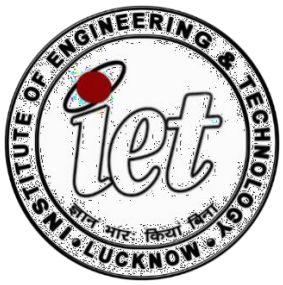
Institute of Engineering & Technology
Sitapur Road, Lucknow



Evaluation Scheme & Syllabus

For

B. Tech. Fourth Year
Computer Science & Engineering

(Effective from the Session: 2025-26 onwards)

DEPARTMENT OF COMPUTER SCEINCE & ENGINEERING

B. TECH (COMPUTER SCIENCE & ENGINEERING)

CURRICULUM STRUCTURE

SEMESTER- VII

Sl. No.	Course Code	Course Title	Type of Course	Periods			Evaluation Scheme				End Semester		Total	Credit
				L	T	P	CT	TA	Total	PS	TE	PE		
1	IHU-701	Project Management and Entrepreneurship	HSMC	3	0	0	20	10	30	-	70	-	100	3
2	Program Elective-IV	Program Elective Course -IV	PEC Regular Class Room Teaching/ MOOCS	3	0	0	20	10	30	-	70	-	100	3
3	IOE070-IOE079	Open Elective-II	OEC	3	0	0	20	10	30	-	70	-	100	3
4	IOE080-IOE089	Open Elective-III	OEC Regular Class Room Teaching/ MOOCS	3	0	0	20	10	30	-	70	-	100	3
5	ICS751	Project	PL	0	0	8	-	-	-	100	-	-	100	4
6	ICS752	Internship Assessment/ Mini Projects/ Start-up &Entrepreneurship Assessment	PL	0	0	2	-	-	-	100	-	-	100	2
7		MOOCs (for Honours Degree) /Minor Degree												
		Total		**12**	**0**	**10**							**600**	**18**

Internship Assessment/ Mini Project (5-6 weeks) conducted during summer break after VIth semester will be assessed during VII semester.

SEMESTER- VIII

Sl. No.	Course Code	Course Title	Type of Course	Periods			Evaluation Scheme				End Semester		Total	Credit
				L	T	P	CT	TA	Total	PS	TE	PE		
1	ICS851	Project/Industrial Project	PL	0	0	24	-	-	-	150	-	350	500	12
2		MOOCs (for Honours Degree) /Minor Degree	MOOC'S											
		Total		**0**	**0**	**24**							**500**	**12**

Program Elective-IV

1. ICS071- Internet of Things
2. ICS072- Blockchain Technology
3. ICS073- Software Project Management
4. ICS074- Service Oriented Architecture
5. ICS075- Cryptography and Network Security
6. ICS076- Deep Learning
7. ICS077- Data Science
8. ICS078- Quantum Computing

ICS071	**Internet of Things**	
Course Outcome (CO)		**Bloom's Knowledge Level (KL)**
At the end of course, the student will be able to		
CO1	Demonstrate basic concepts, principles and challenges in IoT.	K_2
CO2	Illustrate functioning of hardware devices and sensors used for IoT.	K_2
CO3	Analyze network communication aspects and protocols used in IoT.	K_4
CO4	Apply IoT for developing real life applications using Ardunio programming.	K_3
CO5	Develop IoT infrastructure for popular applications	K_3, K_4

DETAILED SYLLABUS		**3-0-0**
Unit	**Topic**	**Proposed Lectures**
I	**Internet of Things (IoT):** Vision, Definition, Conceptual Framework, Architectural view, technology behind IoT, Sources of the IoT, M2M Communication, IoT Examples. Design Principles for Connected Devices: IoT/M2M systems layers and design standardization, communication technologies, data enrichment and consolidation, ease of designing and affordability.	**08**
II	**Hardware for IoT:** Sensors, Digital sensors, Actuators, Radio Frequency Identification (RFID) technology, Wireless Sensor Networks, participatory sensing technology. Embedded Platforms for IoT: Embedded computing basics, Overview of IOT supported Hardware platforms such as Arduino, Net Arduino, Raspberry pi, Beagle Bone, Intel Galileo boards and ARM cortex.	**08**
III	**Network & Communication aspects in IoT:** Wireless Medium access issues, MAC protocol survey, Survey routing protocols, Sensor deployment & Node discovery, Data aggregation & dissemination.	**08**
IV	**Programming the Ardunio:** Ardunio Platform Boards Anatomy, Ardunio IDE, coding- using emulator, using libraries, additions in Ardunio, programming the Ardunio for IoT.	**08**
V	**Design challenges in IOT:** Development Challenges, Security Challenges, **IoT Applications:** E-health, City Automation, Home automation.	**08**

Note: The instructor of the course is advised to include suitable case studies/practical assignments as per his/her wisdom.

