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

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 and Engineering field required for the growing dynamic IT and ITES industries.

M3. To sculpt strong personal, technical, research, entrepreneurial, and leadership skills.

M4. To inculcate knowledge in lifelong learning, professional ethics and contribution to the society.

M.Tech (COMPUTER SCIENCE AND ENGINEERING)
PROGRAMME EDUCATIONAL OBJECTIVES (PEO)

The program is expected to enable the students to

PEO I Excel in their professional career by applying advanced knowledge and/or pursue higher education including research by applying the knowledge of Computer Science and Engineering.

PEO II Asses the industry requirements and provide tangible solutions with social consciousness and ethical values.

PROGRAM OUTCOMES (ALIGNED WITH GRADUATE ATTRIBUTES) (PO)

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

PO1 **Scholarship of knowledge:** Acquire in-depth knowledge of specific discipline or professional area, including wider and global perspective, with an ability to discriminate, evaluate, analyses and synthesize existing and new knowledge, and integration of the same for enhancement of knowledge.

PO2 **Critical Thinking:** Analyze complex engineering problems critically, apply independent 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 activities confidentially 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

CYBER SECURITY ELECTIVES

ELECTIVE I

SL. NO	COURSE CATEGORY	COURSE CODE	NAME OF THE COURSE	L	T	P	C	S	TCH
1	PE	ITB3721	Concepts of Ethical Hacking	3	0	0	3	0	3
2	PE	ITB3722	Cyber Crime & Security	3	0	0	3	0	3
3	PE	CSA3723	Information Security Architecture	3	0	0	3	0	3
4	PE	CSC3736	Forensic analytics	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	ITB3723	Ethical Hacking and Systems Defense	3	0	0	3	0	3
2	PE	ITB3724	Ethical Hacking and Digital Forensics	3	0	0	3	0	3
3	PE	ITB3725	Mobile and Digital Forensics	3	0	0	3	0	3
4	PE	CSC3737	Social Network Analytics	3	0	0	3	0	3

ELECTIVE III

SL. NO	COURSE CATEGORY	COURSE CODE	NAME OF THE COURSE	L	T	P	C	S	TCH
1	PE	ITB3726	Ethical Hacking for Administrators	3	0	0	3	0	3
2	PE	ITB3727	Criminology and Analytics	3	0	0	3	0	3
3	PE	ITB3728	Cyber Threats	3	0	0	3	0	3
4	PE	CSA3731	Software Security	2	0	2	3	0	3

ELECTIVE IV – SPECIALIZATION IN CYBER SECURITY

SL. NO	COURSE CATEGORY	COURSE CODE	NAME OF THE COURSE	L	T	P	C	S	TCH
1	PE	ITB3729	Cyber Investigation and Laws	3	0	0	3	0	3
2	PE	ITB3730	Penetration Testing & Vulnerability Assessment	3	0	0	3	0	3
3	PE	CSA3734	Block Chain Technology	3	0	0	3	0	3
4	PE	CSB3732	Risk analysis and Management	2	0	2	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.

		Upon completion of this course, the students will be able to	
Course Outcome		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.	**CO-3** **BTL-3**

Suggested Activities: Basic knowledge of sampling **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. Fundamentals of Data Structures 2. Design and Analysis of Algorithm

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 Data Types-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:HEAP STRUCTURES   (9)

Min-maxheaps-Heaps-Leftistheaps-Binomialheaps-Fibonacciheaps-Skewheaps-Lazy-   binomial heaps.

Suggested Activities: Implement the following Heap structures using C,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:SEARCH STRUCTURES   (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: ALGORITHM DESIGN TECHIQUES(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 2. 3.8-queensproblem 3. 4.Palindrome Partitioning **Suggested Source:** https://nptel.ac.in/courses/106106131/15https://nptel.ac.in/courses/106102011/7	**CO-4** **BTL-2**
MODULE 5:ADVANCED ALGORITHMS (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	Thomas H.Coremen, Charles E.Leiserson,RonaldL.Rivest,CliffordStein,"Introduction to algorithms", Third edition, MIT press,2013
REFERENCE BOOKS	
1	E. Horowitz, S.Sahni and Dinesh Mehta, Fundamentals of Data structures in C++, University Press, 2009.

2	E.Horowitz,S.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 **Suggestedsources:** Norman Matlof,"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. **Suggested Activities**: Simulatedannealing/Modellingonanydatascienceapplication. **Suggested sources:** L.M.Rasdi,SimulatedAnnealingAlgorithmforDeepLearning,Procedia ComputerScience,Volume:72,2015.	**CO-3** **BTL-3**

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

International Journal of Computer Science and Information Technologies, Vol. 2 (5), 2011.

MODULE5: PYTHON FOR MACHINELEARNING	(9)
Baysean Networks-Markov Random Fields-Hidden Markov Models-Tracking methods.Python: Installation-Python for MATLAB ANDRusers-Code Basics-Using NumPy and MatPolitB. **Suggested Activities**: Design a simple application using NumPy and MatPolitB. **Suggestedsources:**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	EthemAlpaydin, "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 framework sand 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

GUIDELINES

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	**CO1, CO2, CO3, CO4, CO5 /BTL4**

completion certificate(s) with grades/marks for record in his/her course work.

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

	Upon completion of this course, the students will be able to
Course Outcome	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 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.	**CO-1** **BTL-2**

MODULE 2: DISTRIBUTED DEAD LOCK DETECTION (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: DISTRIBUTED SHAREDMEMORY	**(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: MULTIPROCESSOR OPERATIN GSYSTEM	**(12)**
Basic multiprocessor system architectures – basic multiprocessor system architecture - inter connection networks for multiprocessor systems – caching – hypercube architecture – structures of multiprocessor operating system -operating system design issues – threads 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 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**.**	CO-5 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 soft computing.
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-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	**CO-2** **BTL-2**

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-11fc04cea042	**CO-5** **BTL-2**

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

Suggested Activities: Assignments and Case Study **Suggested sources:** NPTEL and http://mazsola.iit.unimiskolc.hu/tempus/discom/doc/db/tema01a.pdf	
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- 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	**CO-3** **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	RamezElmasri&ShamkantB.Navathe, "Fundamentals of Database Systems", Seventh Edition ,Pearson Education , 2016.
2	Tamer Ozsu M., Patrick Ualduriel, "Principles of Distributed Database Systems", Second

	Edition,Pearson Education, 2003.	
3	Prabhu C.S.R., "Object Oriented Database Systems", PHI, 2003.	
4	Peter Rob and Corlos Coronel, "Database Systems – Design, Implementation and Management",Thompson Learning, Course Technology, 9th Edition, 2011.	
5	Henry FKorth,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-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	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-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 solve the 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	**CO-1** **BTL-2**

receipt of paper from the organizers / publishers.

