
- usages of different types of codes (L4)
- understand the hamming and lee metrics (L2)
• detecting errors using parity check codes. (L5)
• applications of masking techniques. (L3)

Unit IV 9L
Compression: lossless and lossy, Huffman codes, LZW algorithm, Binary Image compression schemes, run length encoding, CCITT group 3 1-D Compression, CCITT group 32D compression, CCITT group 4 2D Compression.

Learning Outcomes:
After completion of this unit the student will be able to
• application of huffman codes(L3)
• loss less transmission in the channel(L6)
• understand the compression schemes(L2)
• applying of 2D compression

Unit V 11L
Case study of CCITT group 3 1-D Compression, CCITT group 3 2D Compression.

Learning Outcomes:
After completion of this unit the student will be able to
• usages of convolutional codes(L3)
• method of doing compression using CITT H261 on videos(L3)
• understanding of CCITT compression(L2)
• comparison of different compression techniques. (L4)

Text Book(s):
3. Fred Halsall, Multimedia Communications.

Course Outcomes:
• design the channel performance using information theory. (L6)
• comprehend various error control code properties. (L6)
• apply linear block codes for error detection and correction(L3)
• design codes for channel performance improvement against burst errors. (L6)
• apply convolution codes for performance analysis & cyclic codes for error detection and correction. (L3)
The course takes a software development perspective to the challenges of engineering software systems that are secure. This course addresses design and implementation issues critical to producing secure software systems. The course deals with the question of how to make the requirements for confidentiality, integrity, and availability integral to the software development process from requirements gathering to design, development, configuration, deployment, and ongoing maintenance.

**Course Objectives:**
- Fix software flaws and bugs in various software.
- Aware of various issues like weak random number generation, information leakage, poor usability, and weak or no encryption on data traffic
- Understand the Techniques for successfully implementing and supporting network services on an enterprise scale and heterogeneous systems environment.
- Learn methodologies and tools to design and develop secure software containing minimum vulnerabilities and flaws.
- Study and handle the various threats, attacks and malwares methodologies.

**Unit I**
Secure Software Design: Identify software vulnerabilities and perform software security analysis, Master security programming practices, Master fundamental software security design concepts, perform security testing and quality assurance.

**Learning Outcomes**
After completion of this unit the student will be able to
- understand the software vulnerabilities and to know the security design concepts (L1)
- perform software security analysis, programming practices (L2)

**Unit II**
Enterprise Application Development: Describe the nature and scope of enterprise software applications, Design distributed N-tier software application, Research technologies available for the Presentation, business and data tiers of an enterprise software application, Design and build a database using an enterprise database system, Develop components at the different tiers in an enterprise system, Design and develop a multi-tier solution to a problem using technologies used in enterprise system, Present software solution.

**Learning Outcomes**
After completion of this unit the student will be able to
- understand the nature and scope of enterprise software applications (L2)
- design N-tier software application and built database system (L4)
- develop multi-tier solution to a problem using technologies used in enterprise system (L5)

**Unit III**
Enterprise Systems Administration: Design, implement and maintain a directory-based server infrastructure in a heterogeneous systems environment, Monitor server resource utilization for system reliability and availability, Install and administer network services (DNS/DHCP/Terminal Services/Clustering/Web/Email).

**Learning Outcomes**
After completion of this unit the student will be able to
- implement a directory-based server infrastructure. (L5)
- install and monitor network services for system reliability and availability. (L6)

**Unit IV**
Obtain the ability to manage and troubleshoot a network running multiple services. Understand the requirements of an enterprise network and how to go about managing them.

**Learning Outcomes**
After completion of this unit the student will be able to
- understand the requirements of an enterprise network (L2)
- troubleshoot a network running multiple services (L5)

**Unit V**
Handle insecure exceptions and command/SQL injection, defend web and mobile applications against attackers, software containing minimum vulnerabilities and flaws.

**Learning Outcomes**
After completion of this unit the student will be able to
- understand the concepts of exceptions and command/SQL injection. (L2)
- handle web and mobile applications against attackers. (L4)

**Text Book(s)**
1. Theodor Richardson, Charles N Thies, Secure Software Design, Jones &Bartlett

**Course Outcomes:**
After completion of course, students would be able to:
- differentiate between various software vulnerabilities. (L4)
- describe software process vulnerabilities for an organization. (L5)
- monitor resources consumption in a software. (L4)
- interrelate security and software development process. (L4)
- design the Software which can able to overcome all threats. (L5)
This course aims to provide an understanding of the various security attacks and knowledge to recognize and remove common coding errors that lead to vulnerabilities. It gives an outline of the techniques for developing a secure application.

Course Objectives:

- Understand the most frequent programming errors leading to software vulnerabilities.
- Identify and analyze security problems in software.
- Understand and protect against security threats and software vulnerabilities.
- Effectively apply their knowledge to the construction of secure software systems

Unit I

Learning Outcomes:
After completing this Unit, students will be able to
- analyze the security policies and flaws(L4)
- interpret the security problems occur in software(L2)
- classify the vulnerabilities(L2)

Unit II
Anti-Tampering, Protecting Against Denial of Service Attack, Copy Protection Schemes, Client-Side Security, Database Security, Applied Cryptography, Randomness and Determinism

Learning Outcomes:
After completing this Unit, students will be able to
- analyze the bugs that can occur in program and try to solve them(L4)
- able to identify the string errors and rectify them(L3)

Unit III
Buffer Overrun, Format String Problems, Integer Overflow, And Software Security Fundamentals SQL Injection, Command Injection, Failure to Handle Errors, And Security Touchpoints

Learning Outcomes:
After completing this Unit, students will be able to
- analyze the different vulnerabilities related to inter data(L4)
- handle the input and validate them(L2)

Unit IV
Cross Site Scripting, Magic URLs, Weak Passwords, failing to Protect Data, Weak Random
Numbers, Improper Use of Cryptography

**Learning Outcomes:**
After completing this Unit, students will be able to
- analyze the different vulnerabilities related to buffer overflow (L4)
- handle the errors and manage exceptions (L2)

**Unit V**
10L
Information Leakage, Race Conditions, Poor Usability, failing to Protect Network Traffic, Improper Use of PKI, Trusting Network Name Resolution.

Case Study of Cross Site Scripting, Magic URLs, Weak Passwords Buffet Overflows, Access Control, Race Conditions.

**Learning Outcomes:**
After completing this Unit, students will be able to
- develop web applications and validate them (L3)
- understand the concept of maintaining session state (L2)

**Text Book(s):**
1. J.Viega, M.Messier, Secure Programming Cookbook, O'Reilly.
2. M.Howard, D.LeBlanc, Writing Secure Code, Microsoft

**Course Outcomes**
After completion of course, students would be able to:
- write secure programs and various risk in the software. (L5)
- describe various possible security attacks (L4)
- classify various errors that lead to vulnerabilities (L2)
- real time software and vulnerabilities associated with them. (L6)
The course is designed to enable the student to apply biometric principles and practices for the secure real-time systems, scientific and business applications. This course lays the foundation both for developing program logic and for writing programs in to diagnose the biometric and cyber problems and to build the system with advance solution to solve problem with cyber ethics.

