



HINDUSTAN
INSTITUTE OF TECHNOLOGY & SCIENCE
(DEEMED TO BE UNIVERSITY)

**DEPARTMENT OF COMPUTER SCIENCE AND
ENGINEERING**

CURRICULUM AND SYLLABUS

Under CBCS

(Applicable for Students admitted from Academic Year 2018-19)

MTech (COMPUTER SCIENCE AND ENGINEERING)

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

SCHOOL OF COMPUTING SCIENCES

HINDUSTAN INSTITUTE OF TECHNOLOGY & SCIENCE**VISION AND MISSION****MOTTO**

“To Make Every Man a Success and No Man a Failure”

VISION

To be an International Institute of Excellence, providing a conducive environment for education with a strong emphasis on innovation, quality, research and strategic partnership blended with values and commitment to society.

MISSION

- To create an ecosystem that promotes learning and world class research.
- To nurture creativity and innovation.
- To instill highest ethical standards and values.
- To pursue activities for the development of the Society.
- To develop national and international collaborations with institutes and industries of eminence.
- To enable graduates to become future leaders and innovators.

Value Statement

- Integrity, Innovation, Internationalization

**DEPARTMENT OF COMPUTER SCIENCE AND
ENGINEERING VISION AND MISSION****VISION**

To excel in Computer Science and Engineering education, research and project management by empowering the students with strong conceptual knowledge.

MISSION

- M1.** To educate the students with basic foundation blocks of core and allied disciplines of Computer Science and Engineering.
- M2.** To provide practical skills in the advancements of the Computer Science and Engineering field required for the growing dynamic IT and ITES industries.

- M3.** To sculpt strong personal, technical, research, entrepreneurial, and leadership skills.
- M4.** To inculcate knowledge in lifelong learning, professional ethics and contribution to the society.

M.Tech (COMPUTER SCIENCE AND ENGINEERING)

PROGRAMME EDUCATIONAL OBJECTIVES (PEO)

The program is expected to enable the students to

- PEO I** Excel in their professional career by applying advanced knowledge and/or pursue higher education including research by applying the knowledge of Computer Science and Engineering.
- PEO II** Asses the industry requirements and provide tangible solutions with social consciousness and ethical values.

PROGRAM OUTCOMES (ALIGNED WITH GRADUATE ATTRIBUTES) (PO)

At the end of this program, graduates will be able to

- PO1 Scholarship of knowledge:** Acquire in-depth knowledge of specific discipline or professional area, including wider and global perspective, with an ability to discriminate, evaluate, analyses and synthesize existing and new knowledge, and integration of the same for enhancement of knowledge.
- PO2 Critical Thinking:** Analyze complex engineering problems critically, apply independent judgment for synthesizing information to make intellectual and/or creative advances for conducting research in a wider, theoretical, practical and policy context.
- PO3 Problem Solving:** Think laterally and originally, conceptualize and solve engineering problems, evaluate a wide range of potential solutions for those and arrive at feasible, optimal solutions after considering public health and safety, cultural, societal and environmental factors in the core areas of expertise.
- PO4 Research Skill:** Extract information pertinent to unfamiliar problems through literature survey and experiments, apply appropriate research methodologies, techniques and tools, design, conduct experiments, analyze and interpret data,, demonstrate higher order skill and view things in a broader perspective, contribute individually / in group(s) to the development of scientific of scientific / technological knowledge in one or more domains of engineering.

PO5 Usage of modern tools: Create, select, learn, and apply appropriate techniques, resources, and engineering and IT tools, including prediction and modeling, to complex engineering activities with an understanding of the limitations.

PO6 Collaborative and multidisciplinary work: Process knowledge and understanding of group dynamics, recognize opportunities and contribute positively to collaborate-multidisciplinary scientific research, demonstrate a capacity for self-management and teamwork, decision—making based on open-mindedness, objectivity and rational analysis in order to achieve common goals and further the learning of themselves as well as others.

PO7 Project Management and Finance: Demonstrate knowledge and understanding of engineering and management principles and apply the same one's own work, as a member and leader in a team, manage projects efficiently in respective disciplines and multidisciplinary environments after consideration of economic and financial factors.

PO8 Communication: Communicate with engineering community, and with society at large, regarding complex engineering activities confidentially and effectively, such as, being able to comprehend and write effective reports and design documentation by adhering to appropriate standards, make effective presentations, and give and receive clear instructions.

PO9 Life-Long Learning: Recognize the need for, and have the preparation and ability to engage in life-long learning independently, with a high level of enthusiasm and commitment to improve knowledge and competence continuously.

PO10 Ethical Practices and Social Responsibility: Acquire professional and intellectual integrity, professional code of conduct, ethics of research and scholarship, consideration of the impact of research outcomes on professional practices and an understanding of responsibility to contribute to the community for sustainable development of society.

PO11 Independent and Reflective Learning: Observe and examine critically the outcomes of one's actions and make corrective measures subsequently, and learn from mistakes without depending on external feedback

PROGRAM SPECIFIC OUTCOMES (PSO)

PSO1: Posses knowledge in Advanced Operating System, Advance Data Base Technology, Advanced Data Structures & Algorithms for analyzing and the solving complex problem.

PSO2: Acquire the skill set especially in Data Science and Engineering, Software Engineering and Information Security.

PSO3: Solve complex problems through innovative system design using modern tools and techniques.

M.Tech - COMPUTER SCIENCE AND ENGINEERING

(65 CREDITS STRUCTURE)

SEMESTER – I

SL. NO	COURSE CATEGORY	COURSE CODE	NAME OF THE COURSE	L	T	P	C	S	TCH
1	BS	MAA3706	Statistics for Computer Science ⁺	3	0	2	4	1	5
2	PC	CSA3701	Advanced Data Structures and Algorithms ⁺	2	0	2	3	1	4
3	PC	CSA3702	Machine Learning ⁺	2	0	2	3	2	4
4	PE	CSA****	Department Elective - I	3	0	0	3	0	3
5	PE	CSA****	Department Elective - II	3	0	0	3	0	3
6	PC	ZZZ3715	Research Methodology & IPR*	2	0	0	2	0	2
PRACTICAL									
7	PC	CSA3781	Mini project	0	0	6	2	0	6
Total							20	4	27

SEMESTER – II

SL. NO	COURSE CATEGORY	COURSE CODE	NAME OF THE COURSE	L	T	P	C	S	TCH
1	PC	CSA3703	Advanced Operating Systems	2	0	2	3	1	4
2	PC	CSA3704	Soft computing	3	1	0	4	1	5
3	PC	CSA3705	Advanced Data Base Technology	2	1	2	4	1	5
4	PC	CSA3706	MOOC Course	0	0	0	2	3	3
5	PE	CSA****	Department Elective - III	3	0	0	3	0	3
6	OE	*****	Open Elective	2	0	0	2	0	2
PRACTICAL									
7	PC	CSA3751	Seminar	0	0	3	2	0	2
Total							20	6	24

*Research Methodology & IPR is a compulsory Course.

⁺Professional Core papers Common to M.Tech. CSE and M.Tech. IT

M.Tech - COMPUTER SCIENCE AND ENGINEERING									
SEMESTER – III									
SL. NO	COURSE CATEGORY	COURSE CODE	NAME OF THE COURSE	L	T	P	C	S	TCH
1	PE	CSA****	Department Elective - IV	3	0	0	3	0	3
PRACTICAL									
2	PC	CSA3782	Project Phase -I	0	0	24	8	0	24
Internship/Mini Project							2	0	
Total							13		27
SEMESTER – IV									
SL. NO	COURSE CATEGORY	COURSE CODE	NAME OF THE COURSE	L	T	P	C	S	TCH
PRACTICAL									
1	CSA3783	PC	Project Phase -II	0	0	24	12	0	24
Total							12		24

M.Tech - COMPUTER SCIENCE AND ENGINEERING**DEPARTMENT ELECTIVES****ELECTIVE I**

SL. NO	COURSE CATEGORY	COURSE CODE	NAME OF THE COURSE	L	T	P	C	S	TCH
1	PE	CSA3721	Advanced Communications	3	0	0	3	0	3
2	PE	CSA3722	Wireless Sensor Networks	3	0	0	3	0	3
3	PE	CSA3723	Information Security Architecture	3	0	0	3	0	3
4	PE	CSA3724	Software Engineering	3	0	0	3	0	3

ELECTIVE II

SL. NO	COURSE CATEGORY	COURSE CODE	NAME OF THE COURSE	L	T	P	C	S	TCH
1	PE	CSA3725	Cloud Computing	3	0	0	3	0	3
2	PE	CSA3726	Human Computer Interaction	3	0	0	3	0	3
3	PE	CSA3727	Digital Forensics	3	0	0	3	0	3
4	PE	CSA3728	Performance Metrics for Advanced Computing	3	0	0	3	0	3

ELECTIVE III

SL. NO	COURSE CATEGORY	COURSE CODE	NAME OF THE COURSE	L	T	P	C	S	TCH
1	PE	CSA3729	Introduction to Intelligent Systems	3	0	0	3	0	3
2	PE	CSA3730	High Performance Computing	3	0	0	3	0	3
3	PE	CSA3731	Software Security	3	0	0	3	0	3
4	PE	CSA3732	Software Quality Management	3	0	0	3	0	3

ELECTIVE IV

SL. NO	COURSE CATEGORY	COURSE CODE	NAME OF THE COURSE	L	T	P	C	S	TCH
1	PE	CSA3733	Computer Vision	3	0	0	3	0	3
2	PE	CSA3734	Block Chain Technology	3	0	0	3	0	3
3	PE	CSA3735	Cryptography and Network Security	3	0	0	3	0	3
4	PE	CSA3736	Software Project Management	3	0	0	3	0	3

SEMESTER – I

COURSE TITLE		STATISTICS FOR COMPUTER SCIENCE		CREDITS	4
COURSE CODE	MAA3706	COURSE CATEGORY	BS	L-T-P-S	3- 0- 2- 1
CIA	60%			ESE	40%
LEARNING LEVEL	BTL-3 - APPLY				
Prerequisite : NIL					
CO	OUTCOMES				PO
1	Develop statistical models for business analytics				1
2	Use forecasting methods to support managerial, financial, and operational statistics.				7
3	Perform marketing analytics using statistical models.				4
4	Analyze customer data for customer acquisition, retention, and profitability				7
5	Analysis of variance				4
MODULE: PROBABILITY					(12)
Introduction to probability –Bayes theorem-Random variables-discrete random variable (Binomial, Poisson, Geometric), Continues random variable (Uniform, Exponential and Normal distribution). Moment generating function. Suggested Activities: Basic knowledge on probability Suggested sources: Introduction to probability					
MODULE 2: TWO DIMENSIONAL RANDOM VARIABLES					(12)
Joint distribution –Marginal and conditional distribution covariance –correlation and regression (linear and Multiple). Central limit theorem, Chebyshev’s inequality. Suggested Activities: Basic knowledge on probability Suggested sources: Probability, Statistics and Random Processes-T.Veerarajan					
MODULE 3: THEORY OF SAMPLING AND TEST OF HYPOTHESIS					(12)
Introduction to hypothesis, Large and small samples test -mean and variance (single and double), test, Independent of attributes and contingency table. Suggested Activities: Basic knowledge of sampling Suggested sources: Probability, Statistics and Random Processes-T.Veerarajan					
MODULE 4: TIME SERIES ANALYSIS					(12)
Introduction to Stochastic process, Time series as a discrete stochastic process. Stationarity, Main characteristics of stochastic process (mean, auto covariation and auto correlation function). Autoregressive models AR (p), Yull-Worker equation Auto regressive moving average models ARMA. Seasonality in Box –Jenkins model. Suggested Activities: Basic knowledge of Time series analysis					

