



D Y PATIL

COLLEGE *of*
ENGINEERING & TECHNOLOGY
(AN AUTONOMOUS INSTITUTE)

KASABA BAWADA, KOLHAPUR

D. Y. Patil College of Engineering and Technology,

Kasaba Bawada Kolhapur

(An Autonomous Institute)

NBA Accredited

NAAC Accredited with 'A' Grade

First Year Syllabus

of

M. Tech. in Computer Science & Engineering

**Department of Computer Science &
Engineering**

2023-24

M. Tech. CSE Scheme of Teaching and Examination w. e. f. A. Y. 2023-2024

(As Per National Education Policy 2020)

D. Y. PATIL COLLEGE OF ENGINEERING & TECHNOLOGY, KOLHAPUR
Teaching and Evaluation Scheme from Year 2023-24
First Year M. Tech. – Computer Science & Engineering
SEMESTER-I

Sr. No.	Course Code	Course Type	Name of the Course	TEACHING SCHEME			Credits	Total Marks	Evaluation Scheme			
				L	T	P			Type	Max. Marks	Minimum Marks For Passing	
1	231CSEL501	PCC	Mathematical Foundations of Computer Science	3	-	-	3	100	ISE	20	20	40
									MSE	30		
									ESE	50	20	
2	231CSEL502	PCC	Advanced Data Structures	3	-	-	3	100	ISE	20	20	40
									MSE	30		
									ESE	50	20	
3	231CSEL551-231CSEL560	PEC	Program Elective-I	3	-	-	3	100	ISE	20	20	40
									MSE	30		
									ESE	50	20	
4	231CSEL561-231CSEL575+	PEC	Program Elective-II (SWAYAM/NPTEL)	-	2	2	3	100	ESE	100	40	40
5	231CSEL503	PCC	Research Methodology	2	-	-	2	50	ISE	50	20	20
6	231CSEP504	PCC	Laboratory-I (Based on Program Core subjects)	-	-	4	2	50	ISE	50	20	20
7	231CSEP505	VSEC	Skill Laboratory-I	-	-	2	1	25	ISE	25	10	10
8	231CSEP506	ELC	Seminar-I	-	-	2	1	50	ISE	50	20	20
9	231CSEP507	LLC	Stress Management by Yoga	1	-	2	2	50	ISE	50	20	20
10	231CSEP508	HSSM	Professional Ethics for Research	1	1	-	2	50	ISE	50	20	20
TOTAL				13	03	12	22	675				

NOTE:-

- Program Elective-I** can be chosen from the **Program Elective Bucket-A** list.
- For **Program Elective-II**: The students can choose course from **Program Elective Bucket-B** list and study on their own by registering to SWAYAM/NPTEL/NPTEL+ Portal. The student should complete the course assignments and appear the examination conducted by SWAYAM/NPTEL/NPTEL+. ESE Marks will be mapped as per the score mentioned on the SWAYAM/NPTEL/NPTEL+ Course completion certificate issued by SWAYAM/NPTEL/NPTEL+.

D. Y. PATIL COLLEGE OF ENGINEERING & TECHNOLOGY, KOLHAPUR
Teaching and Evaluation Scheme from Year 2023-24
First Year M. Tech. - Computer Science & Engineering
SEMESTER-II

Sr. No.	Course Code	Course Type	Name of the Course	TEACHING SCHEME			Credits	Total Marks	Evaluation Scheme			
				L	T	P			Type	Max. Marks	Minimum Marks For Passing	
1	231CSEL509	PCC	Software Architectures	3	-	-	3	100	ISE	20	20	40
									MSE	30		
									ESE	50	20	
2	231CSEL510	PCC	Network Engineering and Management	3	-	-	3	100	ISE	20	20	40
									MSE	30		
									ESE	50	20	
3	231CSEL551- 231CSEL560	PEC	Program Elective – III	3	-	-	3	100	ISE	20	20	40
									MSE	30		
									ESE	50	20	
4	231CSEL561- 231CSEL575+	PEC	Program Elective – IV (SWAYAM/NPTEL)	-	2	2	3	100	ESE	100	40	40
5	231CSEL516- 231CSEL532+	OEC	Open Elective-I (SWAYAM/NPTEL)	-	2	2	3	100	ESE	100	40	40
6	231CSEL511	PCC	Intellectual Property Rights	2	-	-	2	50	ISE	50	20	20
7	231CSEP512	PCC	Laboratory-II (Based on Program Core subjects)	-	-	4	2	50	ISE	50	20	20
8	231CSEP513	VSEC	Skill Laboratory-II	-	-	2	1	25	ISE	25	10	10
9	231CSEP514	ELC	Seminar-II	-	-	2	1	50	ISE	50	20	20
10	231CSEP515	VSEC	Technical Paper Writing	-	1	-	1	25	ISE	25	10	10
TOTAL				11	5	12	22	700				

NOTE:

- Program Elective-III** can be chosen from the **Program Elective Bucket-A** list.
- For **Program Elective-IV**: The students can choose course from **Program Elective Bucket-B** list and study on their own by registering to SWAYAM/NPTEL/NPTEL+ Portal. The student should complete the course assignments and appear the examination conducted by SWAYAM/NPTEL/NPTEL+. ESE Marks will be mapped as per the score mentioned on the SWAYAM/NPTEL/NPTEL+ Course completion certificate issued by SWAYAM/NPTEL/NPTEL+.
- For **Open Elective-I**: The students can choose course from **Open Elective Bucket** list and study on their own by registering to SWAYAM/NPTEL/NPTEL+ Portal which is multidisciplinary in nature (other than the course related to CSE Stream). The student should complete the course assignments and appear the examination conducted by SWAYAM/NPTEL/NPTEL+. ESE Marks will be mapped as per the score mentioned on the SWAYAM/NPTEL/NPTEL+ Course completion certificate issued by SWAYAM/NPTEL/NPTEL+.

Program Elective Bucket - A

Course Code	Program Elective Course Name
231CSEL551	Data Preparation and Analysis
231CSEL552	Block Chain Technology
231CSEL553	Distributed System and Cloud Computing
231CSEL554	Data Storage Technologies and Networks
231CSEL555	Secure Software Design and Enterprise Computing
231CSEL556	Cyber Security and Digital Forensics
231CSEL557	Security Assessment and Risk Analysis
231CSEL558	Human and Computer Interaction
231CSEL559	Knowledge Discovery
231CSEL560	Quantum Computing

Program Electives Bucket - B

Any Program Elective can be chosen from the bucket and should be completed through SWAYAM/NPTEL/NPTEL+ platform

Course Code	Course Code	Web Links
231CSEL561	Introduction to Machine Learning	https://elearn.nptel.ac.in/shop/nptel/introduction-to-machine-learning-iitm/
231CSEL562	Artificial Intelligence Search Methods for problem Solving	https://elearn.nptel.ac.in/shop/nptel/artificial-intelligence-search-methods-for-problem-solving/
231CSEL563	Artificial Intelligence: Knowledge Representation And Reasoning	https://elearn.nptel.ac.in/shop/nptel/artificial-intelligence-knowledge-representation-and-reasoning/
231CSEL564	Fundamentals Of Artificial Intelligence	https://elearn.nptel.ac.in/shop/nptel/fundamentals-of-artificial-intelligence/
231CSEL565	Computer Networks and Internet Protocol	https://elearn.nptel.ac.in/shop/nptel/computer-networks-and-internet-protocol/
231CSEL566	Business analytics and data mining Modeling using R	https://elearn.nptel.ac.in/shop/nptel/business-analytics-and-data-mining-modeling-using-r/
231CSEL567	Data Analytics with Python	https://elearn.nptel.ac.in/shop/nptel/data-analytics-with-python/

231CSEL568	Software Testing	https://elearn.nptel.ac.in/shop/nptel/software-testing/
231CSEL569	Operations and supply chain management	https://elearn.nptel.ac.in/shop/nptel/operations-and-supply-chain-management/
231CSEL570	Machine Learning for Engineering and Science Applications	https://elearn.nptel.ac.in/shop/nptel/machine-learning-for-engineering-and-science-applications/
231CSEL571	Privacy And Security in Online Social Media	Prof. Ponnurangam Kumaraguru
231CSEL572	Natural Language Processing	Prof. Pawan Goyal
231CSEL573	Ethical Hacking	Prof. Indranil Sengupta
231CSEL574	Social Networks	https://elearn.nptel.ac.in/shop/nptel/social-networks/
231CSEL575	Introduction To Internet of Things	Prof. Sudip Misra

Open Electives Bucket

Any Open Elective can be chosen from the bucket and can be completed through Swayam/NPTEL/NPTEL+ platform

Course Code	Course Name	Weblinks
231CSEL516	Text, Textuality and Digital Media	https://elearn.nptel.ac.in/shop/nptel/text-textuality-and-digital-media/
231CSEL517	Water and waste water treatment	https://elearn.nptel.ac.in/shop/nptel/water-and-waste-water-treatment/
231CSEL518	Science, Technology and Society	https://elearn.nptel.ac.in/shop/nptel/science-technology-and-society/
231CSEL519	Patent Law For Engineers And Scientists	https://elearn.nptel.ac.in/shop/nptel/patent-law-for-engineers-and-scientists/
231CSEL520	Non-conventional energy Resources	https://elearn.nptel.ac.in/shop/nptel/non-conventional-energy-resources/
231CSEL521	Literature, Culture and Media	https://elearn.nptel.ac.in/shop/nptel/literature-culture-and-media/
231CSEL522	Introduction to Modern Indian Political Thought	https://elearn.nptel.ac.in/shop/nptel/introduction-to-modern-indian-political-thought/
231CSEL523	Introduction to Political Theory	https://elearn.nptel.ac.in/shop/nptel/introduction-to-political-theory/
231CSEL524	Financial Management For Managers	https://elearn.nptel.ac.in/shop/nptel/financial-management-for-managers/
231CSEL525	Ecology and Society	https://elearn.nptel.ac.in/shop/nptel/ecology-and-society/
231CSEL526	Dairy and Food Process and Products Technology	https://elearn.nptel.ac.in/shop/nptel/dairy-and-food-process-and-products-technology/

