DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

CURRICULUM AND SYLLABUS

(Applicable for Students admitted from Academic Year 2021-22)

M.Tech (COMPUTER SCIENCE AND ENGINEERING)

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

SCHOOL OF COMPUTER SCIENCES

HINDUSTAN INSTITUTE OF TECHNOLOGY & SCIENCE

VISION AND MISSION

Motto:

To Make Every Man *a* Success *and* No Man *a* Failure

VISION :

"TO MAKE EVERY MAN A SUCCESS AND NO MAN A FAILURE"

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
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 andEngineering 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 judgement 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 activitiesconfidentially an 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.

P10 **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.

P11 **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 To impart knowledge in Advanced Operating System, Advance Data Base Technology, Advanced Data Structures & Algorithms for analyzing and the solving complex problem.

PSO2 To develop the skill set of the students especially in Data Science and Engineering, Software Engineering and Information Security.

PSO3 To inculcate the analytical knowledge in the students for innovative system design using modern tools and techniques.

M.Tech - COMPUTER SCIENCE AND ENGINEERING

(65 CREDIT 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	0	5
2	PC	CSA3701	Advanced Data Structures and Algorithms[+]	2	0	2	3	0	4
3	PC	CSA3702	Machine Learning[+]	2	0	2	3	0	4
4	PE	CSA****	Department Elective – I	2	0	2	3	0	4
5	PE	CSA****	Department Elective – II	2	0	2	3	0	4
6	PE	ZZZ3715	Research Methodology & IPR*	2	0	0	2	0	2
PRACTICAL									
7	BS	CSA3781	Mini project	0	0	6	2	0	6
Total							**20**		**29**

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	0	4
2	PC	CSA3704	Soft computing	3	0	2	3	0	5
3	PC	CSA3705	Advanced Data Base Technology	2	1	2	3	0	4
4	PC	CSA3706	MOOC Course	3	0	0	3	0	3
5	PE	CSA****	Department Elective – III	3	1	0	4	0	3
6	OE	******	Open Elective	2	0	0	2	0	3
PRACTICAL									
7	PC	CSA3751	Seminar	0	0	3	2	0	2

			Total				20		25

*Research Methodology & IPR is a compulsory Course

*Professional Core papers Common for M.Tech. CSE with Specialization of Data Science, Artificial Intelligence and Cyber Security

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	PC	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									
7	CSA3783	PC	Project Phase –II	0	0	24	12	0	24
Total							12		24

M.Tech - COMPUTER SCIENCE AND ENGINEERING

DEPARTMENT ELECTIVES(GENERAL)

ELECTIVE I

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

ELECTIVE II

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

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 |

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

COURSE TITLE	STATISTICS FOR COMPUTER SCIENCE			CREDITS		4
COURSE CODE	MAA3706	COURSE CATEGORY	BS	L-T-P-S		3-0-2-0
Version	1.0	Approval Details	23 ACM, 06.02.2021	LEARNING LEVEL		BTL 4
ASSESSMENT SCHEME						
First Periodical Assessment	Second Periodical Assessment	Seminar/ Assignments/ Project	Surprise Test / Quiz	Attendance		ESE
15%	15%	10%	5%	5%		50%
Course Description	This course serves as an introduction to the world of Statistical models. It describes how to use forecasting methods to support managerial, financial, and operational.					
Course Objective	1. In-depth knowledge in the mathematical, probabilistic, and statistical foundations. 2. Programming software engineering skills. 3. Ability to apply statistical analysis and modeling to reason from data in a principled manner. 4. Combined theoretical and technical skills to use for real-world applications.					
Course Outcome	Upon completion of this course, the students will be able to					

	1. Develop statistical models for business analytics
	2. Perform marketing analytics using statistical models.
	3. Analyze customer data for customer acquisition, retention, and profitability.
	4. Analysis time series analysis.
	5. Analysis of variance.

Prerequisites: NIL

CO, PO AND PSO MAPPING

CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	-	2	2	-	1	-	-	1	-	-	-	-	-	-	-
CO-2	-	3	3	3	-	-	3	-	2	2	-	-	-	-	-
CO-3	-	-	2	2	2	1	2	2	2	-	-	-	-	-	-
CO-4	2	-	2	2	2	2	-	-	-	-	-	-	-	2	1
CO-5	-	-	3	-	-	-	-	-	-	-	-	-	-	-	-

1: Weakly related, 2: Moderately related and 3: Strongly related

MODULE 1: 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 unction. **Suggested Activities**: Basic knowledge on probability **Suggested sources: Introduction to probability**	CO-1 BTL-2

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**	CO-2 BTL-2

MODULE3: 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	CO-3 BTL-3

Suggested sources: Probability, Statistics and Random Processes-T.Veerarajan	
MODULE4: 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**	**CO-4** **BTL-2**
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**	**CO-5** **BTL-3**

TEXT BOOKS	
1	T.Veerarajan , "Probability,Statisticsand 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 computerScience 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		2-0-2-0
Version	1.0	Approval Details	23 ACM, 06.02.2021	LEARNING LEVEL		BTL-4

ASSESSMENT SCHEME

First Periodical Assessment	Second Periodical Assessment	Seminar/ Assignments/ Project	Surprise Test / Quiz	Attendance	ESE
15%	15%	10%	5%	5%	50%

Course Description	This course serves as an introduction to the world of Advanced Data Structures and algorithms. And used to Estimate time and space complexities for a given algorithm.
Course Objective	1. To Estimate time and space complexities for a given algorithm. 2. Describetheheappropertyandtheuseofheapsasanimplementationofpriority queues. 3. Illustrate parallel algorithm models. 4. Use a heuristic approach to solve an appropriate problem.
Course Outcome	Upon completion of this course, the students will be able to 1. Illustrate the various self- balanced trees and their operations. 2. Apply an appropriate algorithmic approach to a given problem. 3. Illustrate parallel algorithm models. 4. Use a heuristic approach to solve an appropriate problem.

Prerequisites: 1.FundamentalsofDataStructures2.DesignandAnalysisofAlgorithm

CO, PO AND PSO MAPPING

CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3

CO-1	-	2	2	2	1	2	3	3	3	1	1	2	1	-	-
CO-2	-	2	2	2	2	2	2	2	2	2	3	3	-	-	3
CO-3	1	2	3	3	3	1	2	2	2	1	1	-	-	2	-
CO-4	2	1	3	2	2	2	2	2	2	2	2	2	1	2	-
CO-5	-	-	3	2	2	2	2	2	2	2	3	3	-	1	3

1: Weakly related, 2: Moderately related and 3: Strongly related

MODULE1: INTRODUCTION   (9)

Abstract DataTypes-Time and Space Analysis of Algorithms-Big Oh and Theta Notations- Average, best- and worst-case analysis-Simple recurrence relations–Mappings. **Suggested Activities**: Find the time and space complexities of the following algorithms 1.Sum of n numbers 2. Factorial of n3. Matrix multiplication 4. Insertion sort **Suggested sources:** **https://nptel.ac.in/courses/106105164/https://nptel.ac.in/courses/106105085/18**	**CO-1** **BTL-2**

MODULE 2: HEAPSTRUCTURES   (9)

Min-maxheaps-Heaps-Leftistheaps-Binomialheaps-Fibonacciheaps-Skewheaps-Lazy-binomialheaps. **Suggested Activities**:ImplementthefollowingHeapstructuresusingC, C++, Java or Python **1.** Max-min Heap 2. Binomial Heap 3. Fibonacci Heap **Suggested sources: https://nptel.ac.in/courses/106102064/20, 21**	**CO-2** **BTL-2**

MODULE3: SEARCHSTRUCTURES   (9)

Binarysearchtrees-AVLtrees-2-3trees-2-3-4trees-Red-blacktrees-B-trees-splaytrees–k-d trees, Tries. **Suggested Activities**: Implement the following tree structures using C, C++, Java or Python 1.AVLTree 2.Red-Blacktree 3. Splay Trees 4. K-d Trees5. Tries **Suggested sources: https://nptel.ac.in/courses/106102064/11, 12,14,15,18**	**CO-3** **BTL-3**

MODULE 4: ALGORITHMDESIGNTECHIQUES (9)	
Divide and conquer and Greedy:Quicksort-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. **Suggested Activities**: Solve the following problems 1.Quick sort 2. Strassen's matrix multiplication 3.8-queensproblem 4.Palindrome Partitioning **Suggested Source:** https://nptel.ac.in/courses/106106131/15https://nptel.ac.in/courses/106102011/7	**CO-4** **BTL-2**
MODULE 5: ADVANCEDALGORITHMS (9)	
Parallel Algorithms: Basic Techniques- Work & Efficiency - Distributed Computation - Heuristic &Approximation Approaches. **Suggested Activities**: Implement following heuristic algorithms 1.HillClimbing 2.SimulatedAnnealing 3.ParticleSwarmOptimization 4.GeneticAlgorithm **Suggested sources: https://nptel.ac.in/courses/106104120/4,** **https://nptel.ac.in/courses/106106126/9 - 15**	**CO-5** **BTL-2**
TEXT BOOKS	

1	ThomasH.Coremen,CharlesE.Leiserson,RonaldL.Rivest,CliffordStein,"Introductiontoalgorithms", Third edition, MIT press,2013
REFERENCE BOOKS	
1	E. Horowitz, S.Sahni and Dinesh Mehta, Fundamentals of Data structures in C++, UniversityPress, 2009.
2	E.Horowitz,S.SahniandS.Rajasekaran,ComputerAlgorithms/C++,SecondEdition,UniversityPress, 2007.
3	Mark Allen Weiss, "Data Structures and Algorithm Analysis in C", Third Edition, PearsonEducation, Asia.2007.
4	AnanthGrama,AnshulGupta,GeorgeKarypis,VipinKuma,"IntroductiontoParallelComputing", Second Edition, Addison Wesley, 2003
E BOOKS	
1	OmidBozorg-Haddad,MohammadSolgi,HugoA.LoÃ¡iciga,"Meta-heuristicandEvolutionaryAlgorithms for Engineering Optimization 1st Edition", Wiley , 2017
2	Introduction to Parallel Computing - ResearchGate - Free Ebook
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	2-0-2-0
Version	1.0	Approval Details	23 ACM, 06.02.2021	LEARNING LEVEL	BTL-4

ASSESSMENT SCHEME

First Periodical Assessment	Second Periodical Assessment	Seminar/ Assignments/ Project	Surprise Test / Quiz	Attendance	ESE
15%	15%	10%	5%	5%	50%

Course Description	This course serves as an introduction to Machine learning and to understand real time applications.
Course Objective	1. To Apply multilayer perceptron using simple machine learning techniques. 2. To Use decision trees and statistics models 3. To introduce students to the basic concepts and techniques of Machine Learning 4. To become familiar with regression methods, classification methods, clustering methods 5. To become familiar with Dimensionality reduction Techniques.
Course Outcome	Upon completion of this course, the students will be able to 1. Gain knowledge about basic concepts of Machine Learning 2. To Use data analysis for machine learning 3. Identify machine learning techniques suitable for a given problem 4. Use the optimization technique for solving machine learning problem. 5. Design application using machine learning techniques.