Suggested sources: Time series-Maurice George kendall,j.k.Ord	
MODULE 5: DESIGN OF EXPERIMENTS (12)	
Analysis of variance (one way & two ways) classification - completely randomized design - randomized block design - Lattin square design. Suggested Activities: Basic knowledge of design of experiments Suggested sources: Probability, Statistics and Random Processes-T.Veerarajan	
TEXT BOOKS	
1	T.Veerarajan , “Probability, Statistics and Random Processes” Tata McGraw-Hill,Education 2008
2	Maurice George Kendall, J. K. Ord ,”Time series” Oxford University Press, 1990
REFERENCE BOOKS	
1	K.S.Trivedi.John , “Probability and statistics with reliability, Queuing and computer Science Application”, Second edition, Wiley&Son, 2016
2	Levin Richard and Rubin Davids, “Statistics for Management “, Pearson Publications,2016
3	Robert Stine, Dean Foster , “Statistical for Business: Decision Making and Analysis”. Pearson Education, 2nd edition ,2013
E BOOKS	
1	http://www.math.harvard.edu/~knill/teaching/math144_1994/probability.pdf
2	http://www.dartmouth.edu/~chance/teaching_aids/books_articles/probability_book/book.pdf
MOOC	
1	https://nptel.ac.in/courses/IIT-MADRAS/Principles_of_Communication1/Pdfs/1_5.pdf
2	https://nptel.ac.in/courses/110104024/

COURSE TITLE	ADVANCED DATA STRUCTURES AND ALGORITHMS			CREDITS	3
COURSE CODE	CSA3701	COURSE CATEGORY	PC	L-T-P-S	2- 0- 2- 1
CIA	60%			ESE	40%
LEARNING LEVEL	BTL-4 - ANALYZE				
CO	OUTCOMES				PO
1	Estimate time and space complexities for a given algorithm.				1,2
2	Describe the heap property and the use of heaps as an implementation of priority queues.				1,2,3
3	Illustrate the various self- balanced trees and their operations.				1,2,3
4	Apply an appropriate algorithmic approach to a given problem.				1,2,3,4,5
5	Illustrate parallel algorithm models.				1,2,3,4
6	Use a heuristic approach to solve an appropriate problem.				1,2,3,4,5

Prerequisites : 1. Fundamentals of Data Structures 2. Design and Analysis of Algorithm	
MODULE 1: INTRODUCTION	(9)
<p>Abstract Data Types - Time and Space Analysis of Algorithms - Big Oh and Theta Notations - Average, best and worst case analysis - Simple recurrence relations - Mappings.</p> <p>Suggested Activities: Find the time and space complexities of the following algorithms</p> <p>1. Sum of n numbers 2. Factorial of a n 3. Matrix multiplication 4. Insertion sort</p> <p>Suggested sources: https://nptel.ac.in/courses/106105164/ https://nptel.ac.in/courses/106105085/18</p>	
MODULE 2: HEAP STRUCTURES	(9)
<p>Min-max heaps - Heaps - Leftist heaps - Binomial heaps - Fibonacci heaps - Skew heaps - Lazy- binomial heaps.</p> <p>Suggested Activities: Implement the following Heap structures using C, C++, Java or Python</p> <p>1. Max-min Heap 2. Binomial Heap 3. Fibonacci Heap</p> <p>Suggested sources: https://nptel.ac.in/courses/106102064/20, 21</p>	
MODULE 3: SEARCH STRUCTURES	(9)
<p>Binary search trees - AVL trees - 2-3 trees - 2-3-4 trees - Red-black trees - B-trees - splay trees - k-d trees, Tries.</p> <p>Suggested Activities: Implement the following tree structures using C, C++, Java or Python</p> <p>1. AVL Tree 2. Red-Black tree 3. Splay Trees 4. K-d Trees 5. Tries</p> <p>Suggested sources: https://nptel.ac.in/courses/106102064/11, 12,14,15,18</p>	
MODULE 4: ALGORITHM DESIGN TECHIQUES	(9)
<p>Divide and Conquer and Greedy : Quick sort - Strassen's matrix multiplication - Convex hull - Tree- vertex splitting - Job sequencing with deadlines - Optimal storage on tapes Dynamic Programming and Backtracking: Multistage graphs - 0/1 knapsack - 8- queens problem - graph coloring, Palindrome partitioning.</p> <p>Suggested Activities: Solve the following problems</p> <p>1. Quicksort 2. Strassen's matrix multiplication 3. 8-queens problem 4. Palindrome Partitioning</p> <p>Suggested Sources: https://nptel.ac.in/courses/106106131/15, https://nptel.ac.in/courses/106102011/7</p>	
MODULE 5: ADVANCED ALGORITHMS	(9)
<p>Parallel Algorithms: Basic Techniques- Work & Efficiency - Distributed Computation - Heuristic & Approximation Approaches.</p> <p>Suggested Activities: Implement following heuristic algorithms</p> <p>1. Hill Climbing 2. Simulated Annealing 3. Particle Swarm Optimization 4. Genetic Algorithm</p>	

Suggested sources: https://nptel.ac.in/courses/106104120/4 , 5 https://nptel.ac.in/courses/106106126/9 - 15	
TEXT BOOKS	
1	Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, "Introduction to algorithms", Third edition, MIT press, 2013
REFERENCE BOOKS	
1	E. Horowitz, S. Sahni and Dinesh Mehta, Fundamentals of Data structures in C++, University Press, 2009.
2	E. Horowitz, S. Sahni and S. Rajasekaran, Computer Algorithms/C++, Second Edition, University Press, 2007.
3	Mark Allen Weiss, "Data Structures and Algorithm Analysis in C", Third Edition, Pearson Education, Asia. 2007.
4	Ananth Grama, Anshul Gupta, George Karypis, Vipin Kuma, "Introduction to Parallel Computing", Second Edition, Addison Wesley, 2003
E BOOKS	
1	Omid Bozorg-Haddad, Mohammad Solgi, Hugo A. LoAjiciga, "Meta-heuristic and Evolutionary Algorithms for Engineering Optimization 1st Edition", Wiley, 2017
2	Introduction To Parallel Computing - ResearchGate - Free Ebook, www.researchgate.net
MOOC	
1	Advanced Data structures and Algorithms, https://nptel.ac.in/courses/106105164/
2	Artificial Intelligence Search Methods for problem Solving, https://onlinecourses.nptel.ac.in/noc18_cs51/

COURSE TITLE		MACHINE LEARNING			CREDITS	3
COURSE CODE	CSA3702	COURSE CATEGORY	PC	L-T-P-S	2- 0- 2- 2	
CIA	60%			ESE	40%	
LEARNING LEVEL	BTL-4 - ANALYZE					
CO	OUTCOMES				PO	
1	Apply multilayer perceptron using simple machine learning techniques.				1,2,3	
2	Use decision trees and statistics models				1,2,3	
3	Use data analysis for machine learning				1,2,3	
4	Use Genetic algorithm and reinforced learning for appropriate applications				1,2,3	
5	Use the Python programming for machine learning.				1,2,3,5	
Prerequisites : NIL						
MODULE 1: Introduction						(6+6)

Learning - Types of machine learning - Supervised learning - The brain and the neurons, Linear Discriminants - Perceptron - Linear Separability - Linear Regression - Multilayer perceptron - Examples

of using MLP - Back propagation of error.	
Suggested Activities: Design a Multilayer Perceptron for Rain Forecasting system	
Suggested sources: Enrico C, Simon W, Jay R, Machine Learning Techniques for Space Weather, Elsevier, 2018	
MODULE 2: Classification Algorithms (6+6)	
Decision trees - Constructing decision trees - Classification of regression trees - Regression example - Probability and Learning: Turning data into probabilities - Some basic statistics - Gaussian mixture models - Nearest Neighbor methods.	
Suggested Activities: Explore the Regression Examples in Machine Learning	
Suggested sources: Norman Matlof, "Statistical Regression and Classification: From Linear Models to Machine Learning", CRC Press, 2017.	
MODULE 3: Analysis (6+6)	
The k-Means algorithm - Vector Quantization's - Linear Discriminant Analysis - Principal component analysis - Factor Analysis - Independent component analysis - Locally Linear embedding - Isomap - Least squares optimization - Simulated annealing.	
Suggested Activities: Simulated annealing / Modelling on any data science application.	
Suggested sources: L.M. Rasdi, Simulated Annealing Algorithm for Deep Learning, Procedia Computer Science, Volume: 72, 2015.	
MODULE 4: Optimization Techniques (6+6)	
The Genetic algorithm - Genetic operators - Genetic programming - Combining sampling with genetic programming - Markov Decision Process - Markov Chain Monte Carlo methods: sampling - Monte carlo - Proposal distribution.	
Suggested Activities: Design an Encryption algorithm using Genetic algorithm	
Suggested sources: Harsh Bhasin , Application of Genetic Algorithms in Machine learning,, International Journal of Computer Science and Information Technologies, Vol. 2 (5), 2011.	
MODULE 5: Python for Machine Learning (6+6)	
Baysean Networks - Markov Random moFields - Hidden Markov Models -Tracking methods. Python: Installation - Python for MATLAB AND R users - Code Basics - Using NumPy and MatPolitB.	
Suggested Activities: Design a simple application using NumPy and MatPolitB.	
Suggested sources: Rakshith Vasudev , Introduction to Numpy -1 : An absolute beginners guide to Machine Learning and Data science., 2017.	
TEXT BOOKS	
1	Kevin P. Murphy, "Machine Learning - A probabilistic Perspective", MIT Pres, 2016.
2	Randal S, "Python Machine Learning, PACKT Publishing, 2016.

REFERENCE BOOKS	
1	Ethem Alpaydin, "Machine Learning: The New AI", MIT Press, 2016.
2	Shai Shalev-Shwartz, Shai Ben-David, "Understanding Machine Learning: From Theory to Algorithms", Cambridge University Press, 2014.
3	Sebastian Raschka, "Python Machine Learning", Packt Publishing Ltd, 2015.
E BOOKS	
1	http://www.cs.huji.ac.il/~shais/UnderstandingMachineLearning/index.html
2	http://www.mlyearning.org/
MOOC	
1	https://www.coursera.org/learn/practical-machine-learning
2	https://www.coursera.org/learn/python-machine-learning

SEMESTER – II

COURSE TITLE		ADVANCED OPERATING SYSTEMS			CREDITS	3
COURSE CODE		CSA3703	COURSE CATEGORY	PC	L-T-P-S	2- 0- 2- 1
CIA		60%			ESE	40%
LEARNING LEVEL		BTL - 4 - Analyze				
CO	OUTCOMES					PO
1	Design distributed operating system.					4
2	Detect, prevent and avoid the deadlocks in distributed environment.					2, 9
3	Explain the need for load distribution and the corresponding techniques.					3, 9
4	Design security mechanisms for distributed operating system.					4
5	Analyze and find out the requirements to construct a database operating systems					2, 4
Prerequisites : Fundamentals of Programming						
MODULE 1: DISTRIBUTED OPERATING SYSTEM						(9)
Synchronization Mechanisms: Introduction - concept of a process - concurrent process - the critical section problem - Synchronization problems - language mechanisms for synchronization: Monitors. System Architecture types - issues in distributed operating systems - communication networks - communication primitives. Theoretical Foundations: inherent limitations of a distributed system - lamport logical clocks - vector clocks - casual ordering of messages - global state - cuts of a distributed computation - termination detection.						
MODULE 2: DISTRIBUTED DEADLOCK DETECTION						(9)
Deadlock handling strategies in distributed systems - issues in deadlock detection and resolution - control organizations for distributed deadlock detection - centralized and distributed deadlock detection algorithms - hierarchical deadlock detection algorithms. Agreement protocols - introduction-the system model, a classification of agreement problems, solutions to the Byzantine agreement problem, applications of agreement algorithms.						
MODULE 3: DISTRIBUTED SHARED MEMORY						(9)
Architecture- algorithms for implementing DSM - memory coherence and coherence protocols - design issues. Distributed Scheduling: introduction - issues in load distributing - components of a load distributing algorithm - stability - load distributing algorithm - performance comparison - selecting a suitable load sharing algorithm - requirements for load distributing -task migration and associated issues. Failure Recovery and Fault tolerance: introduction - basic concepts - classification of failures - backward and forward error recovery approaches - recovery in concurrent systems - synchronous and asynchronous check pointing and recovery - check pointing for distributed database systems - recovery in replicated distributed databases systems.						
MODULE 4: MULTIPROCESSOR OPERATING SYSTEM						(9)
Basic multiprocessor system architectures - basic multiprocessor system architecture - inter connection networks for multiprocessor systems - caching - hypercube architecture - structures of multiprocessor operating system -						

operating system design issues - threads - process synchronization - processor scheduling - Memory management. The Mac OS.