Course Objectives:
- familiarize the student to understand the basics of Biometrics and its functionalities
- enable the student to understand the role of biometric in the organization build program
- explain the context of Biometric Applications
- demonstrate the handle to learn to develop applications with biometric security
- train the student to design of biometric recognition for the organization

Unit I
Introduction and Definitions of bio-metrics, Traditional authenticated methods and technologies.

Learning Outcomes:
After completion of this unit the student will be able to
- understand basics of Biometrics (L2).
- list the traditional methods (L1).
- interpret the technologies of biometrics (L2)

Unit II
Bio-metric technologies: Fingerprint, Face, Iris, Hand Geometry Gait Recognition, Ear, Voice, Palm print, On-Line Signature Verification, 3D Face Recognition, Dental Identification and DNA.

Learning Outcomes:
After completion of this unit, the student will be able to
- understand fingerprint, face, iris (L2).
- analyze 3D Face Recognition (L4).
- understand DNA (L2).

Unit III
The law and the use of multi bio-metrics systems.

Learning Outcomes:
After completion of this unit, the student will be able to
- analyze law of biometric systems (L4).
- make use of the multi-biometric systems (L3).

Unit IV

Learning Outcomes:
After completion of this unit, the student will be able to
- understand the government sector and commercial sector for biometrics (L2).
- apply the statistical measurement of biometric (L3).
- make use statistical measurements in biometric (L3).
Unit V


Learning Outcomes:
After completion of this unit, the student will be able to
• develop programs biometric system (L6).
• understand recent trends in biometric technologies(L2)

Text Book(s):

Course Outcomes:
After completion of this course, the student will be able to
• identify the various Biometric technologies. (L3)
• understand DNA(L2).
• analyze law of biometric systems (L34).
• understand the government sector and commercial sector for biometrics (L2).
• understand recent trends in biometric technologies(L2)
The course is designed to enable the student to understand underlying principles and many of the techniques associated with the digital forensic practices and cybercrime, investigate attacks, handling evidences. Student can have a sneak review of Computer Forensics, Network Forensics, And Mobile Forensics.

Course Objectives:
- Familiarize the student about digital and computer forensics.
- Enable the student to learn analysis of crime scene.
- Manage and present evidences
- Demonstrate investigation process with case study.

Unit I
Digital Forensics Science: Forensics science, computer forensics, and digital forensics.
Computer Crime: Criminalistics as it relates to the investigative process, analysis of cyber-criminalistics area, holistic approach to cyber-forensics

Learning Outcomes
After completion of this unit, the student will be able to
- understand the functionalities of Forensic Science (L1).
- list the types of computer and digital crimes (L1).
- analyze areas that are vulnerable to cybercrimes (L5).

Unit II
Cyber Crime Scene Analysis: Discuss the various court orders etc., methods to search and seize electronic evidence, retrieved and unretrieved communications, Discuss the importance of understanding what court documents would be required for a criminal investigation.

Learning Outcomes
After completion of this unit, the student will be able to
- understand the legal procedures to seize evidence (L2).
- learn types of information retrieval procedures from evidences (L2).
- generate necessary documents that assist criminal investigation (L3).

Unit III
Evidence Management & Presentation: Create and manage shared folders using operating system, importance of the forensic mindset, define the workload of law enforcement, explain what the normal case would look like, define who should be notified of a crime, parts of gathering evidence, Define and apply probable cause.

Learning Outcomes
After completion of this unit, the student will be able to
- understand various Operating System functionalities (L1).
- know necessity of forensic mindset to judge the crime instincts (L1).
- learn the acts to be performed at the crime scene (L2).

Unit IV
Computer Forensics: Prepare a case, begin an investigation, understand computer forensics workstations and software, conduct an investigation, complete a case, Critique a case.
Network Forensics: open-source security tools for network forensic analysis, requirements for preservation of network data.
Learning Outcomes
After completion of this unit, the student will be able to
- investigates and Judges a crime from a given case study (L5).
- familiarize with network forensic analysis tools (L4).

Unit V
Mobile Forensics: mobile forensics techniques, mobile forensics tools.

Learning Outcomes
After completion of this unit, the student will be able to
- learn about the mobile specific forensic techniques(L2).
- acquaint with the tools that support mobile forensics (L4).
- familiarize with the various legal acts with respect to Digital Forensics (L2).

Text Book(s)

Course Outcomes:
After completion of this course, the student will be able to
- define the concept of Forensics and its associates. (L1)
- underline the need of digital forensic and role of digital evidences. (L2)
- explain the methodology of incident response and various security issues in ICT world, and identify digital forensic tools for data collection. (L3)
- recognize the importance of various digital forensic tools for analysis to achieve adequate perspectives of digital forensic investigation in various applications /devices like Windows/Unix system. (L4)
- list the method to generate legal evidence and supporting investigation reports and will also be able to use various digital forensic tools. (L5)
The course is designed to enable the student to achieve the analytical tools to understand and analyze complex risk and security issues and developments, as well as the ability to plan and implement strategic processes in organizations and companies. The purpose of the course is to train students through critical reflection and professional insights, to identify opportunities for change in the complex and risky environments in which they operate and to put these reflections into action.

Course Objectives:

- Student will acquire theoretical and empirical knowledge about security policy, risk analysis and organizations in a changing world. Enable the student to perform vulnerability analysis.
- Student will acquire skills to analyze complex risk and security issues and developments, as well as the ability to plan and implement strategic processes in organizations and private companies.
- Students will acquire competences to translate knowledge about the political field of risk and security into risk analysis and strategies and to identify socially, politically and economically sustainable solutions and opportunities for public organizations and private companies.

Unit I


Learning Outcomes:

After completion of this unit the student will be able to
- Describe the critical information characteristics (L1)
- Understand the security counter measures (L1)
- Identify the threats and vulnerabilities (L1)
- Explain Confidentiality, Integrity and Availability (L2)

Unit II

Threats to and Vulnerabilities of Systems: definition of terms (e.g., threats, vulnerabilities, risk), major categories of threats (e.g., fraud, Hostile Intelligence Service (HOIS), malicious logic, hackers, environmental and technological hazards, disgruntled employees, careless employees, HUMINT, and monitoring), threat impact areas, Countermeasures: assessments (e.g., surveys, inspections), Concepts of Risk Management: consequences (e.g., corrective action, risk assessment), cost/benefit analysis of controls, implementation of cost effective controls, monitoring the efficiency and effectiveness of controls (e.g., unauthorized or inadvertent disclosure of information), threat and vulnerability assessment.

