Sanjivani Rural Education Society's

Sanjivani College of Engineering, Kopargaon

(An Autonomous Institute Affiliated to Savitribai Phule Pune University, Pune)

B. Tech. Computer Engineering

2021 Pattern

Curriculum

(B. Tech. Sem-VII & VIII with effect from Academic Year 2024-2025)

At. Sahajanandnagar, Post. Shingnapur Tal. Kopargaon Dist. Ahmednagar,
Maharashtra State, India PIN 423603.

Sanjivani College of Engineering, Kopargaon

(An Autonomous Institute affiliated to SPPU, Pune)

D E C L A R A T I O N

We, the Board of Studies (Computer Engineering), hereby declare that, we have designed the Curriculum of Final Year Computer Engineering Program Curriculum Structure and Syllabus for semester VII of Pattern 2021 w.e.f. from A.Y 2024-25 as per the guidelines. So, we are pleased to submit and publish this FINAL copy of the curriculum for the information to all the concerned stakeholders.

Submitted by

(Dr.D.B.Kshirsagar)
BoS Chairman

Approved by

Dean Academics Director

Vision

- To develop world class engineering professionals with good moral characters and make them capable to exhibit leadership through their engineering ability, creative potential and effective soft skills which will improve the quality of life in society.

Mission

- To impart quality technical education to the students through innovative and interactive teaching and learning process to acquire sound technical knowledge, professional competence and to have aptitude for research and development.
- Develop students as excellent communicators and highly effective team members and leaders with full appreciation of the importance of professional, ethical and social responsibilities.

Program Educational Objectives (PEOs)

1 To prepares the committed and motivated graduates by developing technical competency, research attitude and life-long learning with support of strong academic environment.

2. Train graduates with strong fundamentals and domain knowledge, update with modern technology to analyse, design & create novel products to provide effective solutions for social benefits.

3. Exhibit employability skills, leadership and right attitude to succeed in their professional career.

Program Outcomes (POs)

Engineering Graduates will be able to:

1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

2. **Problem analysis:** Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

5. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

6. **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

7. **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

8. **Ethics:** Apply ethical principles and commit to professional ethics, responsibilities, and norms of the

engineering practice.

9. **Individual and teamwork:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

11. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcomes (PSOs)

1. **Professional Skills:** The ability to apply knowledge of problem solving, algorithmic analysis, software Engineering, Data Structures, Networking, Database with modern recent trends to provide the effective solutions for Computer Engineering Problems.

2. **Problem-Solving Skills:** The ability to inculcate best practices of software and hardware design for delivering quality products useful for the society.

3. **Successful Career:** The ability to employ modern computer languages, environments, and platforms in creating innovative career paths.

SRES's Sanjivani College of Engineering, Kopargaon

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COURSE STRUCTURE- 2021 PATTERN

FINAL YEAR B. TECH: COMPUTER ENGINEERING

LIST OF ABBREVIATIONS			
Abbreviation	**Full Form**	**Abbreviation**	**Full Form**
PCC	Professional Core courses	CIA	Continuous Internal Assessment
PEC	Professional Elective courses	OR	End Semester Oral Examination
OEC	Open Elective courses	PR	End Semester Practical Examination
ISE	In-Semester Evaluation	TW	Continuous Term work Evaluation
ESE	End-Semester Evaluation	MLC	Mandatory Learning Course
PROJ	Project	L	Lecture
LC	Laboratory course	P	Practical
T	Tutorial	NC	Non-Credit
Cat	Category		

SRES's Sanjivani College of Engineering, Kopargaon

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COURSE STRUCTURE- 2021 PATTERN

FINAL YEAR B. TECH: COMPUTER ENGINEERING (A.Y. 2024-25)

SEMESTER VII

Cat.	Code	Course Title	Teaching Scheme				Evaluation Scheme					
			L (hrs)	T (hrs)	P (hrs)	Credits	Theory		Practical			Grand Total
							CIA	ESE	TW	OR	PR	
PCC	CO401	High Performance Computing	3	-	-	3	40	60	-	-	-	100
PCC	CO402	Machine Learning	4	-	-	4	40	60	-	-	-	100
PCC	CO403	Cryptography and Network Security	3	-	-	3	40	60	-	-	-	100
PEC	CO404	Professional Elective – III	3	-	-	3	40	60	-	-	-	100
PEC	CO405	Professional Elective – IV	3	-	-	3	40	60	-	-	-	100
LC	CO406	High Performance Computing Laboratory	-	-	2	1	-	-	50	-		50
LC	CO407	Machine Learning Laboratory	-	-	2	1	-	-		-	50	50
LC	CO408	Cryptography and Network Security Laboratory	-	-	2	1	-	-		50	-	50
PROJ	CO409	Project Stage- I		-	6	3		-	100	50	-	150
MLC	MC410	Mandatory Learning Course-VII	1	-	-	NC	-	-	-	-	-	**PASS/ FAIL**
Total			17	-	12	22	200	300	150	100	50	**800**

Mandatory Learning Course-VII: Financially Smart

Professional Elective-III	**Professional Elective-IV**
CO404 A Natural Language Processing	CO405A Deep Learning and Soft Computing
CO404 B DevOps and Cloud	CO405B Advanced Databases
CO404 C Data Analytics (DA)	CO405C Blockchain Technology

Dr. D.B. Kshirsagar	Dr. A. B. Pawar	Dr. A.G. Thakur
HOD	Dean Academics	Director

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COURSE STRUCTURE- 2021 PATTERN

FINAL YEAR B. TECH: COMPUTER ENGINEERING (A.Y. 2024-25)

SEMESTER VIII

Cat.	Code	Course Title	Teaching Scheme				Evaluation Scheme						
							Theory			Practical			Grand Total
			L (hrs)	T(hrs)	P (hrs)	Credits	CIA	ISE	ESE	TW	OR	PR	
PCC	CO411	Open Elective -I	3	-	-	3	25	-	75	-	-	-	100
PCC	CO412	Open Elective -II	3	-	-	3	25	-	75	-	-	-	100
PCC	CO413	Open Elective –III	2	-	-	2	25	-	75	-	-	-	100
PROJ	CO414	Professional Internship			8	4				100	50		150
PROJ	CO415	Project Stage- II	-	-	4	2	-	-	-	-	50	-	50
Total			8	-	12	14	75	-	225	100	100	-	**500**

Open Elective-I
CO411 A Ethical Hacking
CO411 B Introduction to Game Theory and Mechanism Design
CO411 C Design and Implementation of Human-Computer Interfaces
CO411 D Learning Analytics Tools

Open Elective-II
CO412 A Parameterized Algorithm
CO412 B Deep Learning for Computer Vision
CO412 C Introduction to Industry 4.0 and Industrial IOT

Open Elective-III
CO413 A Innovation, Business Models and Entrepreneurship
CO413 B Knowledge Management
CO413 C Services Marketing: Integration People, Technology, Strategy

Total Credits: 38	**Total Marks**: 1300

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HOD	Dean Academics	Director

SEMESTER VII

CO401: High Performance Computing	
Teaching Scheme	**Evaluation Scheme**
Lectures: 3 Hrs. / Week	**Continuous Internal Assessment (CIA): 40 Marks**
Credits: 3	**End-Sem Exam (ESE): 60 Marks**
	Total: 100 Marks

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Prerequisite Course: (if any) Computer Organization and Architecture, Systems Software, Design and Analysis of Algorithms.

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Course Objectives:

1. To study parallel computing concepts, architectures and programming models.
2. To understand different parallel algorithm design approaches.
3. To learn and understand the different communication operations used in parallel computing.
4. To analyze and measure performance of modern parallel computing systems.
5. To understand and explore different parallel programming models.
6. To learn and understand different open source distributed computing frameworks.

Course Outcomes (COs):

On completion of the course, student will be able to–

CO No.	Statement of Course Outcome	Bloom's Taxonomy	
		Level	Descriptor
CO1	Describe different parallel architectures, inter-connect networks, programming models.	2	Understand
CO2	Apply an efficient parallel algorithm to solve given problem.	3	Apply
CO3	Apply different communication operation for implementation of parallel algorithms involved in parallel computing.	3	Apply
CO4	Analyze and measure performance of modern parallel computing systems.	4	Analyze
CO5	Apply parallel programming model for implementation of different algorithms using concurrent or parallel environments.	3	Apply
CO6	Understanding different, recent open source distributed computing frameworks.	2	Understand

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3	2	2	--	--	--	--	--	3	--	2	3	2	3
CO2	2	2	3	2	--	--	--	--	--	3	--	2	3	2	3
CO3	2	1	3	3	--	--	--	--	--	3	--	2	3	2	3
CO4	2	3	3	2	--	--	--	--	--	2	--	2	3	2	3
CO5	2	2	3	3	--	--	--	--	--	2	--	2	3	2	3
CO6	2	3	3	2	3	--	3	--	--	1	--	2	3	2	3