MODULE 5: DATABASE OPERATING SYSTEM

(9)

Requirements of a database operating system Concurrency control: theoretical aspects - introduction, database systems - a concurrency control model of database systems- the problem of concurrency control - Serializability theory- distributed database systems, concurrency control algorithms - introduction, basic synchronization primitives, lock based algorithms-timestamp based algorithms, optimistic algorithms - concurrency control algorithms, data replication.

Practical Component

1. Implementation of semaphores for multiprocessor OS
2. Implementation of multithreading for multiprocessor OS
3. Implementation of multiple sleeping barbers problem for synchronization in distributed OS
4. Implementation of network operating system.
5. Design a real time operating system to control the temperature of a boiler.
6. Implementation of transactions and concurrency in Database operating system.
7. Implement a banking application using distributed Operating system.

TEXT BOOKS

- | | |
|---|--|
| 1 | Mukesh Singhal, Niranjana G. Shivaratri, "Advanced concepts in operating systems", TMH, 2011 |
|---|--|

REFERENCE BOOKS

- | | |
|---|---|
| 1 | Abraham Silberschatz, Peter B. Galvin, G. Gagne, "Operating System Concepts", Ninth Edition, Addison Wesley Publishing Co., 2013. |
| 2 | Andrew S. Tanenbaum, "Modern operating system", PHI, 3rd edition, 2008 |
| 3 | Pradeep K. Sinha, "Distributed operating system-Concepts and design", PHI, 2003. |
| 4 | Andrew S. Tanenbaum, "Distributed operating system", Pearson education, 2003 |

E BOOKS

- | | |
|---|---|
| 1 | https://books.google.co.in/books/about/Advanced_Concepts_In_Operating_Systems.html?id=nel4vdeLcqkC |
| 2 | http://www.cs.iit.edu/~sun/pdfd/cs550-lec1.pdf |

COURSE TITLE		SOFT COMPUTING		CREDITS	4
COURSE CODE	CSA3704	COURSE CATEGORY	PC	L-T-P-S	3- 1- 0- 1
CIA	50%		ESE	50%	
LEARNING LEVEL	BTL4 - Analyze				
CO	OUTCOMES			PO	
1	Apply concepts of fuzzy sets, fuzzy logic and heuristics based systems.			1,2,3	
2	Derive appropriate rules for inference systems.			1,2	
3	Use the mathematical background to optimize neural network learning.			3,9	
4	Implement optimization algorithms and random search procedures useful to seek global optimum in self-learning.			4,7,10	
5	Develop case studies to illustrate the intelligent behavior of programs based on soft computing.			6,7,10	
Prerequisites :Artificial Intelligence, Problem solving , Expert Systems					
MODULE 1: FUZZY SET THEORY					(12)
Introduction to Neuro - Fuzzy and Soft Computing - Fuzzy Sets - Basic Definition and Terminology - Set-theoretic Operations - Member Function Formulation and parameterization - Fuzzy Rules and Fuzzy Reasoning - Extension Principle and Fuzzy Relations - Fuzzy If-Then Rules - Fuzzy Reasoning - Fuzzy Inference Systems - Mamdani Fuzzy Models - Sugeno Fuzzy Models - Tsukamoto Fuzzy Models - Input Space Partitioning and Fuzzy Modeling. Suggested Activities: Apply fuzzy logic and reasoning to handle uncertainty and solve engineering problems. Suggested sources: https://swayam.gov.in/course/4574-introduction-to-soft-computing					
MODULE 2: OPTIMIZATION					(12)
Derivative-based Optimization - Descent Methods - The Method of Steepest Descent - Classical Newton's Method - Step Size Determination - Derivative-free Optimization - Genetic Algorithms - Simulated Annealing - Random Search - Downhill Simplex Search- Particle Swarm Techniques - Ant Colony Optimization. Suggested Activities: Develop the application based on Genetic Algorithm and Ant Colony optimization Suggested sources: https://swayam.gov.in/course/4574-introduction-to-soft-computing					
MODULE 3: NEURAL NETWORKS					(12)
Supervised Learning Neural Networks - Perceptrons - Adaline - Back propagation Mutilayer Perceptrons - Radial Basis Function Networks - Unsupervised Learning Neural Networks - Competitive Learning Networks - Kohonen Self-Organizing Networks - Learning Vector Quantization - Hebbian Learning.					

<p>Suggested Activities: Compare and Analyze the features of supervised and Unsupervised Neural Networks Suggested sources: https://swayam.gov.in/course/4574-introduction-to-soft-computing</p>	
<p>MODULE 4: NEURO FUZZY MODELING (12)</p> <p>Adaptive Neuro-Fuzzy Inference Systems - Architecture - Hybrid Learning Algorithm - Learning Methods that Cross-fertilize ANFIS and RBFN - Coactive Neuro Fuzzy Modeling - Framework Neuron Functions for Adaptive Networks - Neuro Fuzzy Spectrum.</p> <p>Suggested Activities: Build Adaptive Neuro-Fuzzy Inference Systems (ANFIS), train Sugeno systems using neuro-adaptive learning</p> <p>Suggested sources: http://in.mathworks.com/help/fuzzy/adaptive-neuro-fuzzy-inference-systems.html</p>	
<p>MODULE 5: APPLICATIONS OF COMPUTATIONAL INTELLIGENCE (12)</p> <p>Printed Character Recognition - Inverse Kinematics Problems - Automobile Fuel Efficiency Prediction - Soft Computing for Color Recipe Prediction.</p> <p>Suggested Activities: Prepare the students for developing intelligent modeling, optimization and control of non-linear systems through case studies.</p> <p>Suggested sources: https://towardsdatascience.com/introductory-guide-to-artificial-intelligence-11fc04cea042</p>	
<p>TEXT BOOKS</p>	
1	J.S.R.Jang, C.T.Sun and E.Mizutani, "Neuro-Fuzzy and Soft Computing", PHI, 2004, Pearson Education.
2	N.P.Padhy, "Artificial Intelligence and Intelligent Systems", Oxford University Press, 2006
<p>REFERENCE BOOKS</p>	
1	Samir Roy" Introduction to Softcomputing "Neuro Fuzzy and Genetic Algorithms", First edition, Pearson Publishers, 2015.
2	J.S.R.Jang, C.T.Sun and E.Mizutani, "Neuro-Fuzzy and Soft Computing", Pearson, 2004.
3	Timothy J.Ross, "Fuzzy Logic with Engineering Applications", McGraw-Hill, 1997.
4	Davis E.Goldberg, "Genetic Algorithms: Search, Optimization and Machine Learning", Addison Wesley, 2009.
5	S. Rajasekaran and G.A.V.Pai, "Neural Networks, Fuzzy Logic and Genetic Algorithms", PHI, 2003.
<p>E BOOKS</p>	

1	https://stimmelstep.firebaseio.com/15/Introduction-to-Soft-Computing-Neuro-Fuzzy-and-Genetic- Algorithms.pdf
2	http://www.a-zshiksha.com/forum/viewtopic.php?f=147&t=61593
MOOC	
1	https://www.class-central.com/tag/soft-computing
2	https://www.class-central.com/course/nptel-introduction-to-soft-computing-10053

COURSE TITLE	ADVANCED DATA BASE TECHNOLOGY			CREDITS	4
COURSE CODE	CSA370 5	COURSE CATEGORY	PC	L-T-P-S	2- 1- 2- 0
CIA	60%			ESE	40%
LEARNING LEVEL	BTL - 5 (EVALUATE)				
CO	OUTCOMES				PO
1	Implement parallel and distributed databases.				1,2,3,4,5,6,7
2	Implement object and object relational databases.				1,2,3,4,5,6,7
3	Learn advanced data models				1,2,3,4,5,6,7, 11
4	Learn emerging databases				1,2,3,4,5,6,7, 11

Prerequisites :Database Management System

MODULE 1: PARALLEL AND DISTRIBUTED DATABASES (9)

Database System Architectures: Centralized and Client-Server Architectures – Server System Architectures – Parallel Systems- Distributed Systems – Parallel Databases: I/O Parallelism – Inter and Intra Query Parallelism – Inter and Intra operation Parallelism – Design of Parallel Systems- Distributed Database Concepts - Distributed Data Storage – Distributed Transactions – Commit Protocols – Concurrency Control – Distributed Query Processing – Case Studies

Suggested Activities: Assignments and Case Study

Suggested sources: NPTEL and <http://mazzola.iit.uni-miskolc.hu/tempus/discom/doc/db/tema01a.pdf>

MODULE 2: OBJECT AND OBJECT RELATIONAL DATABASES(9)

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 – Object Relational and Extended – Relational Systems: Object Relational features in SQL/Oracle – Case Studies.

Suggested Activities: Assignments and Case Study

Suggested sources: NPTEL and https://www.uio.no/studier/emner/matnat/ifi/INF3100/v13/undervisningsmateriale/lysark/sect10_3-

MODULE 3: INTELLIGENT DATABASES**(9)**

Active Databases: Syntax and Semantics (Starburst, Oracle, DB2)- Taxonomy- Applications- Design Principles for Active Rules- Temporal Databases: Overview of Temporal Databases- TSQL2- Deductive Databases: Logic of Query Languages - Datalog- Recursive Rules- Syntax and Semantics of Datalog Languages- Implementation of Rules and Recursion- Recursive Queries in SQL- Spatial Databases- Spatial Data Types- Spatial Relationships- Spatial Data Structures-Spatial Access Methods- Spatial DB Implementation.

Suggested Activities: Assignments and Case Study

Suggested sources: <https://www.cse.iitb.ac.in/~cs6212011/.../Intelligent%20Database%20Systems.ppt>

MODULE 4: ADVANCED DATA MODELS**(9)**

Mobile Databases: Location and Handoff Management - Effect of Mobility on Data Management - Location Dependent Data Distribution - Mobile Transaction Models - Concurrency Control - Transaction Commit Protocols- Multimedia Databases- Information Retrieval- Data Warehousing- Data Mining- Text Mining.

