

**MANONMANIAM SUNDARANAR  
UNIVERSITY**

**M.Sc.,  
NETWORKING & INFORMATION  
TECHNOLOGY**

**SYLLABUS**

**FROM THE ACADEMIC YEAR  
2023 - 2024**

<b>TANSICHE REGULATIONS ON LEARNING OUTCOMES-BASED CURRICULUM FRAMEWORK FOR POSTGRADUATE EDUCATION</b>	
<b>Programme</b>	<b>M.Sc. NETWORKING AND INFORMATION TECHNOLOGY</b>
<b>Programme Code</b>	
<b>Duration</b>	<b>2 years for PG</b>
<b>Programme Outcomes (Pos)</b>	<p><b>PO1: Problem Solving Skill</b> Apply knowledge of Management theories and Human Resource practices to solve business problems through research in Global context.</p> <p><b>PO2: Decision Making Skill</b> Foster analytical and critical thinking abilities for data-based decision-making.</p> <p><b>PO3: Ethical Value</b> Ability to incorporate quality, ethical and legal value-based perspectives to all organizational activities.</p> <p><b>PO4: Communication Skill</b> Ability to develop communication, managerial and interpersonal skills.</p> <p><b>PO5: Individual and Team Leadership Skill</b> Capability to lead themselves and the team to achieve organizational goals.</p> <p><b>PO6: Employability Skill</b> Inculcate contemporary business practices to enhance employability skills in the competitive environment.</p> <p><b>PO7: Entrepreneurial Skill</b> Equip with skills and competencies to become an entrepreneur.</p> <p><b>PO8: Contribution to Society</b> Succeed in career endeavors and contribute significantly to society.</p> <p><b>PO 9 Multicultural competence</b> Possess knowledge of the values and beliefs of multiple cultures and a global perspective.</p>

	<p><b>PO 10: Moral and ethical awareness/reasoning</b> Ability to embrace moral/ethical values in conducting one's life.</p>
<p><b>Programme Specific Outcomes (PSOs)</b></p>	<p><b>PSO1 – Placement</b> To prepare the students who will demonstrate respectful engagement with others' ideas, behaviors, beliefs and apply diverse frames of reference to decisions and actions.</p> <p><b>PSO 2 - Entrepreneur</b> To create effective entrepreneurs by enhancing their critical thinking, problem solving, decision making and leadership skill that will facilitate startups and high potential organizations.</p> <p><b>PSO3 – Research and Development</b> Design and implement HR systems and practices grounded in research that comply with employment laws, leading the organization towards growth and development.</p> <p><b>PSO4 – Contribution to Business World</b> To produce employable, ethical and innovative professionals to sustain in the dynamic business world.</p> <p><b>PSO 5 – Contribution to the Society</b> To contribute to the development of the society by collaborating with stakeholders for mutual benefit.</p>

### Template for P.G., Programmes

Semester-I	Credit	Hours	Semester-II	Credit	Hours	Semester-III	Credit	Hours	Semester-IV	Credit	Hours
Core-I	5	7	Core-IV	5	6	Core-VII	5	6	Core-XI	5	6
Core-II	5	7	Core-V	5	6	Core-VIII	5	6	Core-XII	5	6
Core – III	4	6	Core – VI	4	6	Core – IX	5	6	Project with viva voce	7	10
Elective -I Discipline Centric	3	5	Elective – III Discipline Centric	3	4	Core – X	4	6	Elective - VI (Industry / Entrepreneurship) 20% Theory 80% Practical	3	4
Elective-II Generic:	3	5	Elective -IV Generic:	3	4	Elective - V Discipline Centric	3	3	Skill Enhancement course / Professional Competency Skill	2	4
			Skill Enhancement I	2	4	3.6 Skill Enhancement II	2	3	Extension Activity	1	
						3.7 Internship/ Industrial Activity	2	-			
	<b>20</b>	<b>30</b>		<b>22</b>	<b>30</b>		<b>26</b>	<b>30</b>		<b>23</b>	<b>30</b>
<b>Total Credit Points -91</b>											



**Choice Based Credit System (CBCS), Learning Outcomes Based Curriculum Framework (LOCF) Guideline Based Credits and Hours Distribution System for all Post – Graduate Courses including Lab Hours**

**First Year – Semester – I**

<b>Part</b>	<b>List of Courses</b>	<b>Credits</b>	<b>No. of Hours</b>
	Core – I	5	7
	Core – II	5	7
	Core – III	4	6
	Elective – I	3	5
	Elective – II	3	5
		<b>20</b>	<b>30</b>

**Semester-II**

<b>Part</b>	<b>List of Courses</b>	<b>Credits</b>	<b>No. of Hours</b>
	Core – IV	5	6
	Core – V	5	6
	Core – VI	4	6
	Elective – III	3	4
	Elective – IV	3	4
	Skill Enhancement Course [SEC] – I	2	4
		<b>22</b>	<b>30</b>

**Second Year – Semester – III**

<b>Part</b>	<b>List of Courses</b>	<b>Credits</b>	<b>No. of Hours</b>
	Core – VII	5	6
	Core – VIII	5	6
	Core – IX	5	6
	Core (Industry Module) – X	4	6
	Elective – V	3	3
	Skill Enhancement Course – II	2	3
	Internship / Industrial Activity [Credits]	2	-
		<b>26</b>	<b>30</b>

**Semester-IV**

<b>Part</b>	<b>List of Courses</b>	<b>Credits</b>	<b>No. of Hours</b>
	Core – XI	5	6
	Core – XII	5	6
	Project with VIVA VOCE	7	10
	Elective – VI (Industry Entrepreneurship)	3	4
	Skill Enhancement Course – III / Professional Competency Skill	2	4
	Extension Activity	1	-
		<b>23</b>	<b>30</b>

**Total 91 Credits for PG Courses**



PO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
PO1	✓					
PO2		✓				
PO3			✓			
PO4				✓		
PO5					✓	
PO6						✓

**Mapping of Course Learning Outcomes (CLOs)** with Programme Outcomes (POs) and Programme Specific Outcomes (PSOs) can be carried out accordingly, assigning the appropriate level in the grid

### **Component wise Credit Distribution**

**Part A component and Part B (i) will be taken into account for CGPA calculation for the postgraduate programme and the other components Part B and Part C have to be completed during the duration of the programme as per the norms, to be eligible for obtaining the PG degree**

### **Testing Pattern (25+75)**

#### **Internal Assessment**

**Theory Course:** For theory courses there shall be three tests conducted by the faculty concerned and the average of the best two can be taken as the Continuous Internal Assessment (CIA) for a maximum of 25 marks. The duration of each test shall be one / one and a half hour.

**Computer Laboratory Courses:** For Computer Laboratory oriented Courses, there shall be two tests in Theory part and two tests in Laboratory part. Choose one best from Theory part and other best from the two Laboratory part. The average of the best two can be treated as the CIA for a maximum of 25 marks. The duration of each test shall be one / one and a half hour.

There is no improvement for CIA of both theory and laboratory, and, also for University End Semester Examination.

**Written Examination : Theory Paper (Bloom's Taxonomy based)**

**Question paper Model**

<b>Intended Learning Skills</b>	<b>Maximum 75 Marks</b> <b>Passing Minimum: 50%</b> <b>Duration : Three Hours</b>
	<b>Part –A (10x 2 = 20 Marks)</b> Answer ALL Questions <b>Each Question carries 2 marks</b>
Memory Recall / Example/ Counter Example / Knowledge about the Concepts/ Understanding	Two questions from each UNIT
	<b>Question 1 to Question 10</b>
	<b>Part – B (5 x 5 = 25 Marks)</b> Answer ALL Questions <b>Each questions carries 5 Marks</b>
Descriptions/ Application (problems)	<b>Either-or Type</b> Both parts of each question from the same UNIT
	<b>Question 11(a) or 11(b)</b> To <b>Question 15(a) or 15(b)</b>
	<b>Part-C (3x 10 = 30 Marks)</b> Answer any <b>THREE</b> questions <b>Each question carries 10 Marks</b>
Analysis /Synthesis / Evaluation	There shall be FIVE questions covering all the five units
	<b>Question 16 to Question 20</b>

Each question should carry the course outcome and cognitive level

For instance,

1. [CO1 : K2] Question xxxx
2. [CO3 : K1] Question xxxx

**Credit Distribution for PG Programme in Networking & Information Technology**

**M.Sc Networking & Information Technology**

**First Year: Semester-I**

<b>CORE/ ELECTIVE</b>	<b>SUBJECT TITLE</b>	<b>Credit</b>	<b>Hours per week</b>
Core - I	Applied Mathematics for Information Technology	4	6
Core - II	Advanced Data Structures and Algorithms	4	6
Core - III	Advanced Data Structures – Practical	3	4
	Advanced Java & Networking – Practical	3	4
Elective I	Advanced Computer Networks / Problem Solving Techniques and Applications	3	5
Elective II	Cyber Forensics / Parallel Algorithms and Programming	3	5
	<b>Total</b>	<b>20</b>	<b>30</b>

	<b>Semester-II</b>	<b>Credit</b>	<b>Hours per week</b>
Core-IV	Machine Learning	4	5
Core-V	Advanced Database Systems	4	5
Core – VI	Advanced Database Management Systems Lab	3	4
	Android Application Development – Practical	3	4
Elective – III	Cryptography and Network Security / Theory of Computation	3	4
Elective -IV:	Embedded Systems in Computing/ Advanced Image Processing	3	4
Skill Enhancement Course	Social Network Analysis	2	4
	<b>Total</b>	<b>22</b>	<b>30</b>

<b>Title of the Course</b>		<b>APPLIED MATHEMATICS FOR INFORMATION TECHNOLOGY</b>					
<b>Paper Number</b>		<b>CORE I</b>					
<b>Category</b>	Core	<b>Year</b>	I	<b>Credits</b>	4	<b>Course Code</b>	
		<b>Semester</b>	I				
<b>Instructional Hours per week</b>		<b>Lecture</b>	<b>Tutorial</b>	<b>Lab Practice</b>	<b>Total</b>		
		5	1	--	6		
<b>Objectives of the Course</b>		<ol style="list-style-type: none"> <li>1. Learn and recall allied level mathematics for application problems.</li> <li>2. To understand the role of linear algebra and matrix in computer science problem solving.</li> <li>3. Learn and understand unit step function and Dirac delta function. To study orthogonal functions and Fourier transforms and understand their use in computational problems.</li> <li>4. Learn the concepts of number theory for cryptography.</li> <li>5. Critically analyze and implement programs for the methods studied for a set of selected example problems.</li> </ol>					
<b>Course Outline</b>		<b>UNIT-I</b> Set theory: Operations on sets – Basic set identities – Relations and orderings – Functions					
		<b>UNIT-II</b> :Linear algebra Part I: Linear vector spaces - Linear operators – vectors in $n$ -dimensions – matrix representation of vectors and operators in a basis – linear independence, dimension – inner product – Orthonormal basis –Eigenvalues and eigenfunctions of operators/matrices – Eigen basis, Diagonalizing matrix – Quadratic forms – Complex matrices and forms - Hermitian and Unitary operators/matrices.					
		<b>UNIT-III</b> :Linear algebra Part II: Cayley-Hamilton Theorem - Gram-Schmidt process –Eigen values using QR transformations – QR factorization - generalized eigenvectors — singular value decomposition and applications - pseudo inverse – least square approximations -Toeplitz matrices and some applications.					