Course Contents

Unit-I	**Introduction to Parallel Computing**	No.of Hours	COs
	Introduction, Basics of HPC, Architecting a Supercomputing System, Parallelization Paradigms, Motivating Parallelism, Scope of Parallel Computing. Parallel Programming Platforms: Implicit Parallelism, Trends in Microprocessor and Architectures, Limitations of Memory, System Performance, Physical Organization of Parallel Platforms, Communication Costs in Parallel Machines, Scalable design principles, Architectures: N-wide superscalar architectures, Multi-core architecture.	6Hrs.	CO1
Unit-II	**Principles of Parallel Algorithms Design**	No.of Hours	COs
	Principles of Parallel Algorithm Design: Preliminaries, Decomposition Techniques, Characteristics of Tasks and Interactions, Mapping Techniques for Load Balancing, Methods for Containing Interaction Overheads, Parallel Algorithm Models, Processor Architecture, Interconnect, Communication, Memory Organization, and Programming Models in high performance computing architecture examples: IBM CELL BE, Nvidia Tesla GPU, Intel Larrabee Micro architecture and Intel Nehalem micro-architecture Memory hierarchy and transaction specific	6Hrs.	CO2

	memory design, Thread Organization		
Unit-III	**Basic Communication Operations**	No.of Hours	Cos
	Operations- One-to-All Broadcast and All-to-One Reduction, All-to-All Broadcast and Reduction, All-Reduce and Prefix-Sum Operations, Scatter and Gather, All-to-All Personalized Communication, Circular Shift, Improving the Speed of Some Communication Operations.	6Hrs.	CO3
Unit-IV	**Analytical Models of Parallel Programs**	No.of Hours	COs
	Analytical Models: Sources of overhead in Parallel Programs, Performance Metrics for Parallel Systems, and The effect of Granularity on Performance, Scalability of Parallel Systems, Dense Matrix Algorithms: Matrix-Vector Multiplication, Matrix-Matrix Multiplication.	6Hrs.	CO4
Unit-V	**Parallel Programming – OpenMP, MPI**	No.of Hours	Cos
	Shared Memory Programming Model: OpenMP, Introduction to OpenMP, OpenMP Components, Data Scope Attribute/Clauses, Work-sharing Constructs, Synchronization Constructs, Library Routines & Environment Variables. Distributed Memory Programming Model : MPI, Introduction to MPI, Basic terms in MPI, MPI Implementation, Point to Point Communication, Collective Communication.	6Hrs.	CO5
Unit-VI	**HPC enabled Programming Frameworks**	No.of Hours	Cos
	CUDA Architecture, Using the CUDA Architecture, Applications of CUDA Introduction to CUDA C-Write and launch CUDA C kernels, Manage GPU memory, Manage	6Hrs.	CO6

	communication and synchronization, Parallel programming in CUDA- C. Apache Hadoop, Apache Spark, Apache Flink, OpenCL,		

Books:

Text Books:

1. Ananth Grama, Anshul Gupta, George Karypis, and Vipin Kumar, "Introduction to Parallel Computing", 2nd edition, Addison-Wesley, 2003, ISBN: 0-201-64865-2
2. Jason sanders, Edward Kandrot, “CUDA by Example”, Addison-Wesley, ISBN-13: 978-0-13-138768-3.

Reference Books:

1. Kai Hwang, ”Scalable Parallel Computing”, McGraw Hill 1998, ISBN:0070317984
2. Shane Cook, “CUDA Programming: A Developer's Guide to Parallel Computing with GPUs”, Morgan Kaufmann Publishers Inc. San Francisco, CA, USA 2013 ISBN: 9780124159884
3. David Culler Jaswinder Pal Singh, ”Parallel Computer Architecture: A Hardware/Software Approach”, Morgan Kaufmann,1999, ISBN 978-1-55860-343-1
4. Rod Stephens, “ Essential Algorithms”, Wiley, ISBN: *ISBN*: 978-1-118-61210-1.

E-Resources:-

1. https://nptel.ac.in/courses/106102163

CO402: Machine Learning	
Teaching Scheme	**Examination Scheme**
Lectures: 4 Hrs. / Week	**Continuous Internal Assessment (CIA): 40 Marks**
Credits: 4	**End-Sem Exam (ESE): 60 Marks**
	Total: 100 Marks

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Prerequisite Course: (if any) Data Mining, Discrete Mathematics, Databases

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Course Objectives:

1. To understand the need for machine learning for various problem solving
2. To understand the nature of the problem and apply machine learning algorithms.
3. To study the various supervised, semi-supervised and unsupervised learning algorithms in machine learning
4. To understand the latest trends in machine learning
5. To design appropriate machine learning algorithms for problem solving

Course Outcomes (COs):

On completion of the course, student will be able to–

CO No.	Statement of Course Outcome	Bloom's Taxonomy	
		Level	Descriptor
CO1	Understand different learning based applications.	2	Understand
CO2	Apply different pre-processing methods to prepare training data set for machine learning	3	Apply
CO3	Apply the Regression Techniques to various problems	3	Apply
CO4	Apply the Bayesian algorithm to various problems	3	Apply
CO5	Apply the classification & ensemble techniques.	3	Apply
CO6	Ability to apply Clustering techniques for data.	3	Apply

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO 1	2	1	2	3	--	--	--	--	--	2	--	--	3	--	--
CO 2	3	2	3	2	--	--	--	--	--	--	--	--	2	--	--
CO 3	2	2	3	1	--	--	--	--	--	--	--	--	--	3	2
CO 4	3	1	3	3	--	--	--	--	--	--	--	--	3	2	2
CO 5	3	1	2	2	--	--	--	--	--	--	--	--	3	2	2
CO 6	3	1	2	3	--	3	2	--	--	--	--	--	2	--	3

(Specify values as : 3: High Level, 2: Medium Level, 1: Low Level for mapping of Cos to POs)

Course Contents

Unit-I	**INTRODUCTION TO MACHINE LEARNING**	No.of Hours	COs
	Classic and adaptive machines, Machine learning matters, beyond machine learning-deep learning and bio inspired adaptive systems, Machine learning and Big data. Important Elements of Machine Learning- Data formats, Learn ability, Statistical learning approaches, Elements of information theory.	07 Hrs.	CO1
Unit-II	**FEATURE SELECTION**	No.of Hours	COs
	Scikit- learn Dataset, Creating training and test sets, managing categorical data,. Managing missing features, Data scaling and normalization, Feature selection and Filtering, Principle Component Analysis (PCA)-non-negative matrix factorization, Sparse PCA, Kernel PCA. Atom Extraction and Dictionary Learning	7 Hrs	CO 2
Unit-III	**REGRESSION TECHNIQUES**	No.of Hours	COs
	Linear regression- Linear models, A bi-dimensional example, Linear Regression and higher dimensionality, Ridge, Lasso and Elastic Net, Robust regression with random sample consensus, Polynomial regression, Isotonic regression, **Logistic regression**-Linear classification, Logistic regression,	7 Hrs.	CO 3

	Implementation and Optimizations, Stochastic gradient descendent algorithms, Finding the optimal hyper-parameters through grid search, Classification metric, ROC Curve.		
Unit-IV	**BAYESIAN AND SVM TECHNIQUES**	No.of Hours	COs
	Bayes Theorom, Naïve Bayes Classifiers, Naïve Bayes in Scikit-learn- Bernoulli Naïve Bayes,Multinomial Naïve Bayes, and Gaussian Naïve Bayes. Support Vector Machine(SVM)- Linear Support Vector Machines, Scikit- learn implementation Linear Classification, Kernel based classification, Non- linear Examples. Controlled Support Vector Machines, Support Vector Regression.	7 Hrs.	CO 4
Unit-V	**CLASSIFICATION AND ENSEMBLE LEARNING**	No.of Hours	COs
	Decision Trees- Impurity measures, Feature Importance. Decision Tree Classification with Scikitlearn, Ensemble Learning-Random Forest, AdaBoost, Gradient Tree Boosting, Voting Classifier. Introduction to Meta Classifier: Concepts of Weak and eager learner, Ensemble methods, Bagging, Boosting, Random Forests.K-NN Algorithms	7 Hrs.	CO 5
Unit-VI	**CLUSTERING TECHNIQUES**		
	Clustering Fundamentals- Basics, K-means: Finding optimal number of clusters, DBSCAN, Spectral Clustering. Evaluation methods based on Ground Truth- Homogeneity, Completeness, Adjusted Rand Index. Hierarchical Clustering, Expectation maximization clustering, Agglomerative Clustering- Dendrograms, Agglomerative clustering in Scikit- learn, Connectivity Constraints	7 Hrs	CO 6

Books:

Text Books:

1. Giuseppe Bonaccorso, “Machine Learning Algorithms”, Packt Publishing Limited, ISBN10: 1785889621, ISBN-13: 978-1785889622
2. Tom M. Mitchell, ―Machine Learning, McGraw-Hill Education (India) Private Limited,

2013.

3. Josh Patterson, Adam Gibson, “Deep Learning: A Practitioners Approach”, O‟REILLY, SPD, ISBN: 978-93-5213-604-9, 2017 Edition 1st.

Reference Books:

1. Ethem Alpaydin, ―Introduction to Machine Learning (Adaptive Computation and Machine Learning), The MIT Press 2004.
2. Stephen Marsland, ―Machine Learning: An Algorithmic Perspective, CRC Press, 2009.
3. Ethem Alpaydin, “ Introduction to Machine Learning”, PHI 2nd Edition-2013, ISBN 978-0262-01243-0
4. Peter Flach, “Machine Learning: The Art and Science of Algorithms that Make Sense of Data”, Cambridge University Press, Edition 2012, ISBN-10: 1107422221; ISBN-13: 9781107422223
5. Tom Mitchell “Machine Learning” McGraw Hill Publication, ISBN : 0070428077 9780070428072
6. Nikhil Buduma, “Fundamentals of Deep Learning”, O‟REILLY publication, second edition 2017, ISBN: 149192561

e-Resources:

1. https://machinelearningbook.com/

MOOC/ Video Lectures available at:

1. https://onlinecourses.nptel.ac.in/noc22_cs97/preview
2. https://nptel.ac.in/courses/106106139

CO403: Cryptography and Network Security		
Teaching Scheme	**Examination Scheme**	
Lectures: 3 Hrs. / Week	**Continuous Internal Assessment (CIA): 40 Marks**	
Credits: 3	**End-Sem Exam(ESE): 60 Marks**	
	Total: 100 Marks	

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Prerequisite Course: (if any) Computer Network, Discrete Mathematics

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Course Objectives:

1. To offer an understanding of principle concepts, central topics and basic approaches in cryptography and network security.
2. To know the basics of symmetric key cryptography.
3. To acquire knowledge of standard algorithms and protocols employed to provide confidentiality, integrity and authenticity.
4. To apply algorithmic strategies for authentication in cryptography and network security.
5. To develop problem solving abilities using Cyber Security.
6. To enhance awareness about network security solutions against computer-attacks.