Prerequisites: Fundamentals of Programming

CO, PO AND PSO MAPPING

CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	-	3	2	2	1	2	2	3	3	2	3	2	-	2	3
CO-2	-	2	2	3	1	2	2	3	3	2	3	2	-	2	-
CO-3	3	2	2	1	2	2	3	3	2	3	2	-	2	-	1
CO-4	2	-	2	1	2	2	3	3	2	3	2	-	2	-	2
CO-5	-	-	3	-	2	1	2	2	3	3	2	3	2	-	2

1: Weakly related, 2: Moderately related and 3: Strongly related

MODULE1: INTRODUCTION   (9)

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	CO-1 BTL-2

MODULE 2: CLASSIFICATION ALGORITHMS (9)

Decision trees-Constructing decision trees-Classification of regression trees-Regression example-**Probability and Learning:**Turning data in to probabilities-Some basic statistics-Gaussian mixture models-Nearest Neighbor methods. **Suggested Activities**: Explore the Regression Examples in Machine Learning **Suggested Sources:** NormanMatlof,"StatisticalRegressionandClassification:FromLinearModels toMachineLearning",CRCPress,2017.	CO-2 BTL-2

MODULE3: ANALYSIS (9)

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.	CO-3 BTL-3

Suggested Activities: Simulatedannealing/Modellingonanydatascienceapplication. **Suggestedsources:** L.M.Rasdi,SimulatedAnnealingAlgorithmforDeepLearning,Procedia ComputerScience,Volume:72,2015.	
MODULE4: OPTIMIZATIONTECHNIQUES	**(9)**
The Genetic algorithm-Genetic operators-Genetic programming-Combining sampling with genetic programming-Markov Decision Process-Markov Chain Monte Carlo methods:sampling- Montecarlo-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.	**CO-4** **BTL-2**
MODULE5: PYTHON FOR MACHINELEARNING	**(9)**
Baysean Networks-Markov Random Fields-Hidden MarkovModels-Tracking methods.Python: Installation-Python for MATLAB ANDRusers-Code Basics-Using NumPy and MatPolitB. **Suggested Activities**: Design a simple application using NumPy and MatPolitB. **Suggested Sources:**RakshithVasudev,IntroductiontoNumpy-1:Anabsolutebeginnersguideto MachineLearningandDatascience.,2017.	**CO-5** **BTL-2**

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/machine-learning
2	https://www.my-mooc.com/en/categorie/machine-learning

COURSE TITLE	RESEARCH METHODOLOGY & IPR			CREDITS	2
COURSE CODE	ZZZ3715	COURSE CATEGORY	PC	L-T-P-S	2-0-0-0
Version	1.0	Approval Details	23 ACM, 06.02.2021	LEARNING LEVEL	BTL-2
ASSESSMENT SCHEME					
First Periodical Assessment	Second Periodical Assessment	Seminar/ Assignments/ Project	Surprise Test / Quiz	Attendance	ESE
15%	15%	10%	5%	5%	50%
Course Description	This course is designed to understand the research problem, literature studies, plagiarism and ethics, To get the knowledge about technical writing, to analyze the nature of intellectual property rights and new developments				
Course Objective	1. To give an overview of the research methodology and explain the technique of defining a research problem 2. To explain the functions of the literature review in research. 3. To explain carrying out a literature search, its review, developing theoretical and conceptual frameworksand writing a review. 4. To explain various research designs and their characteristics.				

Course Outcome	Upon completion of this course, the students will be able to 1. Understand research problem formulation. 2. Understand the way of doing Literature review and to write proposal in an effective way. 3. Understanding the data collection, sampling techniques used in the statistical analysis for effective data analysis. 4. Understand that IPR protection provides an incentive to inventors for further research work and investment in R & D, which leads to creation of new and better products, and in turn brings about, economic growth and social benefits. 5. Understand the nature of Intellectual property rights in national and international level collaborations														

Prerequisites: nil

CO, PO AND PSO MAPPING

CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	-	2	1	1	1	2	3	2	3	2	3	2	-	3	2
CO-2	-	2	2	3	1	1	2	3	3	2	3	2	-	2	-
CO-3	3	2	2	1	2	2	3	3	2	3	2	-	2	-	1
CO-4	2	-	2	1	2	2	3	3	2	3	2	-	2	-	2
CO-5	-	-	3	-	2	1	2	2	3	3	2	3	2	-	2

1: Weakly related, 2: Moderately related and 3: Strongly related

MODULE1: RESEARCH PROBLEM FORMULATION (9)

Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem. Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations	**CO-1** **BTL-2**

MODULE 2: RESEARCH PROPOSAL AND ETHICS (9)

Effective literature studies approach, analysis Plagiarism, Research ethics, Effective technical writing, how to write report, Paper Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee.	CO-2 BTL-2

MODULE3: DATA ANALYSIS AND INTERPRETATION	(9)
Classification of Data, Methods of Data Collection, Sampling, Sampling techniques procedure and methods, Ethical considerations in research Data analysis, Statistical techniques and choosing an appropriate statistical technique, Hypothesis, Hypothesis testing, Data processing software (e.g. SPSS etc.), statistical inference, Interpretation of results.	CO-3 BTL-3

MODULE4: NATURE OF INTELLECTUAL PROPERTY	(9)
Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT.	CO-4 BTL-2

MODULE5: PATENT RIGHTS AND NEW DEVELOPMENTS IN IPR	(9)
Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications. Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs.	CO-5 BTL-2

TEXT BOOKS

1	Robert P. Merges, Peter S. Menell, Mark A. Lemley, "Intellectual Property in New Technological Age", 2016.
2	T. Ramappa, "Intellectual Property Rights Under WTO", S. Chand, 2008

REFERENCE BOOKS

1	Ranjit Kumar, 2 nd Edition, "Research Methodology: A Step by Step Guide for beginners"
2	Creswell, John W. Research design: Qualitative, quantitative, and mixed methods, approaches. Sage publications, 2013.

3	Donald Cooper & Pamela Schindler," Business Research Methods ", TMGH, 9th edition

E BOOKS	
1	https://www.modares.ac.ir/uploads/Agr.Oth.Lib.17.pdf
2	https://drive.google.com/file/d/0Bwk5FIsI0ctxNXBvU2dGVlJhSTg/view?usp=drivesdk

MOOC	
1	https://www.coursera.org/browse/physical-science-and-engineering/research-methods
2	https://www.ccrm.in/register.html

COURSE TITLE	MINI PROJECT			CREDITS	2
COURSE CODE	CSA3781	COURSE CATEGORY	PC	L-T-P-S	0- 0- 6- 0
Version	1.0	Approval Details	23 ACM, 06.02.2021	LEARNING LEVEL	BTL-3
ASSESSMENT SCHEME					
First Review (Concept)	Second Review (Design)	Third Review (Experiment/ Analysis)	Project Report and Vivo- voce (Results and Conclusion) Attendance		ESE
20%	30%	20%	30%		---
Course Description	This course is designed to provide sufficient hands-on learning experience related to the design, development and analysis of suitable product/project so as to enhance the technical skill sets in the chosen field.				

Course Objective	1. To Identify problems that have relevance to societal / industrial needs 2. To Exhibit independent thinking and analysis skills 3. To Demonstrate the application of relevant science / engineering principles 4. To judge the value of different contributions 5. To identify promising new directions													
Course Outcome	Upon completion of this course, the students will be able to 1. Demonstrate sound fundamentals in a chosen area of computing 2. Identify and formulate a problem of research interest in the chosen area of computing 3. Analyze the computing problem and propose solutions 4. Explain factual knowledge (terminology, classifications, methods, trends)of current areas of research. 5. State and explain some fundamental principles, generalizations, or theories the student has learned in this course.													

Prerequisites: Basic programming knowledge

CO, PO AND PSO MAPPING

CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	3	3	3	3	-	2	-	-	3	3	3	2	3	3	2
CO-2	3	3	3	3	-	2	-	3	3	3	3	2	3	3	2
CO-3	3	3	3	3	3	-	-	3	3	-	3	2	3	3	3
CO-4	3	3	3	3	3	-	-	3	3	-	3	2	3	3	3
CO-5	3	3	3	3	3	2	-	3	3	-	3	2	3	3	3

1: Weakly related, 2: Moderately related and 3: Strongly related

1. The mini project must be done as the individual Project. 2. Each Student must prepare a title that relates to any engineering discipline and the title MUST emulate any real-world situation. 3. Every project work shall have a guide who is the member of the faculty of the Department. 4. Design, develop, test and implement a hardware/software system that is demonstratable with required data set. 5. Assessment is based on creativity, applicability to the society, project development skills, team work. 6. Technical communication, presentation and report writing skills form an essential component in assessment. 7. The project/software MUST include all the topics that have been taught in class.	CO1, CO2, CO3, CO4, CO5 /BTL4

COURSE TITLE	MOOC Course			CREDITS	3
COURSE CODE	CSA3706	COURSE CATEGORY	PC	L-T-P-S	3- 0- 0- 0
Version	1.0	Approval Details	23 ACM, 06.02.2021	LEARNING LEVEL	BTL-4
ASSESSMENT SCHEME					
First Periodical Assessment	Second Periodical Assessment	Practical Component		ESE	
15%	15%	20%		50%	
Course Description	The objective of this course is to define and clarify the cloud technologies that can be used to deploy cloud-based applications and services. It also explains how they differ in their implementation and usage. Any enterprise may implement any of the cloud				

		deployment models and use the cloud services as per their needs.

Course Objective	1. To analyse, design and develop products/tools/applications to solve the issues related to real world problems. 2. To apply the concepts, principles and algorithms learnt in the field of computer science. 3. To exercise the lifecycle of project development by following the principles of software engineering.

Course Outcome	Upon completion of this course, the students will be able to 1. Develop an Engineering solution through Analyzing the problem and Applying the Engineering Knowledge. 2. Use research-based knowledge and research methods through modern tools 3. Work as an individual and as a team in solving complex problem. 4. Communicate effectively and write effective reports on the design of Engineering solution. 5. State and explain some fundamental principles, generalizations, or theories the student has learned in this course.

Prerequisites: Nil

CO, PO AND PSO MAPPING

CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	3	3	-	-	3	-	-	-	2	-	-	1	1	1	-
CO-2	3	3	-	-	-3	-	-	-	-	2	-	-	1	1	-
CO-3	3	3	-	-	3	1	-	-	-	-	-	-	1	1	-
CO-4	3	3	-	-	3	-	-	-	-	-	-	2	1	1	-
CO-5	3	2	3	-	2	-	-	-	-	-	-	3	1	1	-
1: Weakly related, 2: Moderately related and 3: Strongly related															

GUIDELINES	
1. The MOOC course will be selected as per the HOD instruction The students must register for the selected MOOC Course. Faculty will be assigned to assist for assignment completion. 2. At the end of the course will be directly transferred to the student's coursework. 3. For all other courses the concurrence from a faculty member to set the question paper and evaluate the performance of the student should be obtained. 4. All the internal examination will be conducted. The candidate will have to appear for the 5. end semester examinations. 6. At the end of the online & contact courses, the student should submit the course completion certificate(s) with grades/marks for record in his/her course work.	CO1, CO2, CO3, CO4, CO5 /BTL4

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	ADVANCED OPERATING SYSTEMS			CREDITS	3
COURSE CODE	CSA3703	COURSE CATEGORY	PC	L-T-P-S	2-0-2-0
Version	1.0	Approval Details	23 ACM, 06.02.2021	LEARNING LEVEL	BTL-4

ASSESSMENT SCHEME

First Periodical Assessment	Second Periodical Assessment	Seminar/ Assignments/ Project	Surprise Test / Quiz	Attendance	ESE
15%	15%	10%	5%	5%	50%

Course Description	This course serves as an introduction to Advanced operating systems and to understand real time applications.
Course Objective	1. To Design distributed operating system 2. To Detect, prevent and avoid the deadlocks in distributed environment. 3. To Explain the need for load distribution and the corresponding techniques. 4. To Design security mechanisms for distributed operating system. 5. To Analyze and find out the requirements to construct a database operating systems
Course Outcome	Upon completion of this course, the students will be able to 1. Design distributed operating system. 2. Detect, prevent and avoid the deadlocks in distributed environment. 3. Explain the need for load distribution and the corresponding techniques. 4. Design security mechanisms for distributed operating system. 5. Analyze and find out the requirements to construct a database operating systems

Prerequisites: Fundamentals of Programming

CO, PO AND PSO MAPPING

CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	-	3	2	2	1	1	2	3	3	2	3	2	-	2	3
CO-2	-	2	2	3	1	1	2	3	3	2	3	2	-	2	-
CO-3	3	2	2	3	2	1	3	3	2	3	2	-	2	-	1
CO-4	2	-	2	3	2	2	3	3	2	3	2	-	2	-	2
CO-5	-	-	3	-	2	1	2	2	3	3	2	3	2	-	2

1: Weakly related, 2: Moderately related and 3: Strongly related

MODULE1: DISTRIBUTED OPERATING SYSTEM (12)

Synchronization Mechanisms: Introduction – concept of a process – concurrent process – the critical section problem – Synchronization problems – language mechanisms for	CO-1

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.	BTL-2
MODULE 2: DISTRIBUTED DEADLOCKDETECTION	**(12)**
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.	**CO-2** **BTL-2**
MODULE 3: DISTRIBUTEDSHAREDMEMORY	**(12)**
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.	**CO-3** **BTL-3**
MODULE4:MULTIPROCESSOROPERATINGSYSTEM	**(12)**
Basic multiprocessor system architectures – basic multiprocessor system architecture - inter connection networksfor multiprocessor systems – caching – hypercube architecture – structures of multiprocessor operating system -operating system design issues – threads management- process synchronization – processor scheduling–Memory management- The Mac OS.	**CO-4** **BTL-2**
MODULE 5: DATABASE OPERATING SYSTEM	**(12)**
Requirements of a database operating system Concurrency control: theoretical aspects - introduction, database systems - a concurrency control model of database systems- the	**CO-5**

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.	BTL-2

PRACTICES

1. Implementation of semaphores for multiprocessor OS

2. Implementation of multithreading for multiprocessor OS

3. ImplementationofmultiplesleepingbarbersproblemforsynchronizationindistributedOS

4. Implementation of network operating system.

5. Design a real time operating system to control the temperature of a boiler.

6. ImplementationoftransactionsandconcurrencyinDatabaseoperatingsystem.

7. Implement a banking application using distributed Operating system.

TEXT BOOKS

1	Mukesh Singhal, Niranjan 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

MOOC

1	https://www.coursera.org/learn/practical-machine-learning
2	https://www.coursera.org/learn/python-machine-learning

COURSE TITLE	SOFT COMPUTING			CREDITS	3
COURSE CODE	CSA3704	COURSE CATEGORY	PC	L-T-P-S	3-0-2-0
Version	1.0	Approval Details	23 ACM, 06.02.2021	LEARNING LEVEL	BTL-4

ASSESSMENT SCHEME

First Periodical Assessment	Second Periodical Assessment	Seminar/ Assignments/ Project	Surprise Test / Quiz	Attendance	ESE
15%	15%	10%	5%	5%	50%

Course Description	This course serves as an introduction to Soft Computing and to Developcasestudiestoillustratetheintelligentbehaviorofprogramsbased on softcomputing.
Course Objective	1. To Apply concepts of fuzzy sets, fuzzy logic and heuristics-based systems. 2. To Derive appropriate rules for inference systems. 3. To Use the mathematical background to optimize neural network learning. 4. To Implementoptimizationalgorithmsandrandomsearchproceduresusefulto seek global optimum in self-learning 5. To Develop case studies to illustrate the intelligent behavior of programs based on soft computing.
Course Outcome	Upon completion of this course, the students will be able to 1. Apply concepts of fuzzy sets, fuzzy logic and heuristics-based systems. 2. Derive appropriate rules for inference systems. 3. Use the mathematical background to optimize neural network learning. 4. Implement optimization algorithms and random search procedures useful to seek global optimum in self-learning.