	<p><b>UNIT-IV</b> :Laplace Transforms : Solution of linear differential equations with constant coefficients- – Unit step function and Dirac delta function. Sturm-Liouville theory: Second order linear differential equations . Sturm-Liouville theory: Orthogonality of eigenfunctions – Illustration with Legendre, Laguerre, Hermite, Chebyshev differential equations - expansion of polynomials.</p> <p>Fourier Transforms: Fourier sine and cosine transforms – Fourier transform - convolution theorem - Discrete Fourier transform and Fast Fourier transform.</p> <p><b>UNIT-V</b>:Number Theory: Modular arithmetic - Fermat’s and Euler’s theorem – Testing for primality - Chinese remainder theorem – Discrete logarithms – Groups – Rings – Fields - Finite fields – <math>GF(p)</math> - Polynomial arithmetic – Finite fields of the form <math>GF(2^n)</math>.</p>
Extended Professional Component	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour) (is a part of internal component only, Not to be included in the External Examination question paper)
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
<b>Recommended Text</b>	1. J P Tremblay and R Manohar, <i>Discrete Mathematical Structures with Applications to Computer Science</i> , International Edition (McGraw-Hill, Singapore, 1987; Tata McGraw-Hill, New Delhi, 1997).
<b>Reference Books</b>	<ol style="list-style-type: none"> <li>1. K.Trivedi, “Probability and Statistics with Reliability, Queuing and Computer Science Applications”, Wiley, 2016.</li> <li>2. M. Mitzenmacher and E.Upfal, Probability and Computing :Randomized Algorithms and Probabilistic Analysis”, Cambridge University Press, 2005.</li> <li>3. Alan Tucker, “Applied Combinatorics”, 6<sup>th</sup> Edition, Wiley 2012.</li> </ol>
<b>Website and e-Learning Source</b>	<a href="https://nptel.ac.in/courses/106/106/106106183/">https://nptel.ac.in/courses/106/106/106106183/</a> <a href="https://nptel.ac.in/courses/111/105/111105035/">https://nptel.ac.in/courses/111/105/111105035/</a> <a href="https://nptel.ac.in/courses/111/102/111102133/">https://nptel.ac.in/courses/111/102/111102133/</a> <a href="https://nptel.ac.in/courses/106/103/106103015/">https://nptel.ac.in/courses/106/103/106103015/</a>

**Course Learning Outcome (for Mapping with POs and PSOs)**

Students will be able to

**CLO 1:** Apply mathematical concept for Information Technology problem solving.

**CLO 2:** Design mathematical models for real time projects and applications.

**CLO 3:** Analyze each learning model from a different algorithmic approach

**CLO 4:** Acquire knowledge of relations, functions and mathematical logic

**CLO 5:** Understand the basic concepts of Graph Theory

<b>CO/PSO</b>	<b>PSO1</b>	<b>PSO2</b>	<b>PSO3</b>	<b>PSO4</b>	<b>PSO5</b>	<b>PSO6</b>
<b>CO1</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>3</b>	<b>3</b>	<b>2</b>
<b>CO2</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>3</b>	<b>3</b>	<b>2</b>
<b>CO3</b>	<b>3</b>	<b>2</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>
<b>CO4</b>	<b>3</b>	<b>2</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>
<b>CO5</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>3</b>	<b>3</b>	<b>3</b>
<b>Weightage of course contributed to each PSO</b>	<b>15</b>	<b>10</b>	<b>12</b>	<b>15</b>	<b>15</b>	<b>13</b>

<b>Title of the Course</b>		<b>ADVANCED DATA STRUCTURES AND ALGORITHMS</b>					
<b>Paper Number</b>		<b>CORE</b>					
<b>Category</b>	Core	<b>Year</b>	I	<b>Credits</b>	4	<b>Course Code</b>	
		<b>Semester</b>	I				
<b>Instructional Hours per week</b>	<b>Lecture</b>	<b>Tutorial</b>	<b>Lab Practice</b>	<b>Total</b>			
	5	1	--	6			
<b>Pre-requisite</b>		The Prerequisites for Data Structures And Algorithms is one must be aware of at least one programming language.					
<b>Objectives of the Course</b>		<p>By the end of the course the students will be able to</p> <ul style="list-style-type: none"> <li>➤ Enumerate the Sorting Quick and Heap Sort, Radix Sort, AVL trees and Graph Traversals</li> <li>➤ Summaries the Search Trees, building Optimal search trees, Height balanced and Weight balanced trees</li> <li>➤ Interpret the problems using B –trees, Red Black Trees and Splay trees</li> <li>➤ To Differentiate Interval Trees , Segment Trees, Trees for Weighted Intervals and Higher dimensional Segment Trees</li> <li>➤ To Conceive various algorithmic paradigms for solving various kinds of problems</li> </ul>					
<b>Course Outline</b>		<p><b>UNIT-I :Primary Data Structures</b>, Time and Space Complexity Analysis Sorting – Quick and Heap Sort, Radix Sort, AVL trees, Graph Traversals Asymptotic notations, conditional asymptotic notations, Amortized analysis, NP complete and NP hard Time and Space complexity analysis by solving recurrence equations</p> <p><b>UNIT-II :Optimization Data structures</b> Search Trees, building Optimal search trees, Height balanced and Weight balanced trees B -trees, Red Black Trees and Splay trees</p> <p><b>UNIT-III : Data Structures for sets of Intervals</b> Interval Trees - Segment Trees, Trees for Weighted Intervals, Higher dimensional Segment Trees. Range Counting and Semi group model. K-d trees, Orthogonal Range trees, Leftist heap, Skew heap, Binomial heap and Fibonacci heaps.</p> <p><b>UNIT-IV : Data structures for Strings &amp; Transformations</b> Dynamic Structures, Persistent Structures, Tries, Compressed Tries, Suffix Trees and Suffix Arrays</p>					

	<b>UNIT-V: Advanced Algorithm Design</b> Dynamic Programming - Rod Cutting, Matrix chain multiplication, Longest Common Subsequence .Greedy Algorithms - Activity selection problem, Matroids and Greedy methods
Extended Professional Component	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour) (is a part of internal component only, Not to be included in the External Examination question paper)
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
<b>Recommended Text</b>	1. Thomas H.Cormen, Charles E.Leiserson, Ronald L.Rivest, Clifford Stein, “Introduction to Algorithms: Third Edition”, The MIT Press, 2014.
<b>Reference Books</b>	1. Thomas H.Cormen, “Algorithms Unlocked”, The MIT Press, 2013 2. Peter Brass, “Advanced Data Structures”, Cambridge University Press, 2014
<b>Website and e-Learning Source</b>	<a href="https://goalkicker.com/AlgorithmsBook/">https://goalkicker.com/AlgorithmsBook/</a> <a href="https://nptel.ac.in/courses/106/102/106102064/">https://nptel.ac.in/courses/106/102/106102064/</a> <a href="https://nptel.ac.in/courses/106/102/106102064/">https://nptel.ac.in/courses/106/102/106102064/</a> .

### Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

**CLO1:** Explain how the choice of data structures and algorithm design methods impacts the performance of programs.

**CLO 2:** Describe the concept of Range Counting and Semi group model. K-d trees, Orthogonal Range trees, Leftist heap.

**CLO 3:** Design and implement an appropriate hashing function for an application

**CLO 4:** Compare alternative implementations of data structures with respect to performance.

**CLO 5:** Contrast the benefits of dynamic and static data structures implementations.

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
<b>CO1</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>3</b>	<b>3</b>	<b>3</b>
<b>CO2</b>	<b>3</b>	<b>3</b>	<b>2</b>	<b>3</b>	<b>3</b>	<b>3</b>
<b>CO3</b>	<b>3</b>	<b>2</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>
<b>CO4</b>	<b>3</b>	<b>3</b>	<b>2</b>	<b>3</b>	<b>3</b>	<b>3</b>
<b>CO5</b>	<b>3</b>	<b>3</b>	<b>2</b>	<b>3</b>	<b>3</b>	<b>3</b>
<b>Weightage of course contributed to each PSO</b>	<b>15</b>	<b>13</b>	<b>11</b>	<b>15</b>	<b>15</b>	<b>15</b>



<b>Title of the Course</b>		<b>ADVANCED DATA STRUCTURES - PRACTICAL</b>					
<b>Paper Number</b>		<b>CORE III</b>					
<b>Category</b>	Core	<b>Year</b>	I	<b>Credits</b>	3	<b>Course Code</b>	
		<b>Semester</b>	I				
<b>Instructional Hours per week</b>		<b>Lecture</b>		<b>Tutorial</b>		<b>Lab Practice</b>	<b>Total</b>
		--				4	4
<b>Pre-requisite</b>		The Prerequisites For Data Structures And Algorithms is, one must be aware of at least one programming language.					
<b>Objectives of the Course</b>		<p>The main objectives of this course are to:</p> <ul style="list-style-type: none"> <li>➤ Describe the concept of Activity selection of Huffman coding Implementations</li> <li>➤ Design and implement of Spanning tree Implementations</li> <li>➤ Explain the Implementation of Binary Search Tree</li> <li>➤ Identify the Red Black tree Implementation</li> </ul>					
<b>Course Outline</b>		<b>UNIT-I :</b>					
		1. Implementation of Merge sort and quick sort Algorithms 2. Implementation of Binary Search Tree					
		<b>UNIT-II :</b>					
		3. Red Black Tree Implementation 4. Implementation of Heap Implementation					
		<b>UNIT-III :</b>					
5. Implementation of Fibonacci Heap Implementation 6. Implementation of Graph Traversals							
<b>UNIT-IV :</b>							
7. Implementation of Spanning Tree Implementation 8. Shortest path Algorithms( Dijkstra's, Bellman Ford Algorithms)							
<b>UNIT-V :</b>							
9. Implementation of Matrix Chain Multiplication 10. Activity selection and Huffman coding Implementation							
<b>Extended Professional Component</b>		Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour) (is a part of internal component only, Not to be included in the External Examination question paper)					
<b>Skills acquired from this course</b>		Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill					
<b>Recommended Text</b>		Thomas H.Cormen, Charles E.Leiserson, Ronald L.Rivest, Clifford Stein, “Introduction to Algorithms: Third Edition”, The MIT Press, 2014.					