Books:

1. O. Hersent, D. Boswarthick, O. Elloumi "The Internet of Things key applications and protocols",Wiley Publications, 2012
2. Jeeva Jose "Internet of Things", Khanna Publishing House,2025
3. Shriram K Vasudevan, RMD Sundaram, Abhishek S Nagarajan "Internet of Things", 3rd Edition, Wiley Publications, 2025
4. Michael Miller "The Internet of Things" by Pearson,2015
5. Raj Kamal "Internet of Things", McGraw-Hill, 1st Edition, 2016
6. Arshdeep Bahga, Vijay Madisetti "Internet of Things "A hands on approach", 1st Edition, VPI publications, 2014
7. Adrian McEwen, Hakin Cassimally "Designing the Internet of Things" Wiley Publications,2014

ICS072	Blockchain Technology	
	Course Outcome (CO)	**Bloom's Knowledge Level (KL)**
	At the end of course, the student will be able to	
CO1	Describe the basic understanding of Blockchain architecture along with its primitive.	K_1,K_2
CO2	Explain the requirements for basic protocol along with scalability aspects.	K_2,K_3
CO3	Design the consensus process using frontend and backend.	K_3,K_4
CO4	Apply Blockchain techniques for different use cases like Finance, Trade/Supply and Government activities.	K_4,K_5
CO5	Study the application of Blockchain in Governance, social welfare, and Cryptography.	K_2
	DETAILED SYLLABUS	**3-0-0**

Unit	Topic	Proposed Lectures
I	**Introduction to Blockchain**: 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	**08**
II	**Consensus:** Requirements for the consensus protocols, Proof of Work (PoW), Scalability aspects of Blockchain consensus protocols **Permissioned Blockchains**: Design goals, Consensus protocols for Permissioned Blockchains	**08**
III	**Hyperledger Fabric (A):** Decomposing the consensus process , Hyperledger fabric components, Chaincode Design and Implementation, Beyond Chaincode: fabric SDK and Front End(b) Hyperledger composer tool	**08**
IV	**Design Challenges:** Blockchain in Financial Software and Systems (FSS):(i) Settlements, (ii) KYC, (iii)Capital markets, (iv) Insurance Blockchain in trade/supply chain: (i) Provenance of goods, visibility, trade/supply chain finance, invoice management discounting, etc	**08**
V	**Area of Application:** Blockchain for Government: (i) Digital identity, land records and other kinds of record keeping between government entities, (ii) Public distribution system social welfare systems Blockchain Cryptography, Privacy and Security on Blockchain	**08**

Books:

1. S. Asharaf, Sivadas Neelima, S. Adarsh, and Sumi Maria Abraham "Advanced Blockchain Technologies", Wiley Publications, 2025
2. Andreas M. Antonopoulos "Mastering Bitcoin: Unlocking Digital Cryptocurrencies", O'Reilly Publications, 2014
3. Melanie Swan "Blockchain", O'Reilly Publications, 2015
4. Don Tapscott, Alex Tapscott "Blockchain Revolution", Penguin, New York, 2016
5. Xu, Weber, Staples "Architecture for Blockchain Applications", Springer Publications, 2019
6. Hyperledger Fabric - https://www.hyperledger.org/projects/fabric
7. Zero to Blockchain - An IBM Redbooks course, by Bob Dill, David Smits - https://www.redbooks.ibm.com/Redbooks.nsf/RedbookAbstracts/crse0401.html

ICS073	Software Project Management	
	Course Outcome(CO)	**Bloom's Knowledge Level (KL)**
	At the end of course, the student will be able to	
CO1	Explain SPM basics, project planning and estimation methods	K_2
CO2	Understand Work Breakdown Structure (WBS) and software review techniques.	K_2
CO3	Analyze earned value data and project performance indicators	K_4
CO4	Analyze software quality through testing and Software Quality Assurance (SQA) models.	K_4
CO5	Apply risk and configuration management using software tools.	K_3