5. Develop case studies to illustrate the intelligent behavior of programs based on soft computing.

Prerequisites: Artificial Intelligence, Problem solving, Expert Systems

CO, PO AND PSO MAPPING

CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	3	2	2	1	1	2	3	3	2	3	2	-	2	3	-
CO-2	2	2	3	1	1	2	3	3	2	3	2	-	2	-	-
CO-3	2	2	3	2	1	3	3	2	3	2	-	2	-	1	2
CO-4	1	2	2	2	2	3	3	2	3	2	-	2	-	2	1
CO-5	-	3	-	2	1	2	2	3	3	2	3	2	-	2	-

1: Weakly related, 2: Moderately related and 3: Strongly related

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	**CO-1** **BTL-2**

MODULE2: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-	**CO-2** **BTL-2**

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 – Perceptron - Adaline – Back propagation Multilayer Perceptron – Radial Basis Function Networks – Unsupervised Learning Neural Networks – Competitive Learning Networks – Kohonen Self-Organizing Networks – Learning Vector Quantization– Hebbian Learning. **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	**CO-3** **BTL-3**
MODULE4:NEURO FUZZY MODELING	**(12)**
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. **Suggested Activities:** Build Adaptive Neuro-Fuzzy Inference Systems (ANFIS), train Sugeno systems using neuro-adaptive learning **Suggested sources:** http://in.mathworks.com/help/fuzzy/adaptive-neuro-fuzzy-inference-systems.html	**CO-4** **BTL-2**
MODULE5:APPLICATIONS OF COMPUTATIONAL INTELLIGECE (12)	
Printed Character Recognition – Inverse Kinematics Problems – Automobile Fuel Efficiency Prediction – Soft Computing for Color Recipe Prediction. **Suggested Activities:** Prepare the students for developing intelligent modeling, optimization and control of non-linear systems through case studies. **Suggested sources:** https://towardsdatascience.com/introductory-guide-to-artificial-intelligence-	**CO-5** BTL-2

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TEXT BOOKS

1	J.S.R.Jang, C.T.Sun and E.Mizutani, "Neuro-Fuzzy and Soft Computing", PHI, 2004,PearsonEducation.
2	N.P.Padhy, "Artificial Intelligence and Intelligent Systems", Oxford University Press, 2006

REFERENCE BOOKS

1	SamirRoy"IntroductiontoSoftcomputing"NeuroFuzzyandGeneticAlgorithms",Firstedition,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	DavisE.Goldberg,"GeneticAlgorithms:Search,OptimizationandMachineLearning",AddisonWesley, 2009.
5	S. Rajasekaran and G.A.V.Pai, "Neural Networks, Fuzzy Logic and Genetic Algorithms", PHI,2003.

E BOOKS

1	https://stimelstep.firebaseapp.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	COURSE CATEGORY	PC	L-T-P-S	2-1-2-0
Version	1.0	Approval Details	23 ACM, 06.02.2021	LEARNING LEVEL	BTL-5

ASSESSMENT SCHEME

First Periodical Assessment	Second Periodical Assessment	Seminar/ Assignments/ Project	Surprise Test / Quiz	Attendance	ESE
15%	15%	10%	5%	5%	50%

Course Description	This course serves as an introduction to Advanced Data Base Technology and to learn advanced data models and emerging databases.
Course Objective	1. To Implement parallel and distributed databases. 2. To Implement object and object relational databases 3. To Learn advanced data models 4. To Learn emerging databases
Course Outcome	Upon completion of this course, the students will be able to 1. Implement parallel and distributed databases. 2. Implement object and object relational databases. 3. Learn advanced data models 4. Learn emerging databases

Prerequisites: Database Management System

CO, PO AND PSO MAPPING

CO	PO -1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO -10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	3	2	2	1	1	2	2	3	2	3	2	-	2	3	-

CO-2	2	2	3	1	2	2	2	3	2	3	2	-	2	-	2
CO-3	2	2	3	2	2	3	3	2	3	2	-	2	-	1	1
CO-4	1	2	2	2	1	2	3	2	3	2	-	2	-	2	1
CO-5	-	3	-	2	1	2	2	3	3	2	3	2	-	2	-

1: Weakly related, 2: Moderately related and 3: Strongly related

MODULE 1: PARALLEL AND DISTRIBUTED DATABASES	(12)

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 **Suggestedsources:** NPTEL and http://mazsola.iit.unimiskolc.hu/tempus/discom/doc/db/tema01a.pdf	CO-1 BTL-2

MODULE 2: OBJECT AND OBJECT RELATIONAL DATABASES	(12)

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_3-5.pdf	CO-2 BTL-2

MODULE 3: INTELLIGENT DATABASES	(12)

Active Databases: Syntax and Semantics (Starburst, Oracle, DB2)- Taxonomy- Applications-	CO-3

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	BTL-3
MODULE 4: ADVANCED DATAMODELS	**(12)**
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/	**CO-4** **BTL-2**
MODULE 5:EMERGING TECHNOLOGIES **(12)**	
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	**CO-5** **BTL-2**
TEXT BOOKS	

1	ApproachtoDesign,Implementation,andManagement",SixthEdition,PearsonEducation,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	HenryFKorth,AbrahamSilberschatz,S.Sudharshan,"DatabaseSystemConcepts",SeventhEdition,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

COURSE TITLE	SEMINAR			CREDITS	2
COURSE CODE	CSA3751	COURSE CATEGORY	LAB	L-T-P-S	0-0-3-0
Version	1.0	Approval Details	23 ACM, 06.02.2021	LEARNING LEVEL	BTL-3

ASSESSMENT SCHEME

First Review	Second Review	Third Review	Model Evaluation	ESE
20%	20%	20%	40%	---

Course Description	In this course, students will develop the scientific and technical reading, writing and presentation skills they need to understand and construct research articles.
Course Objective	1. To develop the skills in doing literature survey, technical presentation and report preparation 2. To Selecting a subject, narrowing the subject into a topic 3. To Link the papers and preparing a draft of the paper. 4. To Stud the papers and understanding the authors contributions and critically analysing each paper.
Course Outcome	Upon completion of this course, the students will be able to 1. Acquired the basic skills to for performing literature survey and paper presentation 2. Provide students better communication skills. 3. Describe the current topics in computer science and related areas based on current publications. 4. Prepare the report

Prerequisites: Nil

CO, PO AND PSO MAPPING

CO	PO-	PO-	PO-	PO-	PO-	PO-	PO-	PO-	PO-	PO-	PO-	PO-	PSO	PSO	PSO

	1	2	3	4	5	6	7	8	9	10	11	12	-1	-2	-3
CO-1	1	2	3	-	3	-	-	-	-	-	-	3	-	-	3
CO-2	1	2	3	-	-	-	-	-	-	-	-	-	-	-	3
CO-3	1	2	3	-	-	-	-	-	-	-	-	-	-	-	3
CO-4	1	2	3	-	-	-	-	-	-	-	-	-	-	-	3

1: Weakly related, 2: Moderately related and 3: Strongly related

GUIDELINES

1. For seminar, a student under the supervision of a faculty member, shall collect the literature on a topic and critically review the literature and submit it to the department in a report form and shall make an oral presentation before the Departmental Academic Committee consisting of Department PG Coordinator, Supervisor and two other senior faculty members of the department.

2. Each student will make a seminar presentation using audio/visual aids for a duration of 20-25 minutes and submit the seminar report prepared in Latex only

3. For Seminar there will be only internal evaluation.

4. Out of the total allocated marks distribution of marks shall be 30% for the report, 50% for presentation and 20% for the queries.

5. A candidate has to secure a minimum of 50% of marks to be declared successful.

6. If the student fails to fulfill minimum marks, the student has to reappear during the supplementary examinations.

7. There shall be no semester end examinations for the seminar.

CO1/BTL3

REFERENCE BOOKS

1.	NYIF ,"Technical Analysis: A Personal Seminar", Prentice Hall Press (10 March 2005)
2.	David F. Beer ,"Presenting the Successful Technical Seminar",Wiley-IEEE Press,2003
3.	Si FanJill Fielding-Wells,"What is Next in Educational Research?",Springer 2016

E BOOKS

1.	https://link.springer.com/book/10.1007%2F978-94-6300-524-1

COURSE TITLE	PROJECT PHASE –I			CREDITS	8
COURSE CODE	CSA3782	COURSE CATEGORY	PC	L-T-P-S	0- 0- 24- 0
Version	1.0	Approval Details	23 ACM, 06.02.2021	LEARNING LEVEL	BTL-3

ASSESSMENT SCHEME

First Review	Second Review	Third Review	ESE
10%	20%	20%	50%

Course Description	This course is designed to provide sufficient hands-on learning experience related to the design, development and analysis of suitable product / process so as to enhance the technical skill sets in the chosen field.
Course Objective	1. To provide opportunity to involve in research related to science / engineering 2. To inculcate research culture 3. To enhance the rational and innovative thinking capabilities
Course Outcome	Upon completion of this course, the students will be able to 1. Demonstrate sound fundamentals in a chosen area of computing 2. Identify and formulate a problem of research interest in the chosen area of computing 3. Analyze the computing problem and propose solutions 4. Apply the emerging technologies like – Blockchain, IoT, Robotics, ML, AI,Datamining, Big Data Analytics in solving some challenging problem in chosen area 5. Effectively communicate the work at all stages of the project
Prerequisites: NIL	

CO, PO AND PSO MAPPING

CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	-	2	-	-	1	-	3	-	-	-	-	-	-	-	3
CO-2	-	-	1	-	-	-	-	2	-	2	-	-	-	2	-
CO-3	-	-	-	-	-	1	-	-	2	-	-	-	2	-	-
CO-4	2	-	-	-	-	-	-	2	-	-	-	1	-	-	3
CO-5	-	-	3	-	-	-	-	-	-	-	-	-	-	2	-

1: Weakly related, 2: Moderately related and 3: Strongly related

GUIDELINES	(12)
1. Project may be a theoretical analysis, modeling & simulation, experimentation & analysis, prototype design, fabrication of new equipment, correlation and analysis of data, software development, applied research and any other related activities. 2. Each student is expected to do an individual project. The project work is carried out in two phases – Phase I in III semester and Phase II in IV semester. 3. Phase II of the project work shall be in continuation of Phase I only. 4. At the completion of a project the student will submit a project report, which will be evaluated (end semester assessment) by duly appointed examiner(s). This evaluation will be based on the project report and a viva voce examination on the project. 5. Project should be for two semesters based on the completion of required number of credits as per the academic regulations. 6. Carried out inside or outside the university, in any relevant industry or research institution. 7. Publications in the peer reviewed journals / International Conferences will be an added advantage	CO1, CO2, CO3, CO4, CO5 /BTL4

COURSE TITLE	PROJECT PHASE –II			CREDITS		12
COURSE CODE	CSA3783	COURSE CATEGORY	PC	L-T-P-S		0- 0- 24- 0
Version	1.0	Approval Details	23 ACM, 06.02.2021	LEARNING LEVEL		BTL-3

ASSESSMENT SCHEME

First Periodical Assessment	Second Periodical Assessment	Seminar/ Assignments/ Project	Surprise Test / Quiz	Attendance	ESE
15%	15%	10%	5%	5%	50%