231CSEL527	Soil Fertility And Fertilizers	Prof. Somsubhra Chakraborty, IIT Kharagpur
231CSEL528	Natural Resources Management	Prof. Sudip Mitra, IIT Guwahati
231CSEL529	Irrigation and Drainage	Prof. Damodhara Rao Mailapalli, IIT Kharagpur
231CSEL530	Municipal Solid Waste Management	Prof. Ajay Kalamdhad, IIT Guwahati
231CSEL531	Introduction To Wireless And Cellular Communications	Prof. David Koilpillai
231CSEL532	Science Of Clothing Comfort	Prof. Apurba Das

D. Y. PATIL COLLEGE OF ENGINEERING & TECHNOLOGY, KOLHAPUR
Teaching and Evaluation Scheme from Year 2023-24
First Year M. Tech – Computer Science and Engineering
Exit Courses

Sr. No	Course Code	Name of the Course	Credits
1	231CSEP599	Any two Professional Certification Courses (each of 4-weeks duration) related to CSE stream	6
2	231CSEP600	Internship (Industry/Research/Entrepreneur)	2

Teaching And Evaluation Scheme for First Year M. Tech CSE Programme

Semester – I

Course Title: Mathematical Foundations of Computer Science	
Course Code: 231CSEL501	Semester: I
Teaching Scheme: L-T-P: 3-0-0	Credits: 3
Evaluation Scheme: ISE + MSE Marks: 20 + 30	ESE Marks: 50

COURSE OBJECTIVES

<ul style="list-style-type: none"> To enhance the problem-solving skills in the areas of theoretical computer science.
<ul style="list-style-type: none"> To make the students to use the mathematical concepts in the development of computer applications.
<ul style="list-style-type: none"> To make the student aware of mathematical tools, formal methods & automata techniques to computing.
<ul style="list-style-type: none"> To strengthen the students' ability to carry out formal and higher studies in computer science.

COURSE OUTCOMES

After completion of course, students would be able to:

<ul style="list-style-type: none"> Use mathematical concepts in the design and development of languages.
<ul style="list-style-type: none"> Design regular expressions and automata for different language classes
<ul style="list-style-type: none"> Describe different types of Turing Machines, their use, capability, and limitations.
<ul style="list-style-type: none"> Determine decidability and reducibility of computational problems
<ul style="list-style-type: none"> Determine Computational Complexity and use Probability concepts.
Pre-Requisites Discrete Mathematics and Formal Systems and Automata

Course Contents

Unit 1. Introduction (5) Mathematical notions and terminology of sets, sequences and tuples, functions and relations graphs, strings and languages. Boolean logic properties and representation. Definitions, Theorems and types of proofs, formal proofs, deductive, reduction to definition, proof by construction, contradiction, induction, indirect, automatic, counter- examples.
Unit 2. State Machines and Grammars (7) Types of Languages, Types of grammar, recurrence relations, Regular expressions, Finite State Machines, DFA, NFA, Equivalence of DFA & NFA., Kleen's Theorem, pumping Lemma, Applications 5 Push down automata and CFG PDA, N-PDA, CFG, ambiguous grammar, non ambiguous grammar, CNF, Parsers: Topdown, Bottom-up, applications.
Unit 3. Turing Machines (6) Turing machines, variations of TMs, Combining TM's, programming techniques for TMs, Universal Turing Machines, recursive and recursively enumerable languages.
Unit 4. Decidability and Reducibility (6) Decidable languages, decidable problems concerning context-free languages, FA, PDA,

Turing Machines, Undecidable problems from language theory, A simple undecidable problem (PCP), The halting problem- Diagonalization method, Reduction problems, mapping reducibility.
Unit 5. Computational Complexity (5) Tractable and intractable problems, growth rates of functions. Time complexity of TM. Tractable decision problems. Theory of Optimization.
Unit 6. Introduction to probability theory (7) Probability Models, Sample Space, Events, Algebra of Events, Graphical Methods of Representing Events, Probability Axioms, Combinatorial Problems, Conditional Probability, Independence of Events, Bayes' Rule, Bernoulli Trials.
Reference Books
<ol style="list-style-type: none"> 1. Michael Sipser, Thomson Brooks Cole , “Introduction to Theory of Computation” 2. J. E. Hopcroft, Rajeev Motwani & J. D. Ullman, “Introduction to Automata Theory, Language and Computations”, Pearson Education Asia, 2nd Edition. 3. Kishor S. Trivedi , " Probability and Statistics with Reliability, Queuing and Computer Science Applications", John Wiley & Sons, Inc., 2016. 4. John. Martin, “Introduction to Languages and Theory of Computation”, MGH, 3rd Edition 5. J. P. Trembley, R. Manohar, “Discrete Mathematical Structures with Applications to Computer Science”, 6. E. V. Krishamoorthy , “Theory of Computer Science” 7. John Vince, "Foundation Mathematics for Computer Science A Visual Approach", Springer Nature Switzerland. second Edition.

Course Title : Advanced Data Structures	
Course Code : 231CSEL502	Semester : I
Teaching Scheme : L-T-P : 3-0-0	Credits : 3
Evaluation Scheme : ISE + MSE Marks : 20 + 30	ESE Marks : 50

COURSE OBJECTIVES
<ul style="list-style-type: none"> • To introduce the student regarding the sorting and hashing techniques. • To expose the students with the different traversal techniques used in the tree. • To aware the students regarding the efficient search operation in binary and digital search tree. • To strengthen the ability of the students for implementing different graphs.

COURSE OUTCOMES
After completion of course, students would be able to:
<ul style="list-style-type: none"> • Use the merge sort algorithm for implementing different sorting flavors. • Choose appropriate data structures for implementing the static and dynamic hashing. • Design the different traversal program using trees. • Design the binary search tree application in efficient way. • Learn and implement the digital search tree.

- Implement the different algorithms for graph.

Pre-Requisites	Basic Data Structures
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Course Contents

Unit-1 : External Sorting	(4)
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Introduction, k-way Merge Sort, 2-way Merge Sort, 3-way Merge Sort, 4-way Merge Sort, Merging Runs Time Complexity Buffer Handling for Parallel Operation

Unit-2 : Hashing	(6)
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Introduction to Static Hashing, Hash Tables, Hash Functions, Different Hash Functions, Division Method, Multiplication Method, Mid-Square Method, Folding Method, Secure Hash Functions, Collision Resolution (or Overflow Handling) Techniques, Open Addressing Techniques, Linear Probing Quadratic Probing, Double Hashing, Rehashing, Chaining Technique, Comparison between Open Hashing and Closed Hashing Techniques used for Resolving Collisions, Dynamic Hashing, Motivation for Dynamic Hashing, Pros and Cons of Hashing, Applications of Hashing

Unit-3 : Trees	(6)
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Trees, Introduction, Basic Terminology, Types of Trees, General Trees, Forests, Binary Trees, Binary Search Trees, Expression Trees, Tournament Trees, creating a Binary Tree from a General Tree, traversing a Binary Tree, Pre-order Traversal, In-order Traversal, Post-order Traversal, Level-order Traversal, Constructing a Binary Tree from Traversal Results, Applications of Trees

Unit-4 : Efficient Binary Search Trees	(6)
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Efficient Binary Search Trees, Binary Search Trees, Operations on Binary Search Trees, Searching for a Node in a Binary Search Tree, Inserting a New Node in a Binary Search Tree, Deleting a Node from a Binary Search Tree, Optimal Binary Search Tree (OBST), Self-balancing Binary Search Tree, AVL Trees, Operations on AVL Trees, Red-Black Trees, Properties and Representation of Red-Black Trees Operations on Red-Black Trees, Applications of Red-Black Trees

Unit-5 : Digital Search Structures	(8)
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Digital Search Structures, Introduction to Digital Search Tree, Operations on Digital Search Trees, Insertion, Searching, Deletion, Binary Tries, Compressed Binary Trie, Multi-way Tries, Definition, Compressed Tries, Compressed Tries with Digit Numbers, Inserting into a Compressed Trie with Digit Numbers, Deletion of Element from Compressed tries with Digit Numbers

Unit-6 : Graphs	(6)
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Introduction, Graph Terminology, Directed Graphs, Terminology of a Directed Graph, Transitive Closure of a Directed Graph, Bi-connected Components, Representation of Graphs, Adjacency Matrix Representation, Adjacency List Representation, Graph Traversal Algorithms, Breadth-First Search, Depth-First Search, Topological Sorting, Minimum Spanning Trees, Shortest Path Algorithms, Applications of Graphs.

Reference Books

1. Reema Thareja, S. Rama Sree, advanced data structures, oxford university press, 2018
2. Mark Allen Weiss, Data Structures and Algorithm Analysis in C++, 2nd Edition, Pearson, 2004.

Course Title : Program Elective-I	
Course Code : 231CSEL551- 231CSEL560	Semester : I
Teaching Scheme : L-T-P : 3-0-0	Credits : 3
Evaluation Scheme : ISE+MSE : 20+30	ESE Marks : 50

- Students should choose Program Elective-I from the list of Program Elective Bucket – A list courses.

Program Elective Bucket - A

Course Code	Program Elective Course Name
231CSEL551	Data Preparation and Analysis
231CSEL552	Block Chain Technology
231CSEL553	Distributed System and Cloud Computing
231CSEL554	Data Storage Technologies and Networks
231CSEL555	Secure Software Design and Enterprise Computing
231CSEL556	Cyber Security and Digital Forensics
231CSEL557	Security Assessment and Risk Analysis
231CSEL558	Human and Computer Interaction
231CSEL559	Knowledge Discovery
231CSEL560	Quantum Computing

Course Title : Program Elective-II	
Course Code : 231CSEL561- 231CSEL575+	Semester : I
Teaching Scheme : L-T-P : 0-2-2	Credits : 3
Evaluation Scheme : ISE+MSE : NA	ESE Marks : 100

- Students should choose Program Elective-II from the list of Program Elective Bucket - B courses and completed through the SWAYAM/NPTEL/NPTEL+ MOOCs platform.
- The Course should of the duration of 12 weeks and 3 credits.
- Student also choose any other SWAYAM or NPTEL course of 12 weeks other than the list of Program Elective - B Bucket courses with prior permission from the department.
- The student should complete the course assignments and appear to the Examination conducted by SWAYAM/NPTEL/NPTEL+. ESE Marks out of 100 will be mapped as per the score mentioned on the Course completion certificate issued by SWAYAM/NPTEL/NPTEL+.
- In case, student fails to complete, then he/she should have to enroll again to the same course chosen earlier and complete it with certificate issued by SWAYAM/NPTEL/NPTEL+. In exceptional case, Head of the department is responsible to set the policy of the evaluation marks of ESE.
- Credits can be transferred from the Academic Bank of Credits.