COURSE TITLE	CONCEPTS OF ETHICAL HACKING			CREDITS	3
COURSE CODE	ITB3721	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	Ethical Hacking identifies the vulnerabilities or weaknesses in a computer system or a network and devises a strategy for protecting those vulnerabilities. This Course focus on utilization of ethical hacking tools and their specific applications.				
Course Objective	1. To know about hacking concepts. 2. To learn how to apply the System Hacking strategies in Ethical manner 3. To get awareness of Webserver and Wireless Hacking and its issues 4. To understand cyber defensive measures				
Course Outcome	Upon completion of this course, the students will be able to 1. Elaborate the concepts and terminologies used in Ethical hacking. 2. Apply the System Hacking strategies in Ethical manner. 3. Discuss about of Webserver and Wireless Hacking and its issues. 4. Develop a tool for wireless hacking countermeasure 5. Generate report for given web address by applying the penetration testing				

	tools	

Prerequisites: Cryptography and 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	PO-12	PSO-1	PSO-2	PSO-3
CO-1	-	3	2	2	1	2	2	1	2	2	1	2	1	1	3
CO-2	3	2	2	1	2	2	1	2	2	1	2	1	-	3	1
CO-3	1	-	2	2	1	2	2	1	2	2	1	2	1	-	3
CO-4	2	2	2	1	2	2	1	2	2	1	2	1	-	3	2
CO-5	-	2	2	1	2	2	1	2	2	1	2	1	-	3	-

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

MODULE 1: INTRODUCTION TO ETHICAL HACKING (9)

Introduction-Ethical hacking Terminology-types of hacking technologies-phases of ethical hacking-Foot printing-Social Engineering-Scanning and enumeration.	CO-1 BTL-2

MODULE 2: SYSTEM HACKING (9)

Understanding the password hacking techniques-Rootkits-Trojans-Backdoors-Viruses and worms-sniffers-denial of service-Session hijacking.	CO-2 BTL-3

MODULE 3: WEB SERVER HACKING (9)

Hacking web servers-web application vulnerabilities –Buffer overflow-Wireless hacking-Physical Security.	CO-3 BTL-2

MODULE 4: WIRELESS HACKING	(9)
WEP, WPA Authentication mechanism-wireless sniffers-Physical Security-factors affecting physical security-honeypots-Firewall types.	CO-4 BTL-3
MODULE 5: PENETRATION TESTING	(9)
Cryptography-overview of MD5, SHA, RC4-penetration testing methodologies- steps-pentest legal framework-penetration testing tools.	CO-5 BTL-4

TEXT BOOKS

1.	Michael T. Simpson, Kent Backman, James Corley, *Hands-On Ethical Hacking and Network Defense,* Cengage Learning India Pvt. Ltd, 2016.

REFERENCE BOOKS

1.	Patrick Engebretson, *The Basics of Hacking and Penetration Testing: Ethical Hacking and Penetration Testing Made Easy*, Syngress Basics Series, 2011
2.	James Corley, *Hands-On Ethical Hacking and Network Defense*, 2nd Edition, Cengage Learning India Pvt. Ltd, 2011

E BOOKS

1.	https://www.insecure.in/network_hacking.asp

MOOC

1.	https://www.greatlearning.in/academy/learn-for-free/courses/introduction-to-ethical-hacking
2.	https://www.udemy.com/course/burp-suite/

COURSE TITLE	CYBER CRIME & SECURITY			CREDITS	3
COURSE CODE	ITB3722	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	Cyber Security as a profession is evolving over the years, reason being the increasing rate of cybercrimes. Any industry that transacts online or carries sensitive data is in need of a Cyber Security professional to safeguard its date from such delinquents. Cyberspace being a common platform which is accessed anyone from every corner of the world, the scope of cybersecurity is equally spread across the globe.
Course Objective	1. To know the basics of cyber security 2. To do Malware Analysis & Reversing 3. To deal with file recovery and protection 4. To more about the cyber laws 5. To learn about Cyber Forensic Basics
Course Outcome	Upon completion of this course, the students will be able to 1. Follow the cyber laws and solve issues if any 2. Ascertain the impacts on citizen security 3. Import security in the network activities. 4. Identify threat and perform intrusion analysis.

Prerequisites: CSB231 - Cryptography and 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	PO-12	PSO-1	PSO-2	PSO-3
CO-1	3	3	3	-	1	-	2	-	-	-	-	-	2	1	-
CO-2	3	3	3	-	-	-	-	-	-	2	-	-	2	1	-
CO-3	3	3	3	-	-	1	2	-	-	-	-	2	2	1	-
CO-4	3	3	3	-	-	-	-	-	-	-	-	2	2	1	-
CO-5	3	3	3	-	-	-	2	-	-	-	-	2	2	1	-

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

MODULE 1:CYBER CRIMES AND CYBER LAWS   (9)

Introduction to IT laws & Cyber Crimes – Internet, Hacking, Cracking, Viruses, Virus Attacks, Pornography, Software Piracy, Intellectual property, Legal System of Information Technology, Social Engineering, Mail Bombs, Bug Exploits, and Cyber Security	**CO-1** **BTL-2**

MODULE 2: COMPUTER AND CYBER FORENSIC BASICS   (9)

Introduction to Computers, Computer History, Software, Hardware, Classification, Computer Input-Output Devices, Windows, DOS Prompt Commands, Basic Computer Terminology, Internet, Networking, Computer Storage, Cell Phone / Mobile Forensics, Computer Ethics and Application Programs, Cyber Forensic Basics- Introduction to Cyber Forensics, Storage Fundamentals, File System Concepts, Data Recovery, Operating System Software and Basic Terminology	**CO-2** **BTL-3**

MODULE 3: DATA AND EVIDENCE RECOVERY(9)

Introduction to Deleted File Recovery, Formatted Partition Recovery, Data Recovery Tools, Data Recovery Procedures and Ethics, Preserve and safely handle original media, Document a "Chain of Custody", Complete time line analysis of computer files based on file creation, file modification and file access, Recover Internet Usage Data, Recover Swap Files/Temporary Files/Cache Files, Introduction to Encase Forensic Edition, Forensic Tool	**CO-3** **BTL-3**

Kit (FTK) etc, Use computer forensics software tools to cross validate findings in computer evidence-related cases	