Learning Outcomes:

After completion of this unit, the student will be able to
- understand major categories of threats. (L1)
- identify threat impact areas (L2).
- implement cost effective controls, monitoring the efficiency and effectiveness of controls (L3).
Unit III 9L
Security Planning: Directives and procedures for policy mechanism, Risk Management: acceptance of risk (accreditation), corrective actions information identification, risk analysis and/or vulnerability assessment components, risk analysis results evaluation, roles and responsibilities of all the players in the risk analysis process, Contingency Planning/Disaster Recovery: agency response procedures and continuity of operations, contingency plan components, determination of backup requirements, development of plans for recovery actions after a disruptive event, development of procedures for offsite processing, emergency destruction procedures, guidelines for determining critical and essential workload, team member responsibilities in responding to an emergency situation.

Learning Outcomes:
After completion of this unit, the student will be able to
• explain directives and procedures for policy mechanism (L4).
• understand the procedures for offsite processing, emergency destruction (L1).
• explain roles and responsibilities of all the players in the risk analysis process (L4).

Unit IV 9L
POLICIES AND PROCEDURES: Physical Security Measures: alarms, building construction, cabling, communications center, environmental controls (humidity and air conditioning), filtered power, physical access control systems (key cards, locks and alarms), Personnel Security Practices and Procedures: access authorization/verification (need to know), contractors, employee clearances, position sensitivity, security training and awareness, systems maintenance personnel, Administrative Security Procedural Controls: attribution, copyright protection and licensing , Auditing and Monitoring: conducting security reviews, effectiveness of security programs, investigation of security breaches, privacy review of accountability controls, review of audit trails and logs

Learning Outcomes:
After completion of this unit, the student will be able to
• understand physical security measures (L1)
• employ personnel security practices and procedures(L3)
• explain administrative security procedural controls (L3)

Unit V 6L
Operations Security (OPSEC): OPSEC surveys/OPSEC planning INFOSEC: computer security – audit, cryptography encryption (e.g., point to point, network, link), cryptography key management (to include electronic key), cryptography strength (e.g., complexity, secrecy, characteristics of the key) Case study of threat and vulnerability assessment.

Learning Outcomes:
After completion of this unit, the student will be able to
• understand OPSEC surveys and OPSEC planning (L1)
• explain cryptographic encryption and key management (L3)
• outline cryptography strength (L3)

Text Book(s)

Course Outcomes
After completion of course, students would be able to:
• understand the security counter measures(L1)
• implement cost effective controls, monitoring the efficiency and effectiveness of controls (L3).
• employ personnel security practices and procedures(L3).
This course is designed with the basics of web data elements, documents and its terminology. The searching of web is done using the concept of query languages, ontology. The parallel, distributed and various information retrieval mechanisms are applied here. Few text, multimedia languages, social networks were introduced.

Course Objectives:

- To acquaint with the basics of web elements, documents and terminology
- Identify different web searching methods
- Implement query languages and its operations
- Understand the concept of ontology
- Study various information retrieval mechanisms
- Acquire the knowledge of text, multimedia languages and social networks

Unit I
Information retrieval model, Information retrieval evaluation, Searching the Web
Learning outcomes:
- define the various web elements (L1)
- identify different web searching methods(L2)
- comprehend the information retrieval concept (L2)

Unit II
Document Representation, Query languages and query operation, Meta-data search.
Learning outcomes:
- understand the web document basics(L2)
- practice query languages and operations(L3)
- analyze the query inputs and outputs(L4)

Unit III
Indexing and searching, Scoring and ranking feature vectors.
Learning outcomes:
- discover the various searching mechanisms (L3)
- interpret indexing, scoring and ranking concepts (L2)

Unit IV
Ontology, domain specific search, parallel and distributed information retrieval
Learning outcomes:
- illustrate the concept of ontology(L3)
- compare parallel and distributed information retrieval (L4)

Unit V
Text and multimedia languages, Social networks.Recent trends in Web search and Information retrieval techniques.
**Learning outcomes:**
- demonstrate various text, multimedia languages (L3)
- interpret the social networks(L3)

**Text Book(s)**

**Course outcomes:**
After completing this Course, the student should be able to:
- understand the basic web terminology (L2)
- distinguish different web searching methods(L2)
- experiment the query languages(L4)
- outline the concept of ontology(L4)
- demonstrate the various information retrieval mechanisms (L3)
- apply the text, multimedia language (L3)
The course provides fundamentals of data security and various access control techniques mechanisms that are introduced along with application areas of access control techniques. It also contains an RBAC and smart card technology that has great deal of attention for commercial and real time applications.

Course Objectives
- To narrate and evaluate the design principles of conventional discretionary and mandatory security techniques.
- To learn Different RBAC frameworks for modelling a secure system
- To know methods for assigning access to information in a company based on the individual’s need for the information,
- To specify security administrator and enforce security policies that map naturally to the organization’s structure.
- To utilize a technology that decreases the cost of network administration while improving the enforcement of network security policies.
- To understand reliable and quality data transmission using smart cards.

Unit I 5L
Introduction to Access Control, Purpose and fundamentals of access control, brief history.
Learning Outcomes
After completion of this unit the student will be able to
- list the origins, history, and central concepts of access control (L1)
- review the technical realization and security of data (L2)
- compare principles of conventional discretionary and mandatory security techniques. (L2)
- identify access control policies, access control models, and access control mechanisms. (L1)

Unit II 8L
Role-Based Access Control (RBAC) and Limitations, Core RBAC, Hierarchical RBAC, Statically Constrained RBAC, Dynamically Constrained RBAC, Limitations of RBAC. Comparing RBAC to DAC and MAC Access control policy.
Learning Outcomes
After completion of this unit the student will be able to
- review popular forms of access controls in use today (L2)
- interpret the basic concepts of RBAC and its advantages for system, application, and network security(L3)
- compare security levels of different RBAC models. (L2)
incorporate roles to users using RBAC (L6)

Unit III  
8L
Biba’s integrity model, Clark-Wilson model, Domain type enforcement model, mapping the enterprise view to the system view, Role hierarchies- inheritance schemes, hierarchy structures and inheritance forms, using SoD in real system, Temporal Constraints in RBAC, MAC and DAC.
Integrating RBAC with enterprise IT infrastructures: RBAC for WFMSs, RBAC for UNIX and JAVA environments Case study: Multi-line Insurance Company.

Learning Outcomes
After completion of this unit the student will be able to
• describe the similarities and differences between roles and groups (L1)
• develop access control mechanisms and models (L3)
• illustrate the research concepts and associated prototypes that have been developed to integrate RBAC model concepts into existing enterprise IT infrastructures. (L3)
• trace the integration of the RBAC model into the Web applications (L2)

Unit IV  
9L
SmartCard based Information Security, Smartcard operating system fundamentals, design and implantation principles, memory organization, smart card files, file management, atomic operation, smart card data transmission ATR, PPS Security techniques- user identification, smart card security, quality assurance and testing, smart card life cycle-5 phases, smart card terminals.