Program Electives Bucket - B

Course Code	Course Code	Web Links
231CSEL561	Introduction to Machine Learning	https://elearn.nptel.ac.in/shop/nptel/introduction-to-machine-learning-iitm/
231CSEL562	Artificial Intelligence Search Methods for problem Solving	https://elearn.nptel.ac.in/shop/nptel/artificial-intelligence-search-methods-for-problem-solving/
231CSEL563	Artificial Intelligence: Knowledge Representation And Reasoning	https://elearn.nptel.ac.in/shop/nptel/artificial-intelligence-knowledge-representation-and-reasoning/
231CSEL564	Fundamentals Of Artificial Intelligence	https://elearn.nptel.ac.in/shop/nptel/fundamentals-of-artificial-intelligence/
231CSEL565	Computer Networks and Internet Protocol	https://elearn.nptel.ac.in/shop/nptel/computer-networks-and-internet-protocol/
231CSEL566	Business analytics and data mining Modeling using R	https://elearn.nptel.ac.in/shop/nptel/business-analytics-and-data-mining-modeling-using-r/
231CSEL567	Data Analytics with Python	https://elearn.nptel.ac.in/shop/nptel/data-analytics-with-python/
231CSEL568	Software Testing	https://elearn.nptel.ac.in/shop/nptel/software-testing/
231CSEL569	Operations and supply chain management	https://elearn.nptel.ac.in/shop/nptel/operations-and-supply-chain-management/
231CSEL570	Machine Learning for Engineering and Science Applications	https://elearn.nptel.ac.in/shop/nptel/machine-learning-for-engineering-and-science-applications/
231CSEL571	Privacy And Security In Online Social Media	Prof. Ponnurangam Kumaraguru
231CSEL572	Natural Language Processing	Prof. Pawan Goyal
231CSEL573	Ethical Hacking	Prof. Indranil Sengupta
231CSEL574	Social Networks	https://elearn.nptel.ac.in/shop/nptel/social-networks/
231CSEL575	Introduction To Internet of Things	Prof. Sudip Misra

Course Title : Research Methodology	
Course Code : 231CSEL503	Semester : I
Teaching Scheme : L-T-P : 2-0-0	Credits : 2
Evaluation Scheme : ISE Marks : 50	

COURSE OBJECTIVES

<ul style="list-style-type: none"> To study basic concepts in research methodology.
<ul style="list-style-type: none"> This course addresses the issues inherent in selecting a research problem and discusses the techniques and tools to be employed in completing a research.
<ul style="list-style-type: none"> This will also enable the students to prepare report writing and framing Research proposals.

COURSE OUTCOMES

After completion of course, students would be able to:

<ul style="list-style-type: none"> Demonstrate knowledge of research processes (reading, evaluating, and developing)
<ul style="list-style-type: none"> Perform literature reviews using print and online databases
<ul style="list-style-type: none"> Identify, explain, compare, and prepare the key elements of a research proposal/report

Pre-Requisites	-
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Course Contents

Unit-1 Foundations of Research: Meaning, Objectives, Motivation, Utility. Concept of theory, empiricism, deductive and inductive theory. Characteristics of scientific method – Understanding the language of research – Concept, Construct, Definition, Variable. Research Process

Unit-2: Problem Identification & Formulation – Research Question – Investigation Question – Measurement Issues – Hypothesis – Qualities of a Good Hypothesis – Null Hypothesis & Alternative Hypothesis. Hypothesis Testing – Logic & Importance

Unit-3: Research Design: Concept and Importance in Research – Features of a good research design – Exploratory Research Design – concept, types and uses, Descriptive Research Designs – concept, types and uses. Experimental Design: Concept of Independent & Dependent variables.

Unit-4: Qualitative and Quantitative Research: Qualitative research – Quantitative research – Concept of measurement, causality, generalization, and replication. Merging the two approaches.

Unit-5: Interpretation of Data and Paper Writing – Layout of a Research Paper, Journals in Computer Science, Impact factor of Journals, When and Where to publish? Ethical issues related to publishing, Plagiarism, and Self-Plagiarism.

Unit-6: Use of tools/techniques for Research: Methods to search required information effectively, Reference Management Software like Mendeley, Software for paper formatting like LaTeX/MS Office, Software for detection of Plagiarism

Reference Books

1. Business Research Methods – Donald Cooper & Pamela Schindler, TMGH, 9th edition
2. Business Research Methods – Alan Bryman & Emma Bell, Oxford University Press.
3. Research Methodology – C. R. Kothari

Course Title : Laboratory I (Based on Program Core courses)

Course Code : 231CSEP504

Semester : I

Teaching Scheme : L-T-P : 0-0-4

Credits : 2

Evaluation Scheme : ISE Marks : 50

Pre-Requisites

Any Programming Language

Students should perform minimum 10-12 assignment based on the program core courses i.e. Mathematical Foundations of Computer Science and Advanced Data Structures using any programming language.

Course Title : Skill Laboratory-I

Course Code : 231CSEP505

Semester : I

Teaching Scheme : L-T-P : 0-0-2

Credits : 1

Evaluation Scheme : ISE Marks : 25

Pre-Requisites

Any Programming Language

Students should perform minimum 7-8 assignment based on the program Elective courses using any programming language and tools.

Course Title : Seminar-I

Course Code : 231CSEP506

Semester : I

Teaching Scheme : L-T-P : 0-0-2

Credits : 1

Evaluation Scheme : ISE Marks : 50

- Each student is required to deliver a seminar presentation on a domain and topic preferably from the area in which the student intends to work for his/her dissertation work.
- Preparation and presentation of a seminar is intended to investigate domain and identifying the topic for the dissertation work.
- The student needs to submit the detail seminar report on the domain and the topic identified.

Course Title : Stress Management by Yoga	
Course Code : 231CSEP507	Semester : I
Teaching Scheme : L-T-P : 1-0-2	Credits : 2
Evaluation Scheme : ISE Marks : 50	

COURSE OBJECTIVES

- To achieve overall health of body & mind
- To apply yoga therapy for reducing stress.

COURSE OUTCOMES

After completion of course, students would be able to:

- Identify the yoga methods to become healthy.
- Apply suitable yoga technique for reducing stress.

Pre-Requisites	Human relationship
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Course Contents	
Unit 1: Introduction to yoga	(2)
Types of yoga –Mantra yoga, Bhakti Yoga, Karma Yoga, Raja Yoga, Hath Yoga, Five Tattvas, or Pancha-mahabhuta, What is prana and its types? Panch Kosha (five layers of our existence)	
Unit 2: Stress & its effects	(2)
Definition, Causes	
Unit 3: Ashtanga Yoga	(3)
1. Yama (Five)- 2. Niyama (Five) 3. Asana 4. Pranayama 5. Pratyahara 6. Dharana 7. Dhyana 8. Samadhi	
Unit 4: Pranayama (Breathing Techniques)	(2)
1. Bhastrika Pranayama 2. Kapal Bhati Pranayama 3. Bahaya Pranayama 4. Ujjayi 5. Anulom Vilom Pranayama 6. Bharamari Pranayama 7. Udgeeth Pranayama 8. Pranav Pranayama	
Unit 5: Suryanamskar	(2)
Surya Namaskar is a sequence of 12 powerful yoga poses. Steps & benefits	
Unit 6: Yogik Sukshma Vyayam & Asana	(3)
Reference Books	
1. Pranayam Rahasya (English)by Divya Prakashan 2. Yog sadhana & chikistya Rahasya by Divya Prakashan 3. Raja Yoga by Swami Vivekananda	

Course Title : Professional Ethics for Research	
Course Code : 231CSEP508	Semester : I
Teaching Scheme : L-T-P : 1-1-0	Credits : 2
Evaluation Scheme : ISE Marks : 50	

COURSE OBJECTIVES

- To give an overview of the ethics and its applications in the academic research.
- To explain the different ethical aspect in research.
- To explain the art of publications with consideration of ethics

COURSE OUTCOMES

After completion of course, students would be able to:

- Understand the basics of ethics and its application in academic research.
- Analyze research in connection with ethics.
- Apply the ethics inside the publication of research.

Pre-Requisites	-
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Course Contents

<p>Unit-1: Introduction (4)</p> <p>Origins of Modern Experimental Science, Science as a Culture and Philosophy, Morals, Ethics and Laws, Evolution of Social Ethics, Necessity for a ‘Standalone’ Document by INSA, Ethical Issues in Indian Science–A representative Note, The Dilemmas of Research Ethics, Ethics of Education, Ethics and Higher Education, Ethics in Academic Research, Issues in Research Ethics, Postulates for Maintaining Ethical Standards in Higher Education</p>
<p>Unit-2: Ethics of Research (5)</p> <p>Introduction, Topic of Research, Collaborative Research and Sharing of Credits, Research Supervisor-Student Relationship, Laboratory Record, Complete Experimental Details are Important, Clarity in Writing, Some Helpful Suggestions for Preparation of Manuscripts, Options in the Visual Display of Data, Fidelity of Analysis, Precision, Accuracy and Errors, Significant Figures, Overconfidence Effect, Safety, Research Involving Animal Subjects, Research on Human Samples, Need for Institutional Ethical Committees</p>
<p>Unit-3: Ethics of Publication (3)</p> <p>Introduction, Authors and Contributors, Undesirable Authorships, General Responsibilities of Authors, Ethical Conventions of Publications, Where to Publish?, Pre-print Archives, Peer-Reviewed Scholarly Journals, Responsibilities of the Editors, Responsibilities of Reviewer, Responsibilities of Publishers, Ethics of Retraction.</p>
<p>Reference Books</p> <p>1. Kambadur Muralidhar, Amit Ghosh, Ashok Kumar Singhvi, ETHICS in Science Education, Research and Governance, Indian National Science Academy New Delhi, India, 2019</p>

Teaching And Evaluation Scheme for First Year M. Tech CSE Programme

Semester –II

Course Title : Software Architectures	
Course Code : 231CSEL509	Semester : II
Teaching Scheme : L-T-P : 3-0-0	Credits : 3
Evaluation Scheme : ISE + MSE Marks : 20 + 30	ESE Marks : 50

Pre-Requisites	Basics of Software Engineering
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COURSE OBJECTIVE
1. To introduce the student regarding need of the software architectures.
2. To expose the students with the different software architecture patterns.
3. To aware the students regarding the software architecture requirements and design.
4. To strengthen the ability of the students for documenting, implementing and testing the software architecture.