MODULE 4: CYBER FORENSICS INVESTIGATION **(9)**	
Introduction to Cyber Forensic Investigation, Investigation Tools, eDiscovery, Digital Evidence Collection, Evidence Preservation, E-Mail Investigation, E-Mail Tracking, IP Tracking, E-Mail Recovery, Encryption and Decryption methods, Search and Seizure of Computers, Recovering deleted evidences, Password Cracking	**CO-4** **BTL-4**
MODULE 5: INTRUSION ANALYSIS **(9)**	
Intrusion Analysis as a Core Skill set, Methods to Performing Intrusion Analysis, Intrusion Kill Chain, Passively Discovering Activity in Historical Data and Logs, Detecting Future Threat Actions and Capabilities, Denying Access to Threats, Delaying and Degrading Adversary Tactics and Malware, Identifying Intrusion Patterns and Key Indicators	**CO-5** **BTL-4**

TEXT BOOKS	
1.	Thomas J. Holt, Adam M. Bossler, Kathryn C. Seigfried-Spellar, C*ybercrime and Digital Forensics: An Introduction*, 2nd Edition, CRC press, 2018
REFERENCE BOOKS	
1.	Nina Godbole, SunitBelapure ,*Cyber Security*, Wiley, 2011.
2.	Dan Shoemaker and Wm Arthur Conklin, *Cyber Security – the Essential body of knowledge*, Cengage Learning, 2012
E BOOKS	
1.	https://www.kobo.com/us/en/ebook/cyber-security-cyber-crime-and-cyber-forensics
MOOC	
1.	https://www.shiksha.com/it-software/cyber-security-chp
2.	https://onlinecourses.swayam2.ac.in/ugc19_hs25/preview

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	FORENSICS ANALYTICS			CREDITS	3
COURSE CODE	CSC3736	COURSE CATEGORY	DE	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%

	Digital forensics involves the investigation of computer-related crimes with the goal of obtaining evidence to be presented in a court of law. In this Subject the principles and techniques for digital forensics investigation and the spectrum of available computer forensics tools are discussed.
Course Description	

Course Objective	1. To know investigative procedures 2. To identify and apply appropriate forensics tools to acquire, preserve and analyze system image 3. To Review and critique a forensics report 4. To learn about disk and network forensics 5. To know more about information security Act.

Course Outcome	Upon completion of this course, the students will be able to 1. Familiarize with the concept of Cyber-crimes 2. Use network Forensics Tool 3. Formulate and design concepts Related to disk forensics 4. Appreciation of nuances of software Forensics 5. Frame the cybercrime charges using IT Act 2000

Prerequisites: Cryptography and 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	PO-12	PSO-1	PSO-2	PSO-3
CO-1	3	2	1	-	3	-	-	-	-	1	-	3	2	1	-
CO-2	3	2	1	-	3	-	-	-	-	-	-	3	2	1	-
CO-3	3	2	1	-	3	-	-	-	-	-	-	3	2	1	-
CO-4	3	2	1	-	3	-	-	-	-	1	-	3	2	1	-
CO-5	3	2	3	-	3	3	-	-	-	1	-	3	2	1	-

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

MODULE 1: CYBER CRIME (6 + 6=12)	
Cyber world - Data - Information – cyber threat - cybercrime – White collar crimes – economic offense – cyber stalking - cyber extortion – insider threat - Hacker - types– cyber terrorism - cyber espionage - cyber warfare -weapons - Child Pornography - Job Racketing - Marketing and Advertisement Rackets - Nigerian Frauds - Card Cloning - salami techniques - Software piracy **Practical component:**Detection of various cyber-attacks using Wireshark. **Suggested Readings:** Evolution of cyber crimes	CO-1 BTL-3
MODULE 2: NETWORK FORENSICS(6 + 6=12)	
Network components - Port scans – SYN flood -Key Loggers - Email Forensics - email spoofing – Phishing – mail header analysis - Network protocols – Protocols Susceptible to Sniffing - Active and Passive Sniffing - Wireshark – Capture and Display Filters - pcap analysis – Problems - Trojans and Backdoors, Overt and Covert Channels, Types of Trojans - Botnets - types of botnet- Structure of bots – Crime bots - Spamming bots - DoS – DDoS Attacks – types - Honey Pots - Forensic evidences. **Practical component:**ICMP Flooded DDoS Attacks using Wireshark. **Suggested Readings:** Network forensics and evidences	CO-2 BTL-3
MODULE 3: DISK FORENSICS (6 +6=12)	
Digital data – digital device – Hard disk – Types – Disk characteristics – SSD - File systems - NTFS – MFT Structure - fragmentation -MFT fragmentation – Files and attributes - File hashing - Slack space – Disk Forensics tools - Win Hex – Disk imaging – write blockers – types of blockers - Data Carving – techniques - Scalpel - Registry Forensics - Registry – registry data types –RegEdit -concept of timeline – Anti forensics. **Practical component:**NTFS, MFT and File Hashing **Suggested Readings:** Best practices for Disk Forensics	CO-3 BTL-4

MODULE 4: SOFTWARE FORENSICS(6 +6=12)	
Volatile Live Vs Offline Forensics - Artefacts - System Information - Linux ~ Windows – System commands - Network information – Network commands - proc file system - Software Program - source code - types of software - Source code repository - software license - commercial piracy - soft lifting - structures & versions - Analysis Tools - Objects of analysis - Obfuscation – code Obfuscation - Stylometric - author characteristics - Software Forensic challenges – Principles of Steganography **Practical component:**Security analysis and reporting using Wireshark. **Suggested Readings:** Analysis Tools, Software Forensic challenges, Principles of Steganography	**CO-4** **BTL-3**
MODULE 5: INFORMATION TECHNOLOGY ACT -2000 (6 + 6=12)	
Information Technology Act 2000 – Digital signature - Electronic Governance- Evidence Management - Adjudication - Offenses - Examiner of electronic evidence - Amended IT Act - Provisions of other Acts amended by I.T. Act. **Practical component:**Case Studies – Cyber Crime charge – trial, IPR Case Studies **Suggested Readings:** Digital Evidence acquisitions	**CO-5** **BTL-4**

TEXT BOOKS	
1.	Dejey, Cyber forensics, Oxford, 2018

REFERENCE BOOKS	
1.	Gerard Johanses, Digital forensics and incident response, 2017

E BOOKS	
1.	http://index-of.es/Varios-2/Computer%20Forensics%20and%20Cyber%20Crime%20An%20Introduction.pdf

MOOC	
1.	https://www.coursera.org/lecture/cyber-security-manufacturing/intrusion-response-recovery-and-forensics-0ifzv
2.	https://www.udemy.com/course/cyber-forensic-1/

COURSE TITLE	ETHICAL HACKINGANDSYSTEMS DEFENSE			CREDITS	3
COURSE CODE	ITB3723	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	Ethical Hacking and Systems Defense combines an ethical hacking methodology with the hands-on application of security tools to better help students secure their systems. Students are introduced to common countermeasures that effectively reduce and/or mitigate attacks				
Course Objective	1. To Understand the various approaches used by attackers 2. To utilize various information security tools given different target systems in different environments. 3. Apply port scanning security tools for real-time problem. 4. Develop a Program the security codes using C and C++ 5. Discuss about DoS and DDoS attacks				
Course Outcome	Upon completion of this course, the students will be able to 1. Use security tools to identifying vulnerabilities in real-time OS. 2. List the features of Network protection and risk managements 3. To known about hacking concepts in defense. 4. Apply the Hacking strategies in Ethical manner.				