<b>Reference Books</b>	Peter Brass, “Advanced Data Structures”, Cambridge University Press, 2014
<b>Website and e-Learning Source</b>	<ol style="list-style-type: none"> <li>1. <a href="https://goalkicker.com/AlgorithmsBook/">https://goalkicker.com/AlgorithmsBook/</a></li> <li>2. <a href="http://algs4.cs.princeton.edu/home/">http://algs4.cs.princeton.edu/home/</a></li> <li>3. <a href="http://techread.dev/en/books/about/algori...">techread.dev/en/books/about/algori...</a></li> </ol>

By the end of the course the students will be able to

**CLO 1:** Define how the design of data structures and algorithm design methods impacts the performance of programs.

**CLO 2:** Implement the applications using Fibonacci Heap and shortest path Algorithms

**CLO 3:** Identify various algorithmic for Implementation of Matrix Chain Multiplication algorithms

**CLO 4 :** Demonstrate the creation of Graph Traversals methods and the concepts of Binary Search tree

**CLO 5:** Construct Data structure programs using Merge sort and Quick sort.

Develop programs for implementing trees and their traversal operations.

<b>CO/PSO</b>	<b>PSO1</b>	<b>PSO2</b>	<b>PSO3</b>	<b>PSO4</b>	<b>PSO5</b>	<b>PSO6</b>
<b>CO1</b>	<b>3</b>	<b>3</b>	<b>2</b>	<b>3</b>	<b>3</b>	<b>3</b>
<b>CO2</b>	<b>2</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>2</b>
<b>CO3</b>	<b>2</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>2</b>
<b>CO4</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>2</b>
<b>CO5</b>	<b>3</b>	<b>3</b>	<b>2</b>	<b>3</b>	<b>3</b>	<b>3</b>
<b>Weightage of course contributed to each PSO</b>	<b>13</b>	<b>15</b>	<b>13</b>	<b>15</b>	<b>15</b>	<b>12</b>

<b>Title of the Course</b>		<b>ADVANCED JAVA &amp; NETWORKING - PRACTICAL</b>					
<b>Paper Number</b>							
<b>Category</b>	Core	<b>Year</b>	I	<b>Credits</b>	3	<b>Course Code</b>	
		<b>Semester</b>	I				
<b>Instructional Hours per week</b>		<b>Lecture</b>	<b>Tutorial</b>	<b>Lab Practice</b>	<b>Total</b>		
		-		4	5		
<b>Pre-requisite</b>		Students should be able to know the concept of Java Fundamentals, Applet, Swings, JDBC, JavaBeans.					
<b>Objectives of the Course</b>		<ul style="list-style-type: none"> <li>• Using Graphics, Animations and Multithreading for designing Simulation and Game based applications.</li> <li>• Design and develop GUI applications using Abstract Windowing Toolkit (AWT), Swing and Event Handling.</li> <li>• Design and develop Web applications</li> <li>• Designing Enterprise based applications by encapsulating an application's business logic.</li> <li>• Designing applications using pre-built frameworks.</li> </ul>					

<b>Course Outline</b>	<ol style="list-style-type: none"> <li>1. Write a program to create a JTable.</li> <li>2. Convert an image in RGB to a grayscale image.</li> <li>3. Count number of access times of the servlet page.</li> <li>4. Write a program to display a string in frame window with pink color as background.</li> <li>5. Create chat application using either TCP or UDP protocol.</li> <li>6. Implement TCP Server for transferring files using Socket and ServerSocket.</li> <li>7. Implement Student information system using JDBC and RMI.</li> <li>8. Create Servlet file and study web descriptor file.</li> <li>9. Write a program to design simple calculator with the use of GridLayout.</li> <li>10. Create login form and perform state management using Cookies, HTTP Session and URL Rewriting.</li> <li>11. Write an Applet which will lay two sound notes in a sequence continuously use the play () methods available in the applet class and the methods in the audio clip interface.</li> <li>12. Write a program to demonstrate the use of InetAddress class and its factor methods.</li> <li>13. Create Servlet file which contains following functions: <ol style="list-style-type: none"> <li>1. Connect</li> <li>2. Create Database</li> <li>3. Create Table</li> <li>4. Insert Records into respective tables</li> <li>5. Update records of particular table in database</li> <li>6. Delete Records from table.</li> <li>7. Delete table and also database</li> </ol> </li> <li>14. Develop Simple Servlet Question Answer Application using Database</li> <li>15. Develop simple shopping cart application using EJB [Stateful Session Bean].</li> </ol>
Extended Professional Component	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
<b>Recommended Text</b>	Java the Complete Reference, ninth edition by Herbert Schild, Publisher: McGraw Hills

<b>Reference Books</b>	<ol style="list-style-type: none"> <li>1. Head First EJB 3.0 by Kathy Sierra, Bert Bates, Publisher: O'Reilly Media</li> <li>2. Head First Servlets and JSP by Bryan Basham, Kathy Sierra &amp; Bert Bates, Publisher: O'Reilly Media</li> <li>3. Just Hibernate, A Lightweight Introduction to the Hibernate Framework by Madhusudhan Konda, Publisher: O'Reilly Media</li> <li>4. Programming Jakarta Struts, 2nd Edition by Chuck Cavaness, Publisher: O'Reilly Media</li> </ol>
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**CLO1:** Learn the Internet Programming, using Java Applets

**CLO 2:** Create a full set of UI widgets and other components, including windows, menus, buttons, checkboxes, text fields, scrollbars and scrolling lists, using Abstract Windowing Toolkit (AWT) & Swings

**CLO 3:** Apply event handling on AWT and Swing components.

**CLO 4:** learn to access database through Java programs, using Java Data Base Connectivity (JDBC)

**CLO 5:** Create dynamic web pages, using Servlets and JSP.

<b>Website and e-Learning Source</b>	<a href="https://nptel.ac.in/courses/106/105/106105191/">https://nptel.ac.in/courses/106/105/106105191/</a> <a href="https://onlinecourses.nptel.ac.in/noc19_cs84/preview">https://onlinecourses.nptel.ac.in/noc19_cs84/preview</a>
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CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	3	2	3	3	3
CO2	3	3	2	3	3	3
CO3	3	3	2	3	3	3
CO4	3	3	2	3	3	3
CO5	3	3	2	3	3	3
<b>Weightage of course contributed to each PO/PSO</b>	<b>15</b>	<b>15</b>	<b>10</b>	<b>15</b>	<b>15</b>	<b>15</b>

<b>Title of the Course</b>		<b>Advanced Computer Networks</b>					
<b>Paper Number</b>							
<b>Category</b>	Elective	<b>Year</b>	I	<b>Credits</b>	3	<b>Course Code</b>	
		<b>Semester</b>	I				
<b>Instructional Hours per week</b>	<b>Lecture</b>		<b>Tutorial</b>		<b>Lab Practice</b>	<b>Total</b>	
	4		1		--	5	
<b>Pre-requisite</b>		While the course has no formal prerequisites, some background in computer networking is useful.					
<b>Objectives of the Course</b>		<p>The main objectives of this course are to:</p> <ul style="list-style-type: none"> <li>➤ Briefly explain the basic components of Networking</li> <li>➤ To Identify an understanding of different components of computer networks, various protocols, modern technologies and their applications</li> <li>➤ To explain and exemplify current QoS architectures and mechanisms, and the QoS support challenges in future networks</li> <li>➤ To Evaluate Cryptography technique knowledge for understanding various Algorithms for security</li> <li>➤ To Conceive relevant management issues and devise adequate network management solutions</li> </ul>					
<b>Course Outline</b>		<p><b>UNIT-I</b> :Foundation Applications – Requirements – Network Architecture and Performance. Perspectives on connecting – Encoding – Framing – Error Detection – Reliable Transmission – Ethernet and Multiple Access Networks.</p> <p><b>UNIT-II</b> :Internet working Design Principles, IP Design, Intra domain Routing (RIP, OSPF), Inter-domain Routing (BGP), Adaptive Routing, Multipath and QoS Routing. Implementation and Performance.</p> <p><b>UNIT-III</b> : Simple Demultiplexer (UDP) – Reliable Byte Stream (TCP) – Remote Procedure Call Fundamentals – Overview of Transport for Real-Time Application (RTP)</p> <p><b>UNIT-IV</b> : Congestion Control and Resource Allocation Issues in Resource Allocation – Queuing Disciplines- Congestion control principles, Hop-by-hop vs. End-to-end congestion control, Explicit vs. Implicit Feedback, Fair Queuing, Flow control, TCP variants (Tahoe, Reno, Vegas, New-Reno, SACK), Load balancing using Multipath TCP. – Congestion Avoidance Mechanisms – Quality of Service</p>					

	<b>UNIT-V: Applications Traditional Applications – Infrastructure Services – Overview of Multimedia Applications and Overlay Networks.</b>
Extended Professional Component	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour) (is a part of internal component only, Not to be included in the External Examination question paper)
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
<b>Recommended Text</b>	Larry L Peterson and Bruce S Davie, “Computer Networks – A Systems Approach”, MK Publishers, Fifth Edition, 2012 James F Kurose and Keith W Ross, “Computer Networking – A Top Down Approach”, Sixth Edition, Pearson Education, 2013
<b>Reference Books</b>	M. Barry Dumas, Morris Schwartz, “Principles of Computer Networks and Communications”, First Edition, Pearson, 2013.
<b>Website and e-Learning Source</b>	<a href="https://nptel.ac.in/courses/106/105/106105031/">https://nptel.ac.in/courses/106/105/106105031/</a> <a href="https://nptel.ac.in/courses/106/105/106105081/">https://nptel.ac.in/courses/106/105/106105081/</a> <a href="https://www.tutorialspoint.com/cryptography/index.h">https://www.tutorialspoint.com/cryptography/index.h</a>

**CLO1:** Describe how computer networks are organized with the concept of layered approach  
**CLO 2:** Assess the contents in a given data link layer packet, based on the layer concept.  
**CLO 3:** Describe how packets in the Internet are delivered.  
**CLO 4:** Design logical sub-address blocks with a given address block  
**CLO 5:** Implement a simple LAN with hubs, bridges and switches.