COURSE OUTCOMES
After completion of course, students would be able to:
1. Learn the need and contexts of the software architectures.
2. Build the software architecture by considering quality attributes and patterns.
3. Design the software architecture requirement and design strategy
4. Learn and implement documentation, implementation and testing of software architecture

Course Contents
Unit-1: Introduction of Software Architecture (8) What Software Architecture Is and What It Isn't, Architectural Structures and View, Architectural Patterns, What Makes a "Good" Architecture?, Inhibiting or Enabling a System's Quality Attributes, Reasoning About and Managing Change, Predicting System Qualities, Enhancing Communication among Stakeholders, Carrying Early Design Decisions, Defining Constraints on an Implementation, Influencing the Organizational Structure, Enabling Evolutionary Prototyping, Improving Cost and Schedule Estimates, Supplying a Transferable, Reusable Model, Allowing Incorporation of Independently Developed Components, Restricting the Vocabulary of Design Alternatives, Providing a Basis for Training
Unit-2: Contexts of Software Architecture (5) Architecture in a Technical Context, Architecture in a Project Life-Cycle Context, Architecture in a Business Context, Architecture in a Professional Context, Stakeholders, How Is Architecture Influenced?, What Do Architectures Influence?
Unit-3: Quality Attributes (5) Architecture and Requirements, Functionality, Quality Attribute Considerations, Specifying Quality Attribute Requirements, Achieving Quality Attributes through Tactics,

Guiding Quality Design Decisions	
Unit-4 : Architectural Patterns	(5)
Architectural Patterns, Overview of the Patterns Catalog, Relationships between Tactics and Patterns, Contents, Using Tactics Together	
Unit-5 : Architecture Requirements and Design	(7)
Gathering, ASRs from Requirements Documents, Gathering ASRs by Interviewing Stakeholders, Gathering ASRs by Understanding the Business Goals, Capturing ASRs in a Utility Tree, Tying the Methods Together, Designing an Architecture, Design Strategy, The Attribute-Driven Design Method, The Steps of ADD	
Unit-6 : Documenting Software Architectures, Implementation, and Testing	(6)
Uses and Audiences for Architecture Documentation, Notations for Architecture Documentation, Views, Choosing the Views, Combining Views, Building the Documentation Package, Documenting Behavior, Architecture Documentation and Quality Attributes, Documenting Architectures That Change Faster Than You Can Document Them, Documenting Architecture in an Agile Development Project, Architecture and Implementation, Architecture and Testing	
Reference Books	
<ol style="list-style-type: none"> 1. Len Bass Paul Clements Rick Kazman, Software Architecture in Practice, Third Edition, Pearson Edu., 2. The Art of Software Architecture: Stephen T. Albin, Wiley dreamtech, (2003). 3. Pattern Oriented Software Architecture Vol. I: Buschmann, F. WSE, (1996). 4. Large Scale Software Architecture: A Practical Guide Using UM: Jeff Garland, Richard Anthony, Wiley dreamtech, (2003). 5. Software Architecture - Perspectives on an Emerging Discipline: Mary Shaw & David Garlan, , PHI, (1996). 6. Design Patterns : Elements of Reusable Object Oriented Software: Gamma, E. et. Al., Addison Wesley, (1995). 7. Software Engineering 7th ed.: Ian Sommerville, Addison Wesley, 2004 	

Course Title : Network Engineering and Management	
Course Code : 231CSEL510	Semester : II
Teaching Scheme : L-T-P : 3-0-0	Credits : 3
Evaluation Scheme : ISE + MSE Marks : 20 + 30	ESE Marks : 50

COURSE OBJECTIVE

1. Expose to the Network Management needs, components and scenarios
2. Learn Network Management standards, models and language
3. Experiment with the available tools, utilities and systems for Network Management
4. Aware of advanced and recent NM Technologies, standards and systems.

COURSE OUTCOMES:
After completion of course, students would be able to:
1. Understand needs of an Network Manager and the Organization Network.
2. Practice and manage different networks using SNMP based NMS.
3. Use Network Management tools, systems and applications.
4. Be conversant with advanced and recent NM technology and standards.

Pre-Requisites	Computer Networks
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Course Contents
<p>Unit-1 : Data Communication and Network Management Overview (6) Analogy of Telephone Network Management, Data and Telecommunication Network, Communication Architectures - OSI, TCP/IP reference models, DCE, Communication protocols and standards, Protocol Stack, Demonstration Network, Challenges of IT Managers, Network Management - Goals, Organization, Functional Grouping/Categories, Tools, NM Arch and Organization, NM Perspectives, NMS Platform.</p>
<p>Unit-2 : SNMP and Network Management (7) Basic Foundations : Standards, Models and Language - NM Standards, NM Models - Organization, Information, Communication, Functional Model, ASN.1, Encoding Structure, Macros, Managed Network - Case Histories and examples, SNMP model - Organization model, System overview - Management Station/Agent Communication, SNMP Packet, SNMP Commands and Arguments.</p>
<p>Unit-3 : SNMPv1 Information model, SNMPv2, SNMPv3 (6) SNMPv1 Information model - SMI, Managed Objects, MIB, Major changes in SNMPv2, SNMPv3: Key Features, Applications, Security and SNMPv3 User-based Security model.</p>
<p>Unit-4 : Remote Monitoring (5) RMON SMI and MIB, RMON1, RMON2 and ATM Remote Monitoring.</p>
<p>Unit-5 : Network Management Tools, Systems and Engineering (6) System Utilities for Management, Network Statistics Measurement Systems, NMS Design, Network Management Systems and Applications.</p>
<p>Unit-6 : Advance Network Management Technology (6) Desktop Management - DMI, DMI/SNMP Mapping, Web Based Management, XML Based NM Technology, Recent NM-related standards and technologies.</p>
Reference Books
<ol style="list-style-type: none"> 1. Network Management Principles and Practices - Mani Subramanian, Pearson, Second Edition. 2. Network Management Concepts and Practice : A Hands-on Approach - J. Richard Burke, Pearson Education. 3. Advances in Network Management - Jianguo Ding, CRC Press 4. Network Management: Accounting and Performance Strategies - Benoit Claise, Ralf Wolter, Cisco Press - Pearson Education.

Course Title : Program Elective-III	
Course Code : 231CSEL551- 231CSEL560	Semester : II
Teaching Scheme : L-T-P : 3-0-0	Credits : 3
Evaluation Scheme : ISE+MSE : 20+30	ESE Marks : 50

- Students should choose Program Elective-III from the list of Program Elective Bucket – A list courses.

Program Elective Bucket - A

Course Code	Program Elective Course Name
231CSEL551	Data Preparation and Analysis
231CSEL552	Block Chain Technology
231CSEL553	Distributed System and Cloud Computing
231CSEL554	Data Storage Technologies and Networks
231CSEL555	Secure Software Design and Enterprise Computing
231CSEL556	Cyber Security and Digital Forensics
231CSEL557	Security Assessment and Risk Analysis
231CSEL558	Human and Computer Interaction
231CSEL559	Knowledge Discovery
231CSEL560	Quantum Computing

Course Title : Program Elective-IV	
Course Code : 231CSEL561- 231CSEL575+	Semester : II
Teaching Scheme : L-T-P : 0-2-2	Credits : 3
Evaluation Scheme : ISE+MSE : NA	ESE Marks : 100

- Students should choose Program Elective-IV from the list of Program Elective Bucket – B courses and completed through the SWAYAM/NPTEL/NPTEL+ MOOCs platform.
- The Course should of the duration of 12 weeks and 3 credits.
- Student also choose any other SWAYAM or NPTEL course of 12 weeks other than the list of Program Elective - B Bucket courses with prior permission from the department.
- The student should complete the course assignments and appear to the Examination conducted by SWAYAM/NPTEL/NPTEL+. ESE Marks out of 100 will be mapped as per the score mentioned on the Course completion certificate issued by SWAYAM/NPTEL/NPTEL+.
- In case, student fails to complete, then he/she should have to enroll again to the same course chosen earlier and complete it with certificate issued by SWAYAM/NPTEL/NPTEL+. In exceptional case, Head of the department is responsible to set the policy of the evaluation marks of ESE.
- Credits can be transferred from the Academic Bank of Credits.