5. Awareness of Security policies in defenses field.

Prerequisites: Cryptography and 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	PO-12	PSO-1	PSO-2	PSO-3
CO-1	3	2	1	-	1	-	-	-	-	-	-	1	2	1	-
CO-2	3	2	1	-	-	-	-	-	-	2	-	1	2	1	-
CO-3	3	2	1	-	-	1	-	-	-	-	-	1	2	1	-
CO-4	3	2	1	-	-	-	-	-	-	-	-	1	2	1	-
CO-5	3	2	1	-	-	-	-	-	-	-	-	1	2	1	-

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

MODULE 1: TCP/IP OVERVIEW CONCEPTS   (9)

Overview of TCP/IP-IP addressing-numbering systems-Denial of service attacks-distributed denial of service attacks.	**CO-1** **BTL-2**

MODULE 2: PORT SCANNING   (9)

Introduction to port scanning-types of port scan-port scanning tools-ping sweeps-Understanding scripting-Enumeration-Net BIOS basics-Enumeration tools.	**CO-2** **BTL-3**

MODULE 3: PROGRAMMING FOR SECURITY PROFESSIONALS   (9)

Introduction to programming fundamentals-Basics of C-Basics of HTML-Understanding perl-Understanding oops concepts.	**CO-3** **BTL-3**

MODULE 4: DESKTOP AND SERVER OS VULNERABILITIES   (9)

Windows OS vulnerabilities-tools for identifying vulnerabilities in windows-Linux OS vulnerabilities-vulnerabilities of embedded OS	**CO-4** **BTL-3**

MODULE 5: NETWORK PROTECTION SYSTEMS　　　　　(9)	
Understanding routers-understanding firewalls-risk analysis tools for firewalls-understanding intrusion and detection and prevention systems-honeypots.	**CO-5** **BTL-3**

TEXT BOOKS	
1.	Michael T Simpson, Nicholas Antil, Hands-On Ethical Hacking And Network Defense, 3rd Edition, Cengage Learning, 2012.

REFERENCE BOOKS	
1.	James S. Tiller, The Ethical Hack: A Framework for Business Value Penetration Testing, Auerbach Publications, 2004.

E BOOKS	
1.	https://www.vitalsource.com/products/ethical-hacking-and-systems-defense-national-sean-philip-oriyano-v9781284239652

MOOC	
1.	https://www.nationalcyberwatch.org/programs-resources/curriculum/technical-course/ncc-214-ethical-hacking-systems-defense/
2.	https://nic.campusconcourse.com/view_syllabus?course_id=41104

COURSE TITLE	ETHICAL HACKING AND DIGITAL FORENSICS		CREDITS	3
COURSE CODE	ITB3724	COURSE CATEGORY	DE	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	Ethical hacker and computer hacking forensic investigator is to keep the important data of a business organization or a security agency safe from the malicious hackers. But ethical hackers investigate only the probabilities of hacking a computer system.
Course Objective	1. Define computer forensics. 2. Identify the process in taking digital evidence. 3. Describe how to conduct an investigation using methods of memory, operating system, network and email forensics. 4. Assess the different forensics tools. 5. Differentiate among different types of security attacks. 6. Describe the concept of ethical hacking.
Course Outcome	Upon completion of this course, the students will be able to 1. Understand the history of hacking 2. Interpret hacking methods and remedial measures 3. 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	1	-	-	-	1	2	1	-	-	-	1	-	2	1	3
CO-2	-	-	2	1	-	-	-	1	2	2	-	1	2	2	2
CO-3	-	1	-	-	-	1	2	-	-	-	2	-	2	1	2

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

MODULE 1: HISTORY OF HACKING	(9)
History and current state of hacking and penetration testing-Profiles of hackers and cybercriminals-History of computer hacking-Common hacking methodologies-Ethical hacking and penetration testing in relation to black-hat and white-hat activities-Laws and ethical standards for penetration testers and ethical hackers	CO-1 BTL-1

MODULE 2: HACKING AND ATTACKS	(9)
Hacking windows – Network hacking – Web hacking – Password hacking. A study on various attacks – Input validation attacks – SQL injection attacks – Buffer overflow attacks - Privacy attacks.	CO-1 BTL-2

MODULE 3:COMPUTER NETWORKS	(9)
TCP / IP – Checksums – IP Spoofing port scanning, DNS Spoofing. Dos attacks – SYN attacks, Smurf attacks, UDP flooding, DDOS – Models. Firewalls – Packet filter firewalls, Packet Inspection firewalls – Application Proxy Firewalls. Batch File Programming	CO-2 BTL-3

MODULE 4: COMPUTER FRAUD	(9)
Fundamentals of Computer Fraud – Threat concepts – Framework for predicting inside attacks –Managing the threat – Strategic Planning Process. Architecture strategies for computer fraud Prevention – Protection of Web sites – Intrusion detection system – NIDS, HIDS – Penetrating testing process – Web Services – Reducing transaction risks.	CO-2 BTL-2

MODULE 5: DIGITAL FORENSIC (9)	
Key Fraud Indicator selection process customized taxonomies – Key fraud signature selection Process –Accounting Forensics – Computer Forensics – Journaling and it requirements – Standardized logging criteria – Journal risk and control matrix – Neural networks – Misuse detection and Novelty detection.	CO-3 BTL-3

REFERENCE BOOKS	
1	Kenneth C.Brancik "Insider Computer Fraud" Auerbach Publications Taylor & Francis Group, 2008
2	AnkitFadia" Ethical Hacking" 2nd Edition Macmillan India Ltd, 2006
3	Oriyano, Sean-Philip. (2016)Ethical hacking and systems defense,Burlington, MA: Jones Bartlett Learning

COURSE TITLE	MOBILE AND DIGITAL FORENSICS			CREDITS	3
COURSE CODE	ITB3725	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	Mobile device forensics is a branch of digital forensics relating to recovery of digital evidence or data from a mobile device under forensically sound conditions.
Course Objective	Students will be learnt about 1. The threats associated with mobile devices 2. Digital forensic concepts: mobile forensics vs. computer forensics 3. Mobile evidence types and evidence acquisition types 4. Architectural layers of mobile devices 5. Gathering evidence during the forensic investigation