Suggested Activities: Assignments and Case Study

Suggested sources: <https://www.slideshare.net/avnishpatel165/multimedia-database-56310108>, <https://www.geeksforgeeks.org/dbms-multimedia-database/>

MODULE 5: EMERGING TECHNOLOGIES**(9)**

XML Databases: XML-Related Technologies-XML Schema- XML Query Languages- Storing XML in Databases-XML and SQL- Native XML Databases- Web Databases- Geographic Information Systems- Biological Data Management- Cloud Based Databases: Data Storage Systems on the Cloud- Cloud Storage Architectures-Cloud Data Models- Query Languages- Introduction to Big Data-Storage-Analysis.

Suggested Activities: Assignments and Case Study

Suggested sources: <https://www.tutorialspoint.com/xml/>, <https://www.techwalla.com/articles/what-is-a-web-database> <https://www.ibm.com/cloud/learn/what-is-cloud-database>

TEXT BOOKS

- | | |
|---|--|
| 1 | Approach to Design, Implementation, and Management”, Sixth Edition ,Pearson Education, 2015. |
|---|--|

REFERENCE BOOKS

- | | |
|---|--|
| 1 | Ramez Elmasri & Shamkant B.Navathe, “Fundamentals of Database Systems”, Seventh Edition , Pearson Education , 2016. |
| 2 | Tamer Ozsu M., Patrick Ualduriel, “Principles of Distributed Database Systems”, Second Edition, Pearson Education, 2003. |
| 3 | Prabhu C.S.R., “Object Oriented Database Systems”, PHI, 2003. |
| 4 | Peter Rob and Corlos Coronel, “Database Systems - Design, Implementation and Management”, Thompson Learning, Course Technology, 9th Edition, 2011. |
| 5 | Henry F Korth, Abraham Silberschatz, S. Sudharshan, “Database System Concepts”, Seventh Edition, McGraw Hill, 2010. |

E BOOKS	
1	http://aries.ektf.hu/~hz/pdf-tamop/pdf-xx/Radvanyi-hdbms-eng2.pdf
2	https://dsinghpune.wordpress.com/advanced-database-management-system/
MOOC	
1	https://www.coursera.org/learn/distributed-database
2	https://nptel.ac.in/courses/106106093/38

ELECTIVES
DEPARTMENT ELECTIVE I

COURSE TITLE		ADVANCED DATA COMMUNICATIONS		CREDITS	3
COURSE CODE		CSA3721	COURSE CATEGORY	PE	L-T-P-S
CIA		50 %		ESE	50 %
LEARNING LEVEL		BTL-3 APPLY			
CO	OUTCOMES				PO
1	Compare different network architectures				2
2	Implement ATM protocol architecture and services.				11
3	Design techniques to control the congestion in the network.				1
4	Apply the different routing protocols to find the shortest path.				2
5	Design the ISA with the associated protocols.				2
Prerequisites : Computer Networks					
MODULE 1: NETWORK ARCHITECTURES					(9)
The need for speed and quality of service, Advanced TCP/IP and ATM Networks, The need for a protocol architecture, The TCP/IP protocol architecture, The OSI model, Internetworking, TCP, UDP, Ipv6.					
MODULE2: ATM NETWORKS					(9)
Packet-switching networks, Frame relay networks, ATM protocol architecture, ATM logical connections, ATM cells, ATM service categories, ATM Adaptation Layer (AAL), The emergence of high-speed LANs, Ethernet, Fibre channel, Wireless LANs.					
MODULE 3: TRAFFIC MANAGEMENT(9)					
Congestion control in data networks and internets, Effects of congestion, Congestion and control, Traffic management, Congestion control in Packet-Switching networks, Frame relay congestion control, The need for flow and error control, Link control mechanisms, ARQ performance, TCP flow control, TCP congestion control performance of TCP over ATM.					
MODULE 4: ROUTING PROTOCOLS					(9)
Overview of graph theory and least-cost paths, Elementary concepts of graph theory, Shortest path length determination, Internet routing principles, Distance-Vector protocol, RIP, Link-State protocol, OSPF, Path-Vector protocols, BGP and IDRP, Multicasting.					
MODULE 5: ADVANCED NETWORKING CONCEPTS					(9)
Integrated Services Architecture (ISA), Queuing discipline, Random early detection, Differentiated services, Real-Time traffic, Resource Reservation : RSVP, Multiprotocol label switching, Real-Time Transport Protocol (RTP).					
TEXT BOOKS					
1	William Stallings, "Data and Computer Communications", 9th Ed., Pearson Education.				

REFERENCE BOOKS	
1	Willam Stallings, "High Speed Networks and Internets - Performance and Quality of Service", 2nd Ed., Pearson Education.
2	Andrew S. Tanenbaum, "Computer Networks", 4th Ed., Pearson Education.
3	James F. Kurose, Keith W. Ross, "Computer Networking: A Top-Down Approach featuring the Internet", 3rd edition, Pearson Education, 2005.
4	William Stallings, "Data and Computer Communications", 9th Ed., Pearson Education.
MOOC	
1	https://www.coursera.org/learn/data-communication-network-services

COURSE TITLE		WIRELESS SENSOR NETWORKS			CREDITS	3
COURSE CODE	CSA3722	COURSE CATEGORY	PE	L-T-P-S	3- 0- 0- 0	
CIA	50%			ESE	50%	
LEARNING LEVEL	BTL 3 - APPLY					
CO	OUTCOMES			PO		
1	Know the basics of Wireless Sensor Networks and Sensor Nodes.			1, 7, 11		
2	Work with the simulation tools			1, 4, 11		
3	Design a deployment scheme			1, 3, 4		
4	Analyze various MAC Protocol and its functions.			1, 2, 11		
5	Design energy efficient routing protocol for WSN			1,2,3		
6	Recall the Network Management and Middleware services.			1, 2, 3		
7	Recall various security techniques in WSN			1, 3, 4, 6, 8		
8	Design WSN for practical applications			1, 2, 9, 11		
Prerequisites : Basic concepts on Data Communications and Networking						
MODULE 1: FUNDAMENTALS OF SENSOR NETWORKS						(9)
Introduction and Overview - Overview of sensor network protocols, architecture, and applications, Challenges, Main features of WSNs; Research issues and trends, Platforms- Standards and specifications-IEEE802.15.4/ Zigbee, Hardware: Telosb, Micaz motes, Software: Overview of Embedded operating systems-Tiny OS, Introduction to Simulation tools- TOSSIM, OPNET, Ns-2.						
Suggested Activities: Simulate WSN using simulations tools.						
Suggested sources: https://nptel.ac.in/courses/106105160/21						
MODULE 2: COMMUNICATION CHARACTERISTICS AND DEPLOYMENT MECHANISMS						(9)

<p>Wireless Communication characteristics - Link quality, fading effects, Shadowing, Localization, Connectivity and Topology - Sensor deployment mechanisms, Coverage issues, Node discovery protocols.</p> <p>Suggested Activities: Design a framework for Node discovery and localization</p> <p>Suggested sources: https://dl.acm.org/citation.cfm?id=3127407</p>	
MODULE 3: MAC LAYER(9)	
<p>Fundamentals of Medium access protocol- Medium access layer protocols - Energy efficiency, Power allocation and Medium access control issues.</p> <p>Suggested Activities: Write a survey on performance evaluation of various MAC Protocols</p> <p>Suggested sources: http://shodhganga.inflibnet.ac.in/bitstream/10603/45996/18/18_summary.pdf</p>	
MODULE 4: NETWORK LAYER AND TRANSPORT LAYER (9)	
<p>Network layer protocols-Data dissemination and processing, multichip and cluster based routing protocols- Energy efficient routing- Geographic routing, Transport layer- Transport protocol Design issues- Performance of Transport Control Protocols.</p> <p>Suggested Activities: Modify Transport Protocol for effective QoS.</p> <p>Suggested sources: https://www.springer.com/cda/content/document/cda_downloaddocument/9789811004117-c2.pdf?SGWID=0-0-45-1551093-p177882352</p>	
MODULE 5: MIDDLEWARE AND SECURITY ISSUES (9)	
<p>Middleware and Application layer -Data dissemination, Data storage, Query processing, Security - Privacy issues, Attacks and Countermeasures.</p> <p>Suggested Activities: Design and implement real world WSN application.</p> <p>Suggested sources: https://www.edx.org/course/sensors-and-devices-in-the-iot</p>	
TEXT BOOKS	
1	Holger Karl & Andreas Willig, "Protocols And Architectures for Wireless Sensor Networks", John Wiley, 2005.
2	N. P. Mahalik, "Sensor Networks and Configuration: Fundamentals, Standards, Platforms, and Applications" Springer Verlag, 2007.
REFERENCE BOOKS	
1	Waltenegus Dargie, Christian Poellabauer , "Fundamentals of Wireless Sensor Networks, Theory and Practice", Wiley Series on wireless Communication and Mobile Computing, 2007.
2	Kazem Sohraby, Daniel manoli , "Wireless Sensor networks- Technology, Protocols and Applications", Wiley InterScience Publications 2010.
3	Bhaskar Krishnamachari , " Networking Wireless Sensors", Cambridge University Press, 2005.
4	C.S Raghavendra, Krishna M.Sivalingam, Taieb znati , "Wireless Sensor Networks", Springer Science 2004.,
E BOOKS	

1	https://www.intechopen.com/books/smart-wireless-sensor-networks
2	https://www.springer.com/cda/content/document/cda_downloadaddocument/9781447155041-c2.pdf?SGWID=0-0-45-1427120-p175382017
MOOC	
1	https://nptel.ac.in/courses/106105160/21
2	https://www.upf.edu/en/web/mooc-upf/-/hands-on-wireless-sensor-networks

COURSE TITLE		INFORMATION SECURITY ARCHITECTURE		CREDITS	3
COURSE CODE	CSA3723	COURSE CATEGORY	PE	L-T-P-S	3- 0- 0- 0
CIA	50%			ESE	50%
LEARNING LEVEL	BTL5 - DESIGN				
CO	OUTCOMES				PO
1	The basics of information security				1,
2	Use the legal, ethical and professional issues in Information Security				2,3
3	Explain Risk management				1
4	Design the logic of various standards				1,3,4
5	Implement Information Security procedures.				10
Prerequisites : NIL					
MODULE 1: INTRODUCTION(9)					
History, Information Security Critical Characteristics of Information, NSTISSC Security Model, Components of an Information System, Securing the Components, Balancing Security and Access, The SDLC, The Security SDLC.					
MODULE 2: SECURITY INVESTIGATION (9)					
Need for Security, Business Needs, Threats, Attacks, Legal, Ethical and Professional Issues Suggested Activities: Design a Secure Business Model Suggested sources: https://dynamapper.com/blog/278-books-about-information-architecture					
MODULE 3: SECURITY ANALYSIS(9)					
Risk Management: Identifying and Assessing Risk, Assessing and Controlling Risk Suggested Activities: Identifying and Assess the Risk					
MODULE 4: LOGICAL DESIGN(9)					
Blueprint for Security, Information Security Policy, Standards and Practices, ISO 17799/BS 7799, NIST Models, VISA International Security Model, Design of Security Architecture, Planning for Continuity. Suggested Activities: To prepare a blueprint for security design of an organisation					

MODULE 5: PHYSICAL DESIGN (9)	
Security Technology, IDS, Scanning and Analysis Tools, Cryptography, Access Control Devices, Physical Security, Security and Personnel.	
TEXT BOOKS	
1	Michael E Whitman and Herbert J Mattord, "Principles of Information Security", Vikas Publishing House, New Delhi, 2012.
REFERENCE BOOKS	
1	Micki Krause, Harold F. Tipton, " Handbook of Information Security Management", Vol 1-3 CRC Press LLC, 2004.
2	Stuart Mc Clure, Joel Scrambray, George Kurtz, "Hacking Exposed", Tata McGraw-Hill, 2003.
3	Matt Bishop, " Computer Security Art and Science", Pearson/PHI, 2002.
E BOOKS	
1	https://dynamapper.com/blog/278-books-about-information-architecture
2	https://www.cyberark.com/blog/8-books-every-security-architect-must-read/