Program Electives Bucket - B

Course Code	Course Code	Web Links
231CSEL561	Introduction to Machine Learning	https://elearn.nptel.ac.in/shop/nptel/introduction-to-machine-learning-iitm/
231CSEL562	Artificial Intelligence Search Methods for problem Solving	https://elearn.nptel.ac.in/shop/nptel/artificial-intelligence-search-methods-for-problem-solving/
231CSEL563	Artificial Intelligence: Knowledge Representation And Reasoning	https://elearn.nptel.ac.in/shop/nptel/artificial-intelligence-knowledge-representation-and-reasoning/
231CSEL564	Fundamentals Of Artificial Intelligence	https://elearn.nptel.ac.in/shop/nptel/fundamentals-of-artificial-intelligence/
231CSEL565	Computer Networks and Internet Protocol	https://elearn.nptel.ac.in/shop/nptel/computer-networks-and-internet-protocol/
231CSEL566	Business analytics and data mining Modeling using R	https://elearn.nptel.ac.in/shop/nptel/business-analytics-and-data-mining-modeling-using-r/
231CSEL567	Data Analytics with Python	https://elearn.nptel.ac.in/shop/nptel/data-analytics-with-python/
231CSEL568	Software Testing	https://elearn.nptel.ac.in/shop/nptel/software-testing/
231CSEL569	Operations and supply chain management	https://elearn.nptel.ac.in/shop/nptel/operations-and-supply-chain-management/
231CSEL570	Machine Learning for Engineering and Science Applications	https://elearn.nptel.ac.in/shop/nptel/machine-learning-for-engineering-and-science-applications/
231CSEL571	Privacy And Security In Online Social Media	Prof. Ponnurangam Kumaraguru
231CSEL572	Natural Language Processing	Prof. Pawan Goyal
231CSEL573	Ethical Hacking	Prof. Indranil Sengupta
231CSEL574	Social Networks	https://elearn.nptel.ac.in/shop/nptel/social-networks/
231CSEL575	Introduction To Internet of Things	Prof. Sudip Misra

Course Title : Open Elective-I	
Course Code : 231CSEL516- 231CSEL532+	Semester : II
Teaching Scheme : L-T-P : 0-2-2	Credits : 3
Evaluation Scheme : ISE+MSE : NA	ESE Marks : 100

- Students should choose Open Elective-I from the list of Open Elective Bucket courses and completed through the SWAYAM/NPTEL/NPTEL+ MOOCs platform.
- The Course should of the duration of 12 weeks and 3 credits.
- Student can also choose any other SWAYAM or NPTEL course of 12 weeks other than the list of Open Elective Bucket courses in multidisciplinary domain other than CSE with prior permission from the department.
- The student should complete the course assignments and appear to the Examination conducted by SWAYAM/NPTEL/NPTEL+. ESE Marks out of 100 will be mapped as per the score mentioned on the Course completion certificate issued by SWAYAM/NPTEL/NPTEL+.
- In case, student fails then he/she should have to enroll again to the same course chosen earlier and complete it with certificate issued by SWAYAM/NPTEL/NPTEL+. In exceptional case, Head of the department is responsible to set the policy of the evaluation marks of ESE
- Credits can be transferred from the Academic Bank of Credits.

Open Electives Bucket

Course Code	Course Name	Weblinks
231CSEL516	Text, Textuality and Digital Media	https://elearn.nptel.ac.in/shop/nptel/text-textuality-and-digital-media/
231CSEL517	Water and waste water treatment	https://elearn.nptel.ac.in/shop/nptel/water-and-waste-water-treatment/
231CSEL518	Science, Technology and Society	https://elearn.nptel.ac.in/shop/nptel/science-technology-and-society/
231CSEL519	Patent Law For Engineers And Scientists	https://elearn.nptel.ac.in/shop/nptel/patent-law-for-engineers-and-scientists/
231CSEL520	Non-conventional energy Resources	https://elearn.nptel.ac.in/shop/nptel/non-conventional-energy-resources/
231CSEL521	Literature, Culture and Media	https://elearn.nptel.ac.in/shop/nptel/literature-culture-and-media/
231CSEL522	Introduction to Modern Indian	https://elearn.nptel.ac.in/shop/nptel/introduction-to-

	Political Thought	modern-indian-political-thought/
231CSEL523	Introduction to Political Theory	https://elearn.nptel.ac.in/shop/nptel/introduction-to-political-theory/
231CSEL524	Financial Management For Managers	https://elearn.nptel.ac.in/shop/nptel/financial-management-for-managers/
231CSEL525	Ecology and Society	https://elearn.nptel.ac.in/shop/nptel/ecology-and-society/
231CSEL526	Dairy and Food Process and Products Technology	https://elearn.nptel.ac.in/shop/nptel/dairy-and-food-process-and-products-technology/
231CSEL527	Soil Fertility And Fertilizers	Prof. Somsubhra Chakraborty, IIT Kharagpur
231CSEL528	Natural Resources Management	Prof. Sudip Mitra, IIT Guwahati
231CSEL529	Irrigation and Drainage	Prof. Damodhara Rao Mailapalli, IIT Kharagpur
231CSEL530	Municipal Solid Waste Management	Prof. Ajay Kalamdhad, IIT Guwahati
231CSEL531	Introduction To Wireless And Cellular Communications	Prof. David Koilpillai
231CSEL532	Science Of Clothing Comfort	Prof. Apurba Das

Course Title : Intellectual Property Rights	
Course Code : 231CSEL511	Semester : II
Teaching Scheme : L-T-P : 2-0-0	Credits : 2
Evaluation Scheme : ISE Marks : 50	

COURSE OBJECTIVES
<ul style="list-style-type: none"> • This course introduces the importance of intellectual property and the protection of creation innovation or ideas that are to be used to make a product or service design layout or process which is economically called patents, utilities, etc. • The course emphasizes intellectual property protection and its importance in estimating the intelligence of an individual that correlates with financial advantages. It also deals with the fundamentals of laws to protect and encourage inventions and creations. • The main objective of this course is to examine the laws and the procedures to protect the intellectual property rights of an intellectual or expert and make it like another property that is nontangible.

COURSE OUTCOMES
After completion of the course, students would be able to:
<ul style="list-style-type: none"> • Build knowledge and also importance in fundamental of Intellectual Property (IP), International organizations, associations and different treaties. • Familiarize with the rights of owners. • Educate students about the new developments in the law of intellectual property rights and filings of IPRs

Pre-Requisites	-
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Course Contents	
Unit-1 Introduction to Intellectual Property: Introduction, Types of Intellectual Property (IP), International Organizations, Agencies and treaties, Importance of Intellectual Property Rights.	
Unit-2 : Law of Copyrights: Fundamentals of Copyrights Law, Originality of Material, Rights to Reproduction, Rights to Perform the Work Publicly, Copyright Ownership issues, Copyright Registration, Notice of Copyright, International Copyright law	
Unit-3: Patent Overview : India Patent Site, Prior search, Patent drafting, Patent filing procedure, Precautions while filing patents, Type of patents	
Unit-4 : Trademarks: Purpose and Function of Trademarks, Acquisition of Trademarks Rights, Protectable Matter, Selecting and Evaluating Trademark, Trademark Registration Processes.	
Unit-5: IPR Filings Filing of Trade design, copyrights, procedures, Law of Patents, Foundation of Patent Law, Patent searching Process, Ownership Rights and transfer	
Unit-6 : New Developments Of Intellectual Property: New Developments in Trade Law, Copyright Law, Patent Law, Intellectual property audits, International overview of Intellectual Property, International-Trademark Law, Copyright Law, International Patent Law, International Development in Trade Secrets Law	
Reference Books	
<ol style="list-style-type: none"> 1. Deborah.E.Bouchoux, "Intellectual Property Right", Cengage Learning 2. Prabuddha Ganguli, "Intellectual Property Right", Unleashing the knowledge economy", Tata Mc.Graw Hill Publishing Company Ltd 	

Course Title : Laboratory II (Based on Program Core courses)	
Course Code : 231CSEP512	Semester : II
Teaching Scheme : L-T-P : 0-0-4	Credits : 2
Evaluation Scheme : ISE Marks : 50	

Pre-Requisites	Any Programming Language
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Students should perform minimum 10-12 assignment based on the program core courses i.e. Software Architectures and Network Engineering and Management using any programming language.

Course Title : Skill Laboratory-II	
Course Code : 231CSEP513	Semester : II
Teaching Scheme : L-T-P : 0-0-2	Credits : 1
Evaluation Scheme : ISE Marks : 25	

Pre-Requisites	Any Programming Language
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Students should perform minimum 7-8 assignment based on the program Elective courses using any programming language and tools.

Course Title : Seminar-II	
Course Code : 231CSEP514	Semester : II
Teaching Scheme : L-T-P : 0-0-2	Credits : 1
Evaluation Scheme : ISE Marks : 50	

- Each student is required to deliver a seminar presentation on synopsis topic identified from the domain and topic during seminar-I.
- Preparation and presentation of a seminar is intended to synopsis on the topic for the dissertation work.
- The student needs to submit the draft of the synopsis based on their dissertation topic.

Course Title : Technical Paper Writing	
Course Code : 231CSEL515	Semester : II
Teaching Scheme : L-T-P : 0-1-0	Credits : 1
Evaluation Scheme : ISE Marks : 25	

COURSE OBJECTIVES
<ul style="list-style-type: none"> • To understand the basics of the technical paper writing. • To learn the writing and ethical aspects of technical paper writing. • To overview the different styles and tools for technical paper writing.

COURSE OUTCOMES
After completion of course, students would be able to:
<ul style="list-style-type: none"> • Demonstrate the knowledge of technical research paper writing. • Write the technical paper with the help of the ethical and technical knowledge • Apply the different styles and tools for writing research paper.

Pre-Requisites	-
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Course Contents
Unit-1 Introduction of Technical Paper Writing Basics, The Scientific Literature and Elements of Scientometrics, Citation Statistics, Scientometrics, Decisions to Take Before You Begin Writing.
Unit-2 : Writing the Paper How to Compose the Title, The Delicate Art of Deciding about Authorship, How (and Why) to List the Addresses, Abstract and Keywords, How to Write the Introduction, How to Write the Material and Methods Section, How to Write the Results, How to Write the Discussion, Acknowledgements and Appendices, How to Cite References, Constructing Figures: A Tricky Art?, Analysis of Sample Graphs, How to Design Tables, The Writing Process: How to Write the First Version.
Unit-3 : Writing Ethics Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticizing, Paraphrasing and Plagiarism, checking Plagiarism
Unit-4 : Publishing the Paper Putting It All Together: Preparing the Final Version, How to Submit a Manuscript, The Manuscript Handling Process (Scientific Editing), On Receipt of the Editor’s Report, How to Write Revisions, Writing and Publishing Scientific Papers, Submitting the Final Version, What Happens to the Manuscript After Acceptance?, What to Do with a Published Paper?,
Unit-5 : Different Publication Categories How to Write a Conference Proceedings Paper, How to Write a Review Article, How to Write a Book Chapter, The Scientific Style
Unit-6 : Different Styles and Tools for Research Using Abbreviations in Scientific Writing, Standard Journal Publishers styles and formats, Latex, Mendeley, formats for writing, Overleaf.
Reference Books
<ol style="list-style-type: none"> 1. Subhash Chandra Parija Vikram Kate, “Writing and Publishing a Scientific Research Paper”, Springer. Unit-2, 4, 5 2. Barbara Gastel, Robert A. Day, “How to Write and Publish a Scientific Paper”, 9th Edition, Greenwood. Unit-2, 4, 5 3. Gábor L. Lövei, “Writing and Publishing Scientific Papers A Primer for the Non-English Speaker”, eBooks, Open Book Publishers – unit -1, 2, 4, 5 4. Phillip A. Laplante . “Technical Writing”, 2016, CRC Press ISBN: 9781466503090 – unit 3, 6 5. B. C. Sharma , “Scientific and Technical Reports How to Write and Illustrate” 2014 – Unit 3. 6