DETAILED SYLLABUS		**3-0-0**
Unit	**Topic**	**Proposed Lectures**
I	**Introduction and Software Project Planning**: Fundamentals of Software Project Management (SPM), Need Identification, Vision and Scope document, Project Management Cycle, Software project estimation, Estimation methods, Estimation models, Decision process.	**08**
II	**Project Organization and Scheduling Project Elements:** Work Breakdown Structure (WBS), Error Tracking, Software Reviews, Types of Review: Inspections, Walkthroughs, Code Reviews, Pair Programming.	**08**
III	**Project Monitoring and Control:** Dimensions of Project Monitoring & Control, Cost Variance (CV), Schedule Variance (SV), Cost Performance Index (CPI), Schedule Performance Index (SPI), Interpretation of Earned Value Indicators,	**08**
IV	**Software Quality Assurance and Testing Objectives**: Testing Principles, Test Plans, Test Cases, Types of Testing, Levels of Testing, Test Strategies, Program Correctness, Program Verification & validation, Testing Automation & Testing Tools, Concept of Software Quality, The SEI Capability Maturity Model CMM.	**08**
V	**Project Management and Project Management Tools:** Software Configuration Items and tasks, Baselines, Plan for Change, Change Control, Change Requests Management, Version Control, Risk Management: Risks and risk types, Risk Breakdown Structure (RBS), Risk Management Process: Risk identification, Risk analysis, Risk planning, Risk monitoring.	**08**

Books:

1. M.Cotterell "Software Project Management", Tata Mc Graw- Hill Publication,1999
2. Royce "Software Project Management", Pearson Education,2000
3. Kieron Conway "Software Project Management", Dreamtech Press,2001
4. S.A. Kelkar "Software Project Management", PHI Publication,2012
5. H. R. Kerzner "Project Management: A Systems Approach to Planning, Scheduling, and Controlling" Wiley, 2017
6. Mohapatra "Software Project Management", Cengage Learning, 2011
7. P. K. Agarwal, S.A.M. Rizvi, "Software Project Management", Khanna Publishing House,2010

ICS074	Service Oriented Architecture	
Course Outcome (CO)		**Bloom's Knowledge Level (KL)**
At the end of course, the student will be able to		
CO 1	Understand of service-oriented computing paradigm, and its evolution.	K_1, K_2
CO 2	Applications of Service Oriented Architecture of B2B integration.	K_2,K_3,
CO 3	Application of standard technologies for web services communication, and Centralize registry system.	K_2, K_3
CO 4	Analysis of the services coordination protocols and composition.	K_3, K_4
CO 5	Design of a problem of SOA using .NET/ J2EE.	K_4, K_5

DETAILED SYLLABUS		**3-0-0**
Unit	**Topic**	**Proposed Lectures**
I	**Introduction**: SOA and MSA Basics: Service Orientation in Daily Life, Evolution of SOA and MSA. Service oriented Architecture and Microservices architecture, Standards and Guidelines for SOA. **Applications**: Considerations for Service-oriented Applications, Patterns for SOA, Pattern-based Architecture for Service-oriented Applications, Composite Applications.	**08**
II	**Web Services Architecture** – Web services Architecture and its characteristics, Web Services, and their approach to distributed computing. B2B Integration before Web Services. Requirement of Web Services, Web services technologies. Internal and external Architecture of Web Services. Web services description language (WSDL).	**08**
III	**SOAP:** Simple Object Access Protocol, Inter-application communication and wire protocols, Structure of a SOAP message, Processing of SOAP message, Reliable messaging, SOAP HTTP binding, Error handling in SOAP. **Registering and Discovering Services**: The role of service registries, Universal Description, Discovery, and Integration (UDDI), Architecture and information in UDDI, Understanding technical models (tModels), UDDI Registry API.	**08**
IV	**Service coordination protocols:** Introduction to coordination protocols, Infrastructure for coordination protocols, transaction in web services. **Service composition:** Service composition models, Exception handling, Dependencies between Coordination and Composition, BPEL: Business Process Execution Language for web Services.	**08**
V	Overview of .NET and J2EE in SOA development. Publishing and Consuming REST-Based XML web services, Publishing and Consuming REST-Based JSON (JavaScript Object Notation) web services, Session tracking in a SOAP Web Service, Consuming a Database-Driven SOAP Web Services.	**08**

Note: Students are encourage to develop an application problem for real world requirement/ area as mini project/ assignment.