Course Outcomes (COs):

On completion of the course, student will be able to–

CO No.	Statement of Course Outcome	Bloom's Taxonomy	
		Level	Descriptor
CO1	Recognize concept of Security needed in Communication of data through computers and networks.	2	Understand
CO2	Understand various Encryption mechanisms for secure transmission of data and management of key required for encryption.	2	Understand
CO3	Understand Encryption mechanisms in Public Key cryptography and implement various encryption techniques.	3	Apply
CO4	Understand authentication requirements and implement various authentication mechanisms	3	Apply
CO5	Apply security tools in various environments for network security.	3	Apply

CO6	Apply appropriate network security solutions against computer-attacks.	3	Apply

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	--	--	--	--	--	--	--	--	--	--	--	2	--	1
CO2	--	--	2	2	--	--	--	--	--	--	2	--	--	3	--
CO3	1	--	--	2	--	--	--	--	--	--	--	--	--	1	--
CO4	--	--	--	--	--	--	2	--	--	--	--	--	--	1	--
CO5	2	--	2	3	--	--	1	--	--	--	2	--	--	2	2
CO6	2	--	2	3	--	--	1	--	--	--	2	--	1	2	1

(Specify values as : 3: High Level, 2: Medium Level, 1: Low Level for mapping of Cos to POs)

Course Contents

Unit-I	**Introduction**	**No. of Hours**	**COs**
	Introduction to Cryptography, Security Threats, Vulnerability, Active and Passive attacks, Security services and mechanism, Conventional Encryption Model. Overview of Network Security, Importance and Challenges of Network Security, Goals and Objectives of Network Security, Basic Terminologies in Network Security. Introduction to Network Protocols, TCP/IP Protocol Suite, Network Architecture and Models (OSI, TCP/IP)	07 Hrs.	CO1
Unit-II	**Symmetric Ciphers**	**No. of Hours**	**COs**
	Math Background: Modular Arithmetic, Euclidean and Extended Euclidean algorithm, Prime numbers, Fermat and Euler's Theorem Substitution &Transposition Techniques, Block Ciphers (DES, AES) : Feistal Cipher Structure, Simplifies DES, DES, Double and Triple DES, Block Cipher design Principles, AES, Modes of Operation	07 Hrs.	CO2
Unit-	**Public Key Cryptography**	**No. of**	**COs**

III		Hours	
	Principles Of Public-Key Cryptography, RSA Algorithm, Key Management, Diffie- Hellman Key Exchange, Elgamal Algorithm, Elliptic Curve Cryptography, X.509 certificate. Digital Signatures: Implementation, Algorithms, Standards (DSS), Authentication Protocol.	07 Hrs.	CO3

Unit-IV	Authentication	No.of Hours	COs
	Key Management: Key Distribution Techniques, Kerberos, Hash and MAC Algorithms: Authentication Requirement, Functions, Message Authentication Code, Hash Functions, Security Of Hash Functions And Macs, MD5 Message Digest Algorithm, Secure Hash Algorithm, Digital Signatures,	07 Hrs.	CO4

Unit-V	Network Threats and Vulnerabilities	No.of Hours	COs
	Types of Network Threats, Common Network Vulnerabilities, Malware and Virus Attacks, Network Intrusions and Unauthorized Access, DoS and DDoS, Pharming attack, Software vulnerabilities: Phishing, buffer overflow, Cross-site scripting, Ransomware, SQL- injection, Sniffing. Introduction to Ethical Hacking, Anonymity, Information Gathering, Scanning Networks and Tools, Vulnerability Analysis.	07 Hrs.	CO5

Unit-VI	Security in Networks	No.of Hours	COs
	Security in Networks: Firewalls and Intrusion Detection/Prevention Systems (IDS/IPS), Virtual Private Networks (VPNs), Network Access Control (NAC), Secure Sockets Layer/Transport Layer Security (SSL/TLS), Network Security Appliances. Email Security – PGP, S/MIME.	07 Hrs.	CO6

Books:

Text Books:

1. William Stallings; “Cryptography and Network Security-Principles and Practices” 6th Edition ,

Pearson Education, 2014, ISBN13:9780133354690.

2. Bernard Menezes, "Network Security and Cryptography", 1st Edition, Cengage Learning, 2010, ISBN 81-315-1349-1.

3. Raef Meeuwisse, "Cybersecurity for Beginners", 2nd Edition, Cyber Simplicity, 2017, ISBN-9781911452157.

Reference Books:

1. M. Speciner, R. Perlman, C. Kaufman, "Network Security: Private Communications in a Public World", Prentice Hall, 2002
2. Michael Gregg, "The Network Security Test Lab: A Step-By-Step Guide", Dreamtech Press, 2015, ISBN-10:8126558148, ISBN-13: 978-8126558148.
3. Charlie Kaufman, Radia Perlman and Mike Spencer, "Network security, private communication in a public world", 2nd Edition, Prentice Hall, 2002, ISBN 9780130460196.
4. V.K. Pachghare, "Cryptography and Information Security", 2nd Edition, PHI, 2015, ISBN-978-81-203-5082-3.

E-Resources:

1. https://onlinecourses.swayam2.ac.in/nou19_cs08/preview

CO404A: Natural Language Processing			
Teaching Scheme		**Examination Scheme**	
Lectures:	**3 Hrs. / Week**	**Continuous Internal Assessment (CIA):**	**40 Marks**
Credits:	**3**	**End-Sem Exam(ESE):**	**60 Marks**
		Total:	**100 Marks**

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Prerequisite Course: Data Mining, Machine Learning, Discrete Mathematics, Data Structure, Artificial Intelligence

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Course Objectives:

1. To study the sentiment analysis with logistic regression.
2. To study sentiment analysis with Naïve Bayes.
3. To study Natural Language Processing with Vector Spaces.
4. To study about auto correct.
5. To study about Part of Speech Tagging and Hidden Markov Models
6. To study Autocomplete and Language Models and Word embeddings with neural networks

Course Outcome: After completion of this course, students are able to

CO No.	Statements of Course Outcomes (CO's)	Bloom's Taxonomy	
		Level	Descriptor
CO1	Understand classification using logistic regression	2	Understand
CO2	Apply the Naive Bayes algorithm for classification of tweets	3	Apply
CO3	Understand the Vector space models	2	Understand
CO4	Understand the probabilistic models	2	Understand
CO5	Understand Part of Speech Tagging and Hidden Markov Models	2	Understand
CO6	Apply Autocomplete and Language Models and Word embeddings with neural networks.	3	Apply

Mapping of COs with POs/PSOs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3

CO1	2	1	2	3	-	-	-	-	-	2	-	-	3	-	-
CO2	3	2	3	2	-	-	-	-	-	-	-	-	2	-	-
CO3	2	2	3	1	-	-	-	-	-	-	-	-	-	2	3
CO4	3	1	3	3	-	-	-	-	-	-	-	-	3	2	2
CO5	3	1	2	2	-	-	-	-	-	-	-	-	3	2	2
CO6	3	1	2	3	-	-	-	-	-	-	-	-	2	-	3

COURSE CONTENTS

Unit-I	**Fundamentals of Natural Language Processing**	**No. of Hours**	**COs**
	History of NLP, Generic NLP system, levels of NLP, Knowledge in language processing, Ambiguity in Natural language, stages in NLP, challenges of NLP, Applications of NLP, Approaches of NLP: Rule based, Data Based, Knowledge Based approaches	06	CO1
Unit-II	**Natural Language Processing with Classification and Vector Spaces**	**No. of Hours**	**COs**
	Sentiment Analysis with Logistic Regression - Learn to extract features from text into numerical vectors, then build a binary classifier for tweets using a logistic regression! **Sentiment Analysis with Naïve Bayes** - Learn the theory behind Bayes' rule for conditional probabilities, then apply it toward building a Naive Bayes tweet classifier of your own! **Vector Space Models-** Vector space models capture semantic meaning and relationships between words. You'll learn how to create word vectors that capture dependencies between words, then visualize their relationships in two dimensions using PCA. **Machine Translation and Document Search** - Learn to transform word vectors and assign them to subsets using locality sensitive hashing, in order to perform machine translation and document search.	08	CO2
Unit-	**Natural Language Processing with Probabilistic Models -1**	**No. of**	**COs**

III		Hours	
	Autocorrect – Learn about autocorrect, minimum edit distance, and dynamic programming, then build your own spellchecker to correct misspelled words! **Part of Speech Tagging and Hidden Markov Models** - Learn about Markov chains and Hidden Markov models, then use them to create part-of-speech tags for a Wall Street Journal text corpus!	08	CO3
Unit-IV	**Natural Language Processing with Probabilistic Models -2**	**No. of Hours**	**COs**
	Autocomplete and Language Models – Learn about how N-gram language models work by calculating sequence probabilities, then build your own autocomplete language model using a text corpus from Twitter! **Word embeddings with neural networks** - Learn about how word embeddings carry the semantic meaning of words, which makes them much more powerful for NLP tasks, then build your own Continuous bag-of-words model to create word embeddings from Shakespeare text.	08	CO4
Unit-V	**Natural Language Processing with Machine Translation and Text Summarization**	**No. of Hours**	**COs**
	Neural Machine Translation- Discover some of the shortcomings of a traditional seq2seq model and how to solve for them by adding an attention mechanism, then build a Neural Machine Translation model with Attention that translates English sentences into German. **Text Summarization** - Compare RNNs and other sequential models to the more modern Transformer architecture, then create a tool that generates text summaries.	08	CO5
Unit-VI	**Applications of Natural Language Processing**	**No. of Hours**	**COs**
	Question Answering - Explore transfer learning with state-of-the-art models like T5 and BERT, then build a model that can answer questions. **Chatbot** - Examine some unique challenges transformer models face	08	CO6

	and their solutions, then build a chatbot using a Reformer model.		