Learning Outcomes
After completion of this unit the student will be able to
• identify smart card applications like identification, financial, mobile phones (SIM), public transit, computer security, schools, and healthcare (L1)
• explain how Smart cards provide computing, portability and secure storage of data and value. (L4)
• understand the integration of smart cards into system to introduce security. (L2)
• construct preset permissions set by the card issuer. (L3)

Unit V  
12L
Recent trends in Database security and access control mechanisms. Case study of Role-Based Access Control (RBAC) systems, Recent Trends related to data security management, vulnerabilities in different DBMS.

Learning Outcomes
After completion of this unit the student will be able to
• record the experience of a real company in its transition from conventional access control methods to RBAC. (L1)
• develop prototypes to integrate the RBAC model into the various enterprise technologies. (L3)
• evaluate the benefits and costs of RBAC from the vantage point of a software end user. (L5)
• report insights related to delegated administration and other functionalities afforded RBAC users. (L2)

Textbook(s):
Course Outcomes:
After completion of course, students would be able to:
• understand and implement classical models. (L2)
• analyse the data, identify the problems, and choose the relevant models (L4)
• assess the strengths and weaknesses of various access control models and to analyse their behaviour. (L5)
• assign security levels are assigned to users, with subjects acting on behalf of users and objects. (L3)
• Use of a common mechanism for a wide variety of purposes. (L3)
This course introduces the student to the different aspects of research paper writing including planning, preparation, layout, literature review write-up etc. Specifically the perspective and style of writing in different sections of a research paper is highlighted. Students will exposed to English language skills relevant to research paper writing.

**Course Objectives:**

- To write clearly, concisely and carefully by keeping the structure of the paper in mind.
- To use standard phrases in English and further improve his command over it.
- To write with no redundancy, no ambiguity and increase the readability of the paper.
- To plan and organize his paper by following a logical buildup towards a proper conclusion.
- To decide what to include in various parts of the paper.
- To write a suitable title and an abstract in order to attract the attention of the reader.
- To identify the correct style and correct tense.
- To retain the scientific value of the paper by using minimum number of words.

**Unit I**
Planning and Preparation, Word Order, breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness.

**Learning Outcomes:**

After the completion of this unit, the student will be able to

- To know the expectations of various journals and referees (L2)
- To know the typical structure of a paper (L3)
- Learn to put words in a sentence in the correct order (L4)
- To write short and clear sentences from the very beginning of the paper (L4)
- To increase the readability of the paper by making it easy to read and 100% clear (L4)
- Learn to be concise without losing any important content (L4)
- To avoid some typical grammar mistakes made in research papers (L4)

**Unit II**

**Learning Outcomes:**

After the completion of this unit, the student will be able to

- Learn to make useful contribution worth recommending for publication (L4)
- Learn good use of language to make readers notice the key findings (L4)
- Learn to anticipate or predict possible objections to the claims made in the paper (L5)
- To understand what is plagiarism, and how to paraphrase other people’s work (L4)
- Learn to attract the right kind of readers with a suitable title (L3)
- Learn to sell the abstract to potential readers by attracting their curiosity (L2)
Unit III 6L
**Review of the Literature**, Methods, Results, Discussion, Conclusions, The Final Check. key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature.

**Learning Outcomes:**
After the completion of this unit, the student will be able to

- have a deep knowledge about everything that has been previously written on the topic and decide what is important to know in Introduction. (L3)
- Learn to provide the right amount of literature regarding the sequence of events leading up to the current situation in the Literature review (L4)

Unit IV 6L
**Writing Skills:** skills are needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusions.

**Learning Outcomes:**
After the completion of this unit, the student will be able to

- Learn to describe the materials used in experiments and/or the methods used to carry out the research (L2)
- The key skill is in reporting the results simply and clearly (L3)
- Learn to structure the Discussion and satisfy the typical requirements of the referees (L4)
- Learn to provide a clear and high-impact take-home message in the conclusion (L5)

Unit V 6L
**Good Paper Writing:** Useful phrases, how to ensure paper is as good as it could possibly be the first-time submission.

**Learning Outcomes:**
After the completion of this unit, the student will be able to

- Learn various lists of frequently used phrases that have a general acceptance in all disciplines and use in specific sections of the paper (L3)
- Learn various kinds of things one should look for when doing the final check (L3)

**Text Book (s):**

**References:**

**Course Outcomes:**
By the end of the course the students will be able to:

- Frame the structure of the paper precisely. (L2).
- Improve his command over English by using standard phrases. (L3).
- Avoid repetition and mistakes in the paper and increase its readability. (L3).
- Organize the paper logically towards a proper conclusion. (L4).
- Decide on the content to be included in various parts of the paper. (L5).
- Identify whether to use personal or impersonal style in the paper. (L5).
- Express the content in a clear and concise way. (L6).
- Attract the attention of the reader by providing a suitable title and an appropriate abstract. (L6).
19EAC742: DISASTER MANAGEMENT

This course is intended to provide fundamental understanding of different aspects of Disaster Management. It will expose the students to the concept and functions of Disaster Management and to build competencies of Disaster Management professionals and development practitioners for effective supporting environment as put by the government in legislative manner. It would also provide basic knowledge, skills pertaining to Planning, Organizing and Decision-making process for Disaster Risk Reduction.

Course Objectives
• to provide students an exposure to disasters, their significance, types & Comprehensive understanding on the concurrence of Disasters and its management.
• to ensure that students begin to understand the relationship between vulnerability, disasters, disaster prevention, risk reduction and the basic understanding of the research methodology for risk reduction measures.
• equipped with knowledge, concepts, and principles, skills pertaining to Planning, Organizing, Decision-making and Problem solving methods for Disaster Management.
• to develop rudimentary ability to respond to their surroundings with potential disaster response in areas where they live, with due sensitivity.

Unit I
Introduction
Disaster: Definition, Factors and Significance; Difference Between Hazard and Disaster; Natural and Manmade Disasters: Difference, Nature, Types and Magnitude.

Learning Outcomes
After the completion of this unit, the student will be able to
• define the meaning, list the factors and mention the significance of disaster (L1)
• distinguish between hazard and disaster (L3)
• compare manmade and natural disaster (L3)
• list the types of disaster and describe their magnitude (L2)

Unit II

Learning Outcomes
After the completion of this unit, the student will be able to
• list the different repercussions of disasters and hazards(L1)
• describe the characteristics of natural disasters and the magnitude of their losses(L2)
• describe the characteristics of man-made disasters and the magnitude of their losses(L2)
• elaborate the outbreaks of diseases and epidemics after disasters (L3)
Unit III

Disaster Prone Areas in India Study of Seismic Zones; Areas Prone to Floods and Droughts, Landslides and Avalanches; Areas Prone to Cyclonic and Coastal Hazards with Special Reference to Tsunami; Post-Disaster Diseases and Epidemics.