Books:

1. Shankar Kambhampaty; Service - Oriented Architecture & Micro services Architecture: For Enterprise, Cloud, Big Data and Mobile; Wiley; 3rd Edition; 2018
2. Gustavo Alonso et al, "Web services Concepts Architecture ans application", Springer-Verlag Berlin Heidelberg New York in 2004
3. Thomas Erl, "Service-Oriented Architecture: Concepts, Technology, and Design", Pearson Education, 2005

Reference Books:

1. Newcomer, Lomow" Understanding SOA with Web Services", Pearson Education, 2005.
2. S. Chatterjee, J.Webber, "Developing Enterprise Web Services, An Architect's Guide", Pearson Education, 2005.
3. D. Woods and T. Mattern," Enterprise SOA Designing IT for Business Innovation" O'REILLY, First Edition, 2006
4. Deitel and Deitel, " Java How to program" Pearson India Education, 2016

ICS075	Cryptography & Network Security	
	Course Outcome (CO)	**Bloom's Knowledge Level (KL)**
	At the end of course, the student will be able to	
CO1	Classify the symmetric encryption techniques and Illustrate various Public key cryptographic techniques.	K2 ,K3
CO2	Understand security protocols for protecting data on networks and be able to digitally sign emails and files.	K1 ,K2
CO3	Understand vulnerability assessments and the weakness of using passwords for authentication	K4
CO4	Be able to perform simple vulnerability assessments and password audits	K3
CO5	Summarize the intrusion detection and its solutions to overcome the attacks.	K2

DETAILED SYLLABUS		**3-0-0**
Unit	**Topic**	**Proposed Lectures**
I	Introduction to security attacks, services and mechanism, Classical encryption techniques- substitution ciphers and transposition ciphers, cryptanalysis, steganography, Stream and block ciphers. Modern Block Ciphers: Block ciphers principles, Shannon's theory of confusion and diffusion, fiestal structure, Data encryption standard (DES), Strength of DES, Idea of differential cryptanalysis, block cipher modes of operations, Triple DES	**08**
II	Introduction to group, field, finite field of the form GF (p), modular arithmetic, prime and relative prime numbers, Extended Euclidean Algorithm, Advanced Encryption Standard (AES) encryption and decryption Fermat's and Euler's theorem, primarily testing, Chinese Remainder theorem, Discrete Logarithmic Problem, Principals of public key crypto systems, RSA algorithm, security of RSA	**08**
III	Message Authentication Codes: Authentication requirements, authentication functions, message authentication code, hash functions, birthday attacks, security of hash functions, Secure hash algorithm (SHA) Digital Signatures: Digital Signatures, Elgamal Digital Signature Techniques, Digital signature standards (DSS), proof of digital signature algorithm,	**08**
IV	Key Management and distribution: Symmetric key distribution, Diffie- Hellman Key Exchange, Public key distribution, X.509 Certificates, Public key Infrastructure. Authentication Applications: Kerberos, Electronic mail security: pretty good privacy (PGP), S/MIME.	**08**
V	IP Security: Architecture, Authentication header, Encapsulating security payloads, combining security associations, key management. Introduction to Secure Socket Layer, Secure electronic, transaction(SET) System Security: Introductory idea of Intrusion, Intrusion detection, Viruses and Related threats, firewalls	**08**

Books:

1. William Stallings, "Cryptography and Network Security: Principals and Practice", Pearson Education, 2016
2. Behrouz A. Frouzan: Cryptography and Network Security, Tata Mc Graw Hill, 2007.
3. C K Shyamala, N Harini, Dr. T.R. Padmnabhan Cryptography and Security, Wiley, 2011.
4. BruceSchiener, "Applied Cryptography". John Wiley& Sons, 1995
5. Bernard Menezes,"Network Security and Cryptography",Cengage Learning. 2010
6. Atul Kahate,"Cryptography and Network Security",Tata Mc Graw Hill, 2009