Course Description	This course is designed to provide sufficient hands-on learning experience related to the design, development and analysis of suitable product/project so as to enhance the technical skill sets in the chosen field.
Course Objective	1. To provide opportunity to involve in research related to science / engineering 2. To inculcate research culture 3. To enhance the rational and innovative thinking capabilities
Course Outcome	Upon completion of this course, the students will be able to 1. Identify a suitable problem to be solved computationally 2. Reflectively analyze proposed solutions to the identified computing problem 3. Design and develop solutions to the problem and analyze results 4. Prepare a thesis and defend the thesis on the work done 5. Augment the knowledge base in the chosen area of computing, adhering to ethical practices at every stage

Prerequisites: NIL

CO, PO AND PSO MAPPING

CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3

CO-1	-	2	-	-	1	-	3	-	-	-	-	-	-	-	3
CO-2	-	-	1	-	-	-	-	2	-	2	-	-	-	2	-
CO-3	-	-	-	-	-	1	-	-	2	-	-	-	2	-	-
CO-4	2	-	-	-	-	-	-	2	-	-	-	1	-	-	3
CO-5	-	-	3	-	-	-	-	-	-	-	-	-	-	2	-

1: Weakly related, 2: Moderately related and 3: Strongly related

Modalities / Requirements	(12)

1. Each student is expected to do an individual project. The project work is carried out in two phases – Phase I in III semester and Phase II in IV semester. Phase II of the project work shall be in continuation of Phase I only.
2. At the completion of a project the student will submit a project report, which will be evaluated (end semester assessment) by duly appointed examiner(s). This evaluation will be based on the project report and a viva voce examination on the project.
3. Use Science/Engineering principles to solvethe identified issues
4. Adopt relevant and well-defined / innovative methodologies to fulfill the specified objective
5. Submission of scientific report in a specified format (after plagiarism check)
6. Project should be for two semesters based on the completion of required number of credits as per the academic regulations.
7. Carried out inside or outside the university, in any relevant industry or research institution.
8. Publications in the peer reviewed journals / International Conferences will be an added advantage
9. Student will be allowed to appear in the final viva voce examination only if he / she has submitted his / her project work in the form of paper for presentation / publication in a conference / journal and produced the proof of acknowledgement of receipt of paper from the organizers / publishers.

CO-1

BTL-2

COURSE TITLE	ADVANCED DATA COMMUNICATIONS			CREDITS	3
COURSE CODE	CSA3721	COURSE CATEGORY	PE	L-T-P-S	2-0-2-0
Version	1.0	Approval Details	23 ACM, 06.02.2021	LEARNING LEVEL	BTL-3

ASSESSMENT SCHEME

First Periodical Assessment	Second Periodical Assessment	Seminar/ Assignments/ Project	Surprise Test / Quiz	Attendance	ESE
15%	15%	10%	5%	5%	50%

Course Description	This course serves as an introduction to Advanced Data Communications and to Apply the different routing protocols to find the shortest path.
Course Objective	1. To Compare different network architectures 2. To Implement ATM protocol architecture and services 3. To Design techniques to control the congestion in the network. 4. To Apply the different routing protocols to find the shortest path. 5. To Design the ISA with the associated protocols.
Course Outcome	Upon completion of this course, the students will be able to 1. Compare different network architectures 2. Implement ATM protocol architecture and services. 3. Design techniques to control the congestion in the network. 4. Apply the different routing protocols to find the shortest path. 5. Design the ISA with the associated protocols.

Prerequisites: Computer Networks

CO, PO AND PSO MAPPING

CO	PO - 1	PO- 2	PO- 3	PO- 4	PO- 5	PO- 6	PO- 7	PO- 8	PO- 9	PO - 10	PO- 11	PO- 12	PSO- 1	PSO- 2	PSO- 3
CO-1	3	2	2	1	1	2	2	3	2	3	2	-	2	1	2
CO-2		2	3	1	2	2	1	3	2	3	2	-	2	-	2
CO-3	2		3	2	2	3	3	2	3	2	-	2	-	1	1

CO-4	1	2	2	2	1	2	3	2	3	2	-	2	-	2	1
CO-5	-	3	-	2	1	2	2	3	3	2	3	2	-	1	-

1: Weakly related, 2: Moderately related and 3: Strongly related

MODULE1: NETWORK ARCHITECTURES (12)	
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. **Suggested Activity:** Disable the network connection to your workstation, using the ifconfig command.	**CO-1** **BTL-2**
MODULE2: ATMNETWORKS (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. **Suggested Activity:** Enable the network connection, using the ifconfig command and check the connection to the machine ns.internic.net.	**CO-1** **BTL-2**
MODULE 3: TRAFFIC MANAGEMENT (12)	
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. **Suggested Activity:** Check the connection to the workstation and to the network with the ping command.	**CO-2** **BTL-3**
MODULE 4:ROUTINGPROTOCOLS (12)	
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. **Suggested Activity:** Search the Internet for RFC 792; these documents are just a simple Internet search away and are available in several formats for improved viewing, searching, etc. Skim that RFC 792 and search for the message type and code that defines an ICMP Echo and an ICMP Echo Reply.	**CO-2** **BTL-2**

MODULE5:ADVANCEDNETWORKINGCONCEPTS (12)	
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). **Suggested Activity:** Find your system's current IP and send ping to it (Execute ifconfig). Do you receive echo response? If that is true,observe the RTTs (Round-trip times), check that those RTTs are substantially smaller than those received when pinging www.telefonica.net, for instance or www.princeton.edu or www.cisco.com	**CO-3** BTL-2

TEXT BOOKS	
1	William Stallings, "Data and Computer Communications", 9th Ed., Pearson Education.

REFERENCE BOOKS	
1	Willam Stallings,"HighSpeedNetworksandInternets-PerformanceandQualityofService",2nd Ed., PearsonEducation.
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	2-0-2-0
Version	1.0	Approval Details	23 ACM, 06.02.2021	LEARNING LEVEL	BTL-3

ASSESSMENT SCHEME

First Periodical Assessment	Second Periodical Assessment	Seminar/ Assignments/ Project	Surprise Test / Quiz	Attendance	ESE
15%	15%	10%	5%	5%	50%

Course Description	The course covers the fundamentals of sensor networks, communication characteristics and deployment mechanisms, MAC layer, network layer and transport layer and middleware and security issues
Course Objective	1. To learn the basic concepts of wireless sensor network 2. To know how to use the simulation tools 3. To understand the wireless sensor network protocols and layers 4. To know how to design deployment scheme 5. To know how to design energy efficient routing protocol
Course Outcome	Upon completion of this course, the students will be able to 1. Know the basics of Wireless Sensor Networks and Sensor Nodes. 2. Work with the simulation tools and design a deployment scheme. 3. Analyze various MAC Protocol and its functions 4. Design energy efficient routing protocol for WSN 5. Recall the Network Management and Middleware services.

Prerequisites: Computer Networks

CO, PO AND PSO MAPPING

CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	3	-	-	-	3	-	3	-	2	-	3	-	-	-	3
CO-2	3	-	-	3	1	-	1	-	2		3	-	-	-	2
CO-3	3	-	3	3	2		1	-	2	2	1	-	-	-	3

CO															
CO-4	3	3	1	1	1	-	1	-	1	-	3	-	-	-	3
CO-5	3	3	3	1	2	-	1	-	1	-	1	-	-	-	3
CO-6	3	3	3	1			1		1		1				1
CO-7	3	1	3	3	1	3	1	3	1		1		1	3	2
CO-8	3	3	1	1	2	1	1	1	3	2	3			1	3

1: Weakly related, 2: Moderately related and 3: Strongly related

MODULE 1: FUNDAMENTALS OF SENSOR NETWORKS (12)

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. **Practical component:** Simulate WSN using simulations tools. **Suggested Readings:** Wireless sensor network platform	**CO-1** **BTL-2**

MODULE 2: COMMUNICATION CHARACTERISTICS AND DEPLOYMENT MECHANISMS(12)

Wireless Communication characteristics - Link quality, fading effects, Shadowing, Localization, Connectivity and Topology - Sensor deployment mechanisms, Coverage issues, Node discovery protocols. **Practical component:** Develop a framework for Node discovery and localization **Suggested Readings:** Communication architecture	**CO-2** **BTL-2**

MODULE 3: MAC LAYER (12)

Fundamentals of Medium access protocol- Medium access layer protocols - Energy efficiency, Power allocation and Medium access control issues **Practical component:** MAC protocol simulation for wireless sensor Network. **Suggested Readings:** Survey on performance evaluation of various MAC Protocols	**CO-3** **BTL-3**

MODULE 4: NETWORK LAYER AND TRANSPORT LAYER (12)

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. **Practical component:** Modify Transport Protocol for effective QoS **Suggested Readings:** Routing Table of a network.	**CO-4** **BTL-3**

MODULE 5: MIDDLEWARE AND SECURITY ISSUES	(12)
Middleware and Application layer -Data dissemination, Data storage, Query processing, Security - Privacy issues, Attacks and Countermeasures. **Practical component:** Develop a real world WSN application **Suggested Readings:** Security threats	**CO-5** BTL-3

TEXT BOOKS

1.	Holger Karl & Andreas Willig, (2005). *Protocols And Architectures for Wireless Sensor Networks*, John Wiley,
2.	N. P. Mahalik. (2007). *Sensor Networks and Configuration: Fundamentals, Standards, Platforms, and Applications,* Springer Verlag.

REFERENCE BOOKS

1.	Waltenegus Dargie, Christian Poellabauer. (2007), *Fundamentals of Wireless Sensor Networks, Theory and Practice*, Wiley Series on wireless Communication and Mobile Computing.
2.	Kazem Sohraby, Daniel manoli. (2010). *Wireless Sensor networks- Technology, Protocols and Applications*, Wiley InterScience Publications.
3.	Bhaskar Krishnamachari. (2005). *Networking Wireless Sensors*, Cambridge University Press.
4.	C.S Raghavendra, Krishna M.Sivalingam, Taieb znati. (2004). *Wireless Sensor Networks*, Springer Science.

E BOOKS

1.	https://www.intechopen.com/books/smart-wireless-sensor-networks
2.	https://www.springer.com/cda/content/document/cda_downloaddocument/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	2-0-2-0
Version	1.0	Approval Details	23 ACM, 06.02.2021	LEARNING LEVEL	BTL-5

ASSESSMENT SCHEME

First Periodical Assessment	Second Periodical Assessment	Seminar/ Assignments/ Project	Surprise Test / Quiz	Attendance	ESE
15%	15%	10%	5%	5%	50%

Course Description	The course covers the basics of Information Security, security investigation, analysis, logical design and physical design
Course Objective	1. To learn the basic concepts of information security 2. To know how to use the issues in Information Security 3. To incorporate approaches for risk management and best practices 4. To provide basic understanding of legal and regulatory requirements and international standards 5. To incorporate the foundational understanding of Information Security procedures
Course Outcome	Upon completion of this course, the students will be able to 1. The basics of information security. 2. Use the legal, ethical and professional issues in Information Security 3. Analyze Risk management. 4. Design the logic of various standards 5. Implement Information Security procedures

Prerequisites: Nil

CO, PO AND PSO MAPPING

CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	2	-	-	-	3	-		-	1	-		-	-	3	
CO-2	3	3	3		1	-		-	1	2		-	-	3	2
CO-3	3	-	3			1		-	2			-	-	1	2

CO-4	3	3	3	2		-		-	2	2		-	-	2	3
CO-5	3	3	3		2	-		1	2	2		-	1	2	3

1: Weakly related, 2: Moderately related and 3: Strongly related

MODULE 1: INTRODUCTION   (12)

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. **Practical component:** Configure the Wireless Access Points. **Suggested Readings:** Fundamental concepts of Information Security	**CO-1** **BTL-2**

MODULE 2: SECURITY INVESTIGATION   (12)

Need for Security, Business Needs, Threats, Attacks, Legal, Ethical and Professional Issues **Practical component:** Design a Secure Business Model **Suggested Readings:** Information Security threats and vulnerabilities	**CO-2** **BTL-3**

MODULE 3: SECURITY ANALYSIS   (12)

Risk Management: Identifying and Assessing Risk, Assessing and Controlling Risk **Practical component:** Identify and Assess the Risk **Suggested Readings:** Risk treatment plan	**CO-3** **BTL-3**

MODULE 4: LOGICAL DESIGN   (12)

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. **Practical component:** To prepare a blueprint for security design of an organisation **Suggested Readings:** Network policies	**CO-4** **BTL-5**

MODULE 5: PHYSICAL DESIGN   (12)

Security Technology, IDS, Scanning and Analysis Tools, Cryptography, Access Control Devices, Physical Security, Security and Personnel. **Practical component:** Configure IDS **Suggested Readings:** Firewall technologies	**CO-5** **BTL-5**

TEXT BOOKS

1.	Michael E Whitman and Herbert J Mattord. (2012). *Principles of Information Security*, Vikas Publishing House, New Delhi.