Program Elective – A Bucket List

Course Code	Program Elective Course Name
231CSEL551	Data Preparation and Analysis
231CSEL552	Block Chain Technology
231CSEL553	Distributed System and Cloud Computing
231CSEL554	Data Storage Technologies and Networks
231CSEL555	Secure Software Design and Enterprise Computing
231CSEL556	Cyber Security and Digital Forensics
231CSEL557	Security Assessment and Risk Analysis
231CSEL558	Human and Computer Interaction
231CSEL559	Knowledge Discovery
231CSEL560	Quantum Computing

Course Title : Program Elective - Data Preparation and Analysis	
Course Code : 231CSEL551	Semester : I/II
Teaching Scheme : L-T-P : 3-0-0	Credits : 3
Evaluation Scheme : ISE + MSE Marks : 20 + 30	ESE Marks : 50

COURSE OBJECTIVES

<ul style="list-style-type: none"> To expose the importance of the data coming from the different sources.
<ul style="list-style-type: none"> To make familiar with different data conversion techniques for preparing unstructured data.
<ul style="list-style-type: none"> To prepare the data for analysis and develop meaningful Data Visualizations.
<ul style="list-style-type: none"> To make the students identify and model the meaningful data by using different techniques.

COURSE OUTCOMES

After completion of course, students would be able to:

<ul style="list-style-type: none"> Recall the importance of the data
<ul style="list-style-type: none"> Evaluate the details regarding the data using different parameters
<ul style="list-style-type: none"> Extract the unstructured data by making operations such as cleaning, converting and combining the data
<ul style="list-style-type: none"> Analyze the relationship between the unstructured data
<ul style="list-style-type: none"> Prepare the grouping of data by using clustering and association rules.
<ul style="list-style-type: none"> Design the models for representing the meaningful data.

Course Contents

Unit-1 : Introduction	(6)
Overview, Sources of Data, Process for Making Sense of Data	
Unit-2 : DESCRIBING DATA	(6)

Overview, Observations and Variables, Types of Variables, Central Tendency, Distribution of the Data, Confidence Intervals, Hypothesis Tests	
Unit-3 : PREPARING DATA TABLES	(6)
Overview, Cleaning the Data, Removing Observations and Variables, Generating Consistent Scales Across Variables, New Frequency Distribution, Converting Text to Numbers, Converting Continuous Data to Categories, Combining Variables, Generating Groups, Preparing Unstructured Data	
Unit-4 : UNDERSTANDING RELATIONSHIPS	(6)
Overview, Visualizing Relationships Between Variables, Calculating Metrics About Relationships	
Unit-5 : IDENTIFYING AND UNDERSTANDING GROUPS	(6)
Overview, Clustering, Association Rules, Learning Decision Trees from Data	
Unit-6 : BUILDING MODELS FROM DATA	(6)
Overview, Linear Regression, Logistic Regression, <i>k</i> -Nearest Neighbors, Classification and Regression Trees, Other Approaches	
Reference Books	
1. Glenn J. Myatt, Wayne P. Johnson, making sense of data i a Practical Guide to Exploratory Data Analysis and Data Mining, Second Edition, WILEY, 2014.	

Course Title : Program Elective - Block Chain Technology	
Course Code : 231CSEL552	Semester : I/II
Teaching Scheme : L-T-P : 3-0-0	Credits : 3
Evaluation Scheme : ISE + MSE Marks : 20 + 30	ESE Marks : 50

COURSE OBJECTIVES
<ul style="list-style-type: none"> To make aware regarding the Block chain basics and its functionality. To expose the students regarding the design and working of Bitcoins. To make aware regarding the Ethereum basics and its functionality. To expose the students regarding the development of the Blockchain application.

COURSE OUTCOMES
After completion of course, students would be able to:
<ul style="list-style-type: none"> Understand the design of the Block chain Extract the working details of the Block Chain technology Understand the design and implementation technique of Bitcoin Develop the application using the Block chain Technology Build the applications using Ethereum DApp

Pre-Requisites	Cryptography basics, computer network basics
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Course Contents
Unit-1 Introduction to Blockchain (6)
Backstory of Blockchain, What is Blockchain?, Centralized vs. Decentralized Systems , Layers of Blockchain, Why is Blockchain Important?, Blockchain Uses and Use Cases
Unit-2 : Working of Blockchain (6)
Laying the Blockchain Foundation, Cryptography, Game Theory, Computer Science

Engineering Putting It All Together, Blockchain Applications, Scaling Blockchain	
Unit-3 : Working of Bitcoin	(6)
The History of Money ,Dawn of Bitcoin, The Bitcoin Blockchain, The Bitcoin Network, Bitcoin Scripts, Full Nodes vs. SPVs, Bitcoin Wallets	
Unit-4 : Working of Ethereum	(6)
From Bitcoin to Ethereum , Enter the Ethereum Blockchain, Ethereum Smart Contracts, Ethereum Virtual Machine and Code Execution, Ethereum Ecosystem	
Unit-5 : Blockchain Application Development	(6)
Decentralized Applications, Blockchain Application Development, Interacting with the Bitcoin Blockchain, Interacting Programmatically with Ethereum—Sending Transactions, Interacting Programmatically with Ethereum—Creating a Smart Contract, Interacting Programmatically with Ethereum—Executing Smart Contract Functions, Blockchain Concepts Revisited, Public vs. Private Blockchains, Decentralized Application Architecture	
Unit-6 : Building an Ethereum DApp	(6)
The DApp , Setting Up a Private Ethereum Network , Creating the Smart Contract, Deploying the Smart Contract, Client Application	
Reference Books	
<ol style="list-style-type: none"> 1. Bikramaditya Singhal, Gautam Dhameja, Priyansu Sekhar Panda, Beginning Blockchain A Beginner’s Guide to Building Blockchain Solutions, apress 2. Tiana Laurence, Blockchain For Dummies, John Wiley & Sons, 2017 3. Melanie Swan, Blockchain Blueprint for a New Economy, O’Reilly, 2015 	

Course Title : Program Elective - Distributed System and Cloud Computing	
Course Code : 231CSEL553	Semester : I/II
Teaching Scheme : L-T-P : 3-0-0	Credits : 3
Evaluation Scheme : ISE + MSE Marks : 20 + 30	ESE Marks : 50

COURSE OBJECTIVE
<ul style="list-style-type: none"> • To expose the students to web based distributed systems. • To make the students to identify various coordinating features of coordination based distributed systems. • To make the students aware on the cloud security issues. • To explore the audit and compliances norms and regulations.

COURSE OUTCOMES
After completion of course, students would be able to:
<ul style="list-style-type: none"> • Design web based distributed systems. • Differentiate various coordinating features of distributed systems. • Identify and provide the solutions for cloud security issues. • Apply privacy and security compliance norms in their career.

Pre-Requisites	Networking basics
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Course Contents	
Unit-1: Distributed Systems:	(6)
Computing systems, information systems, Pervasive systems, multimedia systems; Architectures: Centralized, Decentralized, Hybrid; Mobile and Ubiquitous Computing: Introduction, Volatile systems, Association, Interoperation, Sensing and Context awareness, Security and Privacy, Adaption.	
Unit-2 : Distributed Web Based Systems:	(6)
Architecture, Web Service, Processes- Clients, Web Servers, Web Server Clusters; Communication- HTTP, SOAP; Naming, Synchronization, Consistency and Replication.	
Unit-3 : Distributed Coordination Based Systems:	(6)
Introduction, Architecture, Processes, Naming, Synchronization, Consistency and Replication.	
Unit-4 : Cloud Computing:	(6)
Cloud Definition, Characteristic Features, Cloud Models- Delivery and Deployment Models; Impact of Cloud Computing, Barriers to Cloud Computing for Adaption in Enterprises;	
Unit-5 : Cloud Security:	(6)
Infrastructure Security- Network Level, Host Level and Application Level; Data Security and storage; Identity Access Management- Challenges, Architecture and practices; IAM Standards and Specifications for Organizations and Consumers; IAM Practices in Cloud.	
Unit-6 : Cloud Privacy:	(6)
Privacy, Data Life Cycle, Key Primary Concerns, Laws and Regulations for Protecting Privacy; Audit and Compliance; Internal Policy Compliance, Governance, Risk and Compliance (GRC); Control Objectives for Cloud Computing- Basic, Specific, Key Management; Regulatory/External Policy Compliance; Cloud Security Standards, Cloud Security Alliance (CSA); Auditing the Cloud for Compliance.	
Reference Books	
<ol style="list-style-type: none"> 1. Distributed Systems Principles and Paradigms - Andrews S. Tanenbaum, Maarten Van Steen, Second Edition, PHI Learning Pvt. Ltd. 2. Distributed Systems Concept and Design - George Coulouris, Jean Dollimore, Tim Kindberg, Fourth Edition, Pearson Education. 3. Pervasive Computing Technology and Architecture of Mobile Internet Applications - Jochen Burkhardt, Horst Henn, Stefan Hepper, Klaus Rindtorff, Thomas Schaeck, Pearson Education, Ltd. 4. Cloud Security and Privacy An Enterprise Perspective on Risk and Compliance- Jin Mather, Subra Kumaraswamy, Shahed Latif, O' Relly. 5. Cloud Computing- Implementation, Management and Security- John W. Rittinghouse, James F. Ransome, CRC Press [Taylor and Francis Group] 6. Cloud Computing Concepts, Technology and Architecture- Thomas Erl, Ricardo Puttini, Zaigham Mahmood. 	