ICS076	Deep Learning	
Course Outcome (CO)		**Bloom's Knowledge Level (KL)**
At the end of course, the student will be able to:		
CO 1	Present the mathematical, statistical, and computational challenges of building neural networks	K2
CO 2	Study the concepts of deep learning	K2
CO 3	Introduce dimensionality reduction techniques	K2
CO 4	Enable the students to know deep learning techniques to support real-time applications	K3
CO 5	Examine the case studies of deep learning techniques	K_5
DETAILED SYLLABUS		**3-0-0**
Unit	**Topic**	**Proposed Lectures**
I	**Introduction**: Introduction to machine learning- Linear models (SVMs and Perceptrons, logistic regression) - Intro to Neural Nets: shallow network- Training a network: loss functions, back propagation and stochastic gradient descent- Neural networks as universal function approximates	**08**
II	**Deep Networks**: A Probabilistic Theory of Deep Learning- Backpropagation and regularization, batch normalization- VC Dimension and Neural Nets-Deep Vs Shallow Networks-Convolutional Networks- Generative Adversarial Networks (GAN), Semi- supervised Learning	**08**
III	**Dimensionality Reduction**: Linear (PCA, LDA) and manifolds, metric learning - Auto encoders and dimensionality reduction in networks - Convnet - Architectures – AlexNet, VGG, Inception, ResNet - Training a Convnet	**08**
IV	**Optimization And Generalization**: Optimization in deep learning- Stochastic Optimization Generalization in neural networks- Spatial Transformer Networks- Recurrent networks, LSTM - Recurrent Neural Network Language Models- Word-Level RNNs & Deep Reinforcement Learning.	**08**
V	**Applications:** Image net- Detection-Audio Wave Net-Natural Language Processing Word2Vec - Joint Detection-Bioinformatics- Face Recognition- Scene Understanding- Gathering Image Captions.	**08**

Note: The instructor of the course is advised to include suitable case studies/practical assignments as per his/her wisdom.

Books:

1. Cosma Rohilla Shalizi, Advanced Data Analysis from an Elementary Point of View, 2015.
2. Deng & Yu, Deep Learning: Methods and Applications, Now Publishers, 2013.
3. Ian Goodfellow, Yoshua Bengio, Aaron Courville, Deep Learning, MIT Press, 2016.
4. Michael Nielsen, Neural Networks and Deep Learning, Determination Press, 2015.
5. Yoshua Bengio, Learning Deep Architectures for AI, now Publishers Inc., 2009.

ICS077	DATA SCIENCE	
Course Outcome (CO)		**Bloom's Knowledge Level (KL)**
At the end of course, the student will be able to		
CO1	Understand and apply the, random number generation and density estimations to perform analysis of various kinds of data.	K1, K2
CO2	Create proficiency with statistical analysis of data.	K2, K3
CO3	Understand and apply the various methods of optimization.	K1, K2
CO4	Understand and apply data processing, classification and validation.	K2, K4
CO5	Study and analyze graphical representation of data using visualization tools.	K2, K3

DETAILED SYLLABUS

Unit	Topic	Proposed Lectures
I	**Introduction:** Basics of Data Science, Selecting rows/observations, Rounding Number, Selecting columns/fields, Merging data, Data aggregation	**08**
II	**Data Analysis**: Introduction, Data Analysis Techniques: Statistical Hypothesis Generation and Testing; Correlation analysis; Sentiment Analysis; Content Analysis.	**08**
III	**Fundamentals of Optimization**: Single-variable and multi-variable optimization; Optimality Criteria; Non-gradient and Gradient-based methods in single variable.	**08**
IV	**Data Preprocessing and Validations**: Discriminant and Cluster Analysis, Multidimensional Scaling, Linear / Polynomial Regression, Logistic Regression (Classification), Manifold learning, 2D/3D Convolution, Introduction to Neural Networks, Evaluation Metrics.	**08**
V	**Data Visualization**: Understanding of Pandas and its architecture, Series and Data Frames, Columns and Indices, Summary statistics, Data Alignment, Ranking and Sorting, Combining and Splitting data frames, Reshaping, Grouping; Data Visualization plots/charts.	**08**

Books:

1. Let us Python, Yashavant Kanetkar and Aditya Kanetkar, First Edition, 2019, BPB Publications.
2. Optimization for Engineering Design, - Algorithms and Examples, Kalyanmoy Deb, Second Edition, 2016, PHI.
3. Machine Learning Refined Foundations, Algorithms, and Applications, Jeremy Watt, Reza Borhani, Aggelos K. Katsaggelos, Cambridge University Press, 2nd Edition, 2020.
4. https://matplotlib.org/tutorials/introductory/pyplot.html.
5. Data science from scratch - First principles with Python, Joel Grus, OâReily, 2015.
6. Machine Learning, Tom Mitchell, McGrawhill, 1997