REFERENCE BOOKS

1.	Micki Krause, Harold F. Tipton. (2004). *Handbook of Information Security Management*, CRC Press LLC, Vol 1-3.
2.	Stuart Mc Clure, Joel Scrambray, George Kurtz. (2003). *Hacking Exposed*, Tata McGraw-Hill.
3.	Matt Bishop. (2002). *Computer Security Art and Science*, Pearson/PHI.

E BOOKS

1.	https://www.routledge.com/Information-Security-Architecture-An-Integrated-Approach-to-Security-in/Killmeyer/p/book/9780849315497
2.	https://www.taylorfrancis.com/books/mono/10.1201/9780203488751/information-security-architecture-jan-killmeyer

MOOC

1.	https://dynomapper.com/blog/278-books-about-information-architecture
2.	https://www.cyberark.com/blog/8-books-every-security-architect-must-read/

COURSE TITLE	SOFTWARE ENGINEERING			CREDITS	3
COURSE CODE	CSA3724	**COURSE CATEGORY**	PE	L-T-P-S	2-0-2-0
Version	1.0	**Approval Details**	23 ACM, 06.02.2021	**LEARNING LEVEL**	BTL-6
ASSESSMENT SCHEME					
First Periodical Assessment	**Second Periodical Assessment**	**Seminar/ Assignments/ Project**	**Surprise Test / Quiz**	**Attendance**	**ESE**
15%	15%	10%	5%	5%	50%
Course Description	This Course covers the core principles, Agile Development and tools, software requirements, software development process and design Concepts, quality management and software process management				

	Course Objective
Course Objective	1. To understand the software life cycle models 2. To understand the software requirements 3. To ensure good quality software 4. To apply principles of software development 5. To equip students with the knowledge and tools and techniques of engineering practices
Course Outcome	Upon completion of this course, the students will be able to 1. To apply the software engineering lifecycle by demonstrating competence in communication, planning, analysis, design, construction, and deployment 2. An ability to work in one or more significant application domains 3. Work as an individual and as part of a multidisciplinary team to develop and deliver quality software 4. Demonstrate an understanding of and apply principles in Multidisciplinary environment based on economic and financial terms. 5. Demonstrate an ability to use the techniques and tools necessary for engineering practice

Prerequisites: Nil

CO, PO AND PSO MAPPING

CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	3	-	-	3	2	-	1	-	2	-		-	-	3	2
CO-2	2	3	3	2	1	2	1	1	2		1	-	-	3	1
CO-3	2	1		2	2	3	2	-	2			-	1	3	3
CO-4	2	1				-1	3	-	2		1	-	-	3	1
CO-5	2	2	2	2	3	2	2	2	2	2	1	-	1	3	3

1: Weakly related, 2: Moderately related and 3: Strongly related

MODULE 1: INTRODUCTION AND AGILE DEVELOPMENT   (12)

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 **Practical component:** Explore the tools related to Agile Development and develop a small project using this technology **Suggested Readings:** Compare the historic models with agile for a business requirement and justify	**CO-1** **BTL-2**

MODULE 2: UNDERSTANDING SOFTWARE REQUIREMENTS (12)	
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 **Practical component:** Use any open source software for requirements elicitation, requirements analysis and requirements validation. **Suggested Readings:** Identify the functional and nonfunctional requirements of a business requirements, justify how to negotiate the requirements when needed for a business requirement	**CO-2** **BTL-3**

MODULE 3: SOFTWARE DESIGN CONCEPTS	(12)
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 **Practical component:** Design an architecture diagram and brief its transactional flow for a business requirement. Design a business requirement using UML **Suggested Readings:** Case Study on Component Based Software Architecture	**CO-3** **BTL-6**

MODULE 4: QUALITY MANAGEMENT	(12)

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. **Practical component:** Justify the quality of a web application using the latest testing tools, Identify and demonstrate the role of SCM Manager on a business project **Suggested Readings:** Classic model of cost of software quality	**CO-4** **BTL-5**	

MODULE 5: MANAGING SOFTWARE PROCESS		**(12)**
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 **Practical component:** Estimate the budget for the business and conduct project bidding among groups **Suggested Readings:** Software Process Assessment.	**CO-5** **BTL-6**	

TEXT BOOKS	
1.	Roger S Pressman. (2010). *Software Engineering A Practitioner's Approach,* Tata McGraw-Hill seventh edition.

REFERENCE BOOKS	
1.	Roger S. Pressman. (2009). *Software Engineering – A Practitioner's Approach*, Tata McGraw-Hill seventh edition.
2.	Richard Fairley. (2008). *Software Engineering Concepts* , Tata Mcgraw Hill.
3.	Ian Sommerville. (2007). *Software Engineering*, Seventh Edition, Pearson Education Asia.
4.	Gopalaswamy Ramesh, Ramesh Bhattiprolu. (2003). *Software Maintenance*, Tata Mcgraw Hill.
5.	Shari Lwarence Pfleeger, Joanne M.Atlee. (2006). *Software Engineering Theory and Practice* , Third Edition, Pearson Education.
6.	Alistair Cockburn. (2001). *Agile Software Development*, First Edition, Pearson Education Asia
7.	Hans Van Vliet. (2008). *Software Engineering: Principles and Practices*, Wiley; 3 edition.

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/

COURSE TITLE	CLOUD COMPUTING			CREDITS	3
COURSE CODE	CSA3725	COURSE CATEGORY	PE	L-T-P-S	2-0-2-0
Version	1.0	Approval Details	23 ACM, 06.02.2021	LEARNING LEVEL	BTL-3

ASSESSMENT SCHEME						
First Periodical Assessment	Second Periodical Assessment	Seminar/ Assignments/ Project	Surprise Test / Quiz	Attendance		ESE
15%	15%	10%	5%	5%		50%

Course Description	Cloud Computing covers the concepts, technology and architecture of Cloud Computing, different cloud service providers, storage infrastructure and Cloud Management, concepts as cloud virtualization technology and cloud, SOA and infrastructure benchmarking
Course Objective	1. To understand the basics of Cloud services and deploy cloud application using cloud platforms 2. To introduce Cloud Models and develop cloud-based applications 3. To provide knowledge in different techniques of Cloud Analytics 4. To Illustrate the use of various cloud system design approaches 5. To evaluate various solutions for cloud computing 6. To be aware of Infrastructure Benchmarking
Course Outcome	Upon completion of this course, the students will be able to 1. Develop and deploy cloud application using popular cloud platforms 2. Design and develop highly scalable cloud-based applications by creating and configuring virtual machines on the cloud and building private cloud. 3. Explain and identify the techniques of big data analysis in cloud. 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. 5. Write comprehensive case studies analysing and contrasting different cloud computing solutions. 6. Understand and use Infrastructure Benchmarking

Prerequisites: CSB4218 - Operating Systems, CSB4217 - Computer Networks

CO, PO AND PSO MAPPING

CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	3	-	-	1	2	-		-	2	-		-	-	1	2
CO-2		3		1	2				2			-	-	1	2
CO-3	3		1	1	1			-	2			-	1	3	3
CO-4	2	3		1	2	-		-	2	2		-	1	1	3
CO-5	2	2	3	1	2				2			-		1	2
CO-6	2		3	1					2					1	

1: Weakly related, 2: Moderately related and 3: Strongly related

MODULE 1: INTRODUCTION   (12)

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. **Practical component:** Develop Cloud security solutions **Suggested Readings:** Case study on Open Source and Commercial Clouds	**CO-1** **BTL-2**

MODULE 2: CLOUD SERVICES AND SOLUTIONS   (12)

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. **Practical component:** Deploy cloud applications **Suggested Readings:** On-demand self- service	**CO-2** **BTL-3**

MODULE 3: CLOUD OFFERINGS AND CLOUD MANAGEMENT   (12)

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	**CO-3** **BTL-3**

Practical component: Deployment and Configuration options in Amazon **Suggested Readings:** Data security and Storage		
MODULE 4: CLOUD VIRTUALIZATION TECHNOLOGY	**(12)**	
Virtualization Defined - Virtualization Benefits - Server Virtua lization - 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 **Practical component:** Hands on virtualization using XenServer **Suggested Readings:** Data virtualization	**CO-4** **BTL-3**	
MODULE 5: CLOUD, SOA AND INFRASTRUCTURE BENCHMARKING	**(12)**	
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 **Practical component:** Build cloud infrastructure **Suggested Readings:** The Business case for going to the Cloud.	**CO-5,6** **BTL-3**	

TEXT BOOKS

1.	Kumar Saurabh. (2011). *Cloud Computing: Insights into New-Era Infrastructure*, Wiley India Pvt. Ltd.

REFERENCE BOOKS

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

E BOOKS

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

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	CSB3726		COURSE CATEGORY	PE	L-T-P-S	2-0-2-0
Version	1.0	Approval Details		23 ACM, 06.02.2021	LEARNING LEVEL	BTL-3

ASSESSMENT SCHEME

First Periodical Assessment	Second Periodical Assessment	Seminar/ Assignments/ Project	Surprise Test / Quiz	Attendance	ESE
15%	15%	10%	5%	5%	50%

Course Description	This course provides an overview of the Human Computer Interaction, cognitive psychology, developing user interfaces, testing and Evaluation Techniques
Course Objective	1. To understand the basic concepts of Human Computer Interaction 2. To know about the user's capabilities 3. To develop Human Computer Interfaces 4. To identify the techniques for Testing and Evaluating the Usability of Human Computer Interaction 5. To learn about the advanced user Interaction
Course Outcome	Upon completion of this course, the students will be able to 1. Relate Human Computer Interaction and summarize its importance. 2. Identify the user's capabilities and recommend guidelines for interfaces. 3. Design Human Computer Interfaces and implement them. 4. Test and Evaluate the Usability of Human Computer Interaction. 5. Formulate advanced user Interaction for real time applications

Prerequisites: Nil

CO, PO AND PSO MAPPING

CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	3	-	-			-		-	2	-		-	-		1
CO-2	2	3		1					2			-	-		2
CO-3	2		3	2	1			1	2	2		-			3
CO-4	2			2	1	3		1	2	2		-	1	1	2

CO-5	2			3	1			2	2	2		-	1	2	2

1: Weakly related, 2: Moderately related and 3: Strongly related

MODULE 1: INTRODUCTION (12)

Human Computer Interaction –Background – Importance of Human Computer Interaction – Software development and Human Computer Interaction – Display devices – Models of interaction –context of interaction. **Practical component:** Model the Human Computer Interaction **Suggested Readings:** Human factors involved in the acceptance of computer interfaces.	**CO-1** **BTL-2**

MODULE 2: USER CAPABILITIES   (12)

Users' physical capabilities – Cognition – Design considerations – Memory - guidelines for interfaces – Memory and learning – Computer Human Systems. **Practical component:** Develop of comprehensive, friendly and usable human-computer interfaces **Suggested Readings:** Tangible and embodied user interactions	**CO-2** **BTL-3**

MODULE 3: INTERFACE DESIGN   (12)

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 **Practical component:** Develop a user interface for games **Suggested Readings:** Study of standard user interfaces on the Internet	**CO-3** **BTL-3**

MODULE 4: TESTING AND EVALUATION   (12)

Importance of Evaluation – Evaluation Techniques –Usability Engineering – Usability Process – Usability Metrics - Socio Technical Design - Ergonomics, Health and Safety – Social Implications **Practical component:** Apply usability metrics to critically evaluate commercial products **Suggested Readings:** Evaluation tools	**CO-4** **BTL-3**

MODULE 5: VARIETIES OF INTERACTION   (12)

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	**CO-5** **BTL-3**

Decision- Support Systems -Online Communities -Virtual Environments -Privacy, Security, and Trust: Human– Computer Interaction Challenges and Opportunities

Practical component: Develop a modern GUI

Suggested Readings: To carry out research on latest human interaction systems and the related technology.

TEXT BOOKS	
1.	Christine Faulkner. (2010). *The Essence of Human-Computer Interaction*, First Edition, Pearson Education.
2.	Julie A.Jacko. (2012). *The Human Computer Interaction Handbook Fundamentals, Evolving Technologies, and Emerging Applications*, Third Edition, CRC Press, Taylor & Francis Group.