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO 5	PSO 6
CO1	3	3	2	2	3	3
CO2	3	2	3	2	3	3
CO3	3	2	3	2	2	1
CO4	3	3	3	3	3	3
CO5	3	2	3	3	3	3
Weightage of course contributed To each PSO	15	12	14	12	14	13

<b>Title of the Course</b>		<b>Problem Solving Techniques and Applications</b>					
<b>Paper Number</b>							
<b>Category</b>	Elective	<b>Year</b>	I	<b>Credits</b>	3	<b>Course Code</b>	
	I	<b>Semester</b>	I				
<b>Instructional Hours per week</b>		<b>Lecture</b>		<b>Tutorial</b>		<b>Lab Practice</b>	<b>Total</b>
		4		1		--	5
<b>Pre-requisite</b>		The Prerequisites of Problem solving techniques and applications to solve the real world problem through programming in an efficient manner. This course provides adequate knowledge to solve the problems in respective domains.					
<b>Objectives of the Course</b>		<ul style="list-style-type: none"> <li>➤ Describe the basics of computer and understand the problem solving aspect.</li> <li>➤ Demonstrate the algorithm and flow chart for the given problem. Design and develop program to evaluate simple expressions and logical operations.</li> </ul>					
<b>Course Outline</b>		<b>UNIT-I</b> :: Introduction Notion of algorithms and programs – The problem-solving aspect – General problem-solving strategies - Problem solving using top down design. Programming in C: Data types - Control statements – Functions – Arrays – Structures – Pointers – Pointers and Functions - Pointers and Arrays – Pointers and Structures - Dynamic memory allocation.					
		<b>UNIT-II</b> : Fundamental Algorithms Exchanging the values of two variables – Counting - Summation of a set of numbers - Factorial computation - Sine function computation - Fibonacci Series generation - Reversing the digits of an integer – Base Conversion					
		<b>UNIT-III</b> : Factoring Methods Finding the square root of a number - Generating prime numbers - Generating the prime factors of an integer – Generation of pseudo random numbers - Raising a number to a large power – Computing the nth Fibonacci number					
		<b>UNIT-IV</b> : Array Techniques Array order reversal – Removal of duplicates from an ordered array - Array counting or histogramming – Partitioning an array – Finding the kth smallest element – Longest monotone subsequence.					
		<b>UNIT-V</b> : Text Processing and Pattern Searching Text line length adjustment – Left and right justification of text – Keyword searching in text – Text line editing – Linear pattern search. Recursive algorithms: Towers of Hanoi – Permutation generation.					



Extended Professional Component	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
<b>Recommended Text</b>	1. R. G. Dromey, How to Solve it by Computer, Prentice Hall of India, 2009. 2. 2. B.W. Kernighan and D.M. Ritchie, The C Programming Language, Second Edition, PHI, NewDelhi, 1990.
<b>Reference Books</b>	1. Jeri R. Hanly, Elliot B. Koffman, Problem Solving and Program Design in C, 5th Edition, Pearson Education, 2009. 2. Herbert Schildt, The Complete Reference – C, Fourth Edition, McGraw Hill, 2010
<b>Website and e-Learning Source</b>	<a href="https://onlinecourses.nptel.ac.in/noc20_cs81/preview">https://onlinecourses.nptel.ac.in/noc20_cs81/preview</a> <a href="https://nptel.ac.in/courses/106/101/106101208/">https://nptel.ac.in/courses/106/101/106101208/</a>

**CLO1:** Develop technical project reports and present them orally among the user.

**CLO 2:** Understand how technological advances impact society and the social, legal, ethical and cultural ramifications of computer technology and their usage.

**CLO 3:** Communicate computer science concepts, designs, and solutions effectively and professionally.

**CLO 4:** Demonstrate the concept of pointer and perform I/O operations.

**CLO 5:** Develop & Implement programs with suitable modules to solve the given problem

<b>CO/PSO</b>	<b>PSO1</b>	<b>PSO2</b>	<b>PSO3</b>	<b>PSO4</b>	<b>PSO 5</b>	<b>PSO 6</b>
<b>CO1</b>	<b>3</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>3</b>	<b>3</b>
<b>CO2</b>	<b>3</b>	<b>2</b>	<b>3</b>	<b>2</b>	<b>3</b>	<b>3</b>
<b>CO3</b>	<b>3</b>	<b>2</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>1</b>
<b>CO4</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>
<b>CO5</b>	<b>3</b>	<b>2</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>
<b>Weightage of course contributed To each PSO</b>	<b>15</b>	<b>12</b>	<b>14</b>	<b>12</b>	<b>14</b>	<b>13</b>

<b>Title of the Course</b>		<b>Cyber Forensics</b>					
<b>Paper Number</b>							
<b>Category</b>	Elective II	<b>Year</b>	I	<b>Credits</b>	3	<b>Course Code</b>	
		<b>Semester</b>	I				
<b>Instructional Hours per week</b>		<b>Lecture</b>	<b>Tutorial</b>	<b>Lab Practice</b>	<b>Total</b>		
		4	1	--	5		
<b>Pre-requisite</b>		This course provides to use various forensic investigation approaches and tools necessary to start a computer forensics investigation. It also aims at increasing the knowledge and understanding in cyber security and ethical hacking.					
<b>Objectives of the Course</b>		<p>The main objectives of this course are to:          By the end of the course the students will be able to</p> <ul style="list-style-type: none"> <li>➤ Understand the fundamentals of Computer Forensics (K1)</li> <li>➤ Learn the issues of Data Acquisition and Data Recovery.(K2)</li> <li>➤ Explore networking in cyber forensics.(K3)</li> <li>➤ Learn to analyze and validate forensics data.(K4,K5)</li> <li>➤ Be familiar with forensic tools and case studies. (K6)</li> </ul>					
<b>Course Outline</b>		<b>UNIT-I :</b>					
		<b>Overview of Computer Forensics Technology</b> Computer Forensics Fundamentals - Types of Computer Forensics Technology - Types of Vendor and Computer Forensics Services.					
		<b>UNIT-II :</b>					
		<b>Computer Forensics Evidence and Capture</b> Data Recovery - Evidence Collection and Data Seizure – Duplication and Preservation of Digital Evidence – Computer Image Verification and Authentication.					
		<b>UNIT-III :</b>					
		<b>Computer Forensics Analysis</b> Discover of Electronic Evidence – Identification of Data – Reconstructing Past Events – Networks					
		<b>UNIT-IV :</b>					
		<b>Counter Measures for Information Warfare:</b> Fighting against Macro Threats: Defensive Strategies for Governments and Industry Groups - Information Warfare Arsenal: Tactics of the Military – Tactics of Terrorist and Rogues – Tactics of Private Companies					

	<b>UNIT-V:</b> <b>Information Warfare Arsenal of the Future</b> Surveillance Tools for Information Warfare of the Future – Civilian Casualties: The Victims and Refugees of Information Warfare Results and Future Directions: Advanced Computer Forensics.
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
<b>Recommended Text</b>	Chad Steel, Windows Forensics: The Field Guide for Conducting Corporate Computer Investigations, John Wiley & Sons, New Delhi 2006
<b>Reference Books</b>	Majid Yar, Cybercrime and Society, Sage Publications, New Delhi, 2006. Robert M Slade, Software Forensics, Tata McGraw Hill, New Delhi, 2004.
<b>Website and e-Learning Source</b>	<a href="https://onlinecourses.swayam2.ac.in/cec21_ge10/preview">https://onlinecourses.swayam2.ac.in/cec21_ge10/preview</a> <a href="https://nptel.ac.in/courses/106/105/106105031/">https://nptel.ac.in/courses/106/105/106105031/</a>

**CLO1:** To learn about the knowledge and techniques to computer forensics practices and evidence analysis.

**CLO 2:** To learn the issues of data acquisition, data recovery and networking in cyber forensics.

**CLO 3:** To analyze and validate forensics data using forensic tools and case studies

**CLO 4:** Understand about the Defensive Strategies for Governments and Industry Groups

**CLO 5:** Identify the Surveillance Tools for Information Warfare of the Future

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	3	2	2	3	3
CO2	3	2	3	2	3	3
CO3	3	2	3	2	2	1
CO4	3	3	3	3	3	3
CO5	3	2	3	3	3	3
<b>Weightage of course content distributed to each PSO</b>	<b>15</b>	<b>12</b>	<b>14</b>	<b>12</b>	<b>14</b>	<b>13</b>

<b>Title of the Course</b>		<b>Parallel Algorithms and Programming</b>					
<b>Paper Number</b>							
<b>Category</b>	Elective	<b>Year</b>	I	<b>Credits</b>	3	<b>Course Code</b>	
	II	<b>Semester</b>	I				
<b>Instructional Hours per week</b>		<b>Lecture</b>		<b>Tutorial</b>		<b>Lab Practice</b>	<b>Total</b>
		4		1		--	5
<b>Pre-requisite</b>		This course requires the understanding of Parallel Algorithms - Data Structures, Algorithms and Discrete Mathematics of optimization and bit computations.					
<b>Objectives of the Course</b>		<p>The main objectives of this course are to:</p> <p>Students will try to learn:</p> <ul style="list-style-type: none"> <li>• Identify the basic construction and use of parallel computers,</li> <li>• Describe the content and use of the terminology for how one measures the performance of parallel algorithms and parallel computers,</li> <li>• Interpret the process to develop computer programs for different types of parallel algorithm and computers.</li> <li>• Review an idea and use basic parallel algorithms and specifications</li> <li>• Conceive the factor of computing and use basic data structures; know about the existence of advanced data structures.</li> </ul>					
<b>Course Outline</b>		<b>UNIT-I : INTRODUCTION</b> : Need for Parallel Processing - Data and Temporal Parallelism - Models of Computation - RAM and PRAM Model - Shared Memory and Message Passing Models- Processor Organizations - PRAM Algorithm - Analysis of PRAM Algorithms- Parallel Programming Languages.					
		<b>UNIT-II : PRAM ALGORITHMS</b> : Parallel Algorithms for Reduction - Prefix Sum - List Ranking -Preorder Tree Traversal - Searching - Sorting - Merging Two Sorted Lists - Matrix Multiplication - Graph Coloring - Graph Searching.					
		<b>UNIT-III : SIMD ALGORITHMS –I:</b> 2D Mesh SIMD Model - Parallel Algorithms for Reduction - Prefix Computation - Selection - Odd-Even Merge Sorting - Matrix Multiplication					
		<b>UNIT-IV : SIMD ALGORITHMS-II:</b> Hypercube SIMD Model - Parallel Algorithms for Selection- Odd-Even Merge Sort- Bitonic Sort- Matrix Multiplication Shuffle Exchange SIMD Model - Parallel Algorithms for Reduction -Bitonic Merge Sort - Matrix Multiplication - Minimum Cost Spanning Tree					

	<b>UNIT-V: UMA Multiprocessor Model -Parallel Summing on Multiprocessor- Matrix Multiplication on Multiprocessors and Multicomputer - Parallel Quick Sort - Mapping Data to Processors.</b>
Extended Professional Component	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour) (is a part of internal component only, Not to be included in the External Examination question paper)
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
<b>Recommended Text</b>	1. Michael J. Quinn, "Parallel Computing: Theory & Practice", Tata McGraw Hill Edition, Second edition, 2017. 2. V. Rajaraman, C. Siva Ram Murthy, "Parallel computers - Architecture and Programming ", PHI learning, 2016.
<b>Reference Books</b>	1. M Sasikumar, Dinesh Shikhare and P Ravi Prakash , " Introduction to Parallel Processing", PHI learning , 2013 2. Seyed H Roosta, "Parallel Programming and Parallel Algorithms" Springer Series New York 2001
<b>Website and e-Learning Source</b>	<a href="https://nptel.ac.in/courses/106/103/106103188/">https://nptel.ac.in/courses/106/103/106103188/</a> <a href="https://nptel.ac.in/courses/106/104/106104120/">https://nptel.ac.in/courses/106/104/106104120/</a> <a href="https://nptel.ac.in/courses/106/106/106106112/">https://nptel.ac.in/courses/106/106/106106112/</a> <a href="https://nptel.ac.in/courses/106102163">https://nptel.ac.in/courses/106102163</a>