ICS078	Quantum Computing	
Course Outcome (CO)		**Bloom's Knowledge Level (KL)**
At the end of course , the student will be able to		
CO 1	Distinguish problems of different computational complexity and explain why certain problems are rendered tractable by quantum computation with reference to the relevant concepts in quantum theory.	K_1 , K_2
CO 2	Demonstrate an understanding of a quantum computing algorithm by simulating it on a classical computer, and state some of the practical challenges in building a quantum computer.	K_2 , K_3
CO 3	Contribute to a medium-scale application program as part of a co-operative team, making use of appropriate collaborative development tools (such as version control systems).	K_2 , K_3
CO 4	Produce code and documentation that is comprehensible to a group of different programmers and present the theoretical background and results of a project in written and verbal form.	K_3 , K_4
CO 5	Apply knowledge, skills, and understanding in executing a defined project of research, development, or investigation and in identifying and implementing relevant outcomes.	K_3, K_5
DETAILED SYLLABUS		**3-0-0**
Unit	**Topic**	**Proposed Lectures**
I	**Fundamental Concepts:** Global Perspectives, Quantum Bits, Quantum Computation, Quantum Algorithms, Quantum Information, Postulates of Quantum Mechanisms.	**08**
II	**Quantum Computation**: Quantum Circuits – Quantum algorithms, Single Orbit operations, Control Operations, Measurement, Universal Quantum Gates, Simulation of Quantum Systems, Quantum Fourier transform, Phase estimation, Applications, Quantum search algorithms – Quantum counting – Speeding up the solution of NP – complete problems – Quantum Search for an unstructured database.	**08**
III	**Quantum Computers:** Guiding Principles, Conditions for Quantum Computation, Harmonic Oscillator Quantum Computer, Optical Photon Quantum Computer – Optical cavity Quantum electrodynamics, Ion traps, Nuclear Magnetic resonance	**08**
IV	**Quantum Information:** Quantum noise and Quantum Operations – Classical Noise and Markov Processes, Quantum Operations, Examples of Quantum noise and Quantum Operations – Applications of Quantum operations, Limitations of the Quantum operations formalism, Distance Measures for Quantum information.	**08**
V	**Quantum Error Correction:** Introduction, Shor code, Theory of Quantum Error –Correction, Constructing Quantum Codes, Stabilizer codes, Fault – Tolerant Quantum Computation, Entropy and information – Shannon Entropy, Basic properties of Entropy, Von Neumann, Strong Sub Additivity, Data Compression, Entanglement as a physical resource .	**08**

Books:

1. Micheal A. Nielsen. &Issac L. Chiang, "Quantum Computation and Quantum Information", Cambridge University Press, Fint South Asian edition, 2002.
2. Eleanor G. Rieffel , Wolfgang H. Polak , "Quantum Computing - A Gentle Introduction" (Scientific and Engineering Computation) Paperback – Import,3 Oct 2014
3. Scott Aaronson, "Computing since Democritus " , Cambridge University Press ,2013
4. N. David Mermin ," Computer Science: An Introduction", Cambridge University Press, 2007
5. Noson S. Yanofsky and Mirco A. Mannucci , "Quantum Computing for Computer Scientists", Cambridge University Press, 2008

B.Tech. VIIth Semester

List of Open Elective-II and Open Elective-III

To be offered by CSE Department:

1. Digital & Social Media Marketing (Open for all branches)
2. Data Warehousing and Data Mining (For student other than CSE/CSE(AI))
3. Big Data (For student other than CSE/ CSE(AI)
4. Natural Language Processing (For student other than CSE/CSE(AI))