Books:

Text Books:

1. Christopher D.Manning and Hinrich Schutze,, "Foundations of Statistical Natural Language Processing" , MIT Press, 1999
2. Introduction to Natural Language Processing By Jacob Eisenstein
3. Foundation of Statistical Natural Language Processing - Christopher D Manning and Hinrich Schütze.
4. James Allen, "Natural Language Understanding", Pearson Publication, ISBN: 978-81-317-0895- 8 2nd Edition
5. Daniel Jurafsky, James H. Martin, "Speech and Language Processing", Second Edition, Prentice Hall, 2008.
6. Jacob Eisenstein, "An Introduction to Information Retrieval", Cambridge University Press

Reference Books:

1. Practical Natural Language Processing: A Comprehensive Guide to Building Real-World NLP Systems by Sowmya Vajjala, Bodhisattwa Majumder, Anuj Gupta, Harshit Surana (Published on June 17, 2020)
2. Nitin Indurkhya and Fred J. Damerau**, "**Handbook of Natural Language Processing", 2nd ed. CRC press
3. Natural Language Processing with Python: Analyzing Text with the Natural Language Toolkit Paperback – 7 July 2009.

E-Resources:

1. https://www.coursera.org/specializations/natural-language-processing
2. https://onlinecourses.nptel.ac.in/noc23_cs45/preview

CO404 B : DevOps and Cloud	
Teaching Scheme	**Examination Scheme**
Lectures: 3 Hrs. / Week	**Continuous Internal Assessment (CIA): 40 Marks**
Credits: 3	**End-Sem (ESE): 60 Marks**
	Total: 100 Marks

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Prerequisite Course: (if any) Software Engineering, Cloud Computing, Databases

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Course Objectives:

1. The objective is to understand the fundamentals of DevOps culture, its goals, practices and tools for automating the IT infrastructure and manage application life cycle.
2. The overall objective of this course is to provide students with practical experience in applying agile methodology to their work environment.
3. Students will get a range of tools to apply to their work.

Course Outcomes (COs): On completion of the course, student will be able to–

Course Outcome	**Bloom's Taxonomy**	
	Level	**Descriptor**
1. Be able to compare and contrast the differences between Agile and other project management methodologies	4	Analyse
2. Be able to interpret and apply various principles, phases and activities of the Scrum methodology	2	Understand
3. Be able to identify and use various tools for Agile development and CI/CD	3	Apply
4. Be able to understand and implement DevOps principles for CI/CD	2	Understand

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PS O1	PS O2	PS O3
CO 1	1	--	2	2	2	--	--	--	--		3	2	3	2	1

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

COURSE CONTENTS

Unit I	**Introduction to DevOps**	**No. of Hours**	**COs**
	Background of SDLC, Agile, ITIL and Need for DevOps, History of DevOps, Role of a DevOps Engineer, Terminologies in DevOps.	3	1
Unit II	**Version Control systems**	**No. of Hours**	**COs**
	Introduction to Version Control Systems (VCS), Need for using a Version Control Systems, Types of Version Control Systems: Simple VCS, Centralized VCS and Distributed VCS, Introduction to GIT, SVN and Bitbucket, Git Essentials, Git Commandline, Git architecture and versions of Git, Cloning, Check-in and Commit of Git Repositories, Fetching the Repositories, Git Pull and Git Branching Technique	7	2
Unit III	**Configuration Management Tools**	**No. of Hours**	**COs**
	Introduction to Configuration Management tools, Types of Configuration Management Tools : Pushbased & Pull-based, Introduction to Ansible, Puppet, Chef & Salt, Ansible : What is Ansible and its Architecture, Why do we need Ansible, Ansible Terminologies, Advantages, Infrastructure-as-a-code, Writing Ansible Playbooks using YAML, Ansible Case Study : SPLUNK, Best practices	8	2
Unit IV	**Vagrant and Containerization**	**No. of Hours**	**COs**
	Introduction to Vagrant and its Uses, Installation of Vagrant in Linux and Windows, Understanding the VagrantFile, Provisioning Virtual Machines with Vagrant using Virtualbox, Networking & Port Forwarding with Vagrant Introduction to	8	3

	Containerization, Docker Essentials, What is Docker Hub and Images, Fundamentals of Microservices, Understanding the DockerFile, Docker Compose and Docker Swarm, Difference between Docker Swarm and Kubernetes for Container Orchestration		
Unit V	**CI/CD Pipelines and Continuous Monitoring**	**No. of Hours**	**COs**
	What is Continuous Integration and Continuous Deployment (CI/CD), Need of CI/CD in DevOps, Practical Implementation of CI/CD pipelines using Jenkins, Understanding the Jenkins Plugins, Continuous Testing & E-mail notifications, Benefits of a production-ready software Introduction to Continuous Monitoring, Why Continuous Monitoring is essential, Continuous Monitoring with Nagios, Datadog and AWS CloudWatch, Application Performance Monitoring with New Relic, Centralized Logging with ELK (Elasticsearch-Logstash-Kibana)	7	4
Unit VI	**DevOps Capabilities**	**No. of Hours**	**COs**
	Successful paths to automate the IT processes, Adopting DevOps in organization, Myths about DevOps , Bringing DevOps culture and Team collaboration, Improving the customer feedback and enhancing the Business	4	4
Books:			
Reference Books:			
R1. Emily Freeman, DevOps For Dummies, John Wiley & Sons (2019), ISBN: 1119552222, 9781119552222 2. R2: Joakim Verona, Practical DevOps – Second Edition, May 2018, Packt Publishing, ISBN: 9781788392570 3. R3: Lorin Hochstein & Rene Moser, Ansible : Up and Running, 2nd Edition, O'Reilly Media, ISBN13: 978-1491979808.			
E-Resources(E):			
https://in.coursera.org/learn/DevOps			

CO404 C: Data Analytics		
Teaching Scheme	**Examination Scheme**	
Lectures: 3 Hrs. / Week	**Continuous Internal Assessment (CIA): 40 Marks**	
Credits: 3	**End-Sem Exam (ESE): 60 Marks**	
	Total: 100 Marks	

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Prerequisite Course: (if any) Data Mining, Machine Learning, Design and Analysis of Algorithms

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Course Objectives:

1. To study Data Analytical Life cycle model.
2. To study various statistical techniques of data analytics.
3. To study of Predictive data analytics methods
4. To study of various Streams Concepts in Data analytics
5. To study of various practical application of data analytics.
6. To study of different big data visualization techniques.

Course Outcomes (COs):

On completion of the course, student will be able to–

CO No.	Statement of Course Outcome	Bloom's Taxonomy	
		Level	Descriptor
CO1	Understand lifecycle approach to data science and big data analytics projects	2	Understand
CO2	Apply various analytic techniques and tools in big data project	3	Apply
CO3	Apply the predictive data analytics techniques in big data project	3	Apply
CO4	Understand the Stream Data Model and Architecture	2	Understand
CO5	Apply the various application of Data analytics techniques in real time application	3	Apply
CO6	Apply big data visualization techniques in big data project	3	Apply

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	2	3	--	--	--	--	--	2	--	--	3	--	--
CO2	3	2	3	2	--	--	--	--	--	--	--	--	2	--	--
CO3	2	2	3	1	--	--	--	--	--	--	--	--	--	3	2
CO4	3	1	3	3	--	--	--	--	--	--	--	--	3	2	2

CO5	3	1	2	2	--	--	--	--	--	--	--	--	3	2	2
CO6	3	1	2	3	--	3	2	--	--	--	--	--	2	--	3

(Specify values as : 3: High Level, 2: Medium Level, 1: Low Level for mapping of Cos to POs)

Course Contents

Unit-I	**Introduction to Data Analytics**	No.of Hours	COs
	Introduction: Big data overview, state of the practice in Analytics- BI Vs Data Science, Current Analytical Architecture, drivers of Big Data, Emerging Big Data Ecosystem and new approach. Data Analytic Life Cycle: Overview, phase 1- Discovery, Phase 2- Data preparation, Phase 3- Model Planning, Phase 4- Model Building, Phase 5- Communicate Results, Phase 6- Operationalize. Case Study: GINA.	07 Hrs.	CO1
Unit-II	**Basic Data Analytics Methods**	No.of Hours	COs
	Statistical Methods for Evaluation- Hypothesis testing, difference of means, wilcoxon rank–sum test, type 1 type 2 errors, power and sample size, ANNOVA. Advanced Analytical Theory and Methods: Clustering- Overview, K means- Use cases, Overview of methods, determining number of clusters, diagnostics, reasons to choose and cautions.	7 Hrs	CO 2
Unit-III	**Predictive Analytics**	No.of Hours	COs
	Sampling distribution – Estimation - point, confidence - Test of significance, 1& 2 tailed test, uses of t-distribution, F-distribution, $\chi 2$ distribution - Predictive modeling and Analysis - Regression Analysis, Correlation analysis, Rank correlation coefficient, Multiple correlation.	7 Hrs.	CO 3
Unit-IV	**STREAM data model**	No.of Hours	COs
	Introduction to Streams Concepts, Stream Data Model and	7 Hrs.	CO 4

	Architecture, Stream Computing, Sampling Data in a Stream Filtering Streams, Counting Distinct Elements in a Stream Real time Analytics Platform(RTAP) applications .		
Unit-V	**Data Analytics Applications**	No.of Hours	COs
	Application in Industries: Retail, E-commerce, Finance, Sports, Others - healthcare, education, telecom etc. Application in business functions: Marketing Sales, Supply chain management, HR, Others - Finance, IT, Manufacturing and Strategy.	7 Hrs.	CO 5
Unit-VI	**Big Data Visualization**		
	Introduction to Data visualization, Challenges to Big data visualization, Analytics for unstructured data- Use cases, Map Reduce, Apache Hadoop. The Hadoop Ecosystem- Pig, HIVE, HBase, Mahout, NoSQL. An Analytics Project-Communicating, operationalizing, creating final deliverables.	7 Hrs	CO 6

Books:

Text Books:

1. David Dietrich, Barry Hiller, "Data Science and Big Data Analytics", EMC education services, Wiley publications, 2012, ISBN0-07-120413-X
2. Ashutosh Nandeshwar , "Tableau Data Visualization Codebook", Packt Publishing, ISBN 978-1-84968-978-6
3. Alberto Cordoba, ―Understanding the Predictive Analytics Lifecycle‖, Wiley, 2014
4. Eric Siegel, Thomas H. Davenport, ―Predictive Analytics: The Power to Predict Who Will Click, Buy, Lie, or Die‖, Wiley, 2013.