**CLO1:** Understand the differences among several algorithms solving the same problem and recognize which one is better under different conditions; ☐

**CLO 2:** Understand the difference between sequential and parallel algorithms

**CLO 3:** This applies both to computers with shared memory and with distributed memory. ☐

**CLO 4:** Analyse efficiency of different parallel algorithms. ☐

**CLO 5:** Develop parallel algorithms for standard problems and application

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	3	2	2	3	3
CO2	3	2	3	2	3	3
CO3	3	2	3	2	2	1
CO4	3	3	3	3	3	3
CO5	3	2	3	3	3	3
Weightage of course contributed To each PSO	15	12	14	12	14	13

## Semester II

<b>Title of the Course</b>		<b>MACHINE LEARNING</b>					
<b>Paper Number</b>		<b>CORE</b>					
<b>Category</b>	Core	<b>Year</b>	I	<b>Credits</b>	4	<b>Course Code</b>	
		<b>Semester</b>	II				
<b>Instructional Hours per week</b>	<b>Lecture</b>	<b>Tutorial</b>		<b>Lab Practice</b>	<b>Total</b>		
	4	1		-	5		
<b>Pre-requisite</b>		The Prerequisites for Machine learning is to understand, and practice machine learning approaches and familiarity with data handling techniques.					
<b>Objectives of the Course</b>		<p>By the end of the course the students will be able to</p> <ul style="list-style-type: none"> <li>➤ Gain knowledge about basic concepts of Machine Learning</li> <li>➤ Solve the problems using various machine learning techniques</li> <li>➤ Apply Dimensionality reduction techniques.</li> </ul>					
<b>Course Outline</b>		<p>UNIT-I :Introduction: Machine Learning - Machine Learning Foundations –Overview – Applications - Types of Machine Learning - Basic Concepts in Machine Learning - Examples–Applications. Linear Models for Regression-Linear Basis Function Models-The Bias-Variance Decomposition- Bayesian Linear Regression-Bayesian Model Comparison.</p> <p>UNIT-II :Supervised Learning Linear Models for Classification - Discriminant Functions - Probabilistic Generative Models - Probabilistic Discriminative Models - Bayesian Logistic Regression - Decision Trees - Classification Trees - Regression Trees – Pruning - Neural Networks - Feed-Forward Network Functions - Error Back-Propagation - Regularization - Mixture Density and Bayesian Neural Networks - Kernel Methods - Dual Representations - Radial Basis Function Networks - Ensemble methods - Bagging - Boosting.</p> <p>UNIT-III :Unsupervised Learning Clustering- K-means - EM - Mixtures of Gaussians - The EM Algorithm in General -Model Selection for Latent Variable Models - High-Dimensional Spaces - The Curse of Dimensionality - Dimensionality Reduction - Factor Analysis - Principal Component Analysis - Probabilistic PCA- Independent Components Analysis.</p> <p>UNIT-IV :Probabilistic Graphical Models Directed Graphical Models - Bayesian Networks - Exploiting Independence Properties - From Distributions to Graphs - Examples - Markov Random Fields - Inference in Graphical Models - Learning – Naive Bayes Classifiers - Markov Models – Hidden Markov Models – Inference – Learning- Generalization – Undirected graphical models - Markov Random Fields- Conditional Independence Properties - Parameterization of MRFs - Examples - Learning - Conditional Random Fields (CRFs) - Structural SVMs</p>					

	UNIT-V :Advanced Learning Sampling – Basic sampling methods – Monte Carlo - Reinforcement Learning - K-Armed Bandit Elements - Model-Based Learning - Value Iteration- Policy Iteration - Temporal Difference Learning- Exploration Strategies- Deterministic and Non-deterministic Rewards and Actions Eligibility Traces- Generalization- Partially Observable States- The Setting- Example - Semisupervised Learning - Computational Learning Theory - Mistake Bound Analysis - Sample Complexity Analysis - VC Dimension - Occam Learning - Accuracy and Confidence Boosting.
Extended Professional Component	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour) (is a part of internal component only, Not to be included in the External Examination question paper)
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
<b>Recommended Text</b>	Christopher Bishop, “Pattern Recognition and Machine Learning” Springer, 2006
<b>Reference Books</b>	Kevin P. Murphy, “Machine Learning: A Probabilistic Perspective”, MIT Press, 2012 EthemAlpaydin, “Introduction to Machine Learning”, Prentice Hall of India, 2005 Tom M. Mitchell, Machine Learning, McGraw-Hill Education (India) Private Limited, 2013. Hastie, Tibshirani, Friedman, “The Elements of Statistical Learning” (2nd ed)., Springer, 2008 Stephen Marsland, “Machine Learning –An Algorithmic Perspective”, CRC Press, 2009
<b>Website and e-Learning Source</b>	<a href="https://nptel.ac.in/courses/106/106/106106139/">https://nptel.ac.in/courses/106/106/106106139/</a> <a href="https://www.coursera.org/learn/machine-learning">https://www.coursera.org/learn/machine-learning</a> <a href="https://onlinecourses.nptel.ac.in/noc21_cs24/preview">https://onlinecourses.nptel.ac.in/noc21_cs24/preview</a>
<p><b>CLO 1:</b> To introduce students to the basic concepts and techniques of Machine Learning.</p> <p><b>CLO 2:</b> To become familiar with regression methods, classification methods, clustering methods.</p> <p><b>CLO 3:</b> To become familiar with Dimensionality reduction Techniques.</p> <p><b>CLO 4:</b> Identify machine learning techniques suitable for a given problem</p> <p><b>CLO 5:</b> Design application using machine learning techniques</p>	

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	3	2	3	3	3
CO2	2	3	3	3	3	2
CO3	2	3	3	3	3	2
CO4	3	3	3	3	3	2
CO5	3	3	2	3	3	3
<b>Weightage of course contributed to each PSO</b>	<b>13</b>	<b>15</b>	<b>13</b>	<b>15</b>	<b>15</b>	<b>12</b>



<b>Title of the Course</b>		<b>ADVANCED DATABASE SYSTEMS</b>					
<b>Paper Number</b>		<b>CORE</b>					
<b>Category</b>	Core	<b>Year</b>	I	<b>Credits</b>	4	<b>Course Code</b>	
		<b>Semester</b>	II				
<b>Instructional Hours per week</b>		<b>Lecture</b>	<b>Tutorial</b>	<b>Lab Practice</b>	<b>Total</b>		
		4	1	--	5		
<b>Pre-requisite</b>		This course requires a broad understanding of database concepts, database management system software, and the method of handling object relational, temporal, multimedia, spatial, logic based, mobile databases and Emerging Trends in it.					
<b>Objectives of the Course</b>		<p>Students will try to learn:</p> <ul style="list-style-type: none"> <li>● Define the study of database system usage and design Object oriented models. Outline introductory knowledge about the query processing in object-based databases and its usage.</li> <li>● Interpret the basics of spatial, temporal and mobile databases and their applications.</li> <li>● Review an idea about emerging databases such as XML, Data warehouse and NoSQL.</li> <li>● Compare and contrast various indexing strategies in different database systems and appraise how advanced databases differ from traditional databases.</li> <li>● To conceive inquisitive attitude towards research and current trend topics in databases.</li> </ul>					
<b>Course Outline</b>		<p><b>UNIT-I :Database System:</b> Introduction-Data Independence-Database System Architecture- The External Level - The Conceptual Level - The Internal Level - Mappings - The Database Administrator - Data Dictionary - Data Models - Record-Based Data Models - Object based Data Models - Physical Data Models-Hierarchical Data Models - Network Data Models-Relational Data Model Entity-Relationship Models - Object Oriented Data Model-Comparison Between Data Models.</p> <p><b>UNIT-II : Object And Object Relational Databases:</b> Concepts for Object Databases Object Identity - Object structure - Type Constructors - Encapsulation of Operations - Methods - Persistence - Type and Class Hierarchies - Inheritance - Complex Objects - Object Database Standards, Languages and Design: ODMG Model - ODL - OQL -</p> <p><b>UNIT-III : Temporal Databases:</b> Introduction-Intervals-Packing and Unpacking relations- Generalizing the relational operators - Database Design - Integrity Constraints - <b>Multimedia Databases:</b> Multimedia Sources - Multimedia Database Queries - Information Retrieval- Data Warehousing- Data mining- Text Mining. Multimedia Database Applications. <b>Spatial Databases:</b> Spatial Data- Spatial Database Characteristics - Spatial Data Model-Spatial Database Queries - Techniques of Special Database Query.</p>					

	<p><b>UNIT-IV : Logic based Databases:</b> Introduction Overview-Proportional calculus - Predicate Calculus - Deductive Database Systems - Recursive Query Processing. <b>Mobile Databases:</b> Architecture of Mobile Databases - Characteristics of Mobile Computing - Mobile DBMS - Location and Handoff Management - Effect of Mobility on Data Management - Location Dependent Data Distribution - Mobile Transaction Models - Concurrency Control - Transaction Commit Protocols.</p> <p><b>UNIT-V : Advanced Topics :</b> Overview of Distributed Databases - Data Fragmentation - Replication - XML Databases - XML Schema - NOSQL Database: Characteristics - CAP theorem - Types of NoSQL <b>Data stores:</b> Column Oriented, Document, Key-Value and Graph Types - Applications. <b>Emerging Database Technologies:</b> Introduction - Internet Databases: Internet Technology - The World Wide Web-Web Technology - Web Databases - Cloud Based Databases Advantages -Current Trends.</p>
Extended Professional Component	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour) (is a part of internal component only, Not to be included in the External Examination question paper)
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
<b>Recommended Text</b>	<ol style="list-style-type: none"> <li>1. Abraham Silberschatz, Henry F. Korth, S. Sudharshan, “Database System Concepts”, Sixth Edition, Tata McGraw Hill, 2014.</li> <li>2. C.J. Date, A. Kannan, S. Swamynathan, “An Introduction to Database Systems”, 8th Edition, Pearson Education,2006.</li> <li>3. RamezElmasri, Shamkant B. Navathe, “Fundamentals of Database Systems”, Seventh Edition, Pearson Education, 2017.</li> </ol>
<b>Reference Books</b>	<ol style="list-style-type: none"> <li>1. S.K. Singh,” Databse Systems: Concepts, Design and Applications”, 2nd Edition, Person Eduction, 2008.</li> <li>2. Abraham Silberschats, HentryF.Korth and S.Sudarshan,”Database Management System Concepts”, McGraw Hill International Edition,2006.</li> <li>3. Raghu Ramakrishnan, Johannes Gehrke, “Database Management Systems”, Fourth Edition, Tata McGraw Hill, 2010.</li> <li>4. G. K. Gupta, “Database Management Systems”, Tata McGraw Hill, 2011.</li> <li>5. Carlos Coronel, Steven Morris, Peter Rob, “Database Systems: Design, Implementation and Management”, Ninth Edition, Cengage</li> </ol>
<b>Website and e-Learning Source</b>	<ol style="list-style-type: none"> <li>1. <a href="https://people.inf.elte.hu/miiqaai/elektroModulatorDva.pdf">https://people.inf.elte.hu/miiqaai/elektroModulatorDva.pdf</a>.</li> <li>2. <a href="https://www.youtube.com/watch?v=SdW5RKUboKc&amp;list=PLSE8ODhjZXjasmrEd2_Yi1deeE360zv5O">https://www.youtube.com/watch?v=SdW5RKUboKc&amp;list=PLSE8ODhjZXjasmrEd2_Yi1deeE360zv5O</a></li> <li>3. <a href="https://nptel.ac.in/courses/106/106/106106093/">https://nptel.ac.in/courses/106/106/106106093/</a></li> <li>4. <a href="https://nptel.ac.in/courses/106/106/106106095/">https://nptel.ac.in/courses/106/106/106106095/</a></li> <li>5. <a href="https://nptel.ac.in/courses/106/104/106104135/">https://nptel.ac.in/courses/106/104/106104135/</a></li> </ol>