IOE083	**Digital & Social Media Marketing**	
Course Outcome (CO)		**Bloom's Knowledge Level (KL)**
At the end of course, the student will be able to		
CO 1	Understand the Foundations of Digital Marketing.	K1, K2
CO 2	Create and Manage Social Media Content.	K3
CO 3	Acquire and Engage Users through Digital Channels.	K1 , K2
CO 4	Design and Implement Digital Marketing Strategies	K3
CO 5	Analyze Digital Innovation and Emerging Trends	K1 , K2
DETAILED SYLLABUS		**3-0-0**
Unit	**Topic**	**Proposed Lectures**
I	**Introduction to Digital Marketing:** The new digital world - trends that are driving shifts from traditional marketing practices to digital marketing practices, the modern digital consumer and new consumer's digital journey. marketing strategies for the digital world-latest practices.	**08**
II	**Social Media Marketing** -Introduction to Blogging, Create a blog post for your project. Include headline, imagery, links and post, Content Planning and writing; e-commerce: optimizing e-commerce performance, transactions ; Introduction to Facebook, Twitter, Google +, LinkedIn, YouTube, Instagram, and Pinterest; their channel advertising and campaigns	**08**
III	**Acquiring & Engaging Users through Digital Channels:** Understanding the relationship between content and branding and its impact on sales, search engine marketing, mobile marketing, video marketing, and social-media marketing, marketing gamification; Online campaign management; using marketing analytic tools to segment, target and position; overview of search engine optimization (SEO)	**08**
IV	**Designing Organization for Digital Success:** Digital transformation, digital leadership principles, online P.R. and reputation management. ROI of digital strategies, how digital marketing is adding value to business, and evaluating cost effectiveness of digital strategies.	**08**
V	**Digital Innovation and Trends:** The contemporary digital revolution, digital transformation framework; security and privatization issues with digital marketing understanding trends in digital marketing – Indian and global context, online communities and co-creation.	**08**

Reference books:

1. Moutsy Maiti: Internet Mareting, Oxford University Press India, 2017
2. Vandana, Ahuja; Digital Marketing, Oxford University Press India Publication, November, 2015.
3. Eric Greenberg, and Kates, Alexander; Strategic Digital Marketing: Top Digital Experts Share the Formula for Tangible Returns on Your Marketing Investment; McGraw-Hill Professional October, 2013.
4. Ryan, Damian; Understanding Digital Marketing: marketing strategies for engaging the digital generation; Kogan Page, 3rd Edition, 2014.
5. Tracy L. Tuten & Michael R. Solomon, "Social Media Marketing", Sage Publication, 2017

IOE084	Data Warehousing and Data Mining	
	Course Outcome (CO)	**Bloom's Knowledge Level (KL)**
	At the end of course , the student will be able to understand	
CO 1	Be familiar with mathematical foundations of data mining tools.	K1, K2
CO 2	Understand and implement classical models and algorithms in data warehouses and data mining	K3
CO 3	Characterize the kinds of patterns that can be discovered by association rule mining, classification and clustering.	K1, K2
CO 4	Master data mining techniques in various applications like social, scientific and environmental context.	K3
CO 5	Develop skill in selecting the appropriate data mining algorithm for solving practical problems.	K1 , K2
	DETAILED SYLLABUS	**3-0-0**
Unit	**Topic**	**Proposed Lectures**
I	**Data Warehousing:** Overview, Definition, Data Warehousing Components, Building a Data Warehouse, Warehouse Database, Mapping the Data Warehouse to a Multiprocessor Architecture, Difference between Database System and Data Warehouse, Multi-Dimensional Data Model, Data Cubes, Stars, Snow Flakes, Fact Constellations, Concept	**08**
II	**Data Warehouse Process and Technology:** Warehousing Strategy, Warehouse /management and Support Processes, Warehouse Planning and Implementation, Hardware and Operating Systems for Data Warehousing, Client/Server Computing Model & Data Warehousing. Parallel Processors & Cluster Systems, Distributed DBMS implementations, Warehousing Software, Warehouse Schema Design	**08**
III	**Data Mining:** Overview, Motivation, Definition & Functionalities, Data Processing, Form of Data Pre-processing, Data Cleaning: Missing Values, Noisy Data, (Binning, Clustering, Regression, Computer and Human inspection), Inconsistent Data, Data Integration and Transformation. Data **Reduction:**-Data Cube Aggregation, Dimensionality reduction, Data Compression, Numerosity Reduction, Discretization and Concept hierarchy generation, Decision Tree.	**08**
IV	**Classification**: Definition, Data Generalization, Analytical Characterization, Analysis of attribute relevance, Mining Class comparisons, Statistical measures in large Databases, Statistical-Based Algorithms, Distance-Based Algorithms, Decision Tree-Based Algorithms. **Clustering**: Introduction, Similarity and Distance Measures, Hierarchical and Partitional Algorithms. Hierarchical Clustering- CURE and Chameleon. Density Based Methods-DBSCAN, OPTICS. Grid Based Methods- STING, CLIQUE. Model Based Method –Statistical Approach, Association rules: Introduction, Large Item sets, Basic Algorithms, Parallel and Distributed Algorithms, Neural Network approach.	**08**
V	**Data Visualization and Overall Perspective:** Aggregation, Historical information, Query Facility, OLAP function and Tools. OLAP Servers, ROLAP, MOLAP, HOLAP, Data Mining interface, Security, Backup and Recovery, Tuning Data Warehouse, Testing Data Warehouse. **Warehousing applications and Recent Trends:** Types of Warehousing Applications, Web Mining, Spatial Mining and Temporal Mining	**08**