SOFTWARE ENGINEERING			CREDITS	3	
COURSE CODE	CSA3724	COURSE CATEGORY	PE	L-T-P-S	3- 0- 0- 0
CIA	50%		ESE	50%	
LEARNING LEVEL	BTL6 - CREATE				
CO	OUTCOMES			PO	
1	To apply the software engineering lifecycle by demonstrating competence in communication, planning, analysis, design, construction, and deployment			1,4	
2	An ability to work in one or more significant application domains			2,3	
3	Work as an individual and as part of a multidisciplinary team to develop and deliver quality software			6	
4	Demonstrate an understanding of and apply principles in Multidisciplinary environment based on economic and financial terms.			7	
5	Demonstrate an ability to use the techniques and tools necessary for engineering practice			5	
Prerequisites : NIL					
MODULE 1: INTRODUCTION AND AGILE DEVELOPMENT					(9)
Software and Software Engineering-Process Model-Agile Development- What is Agility? -Agile Process- Extreme Programming- Adaptive Software Development-Scrum-Dynamic System Development Method-Crystal-FDD-LSD-Agile Modelling- Agile Unified Process- Tool set for Agile					

Process	
Suggested Activities: Compare the historic models with agile for a business requirement and justify	
MODULE 2: UNDERSTANDING SOFTWARE REQUIREMENTS (9)	
Requirements Engineering-Establishing the Groundwork-Eliciting Requirements-Developing Use Cases-Building the requirements Model-Negotiating, validating Requirements-Requirements Analysis-Requirements Modeling on Scenarios, Information -Flow, Behaviors, Patterns and Web apps	
Suggested Activities: Identify the functional and nonfunctional requirements of a business requirements, justify how to negotiate the requirements when needed for a business requirement.	
MODULE 3: SOFTWARE DESIGN CONCEPTS (9)	
Design Concepts- Design Process-Design Model-Architectural design- Alternate Architectural Design- Architectural Mapping using data flow- Component level design- component based development-user interface design-webapp interface design-pattern based software design	
Suggested Activities: Design an architecture diagram and brief its transactional flow for a business requirement. Design a business requirements using UML	
MODULE 4: QUALITY MANAGEMENT (9)	
Quality Concepts-Review Techniques- Software Quality Assurance-Software Testing Strategies-Testing Conventional applications- Testing object oriented applications- Testing web applications- Verification and Validation-Software Configuration Management.	
Suggested Activities: Justify the quality of a web application using the latest testing tools, Identify and demonstrate the role of SCM Manager on a business project	
MODULE 5: MANAGING SOFTWARE PROCESS (9)	
Project Management Concepts-Estimation for software Projects-Project Scheduling -Risk Management-Software Reengineering- Reverse Engineering- Software Process Improvement-CMMI- People CMM-Emerging trends in software engineering	
Suggested Activities: Estimate the budget for the business and conduct project bidding among groups	
TEXT BOOKS	
1	“Software Engineering A Practitioner’s Approach” Roger S PressmanTata McGraw-Hill seventh edition, 2010
REFERENCE BOOKS	
1	Roger S. Pressman, “Software Engineering – A Practitioner’s Approach”, Tata McGraw-Hill seventh edition, 2009.
2	Richard Fairley, “Software Engineering Concepts” –, Tata Mcgraw Hill, 2008.
3	Ian Sommerville, “Software Engineering”, Seventh Edition, Pearson Education Asia, 2007.
4	Gopalswamy Ramesh, Ramesh Bhattiprolu, “Software Maintenance” Tata Mcgraw Hill,2003.
5	Shari Lwarence Pfleeger, Joanne M.Atlee “Software Engineering Theory and Practice” , Third Edition, Pearson Education, 2006.

6	Alistair Cockburn, "Agile Software Development", First Edition, Pearson Education Asia, 2001.
7	Hans Van Vliet "Software Engineering: Principles and Practices" –, Wiley; 3 edition, 2008.
E BOOKS	
1	http://dinus.ac.id/repository/docs/ajar/RPL-7th_ed_software_engineering_a_practitioners_approach_by_roger_s._pressman_.pdf
2	Software design- http://www.dim.uchile.cl/~juaperez/beto/otro.bueno.pdf
MOOC	
1	https://www.edx.org/course/software-engineering-essentials
2	https://www.coursera.org/learn/software-processes-and-agile-practices
3	https://nptel.ac.in/courses/106101061/

DEPARTMENT ELECTIVE II

COURSE TITLE	CLOUD COMPUTING			CREDITS	3
COURSE CODE	CSA3725	COURSE CATEGORY	PE	L-T-P-S	3- 0- 0- 0
CIA	50%			ESE	50%
LEARNING LEVEL	BTL-3 APPLY				
CO	OUTCOMES				PO
1	Develop and deploy cloud application using popular cloud platforms.				1
2	Design and develop highly scalable cloud-based applications by creating and configuring virtual machines on the cloud and building private cloud.				2
3	Explain and identify the techniques of big data analysis in cloud.				1
4	Compare, contrast, and evaluate the key trade-offs between multiple approaches to cloud system design, and Identify appropriate design choices when solving real-world cloud computing problems.				2
5	Write comprehensive case studies analysing and contrasting different cloud computing solutions.				3
6	Understand and use Infrastructure Benchmarking				3
Prerequisites : Operating Systems, Computer Networks					
MODULE 1: INTRODUCTION					(9)
Introduction - Essentials - Benefits - Business and IT Perspective - Cloud and Virtualization - Cloud Services Requirements - Cloud and Dynamic Infrastructure - Cloud Computing Characteristics - Cloud Adoption. Cloud Models - Cloud Characteristics - Measured Service - Cloud Models - Security in a Public Cloud - Public versus Private Clouds - Cloud Infrastructure Self Service.					
MODULE 2: CLOUD SERVICES AND SOLUTIONS					(9)
Gamut of Cloud Solutions - Principal Technologies - Cloud Strategy - Cloud Design and Implementation using SOA - Conceptual Cloud Model - Cloud Service Defined. Cloud Solutions - Introduction - Cloud Ecosystem - Cloud Business Process Management - Cloud Service Management - Cloud Stack - Computing on Demand (CoD) - Cloud sourcing.					
MODULE 3: CLOUD OFFERINGS AND CLOUD MANAGEMENT					(9)
Cloud Offerings - Information Storage, Retrieval, Archive and Protection - Cloud Analytics - Testing under Cloud - Information Security - Virtual Desktop Infrastructure - Storage Cloud. Cloud Management - Resiliency - Provisioning - Asset Management - Cloud Governance - High Availability and Disaster Recovery - Charging Models, Usage Reporting, Billing and Metering					
MODULE 4: CLOUD VIRTUALIZATION TECHNOLOGY					(9)
Virtualization Defined - Virtualization Benefits - Server Virtualization - Virtualization for x86					

Architecture - Hypervisor Management Software - Logical Partitioning (LPAR) - VIO Server - Virtual Infrastructure Requirements - Storage virtualization - Storage Area Networks - Network-Attached storage - Cloud Server Virtualization - Virtualized Data Center

MODULE 5: CLOUD, SOA AND INFRASTRUCTURE BENCHMARKING (9)

SOA and Cloud - SOA Defined - SOA and IaaS - SOA-based Cloud Infrastructure Steps - SOA Business and IT Services. OLTP Benchmark - Business Intelligence Benchmark - e-Business Benchmark - ISV Benchmarks Cloud Performance Data Collection and Performance Monitoring Commands Benchmark Tools.

TEXT BOOKS

1	Kumar Saurabh, "Cloud Computing: Insights into New-Era Infrastructure", Wiley India Pvt. Ltd, 2011.
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REFERENCE BOOKS

1	Thomas Erl, Zaigham Mahmood, and Ricardo Puttini, "Cloud Computing Concepts, Technology & Architecture", Prentice Hall, 2013.
2	John Rhoton, "Cloud Computing Explained: Implementation Handbook for Enterprises", Recursive Press, 2013.
3	George Reese, "Cloud Application Architectures: Building Applications and Infrastructure in the Cloud (Theory in Practice)", O'Reilly, 2009.

E BOOKS

1	https://www.manning.com/books/exploring-cloud-computing
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MOOC

1	https://www.mooc-list.com/course/cloud-computing-applications-part-1-cloud-systems-and-infrastructure-coursera
2	https://www.mooc-list.com/course/cloud-computing-concepts-part-2-coursera

COURSE TITLE		HUMAN COMPUTER INTERACTION		CREDITS	3
COURSE CODE	CSB3730	COURSE CATEGORY	PE	L-T-P-S	3- 0- 0- 0
CIA	50%		ESE	50%	
LEARNING LEVEL	BTL – 3 (APPLY)				
CO	OUTCOMES				PO
1	Relate Human Computer Interaction and summarize its importance				1
2	Identify the user’s capabilities and recommend guidelines for interfaces				2
3	Design Human Computer Interfaces and implement them				3
4	Test and Evaluate the Usability of Human Computer Interaction				6
5	Formulate advanced user Interaction for real time applications				4
Prerequisite : NIL					

MODULE 1:INTRODUCTION (9)	
Human Computer Interaction –Background – Importance of Human Computer Interaction – Software development and Human Computer Interaction – Display devices – Models of interaction – context of interaction.	
MODULE 2:USER CAPABILITIES (9)	
Users’ physical capabilities – Cognition – Design considerations – Memory – guidelines for interfaces – Memory and learning – Computer Human Systems.	
MODULE 3:INTERFACE DESIGN (9)	
Principles of Interface Design – Classification of Interaction Styles – Linguistic manipulations – Design Considerations – User Classification and User Types – Design process – Strategies for design representation – Dialogue design notations – Case Studies Suggested Activity – Study of standard user interfaces on the Internet	
MODULE 4: TESTING AND EVALUATION (9)	
Importance of Evaluation – Evaluation Techniques –Usability Engineering – Usability Process – Usability Metrics – Socio Technical Design – Ergonomics, Health and Safety – Social Implications. Suggested Activity – Apply usability metrics to critically evaluate commercial products.	
MODULE 5: VARIETIES OF INTERACTION (9)	
Modeling rich Interactions – Sensor based interactions – Ubiquitous Computing – Virtual and Augmented Reality – Information Visualization. – Multimedia User Interface Design – Mobile Interaction – Human-Computer Interaction and the Web – Human-Centered Design of Decision- Support Systems –Online Communities –Virtual Environments –Privacy, Security, and Trust: Human- Computer Interaction Challenges and Opportunities. Suggested Activity – To carry out research on latest human interaction systems and the related technology.	
TEXT BOOKS	
1	Christine Faulkner, “The Essence of Human-Computer Interaction”, First Edition, Pearson Education, 2010
2.	Julie A.Jacko, “The Human Computer Interaction Handbook Fundamentals, Evolving Technologies, and Emerging Applications”, Third Edition, CRC Press, Taylor & Francis Group, 2012
REFERENCE BOOKS	
1	Wilbert O Galitz, “The essential guide to user interface design”, 3rd Edition, , Wiley , 2007.
2	Ben Shneidermann , Catherine Plaisant, “Designing the user interface, Strategies for effective Human Computer Interaction”, 3rd Edition, Pearson Education, 2008.
3	Alan Dix, Janet Finlay, GreGoryd, Abowd, Russell Beale,“Human – Computer Interaction”, 3rd Edition, Pearson Education, 2004
MOOC	
1	https://www.class-central.com/course/nptel-introduction-to-human-computer-interaction-9906