Students will able to:

**CLO 1:** Explain the features of database management systems and Object relational database

**CLO2 :** Students will be able to understand the needs and concepts of object-oriented database, spatial database, multimedia database, mobile database, data warehousing and data mining and etc...

**CLO 3:** Students will be able to understand NOSQL concepts and XML.

**CLO 4:** Explain Emerging trends and function of advanced database systems.

**CLO 5:** Demonstrate design and develop a database application system as part of a team.

<b>CO/PSO</b>	<b>PSO1</b>	<b>PSO2</b>	<b>PSO3</b>	<b>PSO4</b>	<b>PSO5</b>	<b>PSO6</b>
<b>CO1</b>	<b>3</b>	<b>3</b>	<b>1</b>	<b>3</b>	<b>3</b>	<b>3</b>
<b>CO2</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>
<b>CO3</b>	<b>3</b>	<b>3</b>	<b>2</b>	<b>3</b>	<b>3</b>	<b>3</b>
<b>CO4</b>	<b>3</b>	<b>3</b>	<b>2</b>	<b>3</b>	<b>3</b>	<b>2</b>
<b>CO5</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>
<b>Weightage of course contributed to each PSO</b>	<b>15</b>	<b>15</b>	<b>11</b>	<b>15</b>	<b>15</b>	<b>14</b>

<b>Title of the Course</b>		<b>Advanced Database Management Systems Lab</b>					
<b>Paper Number</b>		<b>CORE</b>					
<b>Category</b>	Core	<b>Year</b>	I	<b>Credits</b>	3	<b>Course Code</b>	
		<b>Semester</b>	II				
<b>Instructional Hours per week</b>	<b>Lecture</b>		<b>Tutorial</b>		<b>Lab Practice</b>		<b>Total</b>
					4		4
<b>Pre-requisite</b>		Good understanding of DBMS concepts and SQL queries					
<b>Objectives of the Course</b>		<ul style="list-style-type: none"> <li>○ Describe the validity of user defined requirements summarize the usage of normal forms</li> <li>○ Interpret the SQL statements and its results</li> <li>○ Summarize the working of the file storage structure using different methods</li> <li>○ Conceive and critically assess the real time data base systems</li> </ul>					
<b>Course Outline</b>		<ol style="list-style-type: none"> <li><b>1. Implementing DDL, DML commands - Using Key constraints</b></li> <li><b>2. Using Foreign key with multiple set of Tables - Incorporate Referential Integrity</b></li> <li><b>3. Query the DB using Different where clause -</b></li> <li><b>4. Implement Aggregate Functions</b></li> <li><b>5. Use different In built Functions of SQL</b></li> <li><b>6. Explore Join Operations</b></li> <li><b>7. Implementing Sub queries - Exploring Complex DB transaction using DCL, TCL commands</b></li> <li><b>8. SQL trigger -Creating Views and Index</b></li> <li><b>9. Create XML DB and validate using XML Schema</b></li> <li><b>10. Create Documents, Columns using NOSQL DB tools</b></li> <li><b>Develop GUI to incorporate all the above mentioned features.</b></li> <li><b>11. Perform ER model and Normalization</b></li> </ol>					
Extended Professional Component		Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour) (is a part of internal component only, Not to be included in the External Examination question paper)					
Skills acquired from this course		Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill					
<b>Recommended Text</b>		Abraham Silberschatz, Henry F. Korth and S. Sudarshan- “Database System Concepts”, Sixth Edition, McGraw-Hill, 2020.					
<b>Reference Books</b>		<ul style="list-style-type: none"> <li>➤ RamezElmasri and Shamkant B. Navathe, “Fundamental Database Systems”, Third Edition, Pearson Education, 2003.</li> <li>➤ Raghu Ramakrishnan, “Database Management System”, Tata McGraw-Hill Publishing Company, 2003.</li> </ul>					
<b>Website and e-Learning Source</b>		<a href="http://www.sqltutorials.com">www.sqltutorials.com</a> <a href="https://www.javatpoint.com/nosql-databases">https://www.javatpoint.com/nosql-databases</a>					

**CLO 1:** Understand the usage of C# programming  
**CLO 2:** Generalize data base connectivity procedure  
**CLO 3:** Identify the purpose of design data base systems and web-based applications  
**CLO 4:** Demonstrate SQL, XML and NOSQL statements usage  
**CLO 5:** Design simple applications with interactive queries

<b>CO/PSO</b>	<b>PSO1</b>	<b>PSO2</b>	<b>PSO3</b>	<b>PSO4</b>	<b>PSO5</b>	<b>PSO6</b>
<b>CO1</b>	<b>2</b>	<b>3</b>	<b>1</b>	<b>1</b>	<b>2</b>	<b>2</b>
<b>CO2</b>	<b>3</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>2</b>
<b>CO3</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>3</b>	<b>2</b>	<b>2</b>
<b>CO4</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>3</b>
<b>CO5</b>	<b>3</b>	<b>3</b>	<b>2</b>	<b>3</b>	<b>2</b>	<b>3</b>
<b>Weightage of course contributed to each PSO</b>	<b>14</b>	<b>13</b>	<b>9</b>	<b>11</b>	<b>10</b>	<b>12</b>

<b>Title of the Course</b>		<b>ANDROID APPLICATION DEVELOPMENT – LAB</b>					
<b>Paper Number</b>		<b>CORE</b>					
<b>Category</b>	Core	<b>Year</b>	I	<b>Credits</b>	3	<b>Course Code</b>	
		<b>Semester</b>	II				
<b>Instructional Hours per week</b>	<b>Lecture</b>		<b>Tutorial</b>		<b>Lab Practice</b>		<b>Total</b>
					4		4
<b>Objectives of the Course</b>		To develop Android Applications					
<b>LIST OF EXERCISES:</b>		<ol style="list-style-type: none"> <li>1. Write an application that draws basic graphical primitives on the screen.</li> <li>2. Develop an application that makes use of Notification Manager.</li> <li>3. Implement an application that uses Multi-threading.</li> <li>4. Develop a native application that uses GPS location information.</li> <li>5. Implement an application that creates an alert upon receiving a message.</li> <li>6. Develop a mobile application to send an email.</li> <li>7. Write a mobile application that creates alarm clock.</li> <li>8. Implement an application that implements Multi-threading.</li> <li>9. Develop an application that makes use of RSS Feed.</li> <li>10. Implement an application that writes data to the SD card.</li> <li>11. Develop an application that uses GUI components, Font and Colors.</li> <li>12. Develop an application that makes use of databases.</li> </ol>					
Extended Professional Component		Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour) (is a part of internal component only, Not to be included in the External Examination question paper)					
Skills acquired from this course		Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill					
<b>Website and e-Learning Source</b>		<a href="https://developer.android.com/">https://developer.android.com/</a>					

#### Course outcome

The student should be able:

- To understand the structure of an Android applications.
- To understand both the basic and advanced concepts of mobile applications.
- To create a seamless user interface that works with different mobile screens.
- To Build enterprise level mobile applications

<b>Title of the Course</b>		<b>Cryptography and Network Security</b>					
<b>Paper Number</b>							
<b>Category</b>	Elective I	<b>Year</b>	I	<b>Credits</b>	3	<b>Course Code</b>	
		<b>Semester</b>	I				
<b>Instructional Hours per week</b>		<b>Lecture</b>	<b>Tutorial</b>	<b>Lab Practice</b>	<b>Total</b>		
		4		--	4		
<b>Pre-requisite</b>		The Prerequisites of Cryptography and information security is to understand the principles and practices of cryptographic techniques					
<b>Objectives of the Course</b>		<p>the students will be able to</p> <ul style="list-style-type: none"> <li>➤ Understand a variety of generic security threats and vulnerabilities, and identify.(K1)</li> <li>➤ Appreciate the application of security techniques and technologies in solving real life security problems in practical systems.(K2)</li> <li>➤ Apply appropriate security techniques to solve security problem(K3,K4)</li> <li>➤ Design security protocols and methods to solve the specific security problems. K5,K6)</li> </ul>					
<b>Course Outline</b>		<b>UNIT-I</b> :Fundamentals and Mathematics of Cryptography Overview - Classical Crypto Systems – Substitution Ciphers – Transposition Ciphers- Stream and Block Ciphers – Introduction to Number Theory – Congruences – Chinese Remainder theorem – Modular Arithmetic - Modular Exponentiation – Fermats and Eulers Theorem - FiniteFields – GF(2 <sup>n</sup> ) Fields.					
		<b>UNIT-II</b> :Encryption Techniques Symmetric Encryption Techniques – DES – AES - Public-Key Cryptography and RSA – Key Management - Diffie-Hellman Key Exchange – Elliptic Curve Cryptography – Symmetric Key Distribution – Kerberos - X.509 Authentication Service - differential cryptanalysis - linear cryptanalysis - side channel attack - lattice reduction attack – Merkle Hellman knapsack attack - Hellman's time-memory trade off (TMTO) attack.					