Course Outcome	Upon completion of this course, the students will be able to
	1. Understand the basics of wireless technologies and security
	2. Become knowledgeable in mobile phone forensics and android forensics
	3. Learn the methods of investigation using digital forensic techniques

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

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

MODULE 1: OVERVIEW OF WIRELESS TECHNOLOGIES AND SECURITY (9)

Personal Area Networks, Wireless Local Area Networks, Metropolitan Area Networks, Wide Area Networks. Wireless threats, vulnerabilities and security: Wireless LANs, War Driving, War Chalking, War Flying, Common Wi-fi security recommendations, PDA Security, Cell Phones and Security, Wireless DoS attacks, GPS Jamming, Identity theft	CO-1 BTL-2

MODULE 2: CIA TRIAD IN MOBILE PHONES (9)

Voice, SMS and Identification data interception in GSM: Introduction, practical setup and tools, implementation- Software and Hardware Mobile phone tricks: Netmonitor, GSM network service codes, mobile phone codes, catalog tricks and AT command set- SMS security issues	CO-1 BTL-2

MODULE 3: MOBILE PHONE FORENSICS (9)

crime and mobile phones, evidences, forensic procedures, files present in SIM card, device data, external memory dump, evidences in memory card, operators systems- Android forensics: Procedures for handling an android device, imaging android USB mass storage devices, logical and physical techniques	CO-2 BTL-2

MODULE 4: DIGITAL FORENSICS	(9)	
Introduction – Evidential potential of digital devices: closed vs. open systems, evaluating digital evidence potential- Device handling: seizure issues, device identification, networked devices and contamination		**CO-2** **BTL-2**
MODULE 5: DIGITAL FORENSICS EXAMINATION PRINCIPLES	**(9)**	
Previewing, imaging, continuity, hashing and evidence locations- Seven element security model- developmental model of digital systems- audit and logs- Evidence interpretation: Data content and context		**CO-3** BTL-2

REFERENCE BOOKS	
1	Gregory Kipper, "Wireless Crime and Forensic Investigation", Auerbach Publications, 2007
2	Iosif I. Andreoulakis, " Mobile phone security and forensics: A practical approach", Springer publications, 2012
3	Andrew Hoog, "Android Forensics: Investigation, Analysis and Mobile Security for Google Android", Elsevier publications, 2011
4	Angus M.Marshall, " Digital forensics: Digital evidence in criminal investigation", John – Wiley and Sons, 2008

COURSE TITLE	SOCIAL NETWORK ANALYTICS			CREDITS	3
COURSE CODE	CSC3737	**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	**Second Periodical**	**Seminar/**	**Surprise Test**	**Attendance**	**ESE**

Periodical Assessment	Assessment	Assignments/ Project	/ Quiz		
15%	15%	10%	5%	5%	50%

Course Description	Social network analysis is the process of investigating social structures through the use of networks and graph theory.
Course Objective	1. Formalize different types of entities and relationships as nodes and edges and represent this information as relational data. 2. Plan and execute network analytical computations. 3. Use advanced network analysis software to generate visualizations and perform empirical investigations of network data. 4. Interpret and synthesize the meaning of the results with respect to a question, goal, or task. 5. Collect network data in different ways and from different sources while adhering to legal standards and ethics standards.
Course Outcome	Upon completion of this course, the students will be able to 1. Develop semantic web related applications 2. Represent knowledge using ontology 3. Discover communities from Social Networks 4. Decentralize Online Social Networks 5. Explore applications of Social Networks.

Prerequisites:

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

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

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

MODULE 1: INTRODUCTION(9)

Introduction to Semantic Web: Limitations of current Web – The Semantic Solution- Development of Semantic Web– Emergence of the Social Web – Social Network analysis: Development of Social Network Analysis – Key concepts and measures in network analysis – Electronic sources for network analysis **Suggested sources:** Tabassum, Shazia& Pereira, Fabiola & Fernandes, Sofia & Gama, João. (2018). Social network analysis: An overview. Wiley Interdisciplinary Reviews: Data Mining and Knowledge Discovery.	**CO-1** **BTL-2**

MODULE 2: MODELLING, AGGREGATING AND KNOWLEDGE REPRESENTATION(9)

Ontology and their role in the Semantic Web: Ontology-based knowledge Representation – Ontology languages for the Semantic Web-Ontology language for Semantic web-Modelling and aggregating social network data **Suggested sources:** - Algergawy, Alsayed(2020), Ontology Modularization with OAPT, Journal on Data Semantics.	**CO-2** **BTL-2**

MODULE 3: SOCIAL MEDIA MINING AND SEARCH   (9)

Discovering Mobile social Networks by semantic Technologies- Online Identities in Social Networking-Detecting communities in social Networking-Discovering Communities from Social Networks: Methodologies and Applications.	**CO-3** **BTL-3**

MODULE 4: SOCIAL NETWORK INFRASTRUCTURES AND COMMUNITIES   (9)

Decentralized Online Social Networks- Multi-Relational Characterization of Dynamic Social Network Communities-Accessibility Testing of Social Websites- Understanding and Predicting Human Behavior for Social Communities- Associating Human-Centered Concepts with Social Networks Using Fuzzy Sets.	**CO-4** **BTL-2**

MODULE 5:	VISUALISATION AND APPLICATIONS OF SOCIAL NETWORKS	(9)
Visualization and Applications of Social Networks- Novel Visualizations and Interactions for Social Networks Exploration- Applications of Social Network Analysis- Online Advertising in Social Networks.		CO-5 BTL-2

TEXT BOOKS	
1	Peter Mika, Social Networks and the Semantic Web, First Edition, Springer 2007.
2	Charles Kadushin, Understanding Social Networks: Theories, Concepts and Findings, First Edition. Oxford University Press, 2012

REFERENCE BOOKS	
1	GuandongXu ,Yanchun Zhang and Lin Li, Web Mining and Social Networking – Techniques and applications, First Edition, Springer, 2011.
2	BorkoFurht, Handbook of Social Network Technologies and Applications, 1st Edition, Springer, 2010.
3	Max Chevalier, Christine Julien and Chantal Soulé-Dupuy, Collaborative and Social Information Retrieval and Access: Techniques for Improved user Modelling, IGI Global Snippet, 2009.