COURSE TITLE		DIGITAL FORENSICS			CREDITS	3
COURSE CODE		CSA3727	COURSE CATEGORY	PE	L-T-P-S	3- 0- 0- 0
CIA		50%			ESE	50%
LEARNING LEVEL		BTL-3 (APPLY)				
CO	OUTCOMES					PO
1	Summarize the overview and categories of cyber crime					1
2	List out the cybercrime issues					1
3	Recall the digital laws in cyber crime					1
4	List and use the cyber crime tools and evidence					2
5	Apply recovering digital evidences and forensics					3
Prerequisites : NIL						
MODULE 1: INTRODUCTION						(9)
Introduction: Introduction and Overview of Cyber Crime, Nature and Scope of Cyber Crime, Types of Cyber Crime Social Engineering, Categories of Cyber Crime, Property Cyber Crime.						
MODULE 2: CYBER CRIME ISSUES						(9)
Cyber Crime Issues: Unauthorized Access to Computers, Computer Intrusions, white collar Crimes, Viruses and Malicious Code Internet Hacking and Cracking, Virus Attacks.						
MODULE 3: SOFTWARE PIRACY AND LAWS						(9)
Software Piracy, Pornography, Intellectual Property, Mail Bombs, Exploitation, Stalking and Obscenity in Internet, Digital laws and legislation, Law Enforcement Roles and Responses.						
MODULE 4: CYBER CRIME INVESTIGATIONS						(9)
Introduction to Cyber Crime Investigation, Investigation Tools, eDiscovery, Digital Evidence Collection, Evidence Preservation.						
MODULE 5: E-MAIL INVESTIGATION						(9)
Investigation: E-Mail Investigation, E-Mail Tracking, IP Tracking, E-Mail Recovery, Hands on Case Studies. Encryption and Decryption Methods, Search and Seizure of Computers, Recovering Deleted Evidences, Password Cracking.						
TEXT BOOKS						
1	Nelson Phillips and EnfingerSteuart, "Computer Forensics and Investigations", Cengage Learning, New Delhi, 2004.					
REFERENCE BOOKS						
1	Kevin Mandia, Chris Prosize, Matt Pepe, "Incident Response and Computer Forensics ", Tata McGraw - Hill, New Delhi, 2006					
2	Robert M Slade," Software Forensics", Tata McGraw - Hill, New Delhi, 2005.					
3	Bernadette H Schell, Clemens Martin, "Cybercrime", ABC - CLIO Inc, California, 2004.					
4	"Understanding Forensics in IT ", NIIT Ltd, 2005.					
E BOOKS						

1	https://www.open.edu/openlearn/science-maths-technology/digital-forensics/content-section-0?active-tab=description-tab
MOOC	
1	https://www.mooc-list.com/course/computer-forensics-edx

COURSE TITLE		PERFORMANCE METRICS FOR ADVANCED COMPUTING			CREDITS	3
COURSE CODE	CSA3728	COURSE CATEGORY	PE	L-T-P-S	3- 0- 0- 0	
CIA	50%			ESE	50%	
LEARNING LEVEL	BTL-3 - APPLY					
CO	OUTCOMES				PO	
1	Apply basic performance metrics to measure the performance of a computer systems.				1,2,3	
2	Use Principles of Experimentation for simulations				1,2,3	
3	Use performance metrics and Non Performance metrics for computing				1,2,3	
4	Measuring Performance of Real time Applications				1,2,3	
5	Measuring Performance of Advanced Computing Applications				1,2,3	
Prerequisites : Operating Systems, Computer Networks, Computer Architecture						
MODULE 1: Performance of Computer Systems					(6+6)	
Performance of Computer Systems, Technology - Circuit speed (clock, MHz), Processor technology (how many transistors on a chip), Organization - Type of processor (ILP), Configuration of the memory hierarchy, type of I/O devices, Number of processors in the system, Software - Quality of the compilers, Organization & quality of OS, databases, etc.						
Suggested Activities: Design a computing Device for the given performance.						
Suggested sources: https://www.dellemc.com/hi-in/solutions/high-performance-computing/index.htm						
MODULE 2: Principles of Experimentation					(6+6)	
Principles of Experimentation - Meaningful metrics, Reproducibility, Real programs, Simulation Metrics.						
Suggested Activities: Design a simulation application for the simple HPC.						
Suggested sources: https://www.ansys.com/en-in/products/platform/ansys-high-performance-computing .						
MODULE 3: Metrics that Measure Performance					(6+6)	
Metrics that Measure Performance - Execution time, Throughput, Raw speed, Clock Speed, Component metrics, Metrics Not to Performance Use - MIPS, MFLOPS, Variation of Means - arithmetic, harmonic, weighted means, Speedup, Scalability						

Suggested Activities: Design a Cluster with given Performance Metrics.	
Suggested sources: https://aapm.onlinelibrary.wiley.com/doi/pdf/10.1002/mp.12025	
MODULE 4: Case Study (6+6)	
Challenges of Measuring Performance with Real Applications – HPC, Cloud, Kernels.	
Suggested Activities: Survey on Challenges of Measuring Performance with HPC. Suggested sources: https://www.hpcwire.com/2006/07/21/seven_challenges_of_high_performance_computing-1	
MODULE 5: Advanced Metrics (6+6)	
Advanced Computing Metric System - Consistent Representation of Information, Explicit Relationships Repository of Definitions, Comparability, Flexibility and Adaptability, Composability.	
Suggested Activities: Suggest a Computing Metrics for Modern HPC.	
Suggested sources: http://journals.sagepub.com/doi/full/10.1177/1094342015593158 .	
TEXT BOOKS	
1	Brendan Gregg, "Systems Performance: Enterprise and the Cloud", 1st Edition, Holdings Private Limited, 2016.
2	Randal S, "Python Machine Learning, PACKT Publishing, 2016.
REFERENCE BOOKS	
1	Cloud Computing Service Metrics Description, NIST, 2017
2	Grid Computing Performance Metrics Framework, NIST, 2013
3	Nasir Abbas, Yan Zhang, Amir Taherkordi, Tor Skeie, "Mobile Edge Computing: A Survey", Internet of Things Journal IEEE, vol. 5, no. 1, pp. 450-465, 2018.
E BOOKS	
1	http://www.brightcomputing.com/free-ebook-hpc
MOOC	
1	https://www.coursera.org/learn/quantitative-formal-modeling-1



DEPARTMENT ELECTIVE III

COURSE TITLE		INTRODUCTION TO INTELLIGENT SYSTEMS			CREDITS	3
COURSE CODE		CSA372 9	COURSE CATEGORY	PE	L-T-P-S	3- 0- 0- 0
CIA		50%			ESE	50%
LEARNING LEVEL		BTL3 (ANALYZE)				
CO	OUTCOMES					PO
1	Apply the knowledge and reasoning in real world					1,2,3
2	Apply the probabilistic learning models					1,2,3
3	Describe, analyze and apply techniques for constraint satisfaction problems					1
4	determine which type of intelligent system methodology would be suitable for a given type of application problem					1,2
5	Develop an intelligent system for a selected application.					6
Prerequisites : Softcomputing, Artificial Intelligence						
MODULE 1: AI INTRODUCTION(9)						
Introduction -Intelligent Agents -Problem Solving -Solving Problems by Searching - Beyond Classical Search - Adversarial Search - Constraint Satisfaction Problems. Suggested Activities: Discuss the history and implications of Artificial Intelligence research Suggested sources: https://www.jair.org/index.php/jair						
MODULE 2: KNOWLEDGE AND REASONING						(9)
Logical Agents -First-Order Logic - Inference in First-Order Logic -Classical Planning - Planning and Acting in the Real World -Knowledge Representation. Suggested Activities: Describe attributes of search techniques and the situations Suggested sources: https://www.library.ohio.edu/research/the-research-process/basic-search-techniques/						
MODULE 3: UNCERTAIN KNOWLEDGE AND REASONING						(9)
Quantifying Uncertainty -Probabilistic Reasoning - Probabilistic Reasoning over Time -Making Simple Decisions -Making Complex Decisions. Suggested Activities: Dealing with uncertainty Suggested sources: https://www.sciencedirect.com/science/article						
MODULE 4: LEARNING						(9)
Learning from Examples - Knowledge in Learning - Learning Probabilistic Models -Reinforcement Learning -Communicating, Perceiving, and Acting-Natural Language Processing - Natural Language for Communication- Perception Suggested Activities: Describe and apply techniques for automated learning						

Suggested sources: https://www.tutorialride.com/artificial-intelligence/learning-and-expert-system-in-ai.htm	
MODULE 5: EXPERT SYSTEM (9)	
Defining Expert Systems – Expert system architecture-Robot Architectures Suggested Activities: Implement standard algorithms for intelligent system Suggested sources: https://www.ncbi.nlm.nih.gov/pubmed/29126697	
TEXT BOOKS	
1	Stuart Russel and Peter Norwig , “Artificial Intelligence: A Modern Approach”, Prentice Hall third edition, 2012.
REFERENCE BOOKS	
1	Kevin Knight, Eline Rich B.Nair, “Artificial Intelligence”, McGraw Hill Education 3rd edition 2012.
E BOOKS	
1	https://www.amazon.in/INTRODUCTION...INTELLIGENCE...ebook/dp/B015DY3L5
2	www.academia.dk/.../Artificial_Intelligence-A_Guide_to_Intelligent_Systems.pdf
MOOC	
1	https://nptel.ac.in/courses/108104049/

COURSE TITLE		HIGH PERFORMANCE COMPUTING		CREDITS	3
COURSE CODE	CSA3730	COURSE CATEGORY	PE	L-T-P-S	3- 0- 0- 0
CIA		50%		ESE	50%
LEARNING LEVEL		BTL 4 (ANALYZE)			
CO	OUTCOMES				PO
1	Describe the concept of super computing				1
2	Explain the HPC architecture.				1
3	Create a cluster with n nodes and manage the created cluster.				1,2,4,5
4	Illustrate the Symmetric multi-processor architecture.				1
5	Apply parallel algorithm for a suitable application and measure the performance.				1,2,3,4,5
6	Use Open MP programming to solve appropriate problem.				1,2,3,4,5
Prerequisites : 1. Computer Architecture 2. Design and analysis of Algorithms					
MODULE 1: INTRODUCTION (9)					
High performance Computing - Impact of Super computing systems – Anatomy of Super Computing – Computer Performance – History of Super Computing.					
MODULE 2:HPC ARCHITECTURE					(9)

Key properties of HPC Architecture - Parallel Architecture family - Enabling Technology - von-Neumann Sequential processor - Vector & Pipelining - Single instruction, Multiple data array - Multi processors - heterogeneous Computer structures.

Suggested sources: <https://www.youtube.com/watch?v=NIqrWds0cy0>

MODULE 3: COMMODITY CLUSTERS (9)

Introduction - Hardware architecture - Programming interfaces - Software Environment - Basic methods of Use.

Suggested Activities: Create n node cluster in Windows server

Suggested sources: <https://www.youtube.com/watch?v=-vD6PUdf3Js>

MODULE 4: SYMMETRIC MULTI PROCESSOR ARCHITECTURE (9)

Architecture over view -Amdhal's law - Processor core architecture - Memory hierarchy - PCI bus - External I/O interfaces.