	<p><b>UNIT-III :</b> Hash Functions and Signatures Message Authentication and Hash Functions – Description of MD Hash Family – Secure Hash Algorithms – SHA 512 - Digital Signatures and Authentication Protocols – Digital Signature Standard – Process, Services, Attacks on Digital Signature- Digital Signature Schemes.</p> <p><b>UNIT-IV :</b> Security Practices Vulnerability Analysis - Flaw Hypothesis Methodology, NRL taxonomy and Aslam’s model - Auditing - Anatomy of an Auditing System - Design of Auditing Systems - Posteriori Design - Auditing mechanisms - Risk Analysis and Management - Disaster Recovery Planning/Incident Response Planning - Intrusion Detection System</p> <p><b>UNIT-V:</b> Secure Development Secure Coding - OWASP/SANS Top Vulnerabilities - Buffer Overflows - Incomplete mediation - XSS - Anti Cross Site Scripting Libraries - Canonical Data Format - Command Injection - Redirection - Inference – Application Controls - Secure Software Development Life Cycle - Testing, Maintenance and Operation - Evaluation of Security Systems.</p>
Extended Professional Component	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
<b>Recommended Text</b>	1. William Stallings, “Cryptography And Network Security – Principles And Practices”, PearsonEducation, Fourth Edition, 2006.
<b>Reference Books</b>	<p>1. Wade Trappe And Lawrence C. Washington, “Introduction To Cryptography With Coding Theory” Second Edition, Pearson Education, 2007.</p> <p>2. Mark Stamp, “Information Security: Principles And Practice”, Wiley Inter Science, 2011.</p>
<b>Website and e-Learning Source</b>	<p>1. <a href="http://nptel.ac.in/courses/106105031/lecture">http://nptel.ac.in/courses/106105031/lecture</a> by Dr. Debdeep Mukhopadhyay IIT Kharagpur</p> <p>2. <a href="https://ocw.mit.edu/courses/electrical-engineering-andcomputer-science/6-033-computer-system-engineering-spring2009/video-lectures/">https://ocw.mit.edu/courses/electrical-engineering-andcomputer-science/6-033-computer-system-engineering-spring2009/video-lectures/</a> lecture by Prof. Robert Morris and Prof. Samuel Madden MIT.</p>



**CLO1:**To provide students with contemporary knowledge in Cryptography and Security.  
**CLO 2:**To understand how cryptography can be used as an effective tool in providing assurance concerning privacy and integrity of information  
**CLO 3:**To provide skills to design security protocols for security problems.  
**CLO 4:** Analyze particular security problems for given application  
**CLO 5:**Familiar with current research issues and directions of security

<b>CO/PSO</b>	<b>PSO1</b>	<b>PSO2</b>	<b>PSO3</b>	<b>PSO4</b>	<b>PSO 5</b>	<b>PSO 6</b>
<b>CO1</b>	<b>3</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>3</b>	<b>3</b>
<b>CO2</b>	<b>3</b>	<b>2</b>	<b>3</b>	<b>2</b>	<b>3</b>	<b>3</b>
<b>CO3</b>	<b>3</b>	<b>2</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>1</b>
<b>CO4</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>
<b>CO5</b>	<b>3</b>	<b>2</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>
<b>Weightage of course contributed To each PSO</b>	<b>15</b>	<b>12</b>	<b>14</b>	<b>12</b>	<b>14</b>	<b>13</b>

<b>Title of the Course</b>		<b>Theory of Computation</b>					
<b>Paper Number</b>							
<b>Category</b>	Elective III	<b>Year</b>	I	<b>Credits</b>	3	<b>Course Code</b>	
		<b>Semester</b>	II				
<b>Instructional Hours per week</b>	<b>Lecture</b>		<b>Tutorial</b>		<b>Lab Practice</b>	<b>Total</b>	
	4				--	4	
<b>Pre-requisite</b>		Students should possess basic knowledge on Discrete Mathematics and Data Structures					
<b>Objectives of the Course</b>		<p>The main objectives of this course are to:</p> <ul style="list-style-type: none"> <li>➤ Identify the mathematical proofs for testing the computation.</li> <li>➤ Explain the finite automata for solving computational problems</li> <li>➤ Interpret the types of grammar recognized by different machines</li> <li>➤ Differentiate P and NP problems</li> <li>➤ Evaluate the problems based on pumping lemma</li> <li>➤ Conceptualize the complexity of computational problems</li> </ul>					
<b>Course Outline</b>		<p><b>UNIT-I :</b> Understand various Computing models like Finite State Machine, Pushdown Automata, and Turing Machine. Be aware of Decidability and Un-decidability of various problems. Learn types of grammars. Finite Automata Introduction - Basic Mathematical Notation and techniques- Finite State systems – Basic Definitions - Finite Automaton - DFA &amp; NDFA - Finite Automaton with <math>\epsilon</math>-moves - Regular Languages- Regular Expression - Equivalence of NFA and DFA - Equivalence of NDFA"s with and without <math>\epsilon</math>-moves - Equivalence of finite Automaton and regular expressions -Minimization of DFA- - Pumping Lemma for Regular sets - Problems based on Pumping Lemma.</p>					
		<p><b>UNIT-II :</b> Grammar Introduction- Types of Grammar - Context Free Grammars and Languages- Derivations and Languages - Ambiguity- Relationship between derivation and derivation trees - Simplification of CFG - Elimination of Useless symbols - Unit productions - Null productions - Greiback Normal form - Chomsky normal form - Problems related to CNF and GNF.</p>					
		<p><b>UNIT-III :</b> Pushdown Automata- Definitions - Moves - Instantaneous descriptions - Deterministic pushdown automata - Equivalence of Pushdown automata and CFL - pumping lemma for CFL - problems based on pumping Lemma.</p>					

	<b>UNIT-IV</b> : Definitions of Turing machines - Models - Computable languages and functions -Techniques for Turing machine construction - Multi head and Multi tape Turing Machines - The Halting problem - Partial Solvability - Problems about Turing machine- Chomskian hierarchy of languages.
	<b>UNIT-V</b> : Unsolvable Problems and Computable Functions - Primitive recursive functions - Recursive and recursively enumerable languages - Universal Turing machine. MEASURING AND Classifying Complexity: Tractable and Intractable problems- Tractable and possibly intractable problems - P and NP completeness - Polynomial time reductions.
Extended Professional Component	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
<b>Recommended Text</b>	Hopcroft J.E., Motwani R. and Ullman J.D, “Introduction to Automata Theory, Languages and Computations”, Second Edition, Pearson Education, 2008.
<b>Reference Books</b>	John C Martin, “Introduction to Languages and the Theory of Computation”, Third Edition, Tata McGraw Hill Publishing Company, New Delhi, 2007.
<b>Website and e-Learning Source</b>	<a href="https://nptel.ac.in/courses/106/105/106105031/">https://nptel.ac.in/courses/106/105/106105031/</a> <a href="https://nptel.ac.in/courses/106/105/106105081/">https://nptel.ac.in/courses/106/105/106105081/</a> <a href="https://www.tutorialspoint.com/cryptography/index.h">https://www.tutorialspoint.com/cryptography/index.h</a>

**CLO1:** Understand the concepts of mathematical proofs, finite automata and regular expressions.  
**CLO 2:** Understand and critically assess the problems related to turing machine.  
**CLO 3:** Comprehend the context free grammar and to represent the derivations using parse trees.  
**CLO 4:** To conceptualize and differentiate the problems by evaluating its complexity.  
**CLO 5:** Evaluate the problems for context free language based on pumping lemma.

CO/PSO	PSO 1	PSO2	PSO3	PSO4	PSO 5	PSO 6
CO1	3	3	2	2	3	3
CO2	3	2	3	2	3	3
CO3	3	2	3	2	2	1
CO4	3	3	3	3	3	3
CO5	3	2	3	3	3	3
<b>Weightage of course contributed to each PSO</b>	<b>15</b>	<b>12</b>	<b>14</b>	<b>12</b>	<b>14</b>	<b>13</b>

<b>Title of the Course</b>		<b>Embedded Systems in Computing</b>					
<b>Paper Number</b>							
<b>Category</b>	Elective	<b>Year</b>	I	<b>Credits</b>	3	<b>Course Code</b>	
		<b>Semester</b>	II				
<b>Instructional Hours per week</b>		<b>Lecture</b>		<b>Tutorial</b>		<b>Lab Practice</b>	<b>Total</b>
		4				--	4
<b>Pre-requisite</b>		This course requires the understanding of Embedded computing - memory management, programming processes and IOT streams.					
<b>Objectives of the Course</b>		<p>The main objectives of this course are to:</p> <ul style="list-style-type: none"> <li>➤ Define the concepts and architecture of embedded systems</li> <li>➤ Describe Basic of microcontroller 8051 and ARM Architecture</li> <li>➤ Employ the concepts of memory input and output process of operating systems and microcontroller interface.</li> <li>➤ Generalize the concepts of C programming basic and function</li> <li>➤ Oriented to Embedded systems.</li> <li>➤ Review an idea of real time operating system and design issues of Software development tools and Emulators in Embedded Computing</li> <li>➤ Conceptualize the introduction about IOT and Design methodologies platforms used for an embedded systems application with case studies.</li> </ul>					
<b>Course Outline</b>		<p>UNIT-I : Embedded Computing: Challenges of Embedded Systems – Embedded system design process. Embedded processors – 8051 Microcontroller, ARM processor – Architecture, Instruction sets and programming.</p>					
		<p>UNIT-II : Memory and Input / Output Management :Programming Input and Output – Memory system mechanisms – Memory and I/O devices and interfacing – Interrupt handling.</p>					
		<p>UNIT-III : Processes and Operating Systems :Multiple tasks and processes – Context switching – Scheduling policies – Interprocess communication mechanisms – Performance issues.</p>					
		<p>UNIT-IV : Embedded C Programming: Programming embedded systems in C – C-looping structures – Register allocation – Function calls – Pointer aliasing – structure arrangement – bit fields – unaligned data and endianness – inline functions and inline assembly – portability issues.</p>					

	UNIT-V: Embedded System Development :Meeting real time constraints – Multi- State systems and function sequences. Embedded software development tools – Emulators and debuggers. Introduction to Internet of Things -Design issues – Design methodologies – Case studies using IoT– Complete design of example systems.
Extended Professional Component	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
<b>Recommended Text</b>	1. Andrew N Sloss, D. Symes, C. Wright, “ARM System Developers Guide”, Morgan Kauffman/ Elsevier,2006. 2. Arshdeep Bahga, Vijay Madiseti, “Internet of Things – A hands-on approach”, Universities Press, 2015 3. Microcontroller and Embedded Systems”, Pearson Education, Second edition, 2007
<b>Reference Books</b>	1. Michael J. Pont, “Embedded C”, Pearson Education, 2007. 2. Steve Heath, “Embedded System Design”, Elsevier, 2005. 3. Wayne Wolf, “Computers as Components: Principles of Embedded Computer System Design”, Elsevier, 2006.
<b>Website and e-Learning Source</b>	<a href="https://nptel.ac.in/courses/106/105/106105193/">https://nptel.ac.in/courses/106/105/106105193/</a> <a href="https://nptel.ac.in/courses/106/103/106103182/">https://nptel.ac.in/courses/106/103/106103182/</a> <a href="https://nptel.ac.in/courses/106/105/106105159/">https://nptel.ac.in/courses/106/105/106105159/</a> <a href="https://nptel.ac.in/courses/108/102/108102045/">https://nptel.ac.in/courses/108/102/108102045/</a> <a href="https://nptel.ac.in/courses/108/105/108105057/">https://nptel.ac.in/courses/108/105/108105057/</a>

**CLO1:** Explain the embedded system concepts and architecture of embedded systems  
**CLO 2:** Describe the architecture of 8051 microcontroller and write embedded program for 8051 microcontroller.  
**CLO 3:** Demonstrate the open source RTOS and solve the design issues for the same and IOT.  
**CLO 4:** Select elements for an embedded systems tool and Embedded C programming.  
**CLO 5:** Design the interfacing for 8051 microcontroller.