E BOOKS	
1	https://link.springer.com/book/10.1007%2F978-0-387-71001-3
2	https://www.springer.com/gp/book/9781441971418
3	https://mylifemynotes.files.wordpress.com/2012/03/handbook-of-social-network-technologies-and-applns-b-furht-springer-2010-bbs.pdf

MOOC	
1	https://www.coursera.org/learn/social-media-data-analytics
2	https://www.coursera.org/learn/social-network-analysis

COURSE TITLE	ETHICAL HACKING FOR ADMINISTRATORS			CREDITS	3
COURSE CODE	**ITB3726**	**COURSE CATEGORY**	**PE**	**L-T-P-S**	**3- 0- 0- 3**
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 will explore the various means that an intruder has available to gain access to computer resources. We will investigate weaknesses by discussing the theoretical background behind, and whenever possible, actually performing the attack. We will then discuss methods to prevent/reduce the vulnerability.				
Course Objective	1. To develop a comprehensive test plan utilizing penetration testing 2. To integrate social engineering into the testing scenario 3. To identify application weaknesses using vulnerability scanners 4. To assess vulnerabilities of wireless networking protocols				
Course Outcome	Upon completion of this course, the students will be able to 1. Understand the ethics of hacking in a layman perspective 2. Employ pentesting tools and defend an attack 3. Discover different types of attacks and handle buffer overflow issues 4. Deduct and analyse malware using latest trending tools				
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	1	-	1	2	1	2	3	-	2	-	1	-	2	1	3
CO-2	1	-	2	1	-	-	-	1	2	2	-	1	2	2	2
CO-3	1	2	-	-	3	1	2	1	-	-	2	-	2	1	2
CO-4	2	-	2	1	2	-	3	1	2	2	-	1	2	2	2

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

MODULE 1: INTRODUCTION TO ETHICAL DISCLOSURE   (9)

Ethics of Ethical Hacking – Recognizing the Gray Areas in Security – Vulnerability Assessment – Ethical Hacking and Legal System : The Rise of Cyberlaws – Electronic Communication Privacy Act – Digital Millennium Copyright Act (DCMA) - Cyber Security Enhancement Act - Understanding Individuals Cyberlaws .	**CO-1** **BTL-2**

MODULE 2: PENETRATION TESTING AND TOOLS   (9)

Social Engineering Attacks – Common Attacks used in Penetration Testing – Physical Penetration Attacks – Reconnaissance – Common ways into a Building – Defending against physical Penetrations. **Insider Attacks**: Conducting an Insider Attack – Defending Against Insider Attack.	**CO-1** **BTL-2**

MODULE 3: TYPES OF ATTACKS   (9)

Web Server Attacks - Database Attacks - Password Cracking -Network Devices & Attacks - Wireless Network Attacks - Trojans and Backdoor Applications -OS Specific Attacks - Buffer Overflows - Denial of Service Attacks	**CO-2** **BTL-2**

MODULE 4: MALWARE ANALYSIS   (9)

Malware – Latest Trends in Honeynet Technology – Catching Malware – Initial Analysis of Malware.	**CO-3** **BTL-3**

MODULE 5: HACKING MALWARE   (9)

Trends in Malware – De-obfuscating Malware – Reverse Engineering Malware – Malware Operation Phase – Automated Malware Analysis.	**CO-4** **BTL-3**

REFERENCE BOOKS	
1	Allen Harper, Shon Harris, Jonathan Ness, Chris Eagle, Gideon Lenkey, Terron Williams, "Gray Hat Hacking: The Ethical Hackers Handbook : The Ethical Hacker's Handbook", 5th Edition, McGraw Hill , 2015.
2	PatrickEngebretson, "The Basics of Hacking and Penetration Testing: Ethical Hacking and Penetration Testing Made Easy" , 2nd Edition , Syngress, 2013.

COURSE TITLE	CRIMINOLOGY AND ANALYTICS				CREDITS	3
COURSE CODE	ITB3727	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	Crime analysis is one of the most important activities of the majority of the intelligent and law enforcement organizations all over the world.					
Course Objective	1. how to collect, describe and visualize data 2. how to build quantitative models to explain phenomena 3. how to quantitatively evaluate the effectiveness of policies 4. how to map and analyze complex social networks 5. how to implement key machine learning algorithms					
Course Outcome	Upon completion of this course, the students will be able to 1. Know about advanced concepts and types of cybercrime. 2. Describe the various analytical methods for identifying the cybercrimes.					

	3. Identify the ways for mitigating the effects of cybercrimes.

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

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

MODULE 1:DEVIANCE AND CRIMINAL SUBCULTURE IN CYBERSPACE(6)

Introduction to criminal subculture cyberspace – Café Culture and Heresy of Yahooboyism in Nigeria - Internet Gambling . Consolidate the analytics outcome.	**CO-1** **BTL-2**

MODULE 2:PERPETRATORS' PERSPECTIVES AND OFFENDER USE OF THE INTERNET   (10)

Identity Construction Among Hackers - Virtual Sex Offenders: A Clinical Perspective - Self-Reported Internet Child Pornography Consumers: A Personality Assessment Using Bandura's Theory of Reciprocal Determinism - Online Social Networking and Pedophilia: An Experimental Research "Sting" - Adult–Child Sex Advocacy Websites as Learning Environments for Crime - The Internet as a Terrorist's Tool: A Social Learning Perspective .	**CO-1** **BTL-2**

MODULE 3: DIGITAL PIRACY   (12)

Value and Choice: Examining Their Roles in Digital Piracy - Suing the Genie Back in the Bottle: The Failed RIAA Strategy to Deter P2P Network Users - Criminological Predictors of Digital Piracy: A Path Analysis - Change of Music Piracy and Neutralization: An Examination Using Short-Term Longitudinal Data - Digital File Sharing: An Examination of Neutralization and Rationalization Techniques Employed by Digital File Sharers.	**CO-2** **BTL-2**

MODULE 4: VICTIMIZATION   (9)

Cyber-Routine Activities: Empirical Examination of Online Lifestyle, Digital Guardians, and Computer-Crime Victimization - Adolescent Online Victimization and Constructs of Routine Activities Theory - Cyber Stalking: Typology, Etiology, and Victims - Online Social Networking and Women Victims - Malware Victimization: A Routine Activities Framework.	**CO-2** **BTL-2**

MODULE 5: LEGAL AND POLICY ISSUES OF CYBER CRIMES (8)	
Fatwas Chaos Ignites Cyber Vandalism: Islamic Criminal Law Prohibit Cyber Vandalism - Cyber Bullying: Legal Obligations and Educational Policy Vacuum - Human Rights Infringement in the Digital Age.	CO-3 BTL-3

REFERENCE BOOKS	
1	Jai Shankar, Cyber Criminology, "Exploring Internal Crimes and Criminal Behaviour", CRC Press, Taylor and Francis Group, 2016.
2	Colleen Mccue, "Data Mining and Predictive Analysis – Intelligence Gathering and Crime Analysis", Elsevier-Science Direct, 2015.