REFERENCE BOOKS	
1.	Wilbert O Galitz. (2007). *The essential guide to user interface design*, 3rd Edition, , Wiley.
2.	Ben Shneidermann , Catherine Plaisant. (2008). *Designing the user interface, Strategies for effective Human Computer Interaction*, 3rd Edition, Pearson Education.
3.	Alan Dix, Janet Finlay, GreGoryd, Abowd, Russell Beale. (2004). *Human – Computer Interaction*, 3rd Edition, Pearson Education

E BOOKS	
1.	https://www.hcibook.com/e3/

MOOC	
1.	https://www.class-central.com/course/nptel-introduction-to-human-computer-interaction-9906
2.	https://www.edx.org/professional-certificate/gtx-human-computer-interaction

COURSE TITLE	DIGITAL FORENSICS			CREDITS	3
COURSE CODE	CSA3727	COURSE CATEGORY	PE	L-T-P-S	2-0-2-0
Version	1.0	Approval Details	23 ACM, 06.02.2021	LEARNING LEVEL	BTL-3

ASSESSMENT SCHEME

First Periodical Assessment	Second Periodical Assessment	Seminar/ Assignments/ Project	Surprise Test / Quiz	Attendance	ESE
15%	15%	10%	5%	5%	50%

Course Description	This course covers an overview of Cyber Crime, Cybercrime issues, Software Piracy and laws, Cyber Crime Investigation and E-Mail Investigation
Course Objective	1. To understand the essential concepts of Cyber Crime 2. To Identify the cybercrime issues 3. To understand the digital laws in cyber crime 4. To emphasize the importance of digital forensics tools 5. To learn the different techniques and procedures that enable them to perform a digital investigation
Course Outcome	Upon completion of this course, the students will be able to 1. Summarize the overview and categories of cyber crime 2. List out the cybercrime issues 3. Recall the digital laws in cyber crime 4. List and use the cybercrime tools and evidence 5. Apply recovering digital evidences and forensics

Prerequisites: Nil

CO, PO AND PSO MAPPING

CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	3	-	1			-		-	2	1	1	-	-	3	
CO-2	3		2	1	1	1			2	2		-	-	3	1
CO-3	3		2	1	2		1	2	2	2		-		3	1
CO-4		3	2	1	2			1	2	2		-		3	3

CO-5	**2**	**2**	**3**	**2**	**1**		**2**	**1**	**2**	**2**		**-**	**1**	**3**	**3**

1: Weakly related, 2: Moderately related and 3: Strongly related

MODULE 1: INTRODUCTION (12)

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. **Practical component:** Demonstrate using CyberCheckSuite **Suggested Readings:** Emerging digital crimes.	**CO-1** **BTL-2**

MODULE 2: CYBER CRIME ISSUES   (12)

Cyber Crime Issues: Unauthorized Access to Computers, Computer Intrusions, white collar Crimes, Viruses and Malicious Code Internet Hacking and Cracking, Virus Attacks. **Practical component:** Develop a intrusion detection system **Suggested Readings:** Credit card and ATM frauds	**CO-2** **BTL-3**

MODULE 3: SOFTWARE PIRACY AND LAWS   (12)

Software Piracy, Pornography, Intellectual Property, Mail Bombs, Exploitation, Stalking and Obscenity in Internet, Digital laws and legislation, Law Enforcement Roles and Responses. **Practical component:** Live Case Studies **Suggested Readings:** Workload of law enforcement	**CO-3** **BTL-3**

MODULE 4: CYBER CRIME INVESTIGATIONS   (12)

Introduction to Cyber Crime Investigation, Investigation Tools, eDiscovery, Digital Evidence Collection, Evidence Preservation. **Practical component:** Authenticate the evidence **Suggested Readings:** Multimedia evidence	**CO-4** **BTL-3**

MODULE 5: E-MAIL INVESTIGATION   (12)

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. **Practical component:** Develop a intrusion detection system **Suggested Readings:** Time, registry & password recovery.	**CO-5** **BTL-3**

TEXT BOOKS

1.	Nelson Phillips and EnfingerSteuart. (2004). *Computer Forensics and Investigations*, Cengage Learning, New Delhi.
REFERENCE BOOKS	
1.	Kevin Mandia, Chris Prosise, Matt Pepe. (2006). *Incident Response and Computer Forensics* , Tata McGraw - Hill, New Delhi
2.	Robert M Slade. (2005.). *Software Forensics*, Tata McGraw - Hill, New Delhi.
3.	Bernadette H Schell, Clemens Martin. (2004). *Cybercrime*, ABC – CLIO Inc, California.
4.	(2005). *Understanding Forensics in IT* , NIIT Ltd.
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
2.	https://www.edx.org/course/computer-forensics

COURSE TITLE	PERFORMANCE METRICS FOR ADVANCEDCOMPUTING			CREDITS	3
COURSE CODE	CSA3728	**COURSE CATEGORY**	PE	**L-T-P-S**	2-0-2-0
Version	1.0	**Approval Details**	23 ACM, 06.02.2021	**LEARNING LEVEL**	BTL-3
ASSESSMENT SCHEME					
First Periodical Assessment	**Second Periodical Assessment**	**Seminar/ Assignments/ Project**	**Surprise Test / Quiz**	**Attendance**	**ESE**
15%	15%	10%	5%	5%	50%
Course Description	This course covers an overview of Performance of Computer Systems, Principles of Experimentation, Metrics that Measure Performance, Case Study and Advanced Metrics				
Course Objective	1. To understand the basic performance metrics 2. To know about the Principles of Experimentation 3. To provide with different performance and Non Performance metrics 4. To explore the challenges of measuring Performance with Real Applications				

	5. To provide with an up-to-date Advanced performance Metrics
Course Outcome	Upon completion of this course, the students will be able to 1. Apply basic performance metrics to measure the performance of computer systems. 2. Use Principles of Experimentation for simulations 3. Use performance metrics and Non-Performance metrics for computing 4. Measuring Performance of Real time Applications 5. Measuring Performance of Advanced Computing Applications

Prerequisites: CSB4218 - Operating Systems, CSB4217 - Computer Networks, Computer Architecture

CO, PO AND PSO MAPPING

CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	3	3	3	-	2	-	-	-	2	-	-	-	-	-	1
CO-2	3	3	3	-	-	-	-	-	2	-	-	-	1	-	2
CO-3	3	3	3	1	2	-	-	-	2	-	-	-	1	-	1
CO-4	3	3	3	1	1	-	-	-	2	-	-	-	1	-	2
CO-5	3	3	3	-	-	-	-	-	2	-	-	-	1	1	1

1: Weakly related, 2: Moderately related and 3: Strongly related

MODULE 1: Performance of Computer Systems (12)

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. **Practical component:** Design a computing Device for the given performance **Suggested Readings:** Multicore processors	**CO-1** **BTL-2**

MODULE 2: Principles of Experimentation   (12)

Principles of Experimentation - Meaningful metrics, Reproducibility, Real programs, Simulation Metrics. **Practical component:** Design a simulation application for the simple HPC. **Suggested Readings:** Multithread programming	**CO-2** **BTL-3**

MODULE 3: Metrics that Measure Performance (12)

	CO-3 BTL-3
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. **Practical component:** Design a Cluster with given Performance Metrics. **Suggested Readings:** Performance pitfalls	CO-3 BTL-3

MODULE 4: Case Study	(12)
Challenges of Measuring Performance with Real Applications – HPC, Cloud, Kernels. **Practical component:** Survey on Challenges of Measuring Performance with HPC. **Suggested Readings:** Performance tools	CO-4 BTL-3

MODULE 5: Advanced Metrics	(12)
Advanced Computing Metric System - Consistent Representation of Information, Explicit Relationships Repository of Definitions, Comparability, Flexibility and Adaptability, Composability. **Practical component:** Suggest a Computing Metrics for Modern HPC. **Suggested Readings:** Parallel scalability	CO-5 BTL-3

TEXT BOOKS	
1.	Brendan Gregg. (2016). *Systems Performance: Enterprise and the Cloud*, 1st Edition, Holdings Private Limited.
2.	Randal S. (2016). *Python Machine Learning*, PACKT Publishing.

REFERENCE BOOKS	
1.	(2017). *Cloud Computing Service Metrics Description*, NIST, 2017
2.	(2013). Grid Computing Performance Metrics Framework, NIST, 2013
3.	Nasir Abbas, Yan Zhang, Amir Taherkordi, Tor Skeie. (2018). *Mobile Edge Computing: A Survey*, Internet of Things Journal IEEE, vol. 5, no. 1, pp. 450-465.

E BOOKS	
1.	http://www.brightcomputing.com/free-ebook-hpc

MOOC	
1.	https://www.coursera.org/learn/quantitative-formal-modeling-1
2.	https://onlinecourses.nptel.ac.in/noc20_me61/preview

COURSE TITLE	INTRODUCTION TO INTELLIGENT SYSTEMS				CREDITS	3
COURSE CODE	CSA3729		COURSE CATEGORY	PE	L-T-P-S	3-0-0-0
Version	1.0		Approval Details	23 ACM, 06.02.2021	LEARNING LEVEL	BTL-3

ASSESSMENT SCHEME

First Periodical Assessment	Second Periodical Assessment	Seminar/ Assignments/ Project	Surprise Test / Quiz	Attendance	ESE
15%	15%	10%	5%	5%	50%

Course Description	This course covers an overview of the intelligent system to solve real world problems, knowledge and reasoning, uncertain knowledge and reasoning, categories of Learning and Expert Systems
Course Objective	1. To have the ability to solve the real world applications 2. To be aware of the probabilistic learning models 3. To determine the techniques for constraint satisfaction problems 4. To demonstrate the knowledge of the intelligent systems methodologies 5. To have the ability to develop an intelligent system for an application.
Course Outcome	Upon completion of this course, the students will be able to 1. Apply the knowledge and reasoning in real world 2. Apply the probabilistic learning models 3. Describe, analyze and apply techniques for constraint satisfaction problems 4. Determine which type of intelligent system methodology would be suitable for a given type of application problem 5. Develop an intelligent system for a selected application

Prerequisites: CSC4353 - Soft computing, CSB4303 - Artificial Intelligence

CO, PO AND PSO MAPPING

CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	3	3	3	2	1	-	-	-	2	-	-	-	1	-	1
CO-2	3	3	3	2	2	-	-	-	2	-	-	-	1	-	2

CO-3	3	2	2	2	2	-	-	1	2	1	-	-	1	-	3
CO-4	3	3	2	2	1	1	-	2	2	-	2	-	-	-	3
CO-5	2	2	2	2	1	3	-	-	2	-	-	-	1	1	2

1: Weakly related, 2: Moderately related and 3: Strongly related

MODULE 1: AI INTRODUCTION	(12)
Introduction -Intelligent Agents -Problem Solving -Solving Problems by Searching - Beyond Classical Search - Adversarial Search - Constraint Satisfaction Problems. **Practical component:** **Suggested Readings:** Discuss the history and implications of Artificial Intelligence research	**CO-1** **BTL-2**

MODULE 2: KNOWLEDGE AND REASONING	(12)
Logical Agents -First-Order Logic - Inference in First-Order Logic -Classical Planning - Planning and Acting in the Real World -Knowledge Representation. **Practical component:** **Suggested Readings:** Describe attributes of search techniques and the situations	**CO-2** **BTL-3**

MODULE 3: UNCERTAIN KNOWLEDGE AND REASONING	(12)
Quantifying Uncertainty -Probabilistic Reasoning - Probabilistic Reasoning over Time -Making Simple Decisions -Making Complex Decisions. **Practical component:** **Suggested Readings:** Dealing with uncertainty	**CO-3** **BTL-3**

MODULE 4: LEARNING	(12)
Learning from Examples - Knowledge in Learning - Learning Probabilistic Models – Reinforcement Learning -Communicating, Perceiving, and Acting-Natural Language Processing - Natural Language for Communication- Perception. **Practical component:** **Suggested Readings:** Describe and apply techniques for automated learning	**CO-4** **BTL-3**

MODULE 5: EXPERT SYSTEM	(12)
Defining Expert Systems – Expert system architecture-Robot Architectures **Practical component:** **Suggested Readings:** Implement standard algorithms for intelligent system	**CO-5** BTL-3

TEXT BOOKS

1.	Stuart Russel and Peter Norwig. (2012). *Artificial Intelligence: A Modern Approach*, Prentice Hall third edition.

REFERENCE BOOKS	
1.	Kevin Knight, Eline Rich B.Nair. (2012). *Artificial Intelligence*, McGraw Hill Education 3rd edition.