Learning Outcomes
After the completion of this unit, the student will be able to
- describe the seismic zones and their characteristics(L2)
- identify the areas prone to floods and droughts(L1)
- distinguish between landslides and avalanches(L3)
- identify areas prone to cyclonic and coastal hazards(L4)
- enumerate the post disaster diseases and epidemics(L2)

Unit IV

Disaster Preparedness and Management Preparedness: Monitoring of Phenomena Triggering a Disaster or Hazard; Evaluation of Risk: Application of Remote Sensing, Data from Meteorological and Other Agencies, media reports: governmental and Community Preparedness.

Learning Outcomes
After the completion of this unit, the student will be able to
- describe the monitoring of phenomena triggering a disaster/hazard(L2)
- evaluate the risk with the use of remote sensing and meteorological data(L5)
- list the governmental and community measures for disaster preparedness(L2)

Unit V


Learning Outcomes
After the completion of this unit, the student will be able to
- define and list the elements of disaster risk(L1)
- enumerate the measures for risk reduction(L2)
- apply the techniques of risk assessment (L4)
- identify the means of people’s participation in risk assessment(L2)

Text Book(s):
2. Sahni, Pardeep, Disaster Mitigation Experiences and Reflections, Prentice Hall of India, New Delhi., 2012
Course Outcomes

At the end of the course, student will be able to

- Identify management activities in pre, during and post phases of Disasters. (L1)
- Plan disaster management activities and specify measure for risk reduction(L4)
- apply risk assessment techniques in real life disaster scenarios(L4)
19EAC744: VALUE EDUCATION

This course is intended to expose the student to the need for human values and methods to cultivate them for leading an ethical life with good moral conduct. Students taking this course will be able to experience a change in personal and professional behavior with these ethical principles guiding him throughout life.

Course Objectives
- to expose the student to need for values, ethics, self-development and standards
- to make the student understand the meaning of different values including duty, devotion, self-reliance etc.
- to imbibe the different behavioral competencies in students for leading an ethical and happy life
- to expose the student to different characteristic attributes and competencies for leading a successful, ethical and happy profession life.

Unit I 7L

Learning Outcomes
After the completion of this unit, the student will be able to
- define the social values and individual attitudes for self development (L1)
- describe the Indian vision of humanism (L2)
- distinguish between moral and non-moral acts (L3)
- list the standards and value principles for moral conduct (L2)

Unit II 7L

Learning Outcomes
After the completion of this unit, the student will be able to
- describe the importance of cultivating values (L2)
- list the different traits of self-developed individual (L1)
- explain the need for loving nature/country/humanity (L2)

Unit III 7L

Learning Outcomes
After the completion of this unit, the student will be able to
- describe the benefits of positivie thinking, integrity and discipline (L2)
- list the different methods for avoiding fault finding, anger (L1)
• explain the methods to overcome suffering, religious intolerance, self-destructive habits(L2)

**Unit IV**

**Learning Outcomes**
After the completion of this unit, the student will be able to
• describe the science of reincarnation(L2)
• explain the relation between self-management and good health(L1)
• elaborate the role of different religions in reaching the common goal(L3)
• list the different techniques for mind-control to improve personality and studies(L1)

**Text Book(s):**

**Course Outcomes**
After successful completion of the course, the student will be able to
• describe the need for human values and methods for self development (L2)
• elaborate the different traits and benefits of a self-developed individual (L1)
• list the different attributes of self-developed individual (L1)
• elaborate the role and scope of books/faith/health/religions in character building and competence development(L3)
This course is intended to expose the student to the philosophy of Indian constitution. Students will be able to understand their fundamental rights/duties and governance structure. Students also appreciate the role of election commission in establishing a democratic society.

Course Objectives
- to familiarize the student about the need for a constitution
- to make the student understand the role of constitution in a democratic society
- to acquaint the student with key constitutional features and fundamental rights of a citizen
- to impart the organs of governance and local administration hierarchy and their responsibilities
- to familiarize the student with the role, responsibilities and administration hierarchy of election commission

Unit I

Learning Outcomes
After the completion of this unit, the student will be able to
- list the outline of drafting committee and their roles in the making of Indian constitution (L1)
- describe the need and role of a constitution in a democratic society(L2)
- elaborate the salient features of Indian constitution(L3)

Unit II

Learning Outcomes
After the completion of this unit, the student will be able to
- list the fundamental rights of a citizen(L1)
- explain the intricacies in the different rights(L2)
- elaborate the fundamental duties of a citizen(L3)
- describe the principles of state policy(L2)

Unit III
Organs of Governance: Parliament, Composition, Qualifications and Disqualifications, Powers and Functions, Executive, President, Governor, Council of Ministers, Judiciary, Appointment and Transfer of Judges, Qualifications, Powers and Functions

Learning Outcomes
After the completion of this unit, the student will be able to
- present the hierarchy of governance (L2)
- list the role/responsibilities/powers of different organs of governance(L1)
- elaborate the guidelines for appointment/transfer of judges(L2)

Unit IV
Local Administration: District’s Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation.

Learning Outcomes
After the completion of this unit, the student will be able to
• describe the administrative organizational hierarchy of municipalities and panchayats(L2)
• appreciate the role/responsibilities/powers of mayor, CEO, elected officials(L3)
• appreciate the importance of grass root democracy(L3)

Unit V 6L

Learning Outcomes
After the completion of this unit, the student will be able to
• describe the administrative hierarchy of election commission(L2)
• elaborate the roles/responsibilities/powers of election commissioners at different levels of hierarchy(L3)
• outline the welfare activities of SC/ST/OBC/Women by different bodies(L3)

Text Book(s):
1. The Constitution of India, 1950 (Bare Act), Government Publication.
2. S. N. Busi, Dr. B. R. Ambedkar, Framing of Indian Constitution, 1/e, 2015.

Course Outcomes
After successful completion of the course, the student will be able to
• describe the philosophy and salient features of Indian constitution(L2)
• list the constitutional rights and duties of a citizen(L1)
• elaborate the central and local administrative hierarchy and their roles(L2)
• describe the roles/responsibilities/powers of different governing and administrative bodies(L2)
• explain the structure/functioning and power of election commission(L2)
This course is aimed to familiarizing the student with pedagogical principles, practices and methodologies. This course is intended for students interested in pursuing a career in teaching and research.

Course Objectives
- to familiarize the student about the need for pedagogy studies, background and conceptual framework
- to expose the student to pedagogical practices in formal/informal classrooms
- to acquaint the student with type of curriculum and guidance materials for effective pedagogy
- to familiarize the student with classroom practices and curriculum assessment procedures
- to make the student understand the effect of undertaking research on teaching quality

Unit I

Learning Outcomes
After the completion of this unit, the student will be able to
- define the aim and rationale behind teacher education (L1)
- classify the different theories of learning (L1)
- elaborate the need and role of curriculum, teacher education (L1)

Unit II
Thematic overview: Pedagogical practices are being used by teachers in formal and informal classrooms in developing countries. Curriculum, Teacher education.