COURSE TITLE	CYBER THREATS			CREDITS	3
COURSE CODE	ITB3728	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	Cyber Threats in computers and computer networks, an attack is any attempt to expose, alter, disable, destroy, steal or gain information through unauthorized access to or make unauthorized use of an asset.
Course Objective	1. To prepare students with the technical knowledge and skills needed to protect and defend computer systems and networks. 2. To develop graduates that can plan, implement, and monitor cyber security mechanisms to help ensure the protection of information technology assets. 3. To develop graduates that can identify, analyze, and remediate computer

					security breaches.										

Course Outcome	Upon completion of this course, the students will be able to
	1. Know about advanced types of cyber threats
	2. Describe the various analytical methods for identifying the cyber threats.
	3. Examine Cyber Threat Intelligence though advanced concepts

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

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

MODULE 1:INTRODUCTION (9)	
Cyber Crime – Cyber Terrorism – Cyber Space – Cyber crime cost – Cyber Threat Strategies- Cyber Decline and Fall.	CO-1 BTL-2

MODULE 2: ORDER & DISORDER, CRIME, WAR AND TERRORISM (9)	
Selforganizing system – Order in human societies – Rules for modern human social systems – External order – Crime War – Crime and Terrorism.	CO-1 BTL-2

MODULE 3: CYBER THREAT ANALYSIS (9)	
Cyber Threat Analysis Program – Client Confidentiality and Sensitivity – Cyber Security Expertise – CTAP Intelligence Catalogs, Infrastructure and Tools.	CO-2 BTL-2

MODULE 4: RESPONDING TO CYBER THREAT (9)	
Cyber global concerns – Cyber trends and the future model – Cyber Security Model – Automation in analyzing the cyber threat.	CO-2 BTL-3

MODULE 5: CYBER THREAT INTELLIGENCE (9)	
Know the Cyber threat – Technological Environment – Adversary tactics – Cyber Intelligence Framework – Strategic Assessment.	CO-3 BTL-2

REFERENCE BOOKS	
1	Susan W. Brenner "Cyber Threats", Oxford Press, 2016.
2	White Paper on "Symantec Cyber Threat Analysis", 2017.

3	Bob Gourley, "The Cyber Threat – know the threat to beat the threat", 2017.

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: SOFTWARE SECURITY FUNDAMENTALS(9)

Defining a discipline: Security Problems in Software - The three pillars of software security - The rise of security engineering - Risk Management framework. **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:SECURITY TESTING (9)

Software penetration Testing - Risk Based Security Testing - Abuse Cases - Software Security meets security operations **Suggested Activity:**Experiment with any one of the Penetration Testing Software	CO-3 BTL-3

MODULE 4:SOFTWARE SECURITYGAP (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

ELECTIVE IV

COURSE TITLE	CYBER INVESTIGATION & LAWS			CREDITS	3
COURSE CODE	ITB3729	**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	Cybercrime investigations for officers. We describe the basic steps necessary when conducting the investigation with law.				
Course Objective	1. To Enable Learner To Understand, Explore, And Acquire A Critical Understanding Cyber Law. 2. DevelopCompetencies For Dealing With Frauds And Deceptions				
Course Outcome	Upon completion of this course, the students will be able to 1. Need for cyber issues there in and to apply a cyber-law 2. Address e-trade and e-governance 3. Resolve the issues and problems arising out of online transactions 4. Understanding crimes with case law				
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	1	-	1	1	1	2	1	-	2	-	1	-	2	1	3
CO-2	1	1	-	-	-	1	2	1	-	-	2	-	2	1	2
CO-3	1	-	1	1	1	2	1	-	2	-	1	-	2	1	3
CO-4	1	-	2	1	-	-	-	1	2	2	-	1	2	2	2

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

MODULE 1: INRODUCTION (9)

Cyber Space- Fundamental definitions -Interface of Technology and Law – Jurisprudence and-Jurisdiction in Cyber Space - Indian Context of Jurisdiction - Enforcement agencies – Need for IT act - UNCITRAL – E-Commerce basics Information Technology Act, 2000 - Aims and Objects — Overview of the Act – Jurisdiction.	**CO-1** **BTL-2**

MODULE 2: E-GOVERNANCE (9)

Electronic Governance – Legal Recognition of Electronic Records and Electronic Evidence -Digital Signature Certificates - Securing Electronic records and secure digital signatures - Duties of Subscribers - Role of Certifying Authorities - Regulators under the Act -The Cyber Regulations Appellate Tribunal - Internet Service Providers and their Liability– Powers of Police under the Act – Impact of the Act on other Laws.	**CO-2** **BTL-2**

MODULE 3: TYPES OF CYBER CRIMES (9)

Cyber Crimes -Meaning of Cyber Crimes –Different Kinds of Cyber crimes – Cyber crimes under IPC, Cr.P.C and Indian Evidence Law - Cyber crimes under the Information Technology Act,2000 - Cyber crimes under International Law - Hacking Child Pornography, Cyber Stalking, Denial of service Attack, Virus Dissemination, Software Piracy, Internet Relay Chat (IRC) Crime, Credit Card Fraud, Net Extortion, Phishing etc - Cyber Terrorism Violation of Privacy on Internet - Data Protection and Privacy – Indian Court cases.	**CO-3** **BTL-2**

MODULE 4: INTELLECTUAL PROPERTY RIGHTS (9)

Intellectual Property Rights – Copyrights- Software – Copyrights vs Patents debate - Authorship and Assignment Issues - Copyright in Internet - Multimedia and Copyright issues - Software Piracy - Trademarks - Trademarks in Internet – Copyright and Trademark cases, Patents.	**CO-3** **BTL-2**

MODULE 5: PATENTS (9)

	Understanding Patents - European Position on Computer related Patents, Legal position on Computer related Patents - Indian Position on Patents – Case Law, Domain names - registration - Domain Name Disputes-Cyber Squatting-IPR cases.	CO-4 BTL-3

REFERENCE BOOKS	
1	Ashwani Kumar Bansal "Justice Yatindra Singh: Cyber Laws", Universal Law Publishing Co., New Delhi, 2010.
2	Farouq Ahmed, "Cyber Law in India", New Era publications, New Delhi, 2015.
3	S.R.Myneni, "Information Technology Law(Cyber Laws)", Asia Law House, 2017
4	Chris Reed, "Internet Law-Text and Materials", Cambride University Press, 2004.
5	Pawan Duggal, "Cyber Law- the Indian perspective" Universal Law Publishing Co., 2018

COURSE TITLE	PENETRATION TESTING AND VULNERABILITY ASSESSMENT		CREDITS		3
COURSE CODE	ITB3730	COURSE CATEGORY	PE	L-T-P-C	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 introducing the new concepts to students such as vulnerability analysis and penetration testing

Course Objective	To understand the in-depth methodologies, techniques, and tools to identify vulnerabilities, exploit, and assess security risk to networks, operating systems, and applications.
Course Outcome	1. Understand vulnerability and its implications. 2. Formulate the techniques of information gathering. 3. Discover the system hacking methods and its advancement. 4. Perform a wireless pen testing