E BOOKS	
1.	https://www.amazon.in/INTRODUCTIONINTELLIGENCEebook/dp/B015DY3L5

MOOC	
1.	https://nptel.ac.in/courses/108104049/
2.	https://www.edx.org/learn/artificial-intelligence

COURSE TITLE	HIGH PERFORMANCE COMPUTING			CREDITS	3
COURSE CODE	CSA3730	COURSE CATEGORY	PE	L-T-P-S	3-0-0-0
Version	1.0	Approval Details	23 ACM, 06.02.2021	LEARNING LEVEL	BTL-3
ASSESSMENT SCHEME					
First Periodical Assessment	Second Periodical Assessment	Seminar/ Assignments/ Project	Surprise Test / Quiz	Attendance	ESE
15%	15%	10%	5%	5%	50%
Course Description	The aim of the course is to study the fundamental techniques for developing HPC applications, the commonly used HPC platforms, the methods for measuring, assessing and analyzing the performance of HPC applications, and the role of administration, workload and resource management in an HPC management software.				
Course Objective	1. Provide systematic and comprehensive treatment of the hardware and the software high performance techniques involved in current day computing. 2. Introduce the fundamentals of high-performance computing with the graphics processing units and many integrated cores using their architectures and corresponding programming environments.				

3. Introduce the learner to fundamental and advanced parallel algorithms through the GPU and MIC programming environments
4. Provide systematic and comprehensive treatment of the components in the pipeline that extract instruction level parallelism.
5. Provide a strong foundation on memory hierarchy design and tradeoffs in both uniprocessor and multiprocessors.

Course Outcome	Upon completion of this course, the students will be able to 1. The learner will be able to design, formulate, solve and implement high performance versions of standard single threaded algorithms 2. The learner will know and will be able to demonstrate the architectural features in the GPU and MIC hardware accelerators. 3. The learner will be able to design programs to extract maximum performance in a multicore, shared memory execution environment processor 4. The learner will be able to design and deploy large scale parallel programs on tightly coupled parallel systems using the message passing paradigm

Prerequisites: Computer Architecture, Design and analysis of Algorithms

CO, PO AND PSO MAPPING

CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	3	3	3	2	1	-	-	-	2	-	-	-	1	-	1
CO-2	3	3	3	2	2	-	-	-	2	-	-	-	1	-	2
CO-3	3	2	2	2	2	-	-	1	2	1	-	-	1	-	3
CO-4	3	3	2	2	1	1	-	2	2	-	2	-	-	-	3
CO-5	2	2	2	2	1	3	-	-	2	-	-	-	1	1	2

1: Weakly related, 2: Moderately related and 3: Strongly related

MODULE 1: INTRODUCTION(9)

High performance Computing - Impact of Super computing systems – Anatomy of Super Computing– Computer Performance – History of Super Computing. **Suggested Activity:** Study about GPU programming	**CO-1** **BTL-2**

MODULE 2: HPCARCHITECTURE(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. **Practical component:** **Suggested Activity:** Study about Xeon Phi Programming Suggested sources: https://www.youtube.com/watch?v=NIqrWds0cy0	**CO-2** **BTL-3**

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=-vD6PUdf3JsSuggested Activity:Create n node cluster in Windows server	**CO-3** **BTL-3**

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 Activity:Study about OpenMP programming Suggested sources: https://www.youtube.com/watch?v=PBPVLJwN0IY	**CO-4** **BTL-3**

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 Activities: Implement parallel algorithm using OpenMP. Suggested sources: https://www.youtube.com/watch?v=nE-xN4Bf8XI https://www.youtube.com/watch?v=6jFkNjhJ-Z4	**CO-5** **BTL-3**

TEXT BOOKS

1.	ThomasSterling,MatthewAnderson,MaciejBrodowicz,"HighPerformanceComputing: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. 5th Edition 2011
2.	JohnPaulShenandMikkoH.Lipasti,ModernProcessorDesign:FundamentalsSuperscalarProcessors, TataMcGraw-Hill. 2005
3.	KaiHwangandBriggs,ComputerArchitectureandParallelProcessing,McGraw-Hill,2012
4.	M.J.Flynn,ComputerArchitecture:PipelinedandParallelProcessorDesign,NarosaPublishingHouse,2008
5.	Kai Hwang, Advanced Computer Architecture: Parallelism, Scalability, Programmability,McGraw-Hill, 3rd 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
2.	https://www.class-central.com/course/udacity-high-performance-computing-1028

COURSE TITLE	SOFTWARE SECURITY			CREDITS	3
COURSE CODE	CSA3731	COURSE CATEGORY	PE	L-T-P-S	3-0-0-0
Version	1.0	Approval Details	23 ACM, 06.02.2021	LEARNING LEVEL	BTL-3
ASSESSMENT SCHEME					
First Periodical Assessment	Second Periodical Assessment	Seminar/ Assignments/ Project	Surprise Test / Quiz	Attendance	ESE
15%	15%	10%	5%	5%	50%
Course Description	This course unit introduces students to basic and advanced approaches to formally build verified trustworthy software systems, where trustworthy comprise five attributes: reliability, availability, safety, resilience and security.				

| Course Objective | 1. Lean how and why (certain) software defenses can be bypassed |
| | 2. Familiarize with exploit development techniques, in order to better understand the boundaries of protection mechanisms and argue about their effectiveness |

Course Outcome	Upon completion of this course, the students will be able to
	1. Explain software security fundamentals
	2. Do code review with a tool
	3. Perform Security Testing
	4. Identify the Security Gap
	5. Analyze the files both statically and dynamically

Prerequisites: Security Software Engineering

CO, PO AND PSO MAPPING

CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	3	3	3	2	1	-	-	-	2	-	-	-	1	-	1
CO-2	3	3	3	2	2	-	-	-	2	-	-	-	1	-	2
CO-3	3	2	2	2	2	-	-	1	2	1	-	-	1	-	3
CO-4	3	3	2	2	1	1	-	2	2	-	2	-	-	-	3
CO-5	2	2	2	2	1	3	-	-	2	-	-	-	1	1	2

1: Weakly related, 2: Moderately related and 3: Strongly related

MODULE 1: SOFTWARESECURITYFUNDAMENTALS (9)

Defining a discipline: Security Problems in Software - The three pillars of software security - The rise of security engineering - Risk Management framework. **Suggested Activity:**Study about the common security issues of software	CO-1 BTL-2

MODULE 2: TOUCH POINT SOFTWARE SECURITY (9)

Introduction to software security touch points -Code review with a tool **Suggested Activity:**Identify the Seven Touchpoints for Software Security	CO-2 BTL-3

MODULE 3:SECURITYTESTING(9)

Software penetration Testing - Risk Based Security Testing - Abuse Cases - Software Security meets security operations	CO-3 BTL-3

Suggested Activity:Experiment with any one of the Penetration Testing Software	
MODULE 4:SOFTWARESECURITYGAP(9)	
Enterprise Software Security Program -Knowledge for software security - Taxonomy of coding errors Suggested Activity:Study about various coding errors	**CO-4** **BTL-3**
MODULE 5: ANALYSIS OF FILES	
Static and Dynamic analysis of files**.** Static analysis methods - feature selection, feature extraction and dataset creation - Dynamic analysis methods (use procmon) Suggested Activities:Perform dynamic analysis of malware using procmon	**CO-5** **BTL-3**

TEXT BOOKS	
1.	Gary R.McGraw, "Software Security : Building Security In", Addison Wesley, 2006

REFERENCE BOOKS	
1.	Sommerville, "Software Engineering", Adison Wesley, 10th Edition, 2016
2.	Pfleeger, "Software Engineering", Prentice Hall, 4th Edition, 2010
3.	Carlo Ghezzi, Mehdi Jazayari and Dino Mandrioli, "Fundamentals of Software Engineering",Prentice Hall of India, 2th Edition, 2004
4.	CraigLarman,"AgileandIterativeDevelopment:AManager'sGuide",PearsonEducation,2009.
5.	M.ShawandD.Garlan,"SoftwareArchitecture:PerspectivesonanEmergingDiscipline", Prentice Hall of India Private Limited , New Delhi 2010

E BOOKS	
1.	https://www.amazon.com/Secure-Software-Design-Theodor-Richardson/.../14496263..

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	DE	L-T-P-S		3-0-0-0
Version	1.0	Approval Details	23 ACM, 06.02.2021	LEARNING LEVEL		BTL-3

ASSESSMENT SCHEME

First Periodical Assessment	Second Periodical Assessment	Seminar/ Assignments/ Project	Surprise Test / Quiz	Attendance	ESE
15%	15%	10%	5%	5%	50%

Course Description	This course introduces concepts, metrics, and models in software quality assurance. The course covers components of software quality assurance systems before, during, and after software development. It also discusses the standards and certifications required to assess the Software Quality.
Course Objective	The course enables the students to 1. Learn the Software Quality challenges and to develop the Quality Plans. 2. Understand the Quality assurance components in the Project Life cycle. 3. Know the Quality Infrastructure Components. 4. Acquire the knowledge in Quality Metrics. 5. Familiar with the standards and certifications required to assess the Software Quality.
Course Outcome	Upon completion of this course, the students will be able to 1. Relate to quality assurance plan 2. Apply quality assurance tools & techniques in their project 3. Explain the quality management principles 4. Apply Procedures and work instructions in software organizations 5. Describe the Quality certification Procedure and standards

Prerequisites: Software Engineering

CO, PO AND PSO MAPPING

CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PSO-1	PSO-2	PSO-3
CO-1	2	3	3	2	1	2	3	2	1	1	2	1	3	1

CO-2	2	3	3	2	3	2	3	2	2	2	2	1	3	2
CO-3	3	2	2	2	1	2	3	2	2	1	2	1	3	1
CO-4	3	3	3	2	1	2	3	3	2	2	2	1	3	1
CO-5	3	1	2	1	1	1	2	3	2	1	1	1	3	1

1: Weakly related, 2: Moderately related and 3: Strongly related

MODULE1: 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	**CO-1** **BTL-2**

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/	**CO-2** **BTL-3**

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/	**CO-3** **BTL-2**

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	**CO-4** **BTL-2**

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	CO-5
Suggested activities: Find out the quality standards implemented in your university	BTL-2
Suggested sources:https://www.nibusinessinfo.co.uk/content/what-are-quality-management-standards	

TEXT BOOKS	
1	DanielGalin,"SoftwareQualityAssurance:FromTheorytoImplementation",PearsonAddison-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

MOOC	
1.	https://www.udemy.com/course/software-quality-assurance/

COURSE TITLE	COMPUTER VISION			CREDITS	3
COURSE CODE	CSA3733	COURSE CATEGORY	DE	L-T-P-S	3-0-0-0
Version	1.0	Approval Details	23 ACM, 06.02.2021	LEARNING LEVEL	BTL-3

ASSESSMENT SCHEME

First Periodical Assessment	Second Periodical Assessment	Seminar/ Assignments/ Project	Surprise Test / Quiz	Attendance	ESE
15%	15%	10%	5%	5%	50%

Course Description	This course offers the fundamentals of computer vision and various techniques in feature detection, segmentation and recognition.
Course Objective	The course will enable the students to 1. Learn the Fundamentals of image formation and image processing. 2. Know the feature detection and tracking techniques. 3. Expose to various segmentation and alignment techniques. 4. Explore Structure from Motion and Dense motion analysis. 5. Familiar with different recognition methods.
Course Outcome	Upon completion of this course, the students will be able to 1. Explain the fundamentals of image formation, transformation and analysis. 2. Explain the feature detection and tracking techniques. 3. Demonstrate various segmentation and alignment techniques. 4. Explain Structure from Motion and Dense Motion Analysis methodologies. 5. Implement various recognition techniques.