Reference Books:

1. Maheshwari Anil, Rakshit, Acharya, "Data Analytics", McGraw Hill, ISBN: 789353160258.
2. Mark Gardner, "Beginning R: The Statistical Programming Language", Wrox Publication,

ISBN: 978-1-118-16430-3

3. LuísTorgo, “Data Mining with R, Learning with Case Studies”, CRC Press, Talay and Francis Group, ISBN9781482234893
4. Carlo Vercellis, “Business Intelligence - Data Mining and Optimization for Decision Making”, Wiley Publications, ISBN: 9780470753866.

E-Resources:

1. Google Data Analytics Professional Certificate: https://www.coursera.org/instructor/google-career-certificates
2. IBM Data Science Professional Certificate: https://www.coursera.org/professional-certificates/ibm-data-science
3. Data Analytics with Python: https://onlinecourses.nptel.ac.in/noc21_cs45/preview

CO405A: Deep Learning & Soft Computing	
Teaching Scheme	**Examination Scheme**
Lectures: 3 Hrs. / Week	**Continuous Internal Assessment(CIA): 40 Marks**
Credits: 3	**End-Sem Exam(ESE): 60 Marks**
	Total: 100 Marks

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Prerequisite Course: (if any) Data Mining, Machine Learning

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Course Objectives:

1. To explore the Artificial Neural Networks & Deep Learning.
2. To introduce students to understand, explain, and apply the fuzzy set and fuzzy logic in real life applications
3. To understand the use of genetic algorithm to design and develop various applications
4. To study the concepts of Artificial Neural Networks.
5. To examine the different architectures like Recurrent Neural Networks
6. To understand the CNN in deep learning & examine the case studies of deep learning.

Course Outcomes (COs):

On completion of the course, student will be able to–

CO No.	Statement of Course Outcome	Bloom's Taxonomy	
		Level	Descriptor
CO1	Understand basics of ANN & Deep learning	2	Understand
CO2	Apply Various (ANN) Deep learning model.	3	Apply
CO3	Apply principles of soft computing to solve problems in varieties of application domains.	3	Apply
CO4	Applying genetic algorithm and its basic principles for real world engineering problems.	3	Apply
CO5	Apply the CNN in deep learning & Applications.	3	Apply
CO6	Apply the Recurrent Neural Network Language Model.	3	Apply

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO1	2	--	--	--	--	--	--	--	--	--	--	--	2	--	1
CO2	2	--	2	3	--	--	1	--	--	--	2	--	1	2	1
CO3	--	--	2	2	--	--	--	--	--	--	2	--	--	3	--

CO4	1	--	--	2	--	--	--	--	--	--	--	--	--	1	--
CO5	2	--	2	3	--	--	1	--	--	--	2	--	1	2	1
CO6	2	--	2	3	--	--	1	--	--	--	2	--	1	2	1

(Specify values as : 3: High Level, 2: Medium Level, 1: Low Level for mapping of Cos to POs)

Course Contents

Unit-I	**Introduction to Deep Learning**	No.of Hours	COs
	History of Deep Learning, McCulloch Pitts Neuron, Thresholding Logic, Perceptrons, Perceptron Learning Algorithm. Multilayer Perceptrons (MLPs), Sigmoid Neurons, Gradient Descent.	07 Hrs.	CO1
Unit-II	**Artificial Neural Networks(ANN)**	No.of Hours	COs
	Feedforward Neural Networks, Dimension,Deep Vs ShallowNetworks,Generative Adversarial Networks (GAN), Semi-supervised Learning Regularization in autoencoders, Denoising autoencoders, Sparse autoencoders, Contractive autoencoders.	06 Hrs.	CO2
Unit-III	**Soft Computing: Fuzzy Logic**	No.of Hours	COs
	Inroduction of Soft Computing, Fuzzy Set theory, Fuzzy set versus Crisp set, Membership function, Operations on Fuzzy set, Fuzzy Relation, Fuzzification and Defuzzification, Minmax Composition, Fuzzy Logic, Fuzzy Rule based systems, Predicate logic, Fuzzy Decision Making, Fuzzy Control Systems, Fuzzy Classification, Fuzzy controllers, Application of Fuzzy systems(Real life).	07 Hrs.	CO3
Unit-IV	**Soft Computing: Genetic Algorithm**	No.of Hours	COs
	Evolution of Genetic Algorithms (GA), Basic GA framework and different GA architectures, GA operators: Crossover, Selection, Mutation, Fitness function, Convergence Working Principle, Vncoding methods , Bit wise operation in GA, Multi-level Optimization, Applications of GA in Machine Learning.	06 Hrs.	CO4

Unit-V	**Convolutional Neural Networks(CNN)**	No.of Hours	COs
	Convolutional Neural Networks, LeNet, AlexNet, ZF-Net, VGGNet, GoogLeNet, ResNet, Visualizing Convolutional Neural Networks, Guided Backpropagation.	07 Hrs.	CO5

Unit-VI	**Recurrent Neural Networks(RNN)**	No.of Hours	COs
	Recurrent Neural Networks, Backpropagation through time (BPTT), Vanishing and Exploding Gradients, Truncated BPTT, GRU, LSTMs-Recurrent Neural Network Language Models-Word-Level RNNs	07 Hrs.	CO6

Books:

Text Books:

1. Fuzzy Logic with Engineering Applications (3rd Edn.), Timothy J. Ross, Willey, 2010
2. Ian Goodfellow, Yoshua Bengio, Aaron Courville, Deep Learning, MIT Press, 2016.
3. Deng & Yu, Deep Learning: Methods and Applications, Now Publishers, 2013.

Reference Books:

1. Neuro-Fuzzy and soft Computing, J.-S. R. Jang, C.-T. Sun, and E. Mizutani, PHI Learning, 2009
2. Michael Nielsen, Neural Networks and Deep Learning, Determination Press, 2015.
3. Deep learning, Rajiv Chopra,Khanna book Publishing Co. New Delhi

e-Resources:

2. https://cse.iitkgp.ac.in/~dsamanta/courses/sca/index.html
3. http://www.musaliarcollege.com/e-Books/CSE/introduction-to-soft-computing%20(1).pdf
4. http://www.deeplearningbook.org/
5. http://deeplearning.net/tutorial/deeplearning.pdf
6. http://www.dkriesel.com/en/science/neural_networks

MOOC/ Video Lectures available at:

3. https://nptel.ac.in/courses/106/105/106105173/
4. https://nptel.ac.in/courses/117/105/117105084/
5. https://nptel.ac.in/courses/127/105/127105006

CO405B: Advanced Databases	
Teaching Scheme	**Examination Scheme**
Lectures: 3 Hrs. / Week	**Continuous Internal Assessment (CIA):40 Marks**
Credits: 3	**End-Sem Exam(ESE): 60 Marks**
	Total: 100 Marks

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Prerequisite Course: (if any) Database Management System Concepts

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Course Objectives:

1. To understand the types of digital data and big data.
2. To understand the Hadoop architecture.
3. To use map reduce Programming model for NoSQL Data.
4. To learn and use CQL on Column oriented data.
5. To learn and use the Redis Query Language on Key-Value Pair Data.
6. To learn and use the Neo4j Concepts on Graph Data.