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO 5	PSO 6
CO1	3	3	2	2	3	3
CO2	3	2	3	2	3	3
CO3	3	2	3	2	2	1
CO4	3	3	3	3	3	3
CO5	3	2	3	3	3	3
<b>Weightage of course contributed to each PSO</b>	<b>15</b>	<b>12</b>	<b>14</b>	<b>12</b>	<b>14</b>	<b>13</b>

<b>Title of the Course</b>		<b>Advanced Digital Image Processing</b>					
<b>Paper Number</b>							
<b>Category</b>	Elective IV	<b>Year</b>	I	<b>Credits</b>	3	<b>Course Code</b>	
		<b>Semester</b>	II				
<b>Instructional Hours per week</b>	<b>Lecture</b>		<b>Tutorial</b>		<b>Lab Practice</b>	<b>Total</b>	
	4				--	4	
<b>Pre-requisite</b>		Able to know extract from Differential Equations and the understanding of Linear Algebra.					
<b>Objectives of the Course</b>		<ul style="list-style-type: none"> <li>➤ To understand representation of digital images in the spatial and frequency domains.</li> <li>➤ To understand Image Compression, Segmentation and image compression standards.</li> <li>➤ To provide an in-depth understanding of various concepts related to image Representation and Description.</li> <li>➤ To get familiar with image enhancement concepts and image degradation /restoration process.</li> </ul>					
<b>Course Outline</b>		<p>UNIT-I : DIGITAL IMAGE FUNDAMENTALS – Introduction -Resolution and Quantization- Image format-The Origins of digital image processing – fundamental steps in Digital Image Processing -elements of visual perception systems-Light and the electromagnetic Spectrum-Image Sensing and Acquisition- Image sampling and Quantization- Some basic Relationship between Pixels- Introduction to the Basic Mathematical Tools Used in Digital Image Processing</p>					
		<p>UNIT-II : INTENSITY TRANSFORMATION AND SPATIAL FILTERING: Mathematics of Image formation- The Basic of Intensity Transformations and Spatial Filtering- Background-Some basic Intensity Transformation Function – Histogram Processing-Histogram Equations –Histogram Matching-Local Histogram Processing- Smoothing(Low Pass) Spatial Filter – Sharpening (High Pass) Spatial Filter – Highpass, Bandreject, and Bandpass Filters from Low pass Filters – Combining Spatial Enhancement Methods</p>					
		<p>UNIT-III : IMAGE RESTORATIONAND RECONSTRUCTION: Image Modeling- Spatial and Frequency Properties of Noise – Periodic Noise-A Model of the Image Degradation/Restoration Process. Noise Models. Restoration in the Presence of Noise Only-Spatial Filtering- The Weiner-Histogram filter-.Matrix formulation of image restoration- Constrained Least Squares Filtering- Geometric Mean Filter.</p>					

	UNIT-IV : COLOR IMAGE PROCESSING: Color Fundamentals – Color Models - Pseudo color Image Processing - Basics of Full –Color Image Processing-Color Transformations –Color Image Smoothing and Sharpening – Image Segmentation based on color - Using Color in Image Segmentation- Noise in Color Images - Color Image Compression
	UNIT-V: COLOR IMAGE COMPRESSION & WATER MARKING: Fundamentals-Huffman Coding – Golomb Coding – Arithmetic Coding – LZW Coding – Run length Coding – Symbol Based Coding-Bit Plane Coding – Black Transform Coding- Predictive Coding-Wavelet Coding – Digital Image Water marking.
Extended Professional Component	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour) (is a part of internal component only, Not to be included in the External Examination question paper)
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
<b>Recommended Text</b>	R.C. Gonzalez and R. E. Woods, Digital image processing, Addison-Wesley Publishing House, 4th edition, 2018.
<b>Reference Books</b>	Chris Solomon and Toby Breckon, Fundamentals of Digital image processing, A Practical Approach with Examples in MATLAB, First edition, 2011 John wiley& Sons
<b>Website and e-Learning Source</b>	<a href="https://www.imageprocessingplace.com/">https://www.imageprocessingplace.com/</a> <a href="https://www.fundipbook.com/">https://www.fundipbook.com/</a>

**CLO1:**Acquire knowledge of principles of digital image processing

**CLO 2:**Solve problems pertaining to the field of image acquisition, preprocessing, Fourier domain processing.

**CLO 3:**Perform basic image restoration, image segmentation and image compression.

**CLO 4:** Provide the foundations for life-long learning and continual professional development in the areas of image applications.

**CLO 5:**Interpret various image compression standards

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO 5	PSO 6
CO1	3	3	2	2	3	3
CO2	3	2	3	2	3	3
CO3	3	2	3	2	2	1
CO4	3	3	3	3	3	3
CO5	3	2	3	3	3	3
<b>Weightage of course contributed To each PSO</b>	<b>15</b>	<b>12</b>	<b>14</b>	<b>12</b>	<b>14</b>	<b>13</b>

<b>Title of the Course</b>		<b>SOCIAL NETWORK ANALYSIS</b>					
<b>Category</b>	<b>Skill</b>	<b>Year</b>	<b>I</b>	<b>Credits</b>	2	<b>Course Code</b>	
		<b>Semester</b>	<b>II</b>				
<b>Instructional Hours per week</b>		<b>Lecture</b>	<b>Tutorial</b>		<b>Lab Practice</b>	<b>Total</b>	
		4			--	4	
<b>Pre-requisite</b>		Basic understanding of social networks					
<b>Objectives of the Course</b>		To introduce the concepts and fundamentals of social network components and analysis					
<b>Course Outline</b>		<b>UNIT-I: INTRODUCTION TO SEMANTIC WEB AND SOCIAL NETWORKS</b>					
		<p>Introduction to Semantic Web: Limitations of current Web - Development of Semantic Web - Emergence of the Social Web - Social Network analysis: Development of Social Network Analysis - Key concepts and measures in network analysis - Electronic sources for network analysis: Electronic discussion networks, Blogs and online communities - Web-based networks - Applications of Social Network Analysis- Brief history of Social network analysis</p> <p><b>Book 1- Chapter 1,2,3 Book 2: Chapter 1</b></p>					
		<b>UNIT-II: MODELLING, AGGREGATING AND KNOWLEDGE REPRESENTATION</b>					
		<p>Knowledge Representation on the semantic web- Ontology and their role in the Semantic Web - Ontology languages for the Semantic Web-Modelling and aggregating social network data: State-of-the-art in network data representation - Ontological representation of social individuals - Ontological representation of social relationships - Aggregating and reasoning with social network data - Advanced representations</p> <p><b>Book 1: Chapter 4,5,6</b></p>					



	<p><b>UNIT-III: DATA COLLECTION</b></p> <p>Boundary specification – Data collection process- Information bias and issue of reliability – Archival data – Understanding SNA data – Managing SNA data</p> <p><b>Book2 : Chapter 2</b></p> <hr/> <p><b>UNIT-IV : METHODS IN SOCIAL NETWORK ANALYSIS</b></p> <p>Descriptive methods – Graph – Density- Centrality – cliques – MDS- structural equivalence – Two mode networks – Inferential methods – QAP- ERGM</p> <p><b>Book 2- Chapter 3, 4</b></p> <hr/> <p><b>UNIT-V: CASE STUDIES</b></p> <p>Case studies – Evaluation of web-based social network extraction – semantic – based social network analysis in the sciences – emergent semantics</p> <p><b>Book 1: Chapter 7,8,9</b></p>
<p>Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)</p>	<p>Case study on recent developments and presentation</p>
<p>Skills acquired from this course</p>	<p>Apply social network in real time applications</p>
<p><b>Recommended Text</b></p>	<p>1. Peter Mika, “Social Networks and the Semantic Web”, Springer 2007.</p> <p>2. Yang, Song, Franziska B. Keller, and Lu Zheng. Social network analysis: Methods and examples. Sage Publications, 2016.</p>

<b>Reference Books</b>	<p>1. Guandong Xu ,Yanchun Zhang and Lin Li, —Web Mining and Social Networking – Techniques and applications, First Edition, Springer, 2011.</p> <p>2. Dion Goh and Schubert Foo, —Social information Retrieval Systems: Emerging Technologies and Applications for Searching the Web Effectively, IGI Global Snippet, 2008.</p>
<b>Website and e-Learning Source</b>	<p><a href="https://bookdown.org/chen/snaEd/ch4.html">https://bookdown.org/chen/snaEd/ch4.html</a></p> <p><a href="https://www.sciencedirect.com/topics/social-sciences/social-network-analysis">https://www.sciencedirect.com/topics/social-sciences/social-network-analysis</a></p> <p><a href="https://www.publichealth.columbia.edu/research/population-health-methods/social-network-analysis">https://www.publichealth.columbia.edu/research/population-health-methods/social-network-analysis</a></p> <p><a href="https://www.ibm.com/docs/en/spss-modeler/18.0.0?topic=analysis-about-social-network">https://www.ibm.com/docs/en/spss-modeler/18.0.0?topic=analysis-about-social-network</a></p>

**Course Learning Outcome (for Mapping with POs and PSOs)**

Students will be able to

<b>CO's</b>	<b>Course Outcomes</b>
<b>CLO1</b>	Understand the fundamentals of social web and elements of social network analysis.
<b>CLO2</b>	Apply and visualize the knowledge representation in social network.
<b>CLO3</b>	Analyse the various methods in social network analysis.
<b>CLO4</b>	Evaluate the tools and methods for analysing the social network data.
<b>CLO5</b>	Investigate the recent potential applications and development of social network with real time case studies.

<b>CO/PSO</b>	<b>PSO1</b>	<b>PSO2</b>	<b>PSO3</b>	<b>PSO4</b>	<b>PSO5</b>	<b>PSO6</b>
<b>CLO1</b>	3	3	3	2	1	1
<b>CLO2</b>	3	3	3	2	1	1
<b>CLO3</b>	3	3	3	2	1	1
<b>CLO4</b>	3	3	3	2	1	1
<b>CLO5</b>	3	3	3	2	1	1
<b>Weightage of course contribute to each PSO</b>						