Prerequisites: Basic Knowledge in Linear Algebra and Vector Calculus

CO, PO AND PSO MAPPING

CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PSO-1	PSO-2	PSO-3
CO-1	3	3	2	3	1	1	1	2	2	1	3	2	2	3

CO-2	3	3	2	3	1	1	1	2	2	1	3	2	2	3
CO-3	3	3	2	3	2	1	1	2	2	1	3	2	2	3
CO-4	3	3	2	3	1	1	1	2	2	1	3	2	2	3
CO-5	3	3	3	1	3	1	1	1	2	1	3	2	2	3

1: Weakly related, 2: Moderately related and 3: Strongly related

MODULE1:IMAGEFORMATIONANDIMAGEPROCESSING (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. **Practical Component:** **1.**Download and install the latest release of OpenCV. Compile it in debug and release mode **2.**write a simple OpenCV program that loads an image from disk and displays it on the screen	**CO-1** **BTL-2**

MODULE 2: FEATUREDETECTIONANDTRACKING(9)

Invariance-key points and 3D flow vectors- RANSAC-SIFT, SURF, ORB- Feature evaluation. Tracking and feature updation-Lucas-Kanade tracker-Kalman filter. **Practical Component:** 1. write a simple OpenCV program for playing a video fi le from disk/ 2. write a Program to add a trackbar slider to the basic viewer window	**CO-2** **BTL-2**

MODULE 3: SEGMENTATIONANDALIGNMENT(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. **Practical Component:** 1.Write a program for Loading and then smoothing an image before it is displayed on the screen 2.Create a new image that is half the width and height of the input image Using cvPyrDown()	**CO-3** **BTL-3**

MODULE 4: STRUCTURE FROM MOTION AND DENSEMOTIONANALYSIS(9)

Structure from motion (sfm)-Triangulation- Two frame sfm - Bundle adjustment.3Dmotion and 2Doptical flow-The Horn Schunck algorithm-Lucas-Kanade Algorithm-Performance evaluation of optical flow results**.** **Practical Component:**	**CO-4** **BTL-2**

1.Write a program to read in a color video and write out the same video in grayscale	
2.Create a three-channel RGB image of size 100-by-100.	
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. Practical Component: Make an application that reads and displays a video and is controlled by sliders.	**CO-5** **BTL-3**
REFERENCE BOOKS	
1	Richard Szeliski ,"Computer Vision: Algorithms and Applications" ,Springer International,2011.
2	ReinhardKlette," Concise Computer Vision: An introduction into theory and Algorithms", ,2014,Springer-Verlag London.
3	R. Hartley and A. Zisserman, "Multiple View Geometry in Computer Vision", Cambridge University Press, 2003.
4	David Aforsyth&Jeanponce ,"Computervision–Amodern Approach",PrenticeHall,2002.
5	BerndJahne and Horst HauBecker "Computer vision and Applications", Academicpress,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 TECHOLOGY			CREDITS	3
COURSE CODE	CSA3734	COURSE CATEGORY	DE	L-T-P-S	3-0-0-0
Version	1.0	Approval Details	23 ACM, 06.02.2021	LEARNING LEVEL	BTL-3

ASSESSMENT SCHEME

First Periodical Assessment	Second Periodical Assessment	Seminar/ Assignments/ Project	Surprise Test / Quiz	Attendance	ESE
15%	15%	10%	5%	5%	50%

Course Description	The blockchain technology course allows the students to explore the driving force behind the cryptocurrency Bitcoin. Along with the Decentralization, Cryptography, Bitcoins with its alternative coins, Smart contracts and outside of currencies.
Course Objective	The course will enable the students to 1. Understand how blockchain systems (mainly Bitcoin and Ethereum) work 2. To securely interact with them 3. Design, build, and deploy smart contracts and distributed applications 4. Integrate ideas from blockchain technology into their own projects.
Course Outcome	Upon completion of this course, the students will be able to 1. State the basic concepts of blockchain 2. Paraphrase the list of Consensus 3. Demonstrate and interpret working of Hyperledger Fabric 4. Implement SDK composer tool 5. Demonstrate the supply chain and explain the Digital identity for government

Prerequisites: Basic idea in Networking, finance, Supply chain, Cryptography, Network Security

CO, PO AND PSO MAPPING

CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PSO-1	PSO-2	PSO-3
CO-1	3	3	2	3	1	1	1	2	2	1	3	2	2	3
CO-2	3	3	2	3	1	1	1	2	2	1	3	2	2	3
CO-3	3	3	2	3	2	1	1	2	2	1	3	2	2	3

CO-4	3	3	2	3	1	1	1	2	2	1	3	2	2	3
CO-5	3	3	3	1	3	1	1	1	2	1	3	2	2	3

1: Weakly related, 2: Moderately related and 3: Strongly related

MODULE1: INTRODUCTIONTOBLOCKCHAIN (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 Activity:** **1**. Study about blockchain tools in the Market	**CO-1** **BTL-2**
MODULE 2: CONSENSUS(9)	
Requirements for the consensus protocols-Proof of Work (PoW)-Scalability aspects of Blockchain consensus protocols: Permissioned Blockchains-Design goals-Consensus protocols for Permissioned Blockchains **Suggested Activity:** Implementing consensus algorithm	**CO-2** **BTL-2**
MODULE 3: HYPERLEDGERFABRIC(9)	
Decomposing the consensus process-Hyperledger fabric components-Chaincode Design and Implementation: Hyperledger Fabric II:-Beyond Chaincode: fabric SDK and Front End-Hyperledger composer tool **Suggested Activity:** Practice with simple experiment on Hyperledger	**CO-3** **BTL-3**
MODULE 4: USECASEI(9)	
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 Suggested Activity: Implement Digital Identity using smart contract	**CO-4** **BTL-2**
MODULE 5: USECASEII(9)	
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 **Suggested Activity:**	**CO-5** **BTL-3**

	Implement a digital bank using Ethereum Blockchain	

TEXT BOOKS

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,LucDesrosiers,NitinGaur,PetrNovotny,AnthonyO'Dowd,Venkatraman Ramakrishna, "Hands On Blockchain with Hyperledger: Building decentralized applications with HyperledgerFabricandComposer",2018.
3	Arshdeep Bahga,Vijay Madisetti,"Blockchain Applications:A Hands-On Approach", Vijay Madisetti publishers 2017.

REFERENCE BOOKS

1	Andreas Antonopoulos,"Mastering Bitcoin:Unlocking Digital Cryptocurrencies" ,O'ReillyMedia,Inc., 2014.
2	Melanie Swa, "Blockchain ",O'Reilly Media, 2014

E BOOKS

1	Blockchain Applications- https://www.blockchain-books.com

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	DE	L-T-P-S	3-0-0-0
Version	1.0	Approval Details	23 ACM, 06.02.2021	LEARNING LEVEL	BTL-3

ASSESSMENT SCHEME

First Periodical Assessment	Second Periodical Assessment	Seminar/ Assignments/ Project	Surprise Test / Quiz	Attendance	ESE
15%	15%	10%	5%	5%	50%

	Course Description	This course focusses on network security and various cryptographic algorithms. Also focuses on email security, firewalls and intruders.
Course Description	This course focusses on network security and various cryptographic algorithms. Also focuses on email security, firewalls and intruders.	

Course Objective	The course will enable the students to 1. Know the security architecture. 2. Learn symmetric cryptographic algorithms. 3. Understand the public key cryptography. 4. Acquire knowledge in various authentication schemes. 5. Grasp E-mail and system security practices.
Course Outcome	Upon completion of this course, the students will be able to 1. Explain security architecture, threats and vulnerabilities. 2. Implement symmetric cryptographic algorithms 3. Apply the differentcryptographic operations of public key cryptography key 4. Apply the various Authentication schemes to authentication applications 5. Recall various Security practices and System security standards

Prerequisites: Computer Networks

CO, PO AND PSO MAPPING

CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PSO-1	PSO-2	PSO-3
CO-1	3	1	1	1	1	1	1	2	1	2	1	1	3	1
CO-2	3	1	3	1	1	1	1	1	1	2	1	2	3	1
CO-3	3	3	3	3	3	1	1	1	1	2	1	2	3	1
CO-4	2	3	3	3	3	1	1	1	1	3	1	1	3	1
CO-5	3	1	1	1	1	1	3	1	3	3	1	1	3	1

1: Weakly related, 2: Moderately related and 3: Strongly related

MODULE1: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.	CO-1 BTL-2

Suggested Reading:	
https://training.apnic.net/wp- content/uploads/sites/2/2016/12/TSEC01.pdf	
MODULE 2: SYMMETRICCRYPTOGRAPHY(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. **Suggested Reading:** http://cs.brown.edu/cgc/net.secbook/se01/handouts/Ch08-CryptoConcepts.pdf	**CO-2** **BTL-3**
MODULE 3: PUBLIC KEYCRYPTOGRAPHY	**(9)**
Number Theory Concepts:Primes–PrimalityTesting–Factorization– Euler'stotientfunction, Fermat's and Euler's Theorem – Chinese Remainder Theorem – Exponentiation and logarithm – ASYMMETRIC KEY CIPHERS:RSAcryptosystem– Keydistribution–Keymanagement–DiffieHellman keyexchange–ElGamalcryptosystem– Ellipticcurvearithmetic-Ellipticcurvecryptography. **Suggested Reading:** http://www.facweb.iitkgp.ac.in/~sourav/PublicKeyCrypto.pdf	**CO-3** **BTL-3**
MODULE 4: AUTHENTICATION	**(9)**
Authentication requirement–Authentication function–MAC–Hashfunction–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 **Suggested Reading:** https://searchsecurity.techtarget.com/definition/authentication	**CO-4** **BTL-3**
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. **Suggested Readings:** https://web.cs.hacettepe.edu.tr/~abc/teaching/bbm463/slides/NetSec.pdf	**CO-5** **BTL-2**
TEXT BOOKS	
1. WilliamStallings,CryptographyandNetworkSecurity:PrinciplesandPractice,PHI7thEdition, 2016.	

REFERENCE BOOKS	
1	BehrouzA.Foruzan, Cryptography and Network Security, Tata McGraw Hill 2007.
2	CharlieKaufman,RadiaPerlman,andMikeSpeciner,NetworkSecurity:PRIVATE CommunicationinaPUBLICWorld,PrenticeHall,ISBN0-13-046019-2
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		DE	L-T-P-S	3-0-0-0
Version	1.0	Approval Details	23 ACM, 06.02.2021		LEARNING LEVEL	BTL-3
ASSESSMENT SCHEME						
First Periodical Assessment	Second Periodical Assessment	Seminar/ Assignments/ Project	Surprise Test / Quiz		Attendance	ESE
15%	15%	10%	5%		5%	50%
Course Description	This course introduces concepts, metrics, and models in software quality assurance. The course covers components of software quality assurance systems before, during, and after software development. It also discusses the standards and certifications required to assess the Software Quality.					
Course Objective	The course enables the students to 1. Learn the Software Quality challenges and to develop the Quality Plans. 2. Understand the Quality assurance components in the Project Life cycle. 3. Know the Quality Infrastructure Components.					

4. Acquire the knowledge in Quality Metrics.

5. Familiar with the standards and certifications required to assess the Software Quality.

Course Outcome	Upon completion of this course, the students will be able to 1. Relate to quality assurance plan 2. Apply quality assurance tools & techniques in their project 3. Explain the quality management principles 4. Apply Procedures and work instructions in software organizations 5. Describe the Quality certification Procedure and standards

Prerequisites: Software Engineering

CO, PO AND PSO MAPPING

CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PSO-1	PSO-2	PSO-3
CO-1	2	3	3	2	1	2	3	2	1	1	2	1	3	1
CO-2	2	3	3	2	3	2	3	2	2	2	2	1	3	2
CO-3	3	2	2	2	1	2	3	2	2	1	2	1	3	1
CO-4	3	3	3	2	1	2	3	3	2	2	2	1	3	1
CO-5	3	1	2	1	1	1	2	3	2	1	1	1	3	1

1: Weakly related, 2: Moderately related and 3: Strongly related

MODULE1:INTRODUCTION (9)

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. **Suggested Activities:** Combine group of projects as program **SuggestedReading:** https://www.greycampus.com/opencampus/project-management-professional/ basic-concepts-of-project-management	**CO-1** **BTL-2**

MODULE 2: COSTESTIMATION(9)

Problems in Software Estimation – Algorithmic Cost Estimation Process, Function Points, SLIM (Software Life cycle Management), COCOMO II (Constructive Cost Model)	**CO-2** **BTL-3**

– Estimating Web Application Development– Concepts of Finance, Activity Based Costing and Economic Value Added (EVA) – Balanced Score Card. **Suggested Activities:** Estimate the cost of a project **Suggested Reading:** http://www.costmanagement.eu/blog-article/what-is-cost-estimation-we-explain-it- to-you-in-4-steps	

MODULE 3: SOFTWAREQUALITYMANAGEMENT(9)

Software Quality Factors – Software Quality Components – Software Quality Plan – Software Quality Metrics – Software Quality Costs – Software Quality Assurance Standard – Certification – Assessment. Suggested Activities: Estimate the cost of a project Suggested Reading: https://www.tutorialspoint.com/ software_testing_dictionary/ quality_management.htm	**CO-3** **BTL-2**

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	**CO-4** **BTL-2**

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	**CO-5** **BTL-2**

TEXT BOOKS

1	Ramesh Gopalaswamy , "Managing and global Software Projects", Tata McGraw Hill Tenth Reprint,2011.

REFERENCE BOOKS

1	RogerS.Pressman,"SoftwareEngineering-APractitioner'sApproach",7thEdition,McGrawHill,2018
2	DanielGalin,"SoftwareQualityAssurance:fromTheorytoImplementation",PearsonAddison-Wesley,2008.
3	Bob hughes and Mike Cotterell, "Software Project Management" 5th edition,2018

4	Royce, W. "Software Project Management: A Unified Framework", Addison Wesley, 6th print 2000.
E BOOKS	
1	https://books.google.co.in/books/about/Software_Project_Management.html?id=O3kZAQAAIAAJ
2	http://library.bec.ac.in/kbc/NOTES%20BEC/CSE/8%20SEM/Software%20Project%20Management.pdf
MOOC	
1.	https://www.udemy.com/course/software-quality-assurance/