Course Title : Program Elective - Data Storage Technologies and Networks	
Course Code : 231CSEL554	Semester : I/II
Teaching Scheme : L-T-P : 3-0-0	Credits : 3
Evaluation Scheme : ISE + MSE Marks : 20 + 30	ESE Marks : 50

COURSE OBJECTIVES
<ul style="list-style-type: none"> • To expose the basics of the storage technology.
<ul style="list-style-type: none"> • To make aware regarding the RAID, NAS and SAN technology.

<ul style="list-style-type: none"> To expose the students with the capacity optimization, backup and recovery techniques.
<ul style="list-style-type: none"> To make aware regarding the design and details of the data center and cloud storage.

COURSE OUTCOMES
After completion of course, students would be able to:
<ul style="list-style-type: none"> Recall the storage basics.
<ul style="list-style-type: none"> Understand and design the storage using RAID, SAN and NAS
<ul style="list-style-type: none"> To implement the different techniques for capacity optimization, backup and recovery.
<ul style="list-style-type: none"> To learn the details regarding design of data center.
<ul style="list-style-type: none"> To recall the different facilities provided by the cloud computing for storing data.

Pre-Requisites	Storage technology basics, computer network basics
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Course Contents	
Unit-1 Storage Basics	(6)
The Importance of Information Technology, The Role of Storage in IT, Storage from 40,000 Feet, The Mechanical Disk Drive, The Anatomy of a Disk Drive, Solid-State Media, Hybrid Drives, Tape, Further Storage Considerations	
Unit-2 : RAID, SAN, NAS	(6)
The History and Reason for RAID, What Is RAID?, RAID Concepts, RAID Levels, What Is an FC SAN?, Why FC SAN?, FC SAN Components, SAN Topologies, iSCSI from 40,000 Feet, Initiators and Targets, IP Network Considerations, What Files, NAS, and Objects Are, Network-Attached Storage, Object Storage	
Unit-3 : Capacity Optimization Technologies	(6)
Capacity Optimization Technologies Overview, Thin Provisioning, Compression, Deduplication, Auto-tiering.	
Unit-4 : Backup and Recovery	(6)
Why We Back Up, It's All about Recovery, Backup Architecture, Backup Methods, Backup Types, Backup Targets and Devices, Backup Retention Policies, Archiving	
Unit-5 : The Wider Data Center Neighborhood	(6)
Data Center Design, Data Center Overview, Data Center Cabling, Working in the Data Center, A Tale of Two Networks, Single Converged Data Center Network	
Unit-6 : Cloud Storage	(6)
The Cloud Overview- Public Cloud, Private Cloud, Hybrid Cloud, Storage and the Cloud.	
Reference Books	
1. Nigel Poulton, Data Storage Networking, Data Storage Networking: Real World Skills for the CompTIA Storage, SYBEX	
2. The Complete Guide to Data Storage Technologies for Network-centric Computing Paperback– Import, Mar 1998 by Computer Technology Research Corporation.	

Course Title: Program Elective - Secure Software Design and Enterprise Computing	
Course Code: 231CSEL555	Semester: I/II
Teaching Scheme: L-T-P: 3-0-0	Credits: 3
Evaluation Scheme: ISE + MSE Marks: 20 + 30	ESE Marks: 50

COURSE OBJECTIVE

1. To fix software flaws and bugs in various software.
2. To make students aware of various issues like weak random number generation, information leakage, poor usability, and weak or no encryption on data traffic.
3. Techniques for successfully implementing and supporting network services on an enterprise scale and heterogeneous systems environment.
4. Methodologies and tools to design and develop secure software containing minimum vulnerabilities and flaws.

COURSE OUTCOMES

After completion of course, students would be able to:

1. Differentiate between various software vulnerabilities
2. Software process vulnerabilities for an organization .
3. Monitor resources consumption in a software.
4. Interrelate security and software development process.

Pre-Requisites	Computer Programming, Software Engineering
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Course Contents

Unit 1: Secure Software Design (6)

Identify software vulnerabilities and perform software security analysis, Master security programming practices, Master fundamental software security design concepts, Perform security testing and quality assurance.

Unit 2: Enterprise Application Development (8)

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.

Unit 3: Enterprise Systems Administration (5)

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).

Unit 4: (6)

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.
Unit 5: (6) Handle insecure exceptions and command/SQL injection, Defend web and mobile applications against attackers, software containing minimum vulnerabilities and flaws.
Unit 6: (5) Case study of DNS server, DHCP configuration, SQL injection attack and other specific attacks.
Reference Books:
1. Theodor Richardson, Charles N Thies, Secure Software Design, Jones & Bartlett 2. Kenneth R. van Wyk, Mark G. Graff, Dan S. Peters, Diana L. Burley, Enterprise Software Security, Addison Wesley.

Course Title: Program Elective - Cyber Security and Digital Forensics	
Course Code: 231CSEL556	Semester: I/II
Teaching Scheme: L-T-P: 3-0-0	Credits: 3
Evaluation Scheme: ISE + MSE Marks: 20 + 30	ESE Marks: 50

COURSE OBJECTIVE

1. Provides an in-depth study of the rapidly changing and fascinating field of cyber security and digital forensics.
2. Combine both the technical expertise and the knowledge required to investigate, detect and prevent digital crimes.
3. Gain knowledge on digital forensics legislations, digital crime, forensics processes and procedures, data acquisition and validation, e-discovery tools
4. Involve in E-evidence collection and preservation, investigating operating systems and file systems, network forensics and mobile device forensics.

COURSE OUTCOMES

After completion of course, students would be able to:

1. Understand cyber threats and frauds and apply appropriate security policies to protect computers and digital information.
2. Use standards and obey cyber laws to enhance information security in the professional and day today day activities.
3. Apply computer forensics, digital detective and various processes, policies and procedures
4. Analyze and adapt E-discovery guidelines and standards, E-evidence, tools and environment.
5. Practice and apply laws concerned with Email, web forensics. network forensics and mobile device forensics and help the society by punishing the culprits.

Pre-Requisites	Information Security and Computer Networks
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Course Contents

Unit 1 Cyber Security Concepts: (7) Introduction to Computer Security, Threats to Network Security, Identifying Types of Threats, Basic Security Terminology, Concepts and Approaches, CIA, Attacks, Exploits, Information
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Gathering (Social Engineering, Foot Printing & Scanning), Cyber Frauds, DoS, Viruses : Internet Frauds, Identity Theft, Cyber Stalking, DoS, DDoS Attacks, Malwares: Viruses, Trojan Horses, The Buffer-Overflow Attack, Spywares, Rootkits, Robots, Ransomwares, Zombies etc, Detecting and Eliminating Viruses and Spyware.	
Unit 2. Cyber Laws:	(5)
Introduction, Cyber Security Regulations, Roles of International Law, the state and Private Sector in Cyberspace, Cyber Security Standards. The INDIAN Cyberspace, National Cyber Security Policy 2013.	
Unit 3. Digital Forensics Introduction:	(6)
Definition of Digital Forensics, Uses of Digital Forensics, Locard's Exchange Principle, Scientific method, Organizations of note, Role of Forensic examiner in the Judicial system. Collecting Evidence : Crime scenes and collecting evidence, Documenting the scene, Chain of custody, Cloning, Live system versus Dead system, Hashing, Final report.	
Unit 4. Legal Aspects:	(6)
Criminal Law - Searches without a warrant, searching with a warrant, eDiscovery, Finding Evidence on the PC, Finding Evidence in System Logs , Getting Back Deleted Files, Operating System Utilities, Expert testimony,	
Unit 5. Internet, E-mail and Network Forensics :	(6)
Internet and E-mail : Internet overview, Web browsers, E-mail, Social networking sites, Social Engg, Network security tools, Network attacks, Incident response, Network evidence and investigations and challenges.	
Unit 6. Mobile Device Forensics:	(6)
Cell Phone Concepts, Cellular networks, Operating Systems, Cell Phone evidence, Cell phone forensic tools, GPS, Challenges and Concerns : Standards and controls, Cloud forensics, Evidence stored in the Cloud, Legal concerns, Solid state drives, Speed of change.	
Reference Books:	
<ol style="list-style-type: none"> 1. Computer Security Fundamentals - Chuck Easttom, Pearson. 3ed Edition. 2. Cyber Security Essentials - James Graham Richard Howard Ryan Olson, CRC Press 3. Information and Cyber Security - Gupta Sarika, Khanna Publishing House, Delhi 4. <i>Cyber Security Essentials</i> - James Graham, Richard Howard, Ryan Olson, CRC Press. 5. The Basics of Digital Forensics: The Primer for Getting Started in Digital Forensics - John Sammons, Syngress, February 24, 2012. 6. Digital Forensic The Fascinating World of Digital Evidences - Nilakshi Jain, DhananjayR Kalbande, Wiley India Pvt Ltd, 2017 edition.. 7. Incident Response & Computer Forensics - Jason Luttgens, Matthew Pepe, Kevin Mandia, McGrawHill Osborne Media, 3 rd edition.2014 	

Course Title: Program Elective - Security Assessment and Risk Analysis	
Course Code: 231CSEL557	Semester: I/II
Teaching Scheme: L-T-P: 3-0-0	Credits: 3
Evaluation Scheme: ISE + MSE Marks: 20 + 30	ESE Marks: 50

COURSE OBJECTIVE
1. Describe the concepts of risk management
2. Define and differentiate various Contingency Planning components.

3. Integrate the IRP, DRP, and BCP plans into a coherent strategy to support sustained organizational operations.
4. Define and be able to discuss incident response options, and design an Incident Response Plan for sustained organizational operations.

COURSE OUTCOMES
After completion of course, students would be able to:
1. Capable of recommending contingency strategies including data backup and recovery and alternate site selection for business resumption planning
2. Skilled to be able to describe the escalation process from incident to disaster in case of security disaster..
3. Capable of Designing a Disaster Recovery Plan for sustained organizational operations.
4. Capable of Designing a Business Continuity Plan for sustained organizational operations.