Course Outcomes (COs): On completion of the course, student will be able to–

Course Outcome	**Bloom's Taxonomy**	
	Level	**Descriptor**
CO1: Understand the Types of Digital Data and Characteristics of Big Data	2	Understand
CO2: Understand the Hadoop Architecture	2	Understand
CO3: Apply the Mapreduce Programming model for NoSQL Data	3	Apply
CO4: Apply the CQL on Column Oriented Data	3	Apply
CO5: Apply the Redis Query Language on Key-Value Pair Data	3	Apply
CO6: Apply the Neo4j Concepts on Graph Data	3	Apply

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO1	1	--	2	2	2	--	--	--	--		3	2	3	2	1

CO2	2	--	2	2	2	--	--	--	--		2	2	2	2	--
CO3	1	--	2		2	--	--	--	--		2	2	2	3	--
CO4	2	--	--	2	--	--	--	--	--		2	2	1	2	--
CO5	2	--	2	2	--	--	--	--	--		2	2	2	3	--
CO6	2	--	3	2	2	--	--	--	--		2	3	2	2	1

COURSE CONTENTS

Unit I	**Types of Digital Data**	**No. of Hours**	**COs**
	Classification of Digital Data. Introduction to Big Data: Characteristics of Data, Evolution of Big Data, Definition of Big Data, Challenges with Big Data, Big Data Analytics: Where do we Begin?, What is Big Data Analytics?, What Big Data Analytics isn't?, Classification of Analytics, Terminologies Used in Big Data Environments.	7	1
Unit II	**Hadoop**	**No. of Hours**	**COs**
	Hadoop Overview, why not RDBMS?, RDBMS versus Hadoop, HDFS (Hadoop Distributed File System), Processing Data with Hadoop, Managing Resources and Applications with Hadoop YARN (Yet another Resource Negotiator).	7	2
Unit III	**MAPREDUCE**	**No. of Hours**	**COs**
	MAPREDUCE Programming: Introduction, Mapper, Reducer, Combiner, Partitioner, Searching, Sorting, Compression. Word Count example using MAPREDUCE	7	3
Unit IV	**Cassandra**	**No. of Hours**	**COs**
	Apache Cassandra – An Introduction, Features of Cassandra, CQL Data Types, CQLSH, Keyspaces, CRUD, Collections, Using a Counter, Time to Live, Alter Commands, Import and Export.	7	4
Unit V	**Redis**	**No. of Hours**	**COs**
	Compared to Other Databases and Software, Features, Why Redis, Strings, Lists, Sets, Hashes , Sorted sets , Strings Publish/Subscribe , Transactions , Expiring Keys. Elastic search.		

		7	5
Unit VI	**GraphDB**	**No. of Hours**	**COs**
	What is GraphDB, GraphDB vs RDBMS, GraphDB vs NoSQL, Data Modelling, Neo4j QL, Neo4j General Clauses, Neo4j Read Clauses, Neo4j Write Clauses, Neo4j Functions.	7	6
Books:			
Text Books:			
T1: Rathinaraja Jeyaraj , Ganeshkumar Pugalendhi, Anand Paul , Big Data with Hadoop MapReduce A Classroom Approach , First Edition , Apple Academic Press, 2020 T2: Seema Acharya, Subjashini Chellappan, Big Data and Analytics,First Editon, Wiley, 2015			
Reference Books:			
R1**.** S.K.Singh, "Database Systems : Concepts, Design and Application", Pearson, Education, ISBN 978-81-317-6092-5 R2. Pramod J. Sadalage and Martin Fowler, "NoSQL Distilled", Addison Wesley, ISBN-10: 0321826620, ISBN-13: 978-0321826626.			
E-Resources(E): https://in.coursera.org/learn/Advanceddatabase			

CO405C: Blockchain Technology	
Teaching Scheme	**Examination Scheme**
Lectures: 3 Hrs. / Week	**Continuous Internal Assessment (CIA):40 Marks**
Credits: 3	**End-Sem Exam(ESE) : 60 Marks**
	Total: 100 Marks

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Prerequisite Course: (if any) Digital forensics, Cyber security,

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Course Objectives:

1. To give students the understanding of emerging abstract models for blockchain Technology.
2. To familiarise with the functional/operational aspects of cryptocurrency eco-system.
3. To understand the bitcoins and its applications in blockchain technology.
4. To understand the Ethereum basics and smart contract and its applications.
5. To understand the Privacy, Security issues in blockchain and its applications.
6. To apply blockchain technology for different real time applications.

Course Outcomes (COs):

On completion of the course, student will be able to–

CO No.	Course Outcome	Bloom's Taxonomy	
		Level	Descriptor
CO1	Describe the basic concepts and technology used for blockchain.	2	Understand
CO2	Describe the primitives of the distributed computing and cryptography related to blockchain.	2	Understand
CO3	Illustrate the concepts of Bitcoin and their usage.	3	Apply
CO4	Implement Ethereum block chain contract.	3	Apply
CO5	Apply security features in blockchain technologies.	3	Apply
CO6	Use smart contract in real world applications.	3	Apply

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	--	--	2	--	--	--	--	--	2	3	2	1	2	--
CO2	2	3	--	2	--	--	--	--	--	2	2	2	1	2	--
CO3	3	3	3	--	3	--	--	--	--	3	2	2	2	2	--

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

(Specify values as : 3: High Level, 2: Medium Level, 1: Low Level for mapping of Cos to POs)

Course Contents

Unit-I	**Introduction to Blockchain**	No.of Hours	COs
	Need for Distributed Record Keeping, Modeling faults and adversaries, Byzantine Generals problem, Consensus algorithms and their scalability problems, Nakamoto's concept with Blockchain based cryptocurrency, Technologies Borrowed in Blockchain – hash pointers, consensus, byzantine fault-tolerant distributed computing, digital cash etc.	06 Hrs.	CO1
Unit-II	**Basic Distributed Computing & Crypto primitives**	No.of Hours	COs
	Atomic Broadcast, Consensus, Byzantine Models of fault tolerance, Hash functions, Puzzle friendly Hash, Collison resistant hash, digital signatures, public key crypto, verifiable random functions, Zero-knowledge systems	06 Hrs.	CO2
Unit-III	**Bitcoin basics**	No.of Hours	COs
	Bitcoin blockchain, Challenges and solutions, proof of work, Proof of stake, alternatives to Bitcoin consensus, Bitcoin scripting language and their use	06 Hrs.	CO3
Unit-IV	**Ethereum basics**	No.of Hours	COs
	Ethereum and Smart Contracts, The Turing Completeness of Smart Contract Languages and verification challenges, Using smart contracts to enforce legal contracts, comparing Bitcoin scripting vs. Ethereum Smart Contracts, Writing smart contracts using Solidity & JavaScript, Distributed Applications (dApps).	06 Hrs.	CO4

Unit-V	**Privacy, Security issues in Blockchain**	No.of Hours	COs
	Pseudo-anonymity vs. anonymity, Zcash and Zk-SNARKS for anonymity preservation, attacks on Blockchains: Sybil attacks, selfish mining, 51% attacks advent of algorand; Sharding based consensus algorithms to prevent these attacks	06 Hrs.	CO5

Unit-VI	**Blockchain Use Cases**	No.of Hours	COs
	Block chain in Financial Service, Supply Chain Management and Government Services	06 Hrs.	CO6

Books:

Text Books:

1. Imran Bashir, "Mastering Blockchain: Distributed ledger technology, decentralization, and smart contracts explained", Packt Publishing. Date: March 2018, ISBN: 9781788839044.
2. Narayanan, Bonneau, Felten, Miller and Goldfeder, "Bitcoin and Cryptocurrency Technologies – A Comprehensive Introduction", Princeton University Press.

Reference Books:

1. Josh Thompson, 'Blockchain: The Blockchain for Beginnings, Guild to Blockchain Technology and Blockchain Programming', Create Space Independent Publishing Platform, 2017.

2. Merunas Grincalaitis, "Mastering Ethereum: Implement Advanced Blockchain Applications Using Ethereum-supported Tools, Services, and Protocols", Packt Publishing.

3. Prof. Sandip Chakraborty, Dr. Praveen Jayachandran, "Blockchain Architecture Design And Use Cases"[MOOC], NPTEL: https://nptel.ac.in/courses/106/105/106105184/

4. Melanie Swan ,"Blockchain : Blueprint for a New Economy" O'Reilly.

E-Resources:

1. https://nptel.ac.in/courses/106/105/106105184/

CO406: High Performance Computing Laboratory	
Teaching Scheme	**Evaluation Scheme**
Practical: 2 Hrs./ Week	**Term Work(TW): 50 Marks**
Credits: 1	**Total: 50 Marks**

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Prerequisite Course: (if any) Computer Organization and Architecture, Digital Electronics and Data Communication

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Course Objectives:

1. To understand and apply different parallel programming construct to implement parallel algorithms.
2. To apply parallel programming tools to write parallel algorithms for sorting algorithms.
3. To implement different data mining algorithms using parallel approach.
4. To build a cluster environment for implementation of MPI routines.
5. To write program using MPI routines to implement different algorithms.
6. To understand the GPU architecture and implement CUDA program for real time applications.

Course Outcomes (COs):

On completion of the course, student will be able to–

CO No.	Statement of Course Outcome	Bloom's Taxonomy	
		Level	Descriptor
CO1	Apply parallel algorithms for different algorithms using concurrent or parallel environments.	3	Apply
CO2	Apply parallel algorithms for sorting applications.	3	Apply
CO3	Apply parallel computing techniques for data mining algorithms.	3	Apply
CO4	Demonstrate the different steps involved in building of a simple Cluster.	3	Apply
CO5	Implement message-passing programs in distributed environment.	3	Apply
CO6	Use GPU architecture using CUDA program for solving real-time ap	3	Apply

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PS	PS	PS

	1	2	3	4	5	6	7	8	9	10	11	12	O1	O2	O3
CO1	2	1	2	3	--	--	--	--	--	2	--	--	3	--	--
CO2	3	2	3	2	--	--	--	--	--	--	--	--	2	--	--
CO3	2	2	3	1	--	--	--	--	--	--	--	--	--	3	2
CO4	3	1	3	3	--	--	--	--	--	--	--	--	3	2	2
CO5	3	1	2	2	--	--	--	--	--	--	--	--	3	2	2
CO6	3	1	2	3	--	3	2	--	--	--	--	--	2	--	3

Tools for High Performance Computing Laboratory

Operating System recommended - 64-bit Open source Linux or its derivative

Programming Languages: PYTHON/Java/OpenMP/MPI

Programming tools recommended Anaconda or Miniconda Frameworks/ Apache Hadoop

Online Tools: MPI libraries

Guidelines for Student Journal

The laboratory assignments are to be submitted by student in the form of journal. Journal may consists of prologue, Certificate, table of contents, and **handwritten write-up** of each assignment (Title, Objectives, Problem Statement, Outcomes, software and Hardware requirements, Date of Completion, Assessment grade/marks and assessor's sign, Theory- Concept in brief, Algorithm/Database design, test cases, conclusion/analysis). **Program codes with sample output of all performed assignments are to be submitted as softcopy.**

Guidelines for Assessment

Continuous assessment of High Performance Computing laboratory work is to be done based on overall performance and lab assignments performance of student. Each lab assignment assessment will assign grade/marks based on parameters with appropriate weightage. Suggested parameters for overall assessment as well as each lab assignment assessment include- timely completion, performance, innovation, efficient codes,punctuality and neatness documentation.