Suggested sources: <https://www.youtube.com/watch?v=PBPVLJwN0IY>

MODULE 5: PARALLEL ALGORITHM AND OPENMP(9)

Introduction to Parallel algorithm - Fork-Join, Divide and Conquer, manager - worker. OpenMP- Overview of OpenMP Programming model - Parallel threads and loops -Synchronization- Reduction. **Suggested Activities:** Implement parallel algorithm using OpenMP.

Suggested sources: <https://www.youtube.com/watch?v=nE-xN4Bf8XI>

<https://www.youtube.com/watch?v=6jFkNjhj-Z4>

TEXT BOOKS

- | | |
|---|---|
| 1 | Thomas Sterling , Matthew Anderson , Maciej Brodowicz , "High Performance Computing: Modern Systems and Practices", 1st Edition , Morgan Kaufman publishers, 2017 |
|---|---|

REFERENCE BOOKS

- | | |
|---|--|
| 1 | John L. Hennessy and David A. Patterson, Computer Architecture: A Quantitative Approach, Morgan Kaufmann. 5 th Edition 2011 |
| 2 | John Paul Shen and Mikko H. Lipasti, Modern Processor Design: Fundamentals Superscalar Processors, Tata McGraw-Hill. 2005 |
| 3 | Kai Hwang and Briggs, Computer Architecture and Parallel Processing, McGraw-Hill , 2012 |
| 4 | M. J. Flynn, Computer Architecture: Pipelined and Parallel Processor Design, Narosa Publishing House,2008 |
| 5 | Kai Hwang, Advanced Computer Architecture: Parallelism, Scalability, Programmability, McGraw-Hill, 3 rd Edition 2005. |

E BOOKS

- | | |
|---|---|
| 1 | https://www.free-ebooks.net/ebook/High-Performance-Computing/pdf |
|---|---|

MOOC

- | | |
|---|---|
| 1 | http://www.nptelvideos.in/2012/11/high-performance-computing.html |
|---|---|

COURSE TITLE		SOFTWARE SECURITY		CREDITS	3
COURSE CODE	CSA3731	COURSE CATEGORY	PE	L-T-P-S	3- 0- 0- 0
CIA		50%		ESE	50%
LEARNING LEVEL		BTL 3, 4, 5 & 6			
CO	OUTCOMES				PO
1	Explain software security fundamentals				PO3, PO5,
2	Do code review with a tool				PO2, PO5
3	Perform Security Testing				PO2, PO5
4	Identify the Security Gap				PO5
5	Analyse the files both statically and dynamically				PO5
Prerequisites : Security Software Engineering					
MODULE 1: SOFTWARE SECURITY FUNDAMENTALS					(9)
Defining a discipline : Security Problems in Software - The three pillars of software security -The rise of security engineering - Risk Management framework.					
MODULE 2: TOUCH POINTS OF SOFTWARE SECURITY					(9)
Introduction to software security touch points -Code review with a tool					
MODULE 3: SECURITY TESTING					(9)
Software penetration Testing - Risk Based Security Testing - Abuse Cases - Software Security meets security operations					
MODULE 4: SOFTWARE SECURITY GAP					(9)
Enterprise Software Security Program -Knowledge for software security - Taxonomy of coding errors					
MODULE 5: ANALYSIS OF FILES(9)					
Static and Dynamic analysis of files. Static analysis methods - feature selection, feature extraction and dataset creation - Dynamic analysis methods (use procmon)					
REFERENCE BOOKS					
1	Gary R.McGraw, "Software Security : Building Security In", Addison Wesley, 2006				
2	Sommerville, "Software Engineering", Adison Wesley, 10th Edition, 2016				
3	Pfleeger, "Software Engineering", Prentice Hall, 4th Edition, 2010				
4	Carlo Ghezzi, Mehdi Jazayari and Dino Mandrioli, "Fundamentals of Software Engineering", Prentice Hall of India, 2th Edition, 2004				
5	Craig Larman, "Agile and Iterative Development: A Manager's Guide", Pearson Education, 2009.				

6	M.Shaw and D. Garlan, "Software Architecture: Perspectives on an Emerging Discipline", Prentice Hall of India Private Limited , New Delhi 2010
E BOOKS	
1	https://www.amazon.com/Secure-Software-Design-Theodor-Richardson/.../14496263..
2	euref.kieskompas.nl/secure-software-design.pdf
MOOC	
1	ceur-ws.org/Vol-1977/paper3.pdf
2	https://pe.gatech.edu/courses/secure-software-development

COURSE TITLE		SOFTWARE QUALITY MANAGEMENT			CREDITS	3
COURSE CODE		CSA3732	COURSE CATEGORY	PE	L-T-P-S	3- 0- 0- 0
CIA		50%			ESE	50%
LEARNING LEVEL		BTL3 (APPLY)				
CO	OUTCOMES					PO
1	Relate to quality assurance plan					2,3
2	Apply quality assurance tools & techniques in their project					2,5
3	Learn the quality management principles					1
4.	procedures and work instructions in software organizations					1,2
5.	Quality certification Procedure					1
Prerequisites :Software Engineering						
MODULE 1: INTRODUCTION						(9)
The Software Quality Challenge - Software Quality Factors - Components of the Software Quality Assurance System. Pre-Project Software Quality Components - Contract Review - Development and Quality Plans Suggested activities: Analyse the Importance of quality Suggested sources: https://www.springer.com/gp/computer-science/software-engineering						
MODULE 2:SOFTWARE QUALITY ASSURANCE COMPONENTS IN THE PROJECT LIFE CYCLE(9)						
Integrating Quality Activities in the Project Life Cycle - Reviews - Software Testing - Strategies - Software Testing -Implementation - Assuring the Quality of Software Maintenance - Assuring The Quality of External Participants' Parts - Case Tools and their Affect on Software Quality.						

Suggested activities:Develop quality assurance models

Suggested sources:www.software-quality-assurance.org/

MODULE 3: SOFTWARE QUALITY INFRASTRUCTURE COMPONENTS(9)

Procedures and Work Instructions - Supporting Quality Devices - Staff Training, Instructing and Certification

- Preventive and Corrective Actions - Configuration Management - Documentation and Quality Records Controls

Suggested activities: Activities of software quality management

Suggested sources:<https://www.coursehero.com/file/13414800/Galin14/>

MODULE 4: SOFTWARE QUALITY MANAGEMENT COMPONENTS(9)

Progress Control- Components, Internal & External Participants, Progress control regimes, Computerized tools, Software Quality Metrics - Objective, Classification, Process & Product Metrics, Implementation & Limitation of Software Metrics - Software Quality Costs - Objective, Classification Model of cost, Extended Model and Applications

Suggested activities: Identify the software quality components

Suggested sources:<https://www.tandfonline.com/doi/abs/10.1080/0954412006874>

MODULE 5: STANDARDS, CERTIFICATION AND ASSESSMENT(9)

SQA Standards - ISO9001 Certification - Software Process Assessment. Organizing for Quality Assurance - Management and its Role in Quality Assurance - The Software Quality Assurance Unit - SQA Trustees and Committees

Suggested activities: Find out the quality standards implemented in your university

Suggested sources:<https://www.nibusinessinfo.co.uk/content/what-are-quality-management-standards>

TEXT BOOKS

- | | |
|---|--|
| 1 | Daniel Galin, "Software Quality Assurance: From Theory to Implementation", Pearson Addison-Wesley, 2012. |
|---|--|

REFERENCE BOOKS

- | | |
|---|---|
| 1 | Roger S. Pressman, "Software Engineering-A Practitioner's Approach", McGraw Hill pub.2010. |
| 2 | Allen Gilles "Software quality: Theory and management", International Thomson, Computer press 1997. |
| 3 | Stephen H.Kan, "Metrics and models in software quality Engineering", Addison -Wesley 2003. 39 |
| 4 | Humphrey Watts, "Managing the Software Process" Addison Wesley, 2017 |

E BOOKS

- | | |
|---|---|
| 1 | http://library.bec.ac.in/kbc/NOTES%20BEC/CSE/8%20SEM/Software%20Project%20Management.pdf |
| 2 | https://books.google.co.in/books?hl=en&lr=&id=XTvpAQAAQBAJ&oi=fnd&pg=PR3&d |

DEPARTMENT ELECTIVE IV

COURSE TITLE	COMPUTER VISION			CREDITS	3
COURSE CODE	CSA3733	COURSE CATEGORY	PE	L-T-P-S	3- 0- 0- 0
CIA	50%			ESE	50%
LEARNING LEVEL	BTL-3 (APPLY)				
CO	OUTCOMES				PO
1	Explain the fundamentals of image formation, transformation and analysis.				1,2,4,11
2	Explain the feature detection and tracking techniques.				1,2,4,11
3	Demonstrate various segmentation and alignment techniques				1,2,4,11
4	Explain Structure from Motion and Dense Motion Analysis methodologies				1,2,4,11
5	Implement various recognition techniques.				1,2,3,4,11
Prerequisites : Basic knowledge in Linear algebra and vector calculus					
MODULE 1: IMAGE FORMATION AND IMAGE PROCESSING					(9)
Introduction to computer vision-Geometric primitives-2D and 3D transformations-3D to 2D projections- Image formation- Lighting- Reflective and Shading. Histogram Equalization-Linear filtering- Non-Linear Filtering-Morphology-Distance transforms- Interpolation- Decimation.					
MODULE 2: FEATURE DETECTION AND TRACKING					(9)

Invariance-key points and 3D flow vectors- RANSAC-SIFT, SURF, ORB- Feature evaluation. Tracking and feature updation-Lucas-Kanade tracker-Kalman filter.	
MODULE 3: SEGMENTATION AND ALIGNMENT (9)	
Segmentation- Active contours, Graph based segmentation- Mean shift- Normalized cut. 2D feature based alignment-Least squares-Iterative algorithms-3D alignment -Pose estimation- Geometric intrinsic calibration.	
MODULE 4: STRUCTURE FROM MOTION AND DENSE MOTION ANALYSIS (9)	
Structure from motion (sfm)-Triangulation- Two frame sfm - Bundle adjustment. 3D motion and 2D optical flow -The Horn Schunck algorithm-Lucas-Kanade Algorithm- Performance evaluation of optical flow results.	
MODULE 5: RECOGNITION (9)	
Object detection- Face detection -Pedestrian detection- Face recognition- Eigenfaces- Active appearance and 3D shape models. Category recognition- Bag of words- Part-based models, Recognition with segmentation- Context and scene understanding.	
REFERENCE BOOKS	
1.	Computer Vision: Algorithms and Applications, Richard Szeliski, Springer International, 2011.
2.	Concise Computer Vision: An introduction into theory and Algorithms, Reinhard Klette,2014, Springer-Verlag London.
3.	R. Hartley and A. Zisserman, Multiple View Geometry in Computer Vision, Cambridge University Press, 2003.
4.	Computer vision - A modern Approach , David A forsyth & Jean ponce , Prentice Hall , 2002.
5.	"Computer vision and Applications" , Bernd Jahne and Horst HauBecker Academic press , 2000
E BOOKS	
1	http://szeliski.org/Book/drafts/SzeliskiBook_20100903_draft.pdf
MOOC	
1	https://in.udacity.com/course/introduction-to-computer-vision--ud810
2	https://www.edx.org/course/computer-vision-image-analysis-1