Prerequisites:

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

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

MODULE 1: INTRODUCTION TO CYBER SECURITY (9)

Penetration Testing phases/Testing Process, types and Techniques, Blue/Red Teaming, Strategies of Testing, Non-Disclosure Agreement Checklist, Phases of hacking, Open source/proprietary Pentest Methodologies	CO-1 BTL-2

MODULE 2: SECURITY ATTACKS, PRINCIPLES AND MANAGEMENT (9)

Information gathering methodologies- Foot printing, Competitive IntelligenceDNS Enumerations- Social Engineering attacks, Port Scanning-Network Scanning Vulnerability Scanning- NMAP scanning tool- OS Fingerprinting- Enumeration	CO-2 BTL-2

MODULE 3: SECURITY PLANS, POLICIES AND PROCEDURES (9)

Password cracking techniques- Key loggers- Escalating privileges- Hiding Files,Double Encoding, Steganography technologies and its Countermeasures. Active and passive sniffing- ARP Poisoning, MAC Flooding- SQL Injection - Errorbased, Union-based, Time-based, Blind SQL, Out-of-band. Injection Prevention Techniques.	CO-3 BTL-3

MODULE 4: OVERVIEW OF SECURITY COUNTERMEASURE TOOLS (9)

Broken Authentication, Sensitive Data Exposure, XML External Entities, Broken Access Code, XSS - Stored, Reflected, DOM Based	CO-4 BTL-2

MODULE 5: TESTING, DIGITAL FORENSICS AND NEXT GENERATION SECURITY(9)

Wi-Fi Authentication Modes, Bypassing WLAN Authentication, Types of Wireless Encryption, WLAN Encryption Flaws, AP Attack, Attacks on the WLAN Infrastructure, DoS-Layer1, Layer2, Layer 3, DDoS Attack, Client Misassociation, Wireless Hacking Methodology, Wireless Traffic Analysis.	CO-5 BTL-2

REFERENCE BOOKS

1.	Kali Linux Wireless Penetration Testing Beginner's Guide by Vivek Ramachandran, Cameron Buchanan, 2015 Packt Publishing
2	SQL Injection Attacks and Defense 1st Edition, by Justin Clarke-Salt, Syngress Publication
3	Mastering Modern Web Penetration Testing By Prakhar Prasad, October 2016 Packt Publishing
4	Kali Linux 2: Windows Penetration Testing, By Wolf Halton, Bo Weaver , June 2016 Packt Publishing

COURSE TITLE	RISK ANALYSIS AND MANAGEMENT			CREDITS	3
COURSE CODE	CSB3732	**COURSE CATEGORY**	PE	**L-T-P-C**	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	This course introduces students about the risk management, environmental assessments				

Description	and social dimensions of risk management
Course Objective	1. Identify, formulate, and solve engineering problems in risk management. 2. Apply knowledge of mathematics, science,andengineeringtotheassessment of risk. 3. Understand the environmental assessments and perception ofriskassessment 4. Suggest risk reduction and risk management measures, also wherethere is a lack of information 5. Reflect upon ethical, subjective and societal dimensions of riskassessments. Implement tools and techniques to evaluate risk in projects
Course Outcome	1. Identify,formulate, and solve engineering problems in riskmanagement. 2. Applyknowledgeofmathematics,science,andengineeringtotheassessment of risk. 3. Understand the environmental assessments and perception ofriskassessment 4. Suggest risk reduction and risk management measures, also wherethere is a lack of information 5. Reflect upon ethical, subjective and societal dimensions of riskassessments. 6. Implement tools and techniques to evaluate risk in projects

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

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

MODULE1: INTRODUCTION TO RISKANALYSIS (9)

Introduction - Risk analysis –Variability and uncertainty of risk analysis-Risk analysis modeling-ProbabilisticriskanalysisforcomplexengineeringsystemEcologicalriskanalysis-Economicsofrisk privacy.	**CO-1 BTL-2**

MODULE2: APPLICATION OF RISK ANALYSIS (9)

Role of risk assessment in human health–Role of risk analysis in pollution prevention-Integrated risk analysis and global climate change-Computer software programs-databases–www-Other onlinesystems- Use of internet.	**CO-2 BTL-2**

MODULE 3: RISK PERCEPTION AND COMMUNICATION (9)	
Risk perception and trust-Insurability of risk–Setting environmental priorities based on risk— Comparative risk analysis – Law and risk assessment –Science and toxic risk assessment.	**CO-3** **BTL-3**

MODULE4:RISK MANAGEMENT	(9)	
Risk management process-Identify-assess-plan responses-Manage process–PRAM Process–Three cycles of strategic level risk management.	CO-4 BTL-2	

MODULE 5: RISK ORGANISATION&CONTROL (9)	
Organizationalstructure-Responsibilities–Functionalroles–Riskresponseactions-Controlrisk documentation – Risk reporting – Risk governance – Risk reviews –Behavioral influences.– Risk identificationtechniques–SWOTanalysis.	CO-5 BTL-2

TEXT BOOKS	
1	VlastaMolak,"Fundamentals of Risk Analysis and Risk Management",2ndEdition,CRCPress, Lewish Publishers,2000.
2	John Bartlet,"Project Risk Analysis and Management Guide",2ndEdition,ARM Publishing Ltd,2010

REFERENCE BOOKS	
1	Naagarazan. R.S., "A textbook on Professional Ethics and Human values", New AgeInternational, New Delhi, 2006.
2	Ranganatham and Madhumathi, "Derivatives and Risk Management", Pearson, 2011
3	Rajiv Srivastav, "Derivatives and Risk Management", Oxford University Press, 2010

E BOOKS	
1	https://the-eye.eu/.../Fundamentals%20of%20Risk%20Analysis%20and%20Risk%20Man.
2	penka.kroser.com.uy/fundamentals_of_risk_and_insurance.pdf

MOOC	
1	https://www.mooc-list.com/tags/risk-management

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	Second Periodical	Seminar/ Assignments/	Surprise Test / Quiz	Attendance	ESE

Assessment	Assessment	Project			
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-Hash chain to Blockchain-Basic consensus mechanisms	CO-1 BTL-2

Suggested Activity:1. Study about blockchain tools in the Market	
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:USECASE I(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:USECASE II(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:**Implement a digital bank using Ethereum Blockchain	**CO-5** **BTL-3**

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	ArshdeepBahga,VijayMadisetti,"Blockchain Applications:A Hands-On Approach", Vijay Madisetti publishers 2017.

REFERENCE BOOKS	
1	Andreas Antonopoulos,"MasteringBitcoin: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/