List of High Performance Computing Laboratory Assignments (Any Eight)

1. **Vector and Matrix Operations-** Design parallel algorithm to
   a) Add two large vectors
   b) Multiply Vector and Matrix
   c) Multiply two N × N arrays using n^2 processors.
2. **Parallel sorting Algorithms-** for Bubble Sort and Merger Sort, based on existing sequential algorithms, design and implement parallel algorithm utilizing all resources available.
3. Parallel Implementation of the K Nearest Neighbors Classifier using python/openmp.
4. Study of Cluster building steps - MPI Cluster setup and overview of different routines.
   a. Different steps to build a MPI cluster over LAN.

b. Master-Slave concept and different MPI routines.

5. Parallel implementation of all pair shortest path algorithm using openmp/MPI
6. Program to implement point-to-point communication using MPI routines.
   a. Parallelizing Trapezoidal Rule using MPI_Send and MPI_Reveive.
7. Program to implement collective communication using MPI routines.
   a. Gather, Scatter and Broadcast operations.
   b. Matrix-Vector multiplication execution.
8. Program to implement Merge sort/ Graph Computation algorithm using MPI routines.
   a. Steps in parallelizing Merge Sort/ Matrix Partitioning.
9. Program to execute matrix multiplication using CUDA.
   a. Basic CUDA host, device and memory constructs.
   b. Thread- warp, block, grid usage.
10. Program to implement Map-Reduce parallelism for Warehouse -Scale Computer.
    a. Parallelism using Map-Reduce programming model.
    b. Example of word count process with key-value pair.

Books:
Text Books:
1. Ananth Grama, Anshul Gupta, George Karypis, and Vipin Kumar, "Introduction to Parallel Computing", 2nd edition, Addison-Wesley, 2003, ISBN: 0-201-64865-2 2. Jason sanders, Edward Kandrot, “CUDA by Example”, Addison-Wesley, ISBN-13: 978-0- 13-138768-3.
Reference Books:
1. Kai Hwang, ”Scalable Parallel Computing”, McGraw Hill 1998, ISBN:0070317984. 2. Shane Cook, “CUDA Programming: A Developer's Guide to Parallel Computing with GPUs”, Morgan Kaufmann Publishers Inc. San Francisco, CA, USA 2013 ISBN: 9780124159884. 3. David Culler Jaswinder Pal Singh, ”Parallel Computer Architecture: A Hardware/Software Approach”, Morgan Kaufmann,1999, ISBN 978-1-55860-343-1. 4. Rod Stephens, “Essential Algorithms”, Wiley, ISBN: ISBN: 978-1-118-61210-1.
E-Resources:-
1. https://nptel.ac.in/courses/106102163

CO407: Machine Learning Laboratory	
Teaching Scheme	**Examination Scheme**
Practical: 2 Hrs./ Week	**Practical Exam(PR): 50 Marks**
Credits: 1	**Total: 50 Marks**

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Prerequisite Course: (if any) Data Mining, Discrete Mathematics, Database

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Course Objectives:

1.To understand the need for machine learning for various problem solving

2.To understand nature of the problem and apply machine learning algorithm.

3. To study the various supervised, semi-supervised and unsupervised learning algorithms in machine learning

4.To understand the latest trends in machine learning

5.To design appropriate machine learning algorithms for problem solving.

Course Outcomes (COs):

On completion of the course, student will be able to–

CO No.	Statement of Course Outcome	Bloom's Taxonomy	
		Level	Descriptor
CO1	Apply the Regression Techniques to various problems	3	Apply
CO2	Apply pre-processing methods & Feature Engineering to prepare training data set for machine learning	3	Apply
CO3	Apply the Bayesian algorithm to various problems	3	Apply
CO4	Apply the classification Techniques to various problems	3	Apply
CO5	Apply the ensemble techniques for Data	3	Apply
CO6	Ability to apply Clustering techniques for data.	3	Apply

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO 1	2	1	2	3	--	--	--	--	--	2	--	--	3	--	--
CO 2	3	2	3	2	--	--	--	--	--	--	--	--	2	--	--
CO 3	2	2	3	1	--	--	--	--	--	--	--	--	--	3	2

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

(Specify values as : 3: High Level, 2: Medium Level, 1: Low Level for mapping of Cos to POs)

Tools for Machine Learning Laboratory Practice

Operating System recommended: - 64-bit Open source Linux or its derivative
Programming Languages: PYTHON/R
Programmingtools recommended:Anaconda or Miniconda Frameworks
Online Tools:Google Colab

Guidelines for Student Journal

The laboratory assignments are to be submitted by student in the form of journal. Journal may consists of prologue, Certificate, table of contents, and **handwritten write-up** of each assignment (Title, Objectives, Problem Statement, Outcomes, software and Hardware requirements, Date of Completion, Assessment grade/marks and assessor's sign, Theory- Concept in brief, Algorithm/Database design, test cases, conclusion/analysis). **Program codes with sample output of all performed assignments are to be submitted as softcopy.**

Guidelines for Assessment

Continuous assessment of Machine Learning laboratory work is to be done based on overall performance and lab assignments performance of student. Each lab assignment assessment will assign grade/marks based on parameters with appropriate weightage. Suggested parameters for overall assessment as well as each lab assignment assessment include- timely completion, performance, innovation, efficient codes,punctuality and neatness documentation.

List of Machine Learning Laboratory Assignments

1. **Assignment on Linear Regression:**

The following table shows the results of a recently conducted study on the correlation of the number of hours spent driving with the risk of developing acute backache. Find the equation of the best fit line for this data.

Number of hours spent driving (x)	Risk score on a scale of 0-100 (y)
10	95
9	80
2	10
15	50
10	45
16	98
11	38
16	93

2. Apply the **Principal Component Analysis (PCA)** for Feature Reduction Techniques on any dataset. (For ex: IRIS Dataset.)

(Dataset Downloads Link): https://drive.google.com/file/d/12BY34aCbYLoLjy3gDUMrZEBUf7l5FZsd/view?usp=share_link

3. Assignment on **Decision Tree Classifier**:

A dataset collected in a Cloth shop showing details of customers and whether or not they responded to a special offer to buy a new Sarry is shown in table below. Use this dataset to build a decision tree, with Buys as the target variable, to help in buying lip-sticks in the future. Find the root node of the decision tree. According to the decision tree you have made from the previous training data set, what is the decision for the test data: [Age < 21, Income = Low, Gender = Female, Marital Status = Married]?

ID	Age	Income	Gender	Marital Status	Buys
1	< 21	High	Male	Single	No
2	< 21	High	Male	Married	No
3	21-35	High	Male	Single	Yes
4	>35	Medium	Male	Single	Yes
5	>35	Low	Female	Single	Yes
6	>35	Low	Female	Married	No
7	21-35	Low	Female	Married	Yes
8	< 21	Medium	Male	Single	No
9	<21	Low	Female	Married	Yes
10	> 35	Medium	Female	Single	Yes
11	< 21	Medium	Female	Married	Yes
12	21-35	Medium	Male	Married	Yes
13	21-35	High	Female	Single	Yes
14	> 35	Medium	Male	Married	No

4. Implement **Naive Bayes Classification Algorithm** on any suitable dataset.

(Dataset Downloads Link): https://drive.google.com/file/d/12BY34aCbYLoLjy3gDUMrZEBUf7l5FZsd/view?usp=share_link

5**. Implement SVM Classification Technique on any dataset.**
(For ex: IRIS Dataset.) (Dataset Downloads Link):https://drive.google.com/file/d/12BY34aCbYLoLjy3gDUMrZEBUf7l5FZsd/view?usp=share_link

6. **Assignment on K-Means Clustering**:

We have given a collection of 8 points. P1=[0.1,0.6] P2=[0.15,0.71] P3=[0.08,0.9] P4=[0.16,0.85] P5=[0.2,0.3] P6=[0.25,0.5] P7=[0.24,0.1] P8=[0.3,0.2]. Perform the k-mean clustering with initial centroids as m1=P1 =Cluster#1=C1 and m2=P8=cluster#2=C2. Answer thefollowing

1] Which cluster does P6 belongs to?
2] What is the population of cluster around m2?

3] What is updated value of m1 and m2?