COURSE TITLE		BLOCK CHAIN TECHNOLOGY		CREDITS	3
COURSE CODE	CSA3734	COURSE CATEGORY	PE	L-T-P-S	3- 0- 0- 0
CIA	50%		ESE	50%	
LEARNING LEVEL	BTL-3 (APPLY)				
CO	OUTCOMES				PO
1	State the basic concepts of blockchain				1, 2
2	Paraphrase the list of Consensus				1, 2, 6
3	Demonstrate and Interpret working of Hyperledger Fabric				3, 4, 5
4	Implement SDK composer tool				2, 3, 4
5	Demonstrate the supply chain.				1, 2, 3, 4, 5
6	Explain the Digital identity for government				1, 2, 6, 8
Prerequisites :Basic idea in Networking, finance, Supply chain, Cryptography, Network Security					
MODULE 1: INTRODUCTION TO BLOCKCHAIN					(9)
History: Digital Money to Distributed Ledgers -Design Primitives: Protocols, Security, Consensus, Permissions, Privacy- : Blockchain Architecture and Design-Basic crypto primitives: Hash, Signature- Hashchain to Blockchain-Basic consensus mechanisms					
Suggested sources: http://https://onlinecourses.nptel.ac.in/noc18_cs47/unit?unit=6&lesson=55					
MODULE 2: CONSENSUS					(9)

<p>Requirements for the consensus protocols-Proof of Work (PoW)-Scalability aspects of Blockchain consensus protocols: Permissioned Blockchains-Design goals-Consensus protocols for Permissioned Blockchains</p> <p>Suggested sources: https://onlinecourses.nptel.ac.in/noc18_cs47/unit?unit=18&lesson=64</p>	
<p>MODULE 3: HYPERLEDGER FABRIC (9)</p>	
<p>Decomposing the consensus process-Hyperledger fabric components-Chaincode Design and Implementation: Hyperledger Fabric II:-Beyond Chaincode: fabric SDK and Front End-Hyperledger composer tool</p> <p>Suggested sources: https://onlinecourses.nptel.ac.in/noc18_cs47/unit?unit=31&lesson=66 https://onlinecourses.nptel.ac.in/noc18_cs47/unit?unit=37&lesson=67</p>	
<p>MODULE 4: USE CASE I (9)</p>	
<p>Blockchain in Financial Software and Systems (FSS): -Settlements, -KYC, -Capital markets-Insurance-Use case II: Blockchain in trade/supply chain: Provenance of goods, visibility, trade/supply chain finance, invoice management/discounting</p> <p>Suggested sources: https://onlinecourses.nptel.ac.in/noc18_cs47/unit?unit=45&lesson=68</p>	
<p>MODULE 5: USE CASE II (9)</p>	
<p>Blockchain for Government: Digital identity, land records and other kinds of record keeping between government entities, public distribution system / social welfare systems : Blockchain Cryptography : Privacy and Security on Blockchain</p> <p>Suggested sources: https://onlinecourses.nptel.ac.in/noc18_cs47/unit?unit=49&lesson=69</p>	
<p>TEXT BOOKS</p>	
1	Mark Gates, "Blockchain: Ultimate guide to understanding blockchain, bitcoin, cryptocurrencies, smart contracts and the future of money", Wise Fox Publishing and Mark Gates, 2017.
2	Salman Baset, Luc Desrosiers, Nitin Gaur, Petr Novotny, Anthony O'Dowd, Venkatraman Ramakrishna, "Hands-On Blockchain with Hyperledger: Building decentralized applications with Hyperledger Fabric and Composer", 2018.
3	Arshdeep Bahga, Vijay Madisetti, "Blockchain Applications: A Hands-On Approach", Arshdeep Bahga, Vijay Madisetti publishers 2017.
<p>REFERENCE BOOKS</p>	
1	Andreas Antonopoulos, "Mastering Bitcoin: Unlocking Digital Cryptocurrencies", O'Reilly Media, Inc., 2014.
2	Melanie Swa, "Blockchain ", O'Reilly Media, 2014
<p>E BOOKS</p>	

1	Blockchain Applications- https://www.blockchain-books.com
2	Hyperledger Fabric - https://www.hyperledger.org/projects/fabric
3	Zero to Blockchain - An IBM Redbooks course, by Bob Dill, David Smits,2017 - https://www.redbooks.ibm.com/Redbooks.nsf/RedbookAbstracts/crse0401.html
MOOC	
1	https://onlinecourses.nptel.ac.in/noc18_cs47/preview
2	https://www.udemy.com/blockchain-and-bitcoin-fundamentals/

COURSE TITLE		CRYPTOGRAPHY AND NETWORK SECURITY			CREDITS	3
COURSE CODE		CSA3735	COURSE CATEGORY	PE	L-T-P-S	3- 0- 0- 0
CIA		50%			ESE	50%
LEARNING LEVEL		BTL3(APPLY)				
CO	OUTCOMES					PO
1	Explain security architecture, threats and vulnerabilities					1
2	Implement symmetric cryptographic algorithms					1,3
3	Apply the different cryptographic operations of public key cryptography					1,2,3,4,5
4	Apply the various Authentication schemes to authentication applications.					2,3,4,5,10
5	Recall various Security practices and System security standards					1,7,9,10
Prerequisites : COMPUTER NETWORKS						
MODULE 1: INTRODUCTION						(9)
Professional Aspects of Security, Need for Security at Multiple levels, Security Policies - Model of network security - Security attacks, services and mechanisms - OSI security architecture - Classical encryption techniques: substitution techniques, transposition techniques, steganography- Foundations of modern cryptography: perfect security - information theory - product cryptosystem - cryptanalysis.						
MODULE 2:SYMMETRIC CRYPTOGRAPHY						(9)
Modular arithmetic-Euclid"s algorithm- Congruence and matrices - Groups, Rings, Fields- Finite						

fields- SYMMETRIC KEY CIPHERS: SDES – Block cipher Principles of DES – Strength of DES – Differential and linear cryptanalysis – Block cipher design principles – Block cipher mode of operation – Evaluation criteria for AES – Advanced Encryption Standard – Key distribution.	
MODULE 3: PUBLIC KEY CRYPTOGRAPHY (9)	
Number Theory Concepts: Primes – Primality Testing – Factorization – Euler’s totient function, Fermat’s and Euler’s Theorem – Chinese Remainder Theorem – Exponentiation and logarithm – ASYMMETRIC KEY CIPHERS: RSA cryptosystem – Key distribution – Key management – Diffie Hellman key exchange – ElGamal cryptosystem – Elliptic curve arithmetic-Elliptic curve cryptography.	
MODULE 4: AUTHENTICATION (9)	
Authentication requirement – Authentication function – MAC – Hash function – Security of hash function and MAC – SHA –Digital signature and authentication protocols – DSS-Entity Authentication: Biometrics, Passwords, Challenge Response protocols- Authentication applications – Kerberos, X.509	
MODULE 5: E-MAIL SECURITY AND SYSTEM SECURITY (9)	
Electronic Mail security – PGP, S/MIME – IP security – Web Security – SYSTEM SECURITY: Intruders – Malicious software – viruses – Firewalls.	
TEXT BOOKS	
1	William Stallings, Cryptography and Network Security: Principles and Practice, PHI 7th Edition, 2016.
REFERENCE BOOKS	
1	BehrouzA.Foruzan, Cryptography and Network Security, Tata McGraw Hill 2007.
2	Charlie Kaufman, Radia Perlman, and Mike Speciner, Network Security: PRIVATE Communication in a PUBLIC World, Prentice Hall, ISBN 0-13-046019-2
3	Bruce Schneier , "Applied Cryptography", Wiley publications,2007.
E BOOKS	
1	http://www.freebookcentre.net/special-books-download/Handbook-of-Applied-Cryptography-(A.J.-Menezes,-P.C.-van-Oorschot,-S.A.-Vanstone)
MOOC	
1	https://nptel.ac.in/courses/106105031/

COURSE TITLE		SOFTWARE PROJECT MANAGEMENT			CREDITS	3
COURSE CODE		CSA3736	COURSE CATEGORY	PE	L-T-P-S	3- 0- 0- 0
CIA		50%			ESE	50%
LEARNING LEVEL		BTL3 (APPLY)				
CO	OUTCOMES					PO
1	Understand Software Project Models and Software Management Concepts.					1
2	Apply the various methods of Cost Estimation					2,5
3	Study about Software Quality Management.					1
4	Study about Software Metrics.					1
5	Apply the project Evaluation methods.					2,5
Prerequisites : Software Engineering						
MODULE 1: PROJECT CONCEPTS AND ITS MANAGEMENT						(9)
<p>Project life cycle models-ISO 9001 model-Capability Maturity Model-Project Planning-Project tracking-Project closure. Evolution of Software Economics - Software Management Process Framework: Phases, Artifacts, Workflows, Checkpoints - Software Management Disciplines: Planning / Project Organization and Responsibilities / Automation / Project Control - Modern Project Profiles.</p> <p>Suggested Activities: Combine group of projects as program</p> <p>Suggested Reading: https://www.greycampus.com/opencampus/project-management-professional/basic-concepts-of-project-management</p>						
MODULE 2:COST ESTIMATION						(9)
<p>Problems in Software Estimation - Algorithmic Cost Estimation Process, Function Points, SLIM (Software Life cycle Management), COCOMO II (Constructive Cost Model) - Estimating Web Application Development</p> <p>- Concepts of Finance, Activity Based Costing and Economic Value Added (EVA) - Balanced Score Card.</p> <p>Suggested Activities: Estimate the cost of a project</p> <p>Suggested Reading: http://www.costmanagement.eu/blog-article/what-is-cost-estimation-we-explain-it-to-you-in-4-steps</p>						
MODULE 3: SOFTWARE QUALITY MANAGEMENT						(9)
<p>Software Quality Factors - Software Quality Components - Software Quality Plan - Software Quality Metrics - Software Quality Costs - Software Quality Assurance Standard - Certification - Assessment.</p> <p>Suggested Activities: Estimate the cost of a project</p> <p>Suggested Reading: https://www.tutorialspoint.com/software_testing_dictionary/quality_management.htm</p>						

MODULE 4: SOFTWARE MANAGEMENT AND METRICS (9)	
Software Configuration Management - Risk Management: Risk Assessment: Identification / Analysis / Prioritization - Risk Control: Planning / Resolution / Monitoring - Failure Mode and Effects Analysis (FMEA) - Defect Management - Cost Management. Software Metrics - Classification of Software Metrics: Product Metrics: Size Metrics, Complexity Metrics, Halstead's Product Metrics, Quality Metrics, and Process metrics. Suggested Reading: https://www.sealights.io/software-development-metrics	
MODULE 5: PROJECT EVALUATION AND EMERGING TRENDS (9)	
Strategic Assessment-Technical Assessment-Cost Benefit Analysis-Cash Flow Forecasting-Cost Benefit Evaluation Technique-Risk Evaluation-Software Effort Estimation. Emerging Trends: Import of the internet on project Management - people Focused Process Models. Suggested Reading: https://apps.dtic.mil/dtic/tr/fulltext/u2/a196916.pdf	
TEXT BOOKS	
1	Ramesh Gopaldaswamy , "Managing and global Software Projects", Tata McGraw Hill Tenth Reprint, 2011.
REFERENCE BOOKS	
1	Roger S.Pressman, "Software Engineering- A Practitioner's Approach", 7th Edition ,McGraw Hill, 2018
2	Daniel Galin, "Software Quality Assurance: from Theory to Implementation", Pearson Addison-Wesley, 2008.
3	Bob hughes and Mike Cotterell, "Software Project Management" 5 th edition,2018
4	Royce, W. "Software Project Management: A Unified Framework", Addison Wesley, 6 th print 2000.
E BOOKS	
1	https://books.google.co.in/books/about/Software_Project_Management.html?id=O3kZAQAIAAJ
2	http://library.bec.ac.in/kbc/NOTES%20BEC/CSE/8%20SEM/Software%20Project%20Management.pdf