Learning Outcomes
After the completion of this unit, the student will be able to
- describe the different pedagogical practices used by teachers in formal and informal classrooms (L1)
- explain the pedagogical practices employed in developing countries (L1)
- enumerate the duties of faculty in terms of teaching, research, consultancy, administration (L1)

Unit III
Evidence on the effectiveness of pedagogical practices, Methodology for the in depth stage: quality assessment of included studies. How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy? Theory of change. Strength and nature of the body of evidence for effective pedagogical practices. Pedagogic theory and pedagogical approaches. Teachers’ attitudes and beliefs and Pedagogic strategies.

Learning Outcomes
After the completion of this unit, the student will be able to
- list the measures for effective pedagogy (L1)
- identify the different documentation required to formalize curriculum implementation and quality assessment (L1)
- describe the teachers attitudes and beliefs in pedagogic strategies (L2)
Unit IV 6L
Professional development: alignment with classroom practices and follow-up support, Peer support, Support from the head teacher and the community. Curriculum and assessment, Barriers to learning: limited resources and large class sizes.

Learning Outcomes
After the completion of this unit, the student will be able to
• define the organizational hierarchy in a school administration system(L1)
• list the different barriers to learning(L3)
• enumerate the methods to overcome limited resources and handle large class sizes(L3)
• describe the follow-up support and peer-support in classroom practices(L2)

Unit V 6L
Research gaps and future directions: Research design, Contexts, Pedagogy, Teacher education, Curriculum and assessment, Dissemination and research impact.

Learning Outcomes
After the completion of this unit, the student will be able to
• explain the need for and role of research in teaching profession(L2)
• list the different research activities to be taken up by teachers(L1)
• describe the impact of research on teaching quality and learning process(L2)

Text Book(s):

Course Outcomes
After successful completion of the course, the student will be able to
• describe the theories of learning and conceptual framework of pedagogy(L2)
• explain the pedagogical practices used by teachers in formal and informal classrooms(L2)
• visualize the administrative hierarchy of schools and colleges and define the role(L3)
• appreciate the need for research and define the future direction of teaching career(L3)
• describe the impact of curriculum and assessment on the teaching learning process of a student(L3)
This course is aimed to familiarize the student with basic principles of yoga and different physical/mental practices for managing mind and body. This course helps the student in managing stress during education, home and workplace. Further, principles learnt in this course help in building overall personality for a stress-free, happy and independent life.

Course Objectives
• to familiarize the student about eight parts of yoga and their significance
• to expose the student to the importance and meaning of Yam and Niyam
• to make the student understand the meaning and importance of yogic principles including Ahimsa, Satya, Astheya etc
• to introduce the different yogic poses with a knowledge of their benefits for mind and body
• to familiarize the effect of different types of breathing techniques in concept and in activity

Unit I
Definitions of Eight parts of yoga (Ashtanga).

Learning Outcomes
After the completion of this unit, the student will be able to
• list the eight parts of yoga (L1)
• describe the effects of different parts of yoga on mind and body(L2)
• elaborate the importance of yoga in stress management and personality development(L3)

Unit II
Yam and Niyam.
Do’s and Don’t’s in life.
i) Ahinsa, satya, astheya, bramhacharya and aparigraha
ii) Shaucha, santosh, tapa, swadhyay, ishwarpanidhan.

Learning Outcomes
After the completion of this unit, the student will be able to
• elaborate the importance of Yam and Niyam(L2)
• describe the meaning and significance of Ahinsa, satya, astheya etc(L2)
• explain the need for shaucha, santosh, tapa, swadhyay in leading a healthy and fruitful life(L3)

Unit III
Asan and Pranayam
i) Various yog poses and their benefits for mind & body
ii) Regularization of breathing techniques and its Effects-Types of pranayam.

Learning Outcomes
After the completion of this unit, the student will be able to
• demonstrate the different physical asanas and explain their physical and phychological effects(L4)
• demonstrate the different breathing techniques and describe their physical and mental effects (L4)
• distinguish between different types of pranayamam(L5)

Text Books
Course Outcomes
After successful completion of the course, the student will be able to
• describe the eight parts of yoga and their significance\((L1)\)
• explain the the importance and meaning of \(Yam\) and \(Niyam\)\((L2)\)
• define the meaning and importance of yogic principles including \(Ahimsa\), \(Satya\), \(Astheya\) etc\((L1)\)
• demonstrate the different yogic poses and explain their benefits for mind and body\((L4)\)
• demonstrate the different types of breathing techniques and explain their physical and mental benefits\((L5)\)
This course is aimed to familiarize the student with life enlightenment skills for personality development. This course helps the student in building his holistic personality through human values, ethics and spiritual attributes.

Course Objectives
- to familiarize the student to good personality traits through moral stories
- to make the student understand the goal of human life and importance of good personality in reaching the goal
- to expose the student to the study of Shrimad-Bhagwad-Geeta for developing his/her personality and achieve the highest goal in life
- to familiarize the student to leadership skills for driving nation and mankind to peace and prosperity
- to expose the role of Neetishatakam for developing versatile personality of students.

Unit I
Neetisatakam-Holistic development of personality
Verses- 19,20,21,22 (wisdom)
Verses- 29,31,32 (pride & heroism)
Verses- 26,28,63,65 (virtue)
Verses- 52,53,59 (dont’s)
Verses- 71,73,75,78 (do’s).

Learning Outcomes
After the completion of this unit, the student will be able to
- describe the moral stories illustrating the traits of good personality(L2)
- define the meaning and importance of wisdom, pride, heroism, virtue etc(L1)
- identify do and donts in life from the foundations of human morals/ethics(L5)

Unit II
Approach to day to day work and duties.
Shrimad BhagwadGeeta: Chapter 2-Verses 41, 47,48,
Chapter 3-Verses 13, 21, 27, 35, Chapter 6-Verses 5,13,17, 23, 35,
Chapter 18-Verses 45, 46, 48.

Learning Outcomes
After the completion of this unit, the student will be able to
- describe the characteristics and principles of bhakti yogam, jnana yogam and karma yogam (L1)
- identify the use of different yogic characteristics in different activities of daily life/duties(L4)
- apply the use of yogic principles for leading a stress-free, happy and fruitful life with good developed personality(L4)
Unit III
Statements of basic knowledge.
Shrimad BhagwadGeeta: Chapter2-Verses 56, 62, 68
Chapter 12 - Verses 13, 14, 15, 16,17, 18
Personality of Role model. Shrimad BhagwadGeeta:
Chapter2-Verses 17, Chapter 3-Verses 36,37,42,
Chapter 4-Verses 18, 38,39
Chapter18 – Verses 37,38,63

Learning Outcomes
After the completion of this unit, the student will be able to
• list the characteristics of role model proposed by verses of bhagavad gita(L1)
• explain the methods for obtaining life enlightenment through the practice of four yoga appropriately (L2)
• describe the characteristics of karma yogi/jnana yogi for developing leadership personality (L2)

Text Book(s):
1. Swami Swarupananda, “Srimad Bhagavad Gita”, Advaita Ashram (Publication Department), Kolkata
2. P. Gopinath, Bhartrihari’s Three Satakam (Niti-Sringar-vairagya), Rashtriya Sanskrit Sansthanam, New Delhi.