Pre-Requisites	Computer and Network Security
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Course Contents
<p>Unit 1: Security Basics: (6) Information Security (INFOSEC) Overview: critical information characteristics – availability information states – processing security counter-measures - education, training and awareness, critical information characteristics – confidentiality critical information characteristics – integrity, information states – storage, information states – transmission, security counter measures - policy, procedures and practices, threats, vulnerabilities.</p>
<p>Unit 2: Threats to and Vulnerabilities of Systems: (7) 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</p>
<p>Unit 3: Security Planning: (6) 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 off site processing, emergency destruction procedures, guidelines for determining critical and essential workload, team member responsibilities in responding to an emergency situation.</p>

Unit 4: POLICIES AND PROCEDURES :	(7)
Physical Security Measures: alarms, building construction, cabling, communications centre, 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.	
Unit 5: Operations Security (OPSEC):	(6)
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)	
Unit 6:	(4)
Case study of threats and vulnerability assessment.	
Reference Books	
<ol style="list-style-type: none"> Principles of Incident Response and Disaster Recovery, Whitman & Mattord, Course Technology ISBN: 141883663X Web Link : http://www.cnss.gov/Assets/pdf/nstissi_4011.pdf 	

Course Title: Program Elective - Human and Computer Interaction	
Course Code: 231CSEL558	Semester: I/II
Teaching Scheme: L-T-P: 3-0-0	Credits: 3
Evaluation Scheme: ISE + MSE Marks: 20 + 30	ESE Marks: 50

COURSE OBJECTIVE
1. To study and understand importance of user experience design principles, and good interface design.
2. To understand human psychology in designing good interfaces.
3. To bring out the creativity in the students and build innovative applications that are user friendly.
4. To encourage students to indulge into research in Machine Interface Design

COURSE OUTCOMES : After completion of course, students would be able to:
1. Design user centric, innovative and user friendly interfaces
2. Apply HMI in emerging and established technologies to enhance User Experiences in design activities.
3. Criticize existing interface designs and improve them.
4. Design application for social, international standards with ethics and technical skills.

Pre-Requisites	Software Engineering; Web and Mobile Technologies; Experience in designing interfaces for applications and web sites.
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Course Contents	
Unit 1 Introduction to Human Computer Interface:	(8)
Introduction, Hardware, software and operating environment to use HMI in various fields. The psychopathology of everyday things – complexity of modern devices; human-centered design; fundamental principles of interaction; Psychology of everyday actions-how people do things; the seven stages of action and three levels of processing; human error; Principles to support usability, Learnability, Flexibility, Robustness.	
Unit 2. Understanding Goal Directed Design:	(6)
Goal directed design; Implementation models and mental models; Beginners, expert and intermediates – designing for different experience levels; Understanding users. Modeling users – personas and goals. Processes and methods for user-centered design.	
Unit 3. GUI:	(4)
Benefits of a good UI; popularity of graphics; concept of direct manipulation; advantages and disadvantages; characteristics of GUI; characteristics of Web UI; Mobile App UI; General design principles. and methods for user-centered design, User and task analysis	
Unit 4. Design Guidelines :	(6)
Conceptual Design, Conceptual Design Methods. perception, Gestalt principles, visual structure, reading is unnatural, color, vision, memory, six behavioral patterns, recognition and recall, learning, factors affecting learning, time. The UX Design Process-The Structure: Information Architecture and Interaction Design Visual Design Principles, Information Design and Data Visualization Interaction Design, Information Architecture.	
Unit 5. UX Design Process:	(6)
Prototype and Test Testing your Design, Usability Testing, Types of Usability Testing, Usability Testing Process, Preparing and planning for the Usability Tests, Prototype your Design to Test, Introduction of prototyping tools, conducting Usability Test, communicating Usability Test Results Menus; windows; device base controls, screen base controls. Interaction Paradigms and human factors: Model.	
Unit 6. Detailed Design and Prototyping:	(6)
Concepts, Iterate/ Improve and Deliver Usability testing: Methods: Analytical methods, Empirical methods. Understanding the Usability Test, findings. Assemble testable prototypes, Write script including informed consent and task instructions, Perform practice test(s) team member as participant. Applying the Usability Test, feedback in improving the design. Communication with implementation team. UX Deliverables to be given to implementation team.	
Reference Books	
<ol style="list-style-type: none"> 1. Alan Dix, J. E. Finlay, G. D. Abowd, R. Beale “Human Computer Interaction”, Prentice Hall. 2. Wilbert O. Galitz, “The Essential Guide to User Interface Design”, Wiley publication. 3. Alan Cooper, Robert Reimann, David Cronin, “About Face3: Essentials of Interaction design”, Wiley publication. 	

4. Jeff Johnson, "Designing with the mind in mind", Morgan Kaufmann Publication.
5. Donald A. Norman, "The design of everyday things", Basic books.
6. Rogers Sharp Preece, "Interaction Design: Beyond Human Computer Interaction", Wiley.
7. Guy A. Boy "The Handbook of Human Machine Interaction", Ashgate publishing Ltd.

Course Title: **Program Elective - Knowledge Discovery**

Course Code: 231CSEL559

Semester: I/II

Teaching Scheme: L-T-P: **3-0-0**

Credits: 3

Evaluation Scheme: ISE + MSE Marks: **20 + 30**

ESE Marks: **50**

Pre-Requisites

Basics of database

COURSE OBJECTIVE

1. To introduce the student regarding knowledge discovery and data mining.
2. To expose the students with the data preprocessing techniques.
3. To aware the students regarding the supervised and unsupervised learning methods.
4. To strengthen the ability of the students for making use of data mining software for finding solution of different domain problems.

COURSE OUTCOMES

After completion of course, students would be able to:

1. Learn the need of the knowledge discovery and data mining.
2. Build the data by applying the data processing techniques.
3. Design the training set using supervised and unsupervised learning methods.
4. Learn and build data mining applications using different data mining software.

Course Contents

Unit-1: Introduction to Knowledge Discovery and Data Mining (5)

The KDD Process, Taxonomy of Data Mining Methods, Data Mining within the Complete Decision Support System, KDD and DM Research Opportunities and Challenges, KDD & DM Trend.

Unit-2: Data Preprocessing (6)

DATA CLEANSING BACKGROUND, GENERAL METHODS FOR DATA CLEANSING, APPLYING DATA CLEANSING, Dimension Reduction and Feature Selection – Introduction, Feature Selection Techniques.

Unit-3: Supervised Learning (6)

Introduction, Training Set, Definition of the Classification Problem, Induction Algorithms, Performance Evaluation, Scalability to Large Datasets, The "Curse of Dimensionality", Decision Trees.

Unit-4 : Unsupervised Methods (7)

A survey of Clustering Algorithms, Association Rules- Introduction, Association Rule Mining, Frequent Set Mining- Introduction, Problem Description, Constraint-based Data Mining- Motivations, Background and Notations.

Unit-5 : Data Mining Applications (6)
 Multimedia Data Mining- Introduction, A Typical Architecture of a Multimedia Data Mining System, An Example — Concept Discovery in Imagery Data, Data Mining in Medicine- Introduction, Data Mining for Financial Applications- Introduction: Financial Tasks, Specifics of Data Mining in Finance, Data Mining for Intrusion Detection- Introduction, Data Mining Basics, 3Data Mining Meets Intrusion Detection.

Unit-6 : Data Mining Software (6)
 Commercial Data Mining Software- Introduction, Literature Review, Data Mining Software, Supercomputing Data Mining Software, Text Mining Software, Web Mining Software, Weka-A Machine Learning Workbench for Data Mining.

Reference Books

1. Oded Maimon · Lior Rokach, Data Mining and Knowledge Discovery Handbook, Second Edition, Springer

Course Title: Program Elective - Quantum Computing	
Course Code: 231CSEL560	Semester: I/II
Teaching Scheme: L-T-P: 3-0-0	Credits: 3
Evaluation Scheme: ISE + MSE Marks: 20 + 30	ESE Marks: 50

COURSE OBJECTIVE

1. The course will provide an insight of basic of quantum physics from a computer scientist’s perspective, and how it describes reality and understand the philosophical implications of quantum computing.

COURSE OUTCOMES

After completion of course, students would be able to:

1. knowledge of Vector spaces, Matrices, Quantum state, Density operator and Quantum Measurement theory.

Pre-Requisites

Linear Algebra, Theory of Computation

Course Contents

Unit 1: Qubit & Quantum States: (6)
 The Qubit, Vector Spaces. Linear Combination Of Vectors, Uniqueness of a spanning set, basis & dimensions, inner Products, orthonormality, Gram-schmidt orthogonalization, bracket formalism, the Cauchyschwarz and triangle Inequalities.

Unit 2: Matrices & Operators: (8)
 Observables, The Pauli Operators, Outer Products, The Closure Relation, Representation of operators using matrices, outer products & matrix representation, matrix representation of operators in two dimensional spaces, Pauli Matrix, Hermitian unitary and normal operator, Eigen values & Eigen Vectors, Spectral Decomposition, Trace of an operator, important properties of Trace, Expectation Value of Operator, Projection Operator, Positive Operators.

Unit 3:	(5)
Commutator Algebra, Heisenberg uncertainty principle, polar decomposition & singular values, Postulates of Quantum Mechanics.	
Unit 4: Tensor Products:	(7)
Representing Composite States in Quantum Mechanics, Computing inner products, Tensor products of column vectors, operators and tensor products of Matrices. Density Operator: Density Operator of Pure & Mix state, Key Properties, Characterizing Mixed State, Practical Trace & Reduce Density Operator, Density Operator & Bloch Vector.	
Unit 5: Quantum Measurement Theory:	(6)
Distinguishing Quantum states & Measures, Projective Measurements, Measurement on Composite systems, Generalized Measurements, Positive Operator- Valued Measures.	
Unit 6:	(6)
Recent trends in Quantum Computing Research, Quantum Computing Applications of Genetic Programming.	
Reference Books	
<ol style="list-style-type: none"> 1. Quantum Computing without Magic by Zdzislaw Meglicki 2. Quantum Computing Explained By DAVID Mc MAHON 3. Quantum Computer Science By Marco Lanzagorta, Jeffrey Uhlmann 4. An Introduction to Quantum Computing Phillip Kaye, Raymond Laflamme, Michele Mosca. 	