7. Implement **Gradient Boost Classifier Model** on Income Evaluation Data set.
   (Dataset Downloads Link) https://drive.google.com/file/d/1zI-X3zdiuM9u74zQyKIShvAUtPJQ7jUK/view?usp=sharing

Machine Learning Lab Books:
Text Books:
1. Giuseppe Bonaccorso, "Machine Learning Algorithms", Packt Publishing Limited, a. ISBN10: 1785889621, ISBN-13: 978-1785889622 2. Tom M. Mitchell, ―Machine Learning, McGraw-Hill Education (India) Private Limited, a. 2013. 3. Josh Patterson, Adam Gibson, "Deep Learning: A Practitioners Approach", O"REILLY, a. SPD, ISBN: 978-93-5213-604-9, 2017 Edition 1st.
Reference Books:
1. Ethem Alpaydin, ―Introduction to Machine Learning (Adaptive Computation and Machine Learning), The MIT Press 2004. 2. Stephen Marsland, ―Machine Learning: An Algorithmic Perspective, CRC Press, 2009. 3. Ethem Alpaydin, " Introduction to Machine Learning", PHI 2nd Edition-2013, ISBN 978-0262-01243-0 4. Peter Flach, "Machine Learning: The Art and Science of Algorithms that Make Sense of Data", Cambridge University Press, Edition 2012, ISBN-10: 1107422221; ISBN-13: 9781107422223 5. Tom Mitchell "Machine Learning" McGraw Hill Publication, ISBN : 0070428077 9780070428072 6. Nikhil Buduma, "Fundamentals of Deep Learning", O"REILLY publication, second edition 2017, ISBN: 149192561
e-Resources:
7. https://machinelearningbook.com/
MOOC/ Video Lectures available at:
6. https://onlinecourses.nptel.ac.in/noc22_cs97/preview **7.** https://nptel.ac.in/courses/106106139

CO408: Cryptography and Network Security Laboratory		
Teaching Scheme	**Examination Scheme**	
Lectures: 2 Hrs. / Week	**OR Exam:**	**50 Marks**
Credits: 1	**Total:**	**50 Marks**

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Prerequisite Course: (if any) Computer Network, Discrete Mathematics

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Course Objectives:

1. To offer an understanding of principle concepts, central topics and basic approaches in cryptography and network security.
2. To know the basics of symmetric key cryptography.
3. To acquire knowledge of standard algorithms and protocols employed to provide confidentiality, integrity and authenticity.
4. To apply algorithmic strategies for authentication in cryptography and network security.
5. To develop problem solving abilities using Cyber Security.
6. To enhance awareness about network security solutions against computer-attacks.

Course Outcomes (COs):

On completion of the course, student will be able to–

CO No.	**Statement of Course Outcome**	**Bloom's Taxonomy**	
		Level	**Descriptor**
CO1	Recognize concept of Security needed in Communication of data through computers and networks.	2	Understand
CO2	Understand various Encryption mechanisms for secure transmission of data and management of key required for encryption.	2	Understand
CO3	Understand Encryption mechanisms in Public Key cryptography and implement various encryption techniques.	3	Apply
CO4	Understand authentication requirements and implement various authentication mechanisms	3	Apply
CO5	Apply security tools in various environments for network security.	3	Apply
CO6	Apply appropriate network security solutions against computer-attacks.	3	Apply

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	--	--	--	--	--	--	--	--	--	--	--	2	--	1
CO2	--	--	2	2	--	--	--	--	--	--	2	--	--	3	--
CO3	1	--	--	2	--	--	--	--	--	--	--	--	--	1	--
CO4	--	--	--	--	--	--	2	--	--	--	--	--	--	1	--
CO5	2	--	2	3	--	--	1	--	--	--	2	--	--	2	2
CO6	2	--	2	3	--	--	1	--	--	--	2	--	1	2	1

(Specify values as : 3: High Level, 2: Medium Level, 1: Low Level for mapping of Cos to POs)

Tools for Cyber Security Laboratory

Operating System recommended - 64-bit Open source Linux or its derivative
Programming Languages: PYTHON/Java
Programming tools recommended Anaconda or Miniconda Frameworks.
Online Tools: -

Guidelines for Student Journal

The laboratory assignments are to be submitted by student in the form of journal. Journal may consists of prologue, Certificate, table of contents, and **handwritten write-up** of each assignment (Title, Objectives, Problem Statement, Outcomes, software and Hardware requirements, Date of Completion, Assessment grade/marks and assessor's sign, Theory- Concept in brief, Algorithm/Database design, test cases, conclusion/analysis). **Program codes with sample output of all performed assignments are to be submitted as softcopy.**

Guidelines for Assessment

Continuous assessment of Machine Learning laboratory work is to be done based on overall performance and lab assignments performance of student. Each lab assignment assessment will assign grade/marks based on parameters with appropriate weightage. Suggested parameters for overall assessment as well as each lab assignment assessment include- timely completion, performance, innovation, efficient codes,punctuality and neatness documentation.

List of Cyber Security Laboratory Assignments (Any Eight)

1. W.A.P. to implement Caeser Cipher.
2. W.A.P. to implement Playfair Cipher with key ldrp.
3. W.A.P. to implement polyalphabetic Cipher.
4. W.A.P. to implement Hill Cipher. (Use any matrix but find the inverse yourself).
5. W.A.P. to implement Rail fence technique
6. W.A.P. to implement Simple Columnar Transposition technique
7. W.A.P. to implement Advanced Columnar Transposition technique.
8. Write a program for Simplified DES implementation
9. Write a program for Simplified AES implementation.

10. Implementation of Diffe-Hellman key exchange algorithms.

11. W.A.P. to implement Simple RSA Algorithm with small numbers.

List of Mini Projects: (Any one)

1. Design a System to develop a analyzer which will differentiate between different vulnerability and packets entered using it. This system will detect the intrusions coming through the vulnerabilities.
2. Securing Video Conferencing App for online meetings
3. Steganography for Image/Video/Files
4. Secure Image display on online social media.
5. Secure transfer of government subsidies to farmers/BPL people/ students etc
6. Authentication of users for various applications for integrity, availability, confidentiality.
7. Implementing a system for detecting the modification of videos/images on social media
8. Secure App for online exams detecting Keystroke and camera movements.
9. A system to detect the difference between the voice edited in the audio/video
10. A System to check the vulnerabilities in the websites.

CO409: Project Stage-I	
Teaching Scheme	**Evaluation Scheme**
Practical: 06 Hrs. / Week	**Term Work (TW): 100 Marks**
	Oral Presentation (OR): 50 Marks
Credits: 03	**Total: 150 Marks**

Course Objectives:

1. To Apply the knowledge for solving realistic problem
2. To develop problem solving ability
3. To Organize, sustain and report on a substantial piece of team work over a period of several months
4. To Evaluate alternative approaches, and justify the use of selected tools and methods, to Reflect upon the experience gained and lessons learned,
5. To Consider relevant social, ethical and legal issues,
6. To find information for yourself from appropriate sources such as manuals, books, research journals and from other sources, and in turn increase analytical skills.
7. To Work in TEAM and learn professionalism

Course Outcomes (COs):

On completion of the course, student will be able to–

CO No.	Statement of Course Outcome	Bloom's Taxonomy	
		Level	Descriptor
CO1	Solve real life problems by applying knowledge.	3	Apply
CO2	Analyze alternative approaches, apply and use most appropriate one for a feasible solution.	3	Apply
CO3	Write precise reports and technical documents in a nutshell.	3	Apply
CO4	Participate effectively in multi-disciplinary and heterogeneous teams exhibiting teamwork, Interpersonal relationships, conflict management and leadership quality.	3	Apply

Guidelines : Project work Stage – I is an integral part of the Project work. In this,

- The student shall complete the partial work of the Project which will consist of problem statement, literature review, SRS, Model and Design.
- The student is expected to complete the project at least up to the design phase.

- As a part of the progress report of project work Stage-I, the candidate shall deliver a presentation on the advancement in Technology pertaining to the selected project topic.
- The student shall submit the duly certified progress report of Project work Stage-I in standard format for satisfactory completion of the work by the concerned guide and head of the Department/Institute.
- The examinee will be assessed by a panel of examiners of which one is necessarily an external examiner. The assessment will be broadly based on work undergone, content delivery, presentation skills, documentation, question-answers and report.
- Follow guidelines and formats as mentioned in Project Workbook recommended by the Department Board of Studies.

MC410: Mandatory Learning Course VII- Financially Smart		
Teaching Scheme	**Evaluation Scheme**	
Theory: 01 Hrs. / Week	**Total:** PASS/FAIL	
Credits: NC		

This course focuses on the key concepts, tools, and techniques of contemporary personal finance. Financial problems are addressed in the context that they are the result of poor management rather than lack of money. Topics discussed to avoid financial problems include the importance of time value of money and saving, the correct use of credit, and credit cards, the establishment of financial goals, how to reduce the costs of automobile and life insurance, purchase of an automobile, and rent versus purchase of a house.

Personal Financial Literacy Program for Young Adults - Being Financially Smart	
•A- Google Survey – Pre-session (via email)	
•**Unit 1 - Behavioural Finance - 3 hours**	•**Unit 2 -Money Management Skills - 3 hours**
•Section 1 – Let's Talk Money	•Section 1 – Important Concepts
•1. Psychology of Money	•1. Saving vs Investing
•2. Your Relationship with Money	•2. Inflation
•3. Human Behaviour in Financial Markets	•3. Power of Compounding
•Section 2 –Why Financial Literacy?	•Section 2 – Money Management Techniques
•4. Importance of Financial Literacy	•4. S.M.A.R.T.E.R way to Wealth
•5. Costly Money Mistakes	•5. 6 - Money Jar Method
Micro-Project 1 - Exercise	
•**Unit 3 - Steps of Financial Planning** - 3 hours	•**Unit 4 – Risk & Investment Management - 3 hours**
•Section 1 – Let's Start Planning	•Section 1 - Risk Management
•1. Need & Components of Financial Planning	•1.Understanding Risk Management
•2. Personal Income Statement– Cashflow Mgt & NetWorth Mgt.	•2. Life Insurance
•3. S.M.A.R.T Goal Setting	•3. Health Insurance
•Section 2 - Goal Based Investment Planning	•Section 2 - Investment Management
•4. Contingency/Emergency Fund Planning	•4. Asset Allocation
•5. Lifestyle/ Retirement Planning	•5. Mutual Funds - Overview
•6. Estate Planning	•5. Review & Action

Micro-Project 2 - Case Study
• **Unit 5 – Introduction to Business Finance - 3 hours**
• H ow to Read an Income Statement
•How to Read a Balance Sheet
Micro-Project 3 - Case Study
B- Google Survey (via email)
Post -session: - 1. Evaluation 2. Feedback 3. Certification