Course Outcomes
After successful completion of the course, the student will be able to
• List the different parables of neethisathakam and identify their morals(L1)
• enumerate the different traits of human personality for life enlightenment(L2)
• describe the leadership attributes for driving nation and mankind to peace and prosperity(L2)
• explain the applicability of different types of yoga to day-to-day work and duties resulting in responsible personality (L2)
Soft skills comprise pleasant and appealing personality traits as self-confidence, positive attitude, emotional intelligence, social grace, flexibility, friendliness and effective communication skills. The course aims to cause a basic awareness within the students about the significance of soft skills in professional and inter-personal communications and facilitate an all-round development of personality.

Course Objectives
- to familiarize the student to the criteria for self assessment and significance of self-discipline
- to expose the student to attitudes, mindsets, values and beliefs
- to acquaint the student to plan career and goals through constructive thinking
- to enable the student to overcome barriers for active listening and persuasive speaking
- to familiarize the skill of conducting meetings, writing minutes and involving in active group discussions

Unit I
Self-Assessment; Identifying Strength & Limitations; Habits, Will-Power and Drives; Developing Self-Esteem and Building Self-Confidence, Significance of Self-Discipline

Learning Outcomes
After the completion of this unit, the student will be able to
- identify strengths & limitations through self-assessment(L3)
- list the attributes of personalities will good will-power and self-drives(L1)
- describe the reasons for building self-esteem and self-confidence(L2)
- explain the significance of self discipline(L2)

Unit II
Understanding Perceptions, Attitudes, and Personality Types: Mind-Set: Growth and Fixed; Values and Beliefs

Learning Outcomes
After the completion of this unit, the student will be able to
- define the characteristics of different perceptions, attitudes and personality types(L1)
- distinguish between fixed and growing mindsets(L3)
- define the importance and meaning of values and beliefs(L2)

Unit III
Motivation and Achieving Excellence; Self-Actualisation Need; Goal Setting, Life and Career Planning; Constructive Thinking

Learning Outcomes
After the completion of this unit, the student will be able to
- describe the need for having high motivation and achieving excellence(L2)
- define the need for self-actualization(L1)
- plan the life and career goals based on self assessment(L4)
- explain the attributes of constructive thinking(L2)

Unit IV
Communicating Clearly: Understanding and Overcoming barriers; Active Listening; Persuasive Speaking and Presentation Skills.

Learning Outcomes
After the completion of this unit, the student will be able to
• self-assess the barriers for communicating clearly (L4)
• list the attributes of active listening(L1)
• describe the minimal aspects of effective presentation(L2)
• organize ideas resulting a persuasive talk(L3)

Unit V
Conducting Meetings, Writing Minutes, Sending Memos and Notices; Netiquette: Effective E-mail Communication; Telephone Etiquette; Body Language in Group Discussion and Interview.

Learning Outcomes
After the completion of this unit, the student will be able to
• describe the format and structure of writing meeting minutes(L2)
• identify the essential components of memos and notices(L3)
• explain the principles of effective email communication(L2)
• list the basic etiquette of telephone conversation(L1)
• describe the effective body traits during group discussion and interviews(L2)

Text Books

Course Outcomes
After successful completion of the course, the student will be able to
• carry out self assessment and describe the significance of self-discipline(L4)
• define, classify and compare attitudes, mindsets, values and beliefs(L3)
• plan career and goals through constructive thinking and personal assessment(L4)
• overcome barriers for active listening and persuasive speaking (L5)
• conduct meetings, write minutes and involve in active group discussions(L3)
This course introduces students to the science of business analytics. The goal is to provide students with the foundation needed to apply data analytics to real-world challenges they confront daily in their professional lives. Students will learn to identify the ideal analytic tool for their specific needs; understand valid and reliable ways to collect, analyze, and visualize data; and utilize data in decision making for managing agencies, organizations or clients in their workspace.

Course Objectives
- To familiarize the scope, process and advantages of business analytics
- To acquaint the student with the modeling and problem solving skills in business analytics
- To impart the organization and management of business analytics
- To introduce the forecasting models and techniques used in analytics
- To expose the formulation and decision strategies used in business analytics

Unit I

Learning Outcomes
After the completion of this unit, the student will be able to
- define the scope and process of business analytics (L1)
- choose an organizational structure to implement a business analytics process (L4)
- describe the statistical tools and methods used for data modeling and analysis (L2)
- identify the sampling and estimation requirements for data analysis (L1)

Unit II

Learning Outcomes
After the completion of this unit, the student will be able to
- identify the relationships and trends in data (L1)
- utilize linear regression methods for identifying data relationships (L4)
- list the types of data and their models used for business analytics (L1)
- describe the methods for visualization and exploration of data (L2)

Unit III
Organization Structures of Business analytics: Team management, Management Issues, Designing Information Policy, Outsourcing, Ensuring Data Quality, measuring contribution of Business analytics, Managing Changes. Descriptive Analytics, predictive analytics, predicative Modelling, Predictive analytics analysis, Data Mining, Data Mining Methodologies, Prescriptive analytics and its step in the business analytics Process, Prescriptive Modelling, nonlinear Optimization.

Learning Outcomes
After the completion of this unit, the student will be able to
- describe the management issues in the organization structures (L2)
• define the designing information policy and its usage (L1)
• list the methods for ensuring data quality measuring contribution (L1)
• explain the use of data mining methodologies for predictive analytics analysis (L3)
• describe the use of prescriptive analytics methods in business analytics process (L2)

Unit IV                                                                                                                                   10L


Learning Outcomes
After the completion of this unit, the student will be able to
• classify and describe the use of forecasting models (L3)
• model the use of regression forecasting with casual variables (L5)
• identify the appropriate forecasting model for a given data (L5)
• explain the use of monte carlo simulation for forecasting and identify the involved risk (L2)

Unit V                                                                                                                                   8L


Learning Outcomes
After the completion of this unit, the student will be able to
• formulate decision problems (L2)
• list the decision strategies with and without probabilities (L1)
• use the decision trees for analysis (L4)
• describe the value of information, utility and its use in decision making (L4)

Textbook(s):

Course Outcomes
Upon successful completion of the course, the student will be able to
• define the scope, process and advantages of business analytics (L1)
• explain the modeling and problem solving skills in business analytics (L2)
• describe the organization and management of business analytics (L3)
• utilize the forecasting models and techniques used in analytics (L4)
• enumerate and utilize the formulation and decision strategies (L2)
Optimization problems arise in all walks of human activity—particularly in engineering, business, finance and economics. The simplest optimization problems are linear in nature which may be subject to a set of linear constraints. This course will equip the student with the expertise to mathematically model real life optimization problems as Linear Programming (Optimization) Problems and subsequently educate the student to solve these models with the help of the available methods.

Course Objectives
• to impart knowledge on developing mathematical formulation for linear programming and transportation problem
• to familiarize the student in the construction of the required activities in an efficient manner to complete it on or before a specified time limit and at the minimum cost.
• to expose the development of mathematical model for interactive decision-making situations, where two or more competitors are involved under conditions of conflict and competition.
• to illustrate PERT and CPM techniques for planning and implementing projects.
• To impart the knowledge of formulating and analysis of real life problems using advanced tools and techniques for resource optimization
• to provide frameworks for analyzing waiting lines using advanced queuing theory concepts

Unit I
Optimization Techniques, Model Formulation, models, General L.R Formulation, Simplex Techniques, Sensitivity Analysis, Inventory Control Models
Learning Outcomes
After completing this unit, the student will be able to
• identify and develop operational research models from the verbal description of the real system. [L4]
• understand the classification systems of effective Inventory control models[L2]

Unit II
Formulation of a LPP - Graphical solution revised simplex method - dual simplex method - sensitivity analysis - parametric programming
Learning Outcomes
After completing this unit, the student will be able to
• translate a real-world problem, given in words, into a mathematical formulation. [L2]
• utilize the mathematical tools that are needed to solve optimization problems. [L2]

Unit III
Nonlinear programming problem - Kuhn-Tucker conditions min cost flow problem - max flow problem - CPM/PERT
Learning Outcomes
After completing this unit, the student will be able to
• describe the need and origin of the optimization methods[L2]
• classify optimization problems to suitably choose the method needed to solve the particular type of problem[L3]

Unit IV
Scheduling and sequencing - single server and multiple server models - deterministic inventory models - Probabilistic inventory control models - Geometric Programming.

Learning Outcomes

After completing this unit, the student will be able to

• choose linear programming problems to suitably choose the method needed to solve the particular type of problem [L1]
• identify industrial problems involved in inventory, MRP and scheduling [L2]

Unit V

Competitive Models, Single and Multi-channel Problems, Sequencing Models, Dynamic Programming, Flow in Networks, Elementary Graph Theory, Game Theory Simulation

Learning Outcomes

After completing this unit, the student will be able to

• identify the values, objectives, attributes, decisions, uncertainties, consequences, and trade-offs in a real decision problem [L2]
• Apply the models to incorporate rational decision-making process in real life situations [L3]
• Analyze various modeling alternatives & select appropriate modeling techniques for a given situation [L3]

Text Book(s):


Course Outcomes

After the successful completion of the course, the students will be able to:

• Understand the basic concepts of different advanced models of operations research and their applications. (L2)
• Solve linear programming problems using appropriate techniques and optimization solvers, interpret the results obtained and translate solutions into directives for action. (L4)
• Apply the models to incorporate rational decision-making process in real life situations. (L4)
• Analyze various modeling alternatives & select appropriate modeling techniques for a given situation. (L3)
• Validate output from model to check feasibility of implementations. (L5)
• Create innovative modeling frameworks for a given situation. (L6)
• Conduct and interpret post-optimal and sensitivity analysis and explain the primal-dual relationship. (L3)
This course will equip the student with the expertise to mathematically model engineering projects and use effective methods and techniques to plan and execute engineering activities.

Course Objectives
- to introduce the basic principles of strategic cost management and the related terminology
- to familiarize the project planning and execution process involving technical/nontechnical activities
- to acquaint the student with detailed engineering activities and their cost management analysis
- to impart the knowledge of cost analysis and profit planning of engineering projects
- to familiarize the quantitative techniques for optimization of budget allocation

Unit I

Learning Outcomes
After the completion of this unit, the student will be able to
- describe the cost concepts in decision making(L2)
- define the various costs involved in the cost management process(L2)
- list the objectives of cost control(L2)
- identify the different fields of a database for operational control(L2)

Unit II
Project: meaning, Different types, why to manage, cost overruns centres, various stages of project execution: conception to commissioning. Project execution as conglomeration of technical and nontechnical activities.

Learning Outcomes
After the completion of this unit, the student will be able to
- define the meaning of a project and list the different types(L2)
- identify the measures to manage cost overruns(L2)
- describe the various stages of project execution from conception to commissioning(L2)
- plan the proper order of technical/nontechnical activities as part of project execution(L2)

Unit III
Detailed Engineering activities. Pre project execution main clearances and documents Project team: Role of each member. Importance Project site: Data required with significance. Project contracts. Types and contents. Project execution Project cost control. Bar charts and Network diagram. Project commissioning: mechanical and process.

Learning Outcomes
After the completion of this unit, the student will be able to
- identify the different clearance norms required in the pre-project execution phase(L2)
- describe the hierarchy of project team and identify the role of each member(L2)
- list the different contents of project contracts(L2)
- present the project cost control and planning through bar charts, network diagrams etc(L2)
Unit IV
Learning Outcomes
After the completion of this unit, the student will be able to
• describe the cost behavior and profit planning(L2)
• distinguish between marginal costing and absorption costing(L2)
• analyze the variance of standard costing(L2)
• analyze the pricing strategies in project costing(L2)
• identify the quality measures satisfying the appropriate constraints(L2)

Unit V
Budgetary Control; Flexible Budgets; Performance budgets; Zero-based budgets. Measurement of Divisional profitability pricing decisions including transfer pricing. Quantitative techniques for cost management, Linear Programming, PERT/CPM, Transportation problems, Assignment problems, Simulation, Learning Curve Theory
Learning Outcomes
After the completion of this unit, the student will be able to
• define and compare the different budgeting strategies(L2)
• model the cost management as a linear programming problem(L2)
• measure the divisional profitability and decide the appropriate pricing(L2)

Textbook(s):

References:

Course Outcomes
After the successful completion of the course, the students will be able to
• list the basic principles of strategic cost management and define the related terminology(L1)
• plan the project execution process involving technical/nontechnical activities(L4)
• describe the detailed engineering activities and their cost management analysis(L2)
• carry out the cost analysis and profit planning of engineering projects(L5)
• utilize quantitative techniques for optimization of budget allocation(L6)
19ECS891: PROJECT WORK I

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Each student is required to submit a report of first part of project work i.e. about the problem definition, literature review and methodology to be adopted including experiments and tests to be performed on topic of project as per the guidelines decided by the department. The project work is to be evaluated through Presentations and Viva-Voce during the semesterend.
Each student is required to submit a detailed project report about the work on topic of project as per the guidelines decided by the department. The project work is to be evaluated through Presentations and Viva-Voce during the semester and Final evaluation will be done at the end of semester as per the guidelines decided by the department from time to time. The candidate shall present/publish one paper in national/international conference/seminar/journal of repute. However candidate may visit research labs/institutions with the due permission of chairperson on recommendation of supervisor concerned.