Reference books:

1. Jiawei Han, Micheline Kamber, Jian Pei "DATA MINING: Concepts and Techniques", Elsevier, 2007.
2. Alex Berson, Stephen J. Smith, "Data Warehousing, Data-Mining & OLAP", TMH, 2017
3. Mark Humphries, Michael W. Hawkins, Michelle C. Dy, "Data Warehousing: Architecture and Implementation", Pearson, 1998
4. Margaret H. Dunham, S. Sridhar, "Data Mining: Introductory and Advanced Topics" Pearson Education, 2006
5. Arun K. Pujari, "Data Mining Techniques" Universities Press, 2001
6. Pieter Adriaans, Dolf Zantinge, "Data-Mining", Pearson Education, 1996

IOE076	Big Data	
	Course Outcome (CO)	**Bloom's Knowledge Level (KL)**
	At the end of course , the student will be able to	
CO 1	Demonstrate knowledge of Big Data Analytics concepts and its applications in business.	K_1,K_2
CO 2	Demonstrate functions and components of Map Reduce Framework and HDFS.	K_1,K_2
CO 3	Discuss Data Management concepts in NoSQL environment.	K_6
CO 4	Explain process of developing Map Reduce based distributed processing applications.	K_2,K_5
CO 5	Explain process of developing applications using HBASE, Hive, Pig etc.	K_2,K_5
	DETAILED SYLLABUS	**3-0-0**

Unit	Topic	Proposed Lectures
I	**Introduction to Big Data**: Types of digital data, history of Big Data innovation, introduction to Big Data platform, drivers for Big Data, Big Data architecture and characteristics, 5 Vs of Big Data, Big Data technology components, Big Data importance and applications, Big Data features – security, compliance, auditing and protection, Big Data privacy and ethics, Big Data Analytics, Challenges of conventional systems, intelligent data analysis, nature of data, analytic processes and tools, analysis vs reporting, modern data analytic tools.	**06**
II	**Hadoop:** History of Hadoop, Apache Hadoop, the Hadoop Distributed File System, components of Hadoop, data format, analyzing data with Hadoop, scaling out, Hadoop streaming, Hadoop pipes, Hadoop Echo System. **Map Reduce:** Map Reduce framework and basics, how Map Reduce works, developing a Map Reduce application, unit tests with MR unit, test data and local tests, anatomy of a Map Reduce job run, failures, job scheduling, shuffle and sort, task execution, Map Reduce types, input formats, output formats, Map Reduce features, Real-world Map Reduce	**08**
III	**HDFS (Hadoop Distributed File System):** Design of HDFS, HDFS concepts, benefits and challenges, file sizes, block sizes and block abstraction in HDFS, data replication, how does HDFS store, read, and write files, Java interfaces to HDFS, command line interface, Hadoop file system interfaces, data flow, data ingest with Flume and Scoop, Hadoop archives, Hadoop I/O: compression, serialization, Avro and file-based data structures. **Hadoop Environment:** Setting up a Hadoop cluster, cluster specification, cluster setup and installation, Hadoop configuration, security in Hadoop, administering Hadoop, HDFS monitoring & maintenance, Hadoop benchmarks, Hadoop in the cloud	**08**
IV	**Hadoop Eco System and YARN**: Hadoop ecosystem components, schedulers, fair and capacity, Hadoop 2.0 New Features - NameNode high availability, HDFS federation, MRv2, YARN, Running MRv1 in YARN. **NoSQL Databases:** Introduction to NoSQL **MongoDB:** Introduction, data types, creating, updating and deleing documents, querying, introduction to indexing, capped collections **Spark:** Installing spark, spark applications, jobs, stages and tasks, Resilient Distributed Databases, anatomy of a Spark job run, Spark on YARN **SCALA:** Introduction, classes and objects, basic types and operators, built-in control structures, functions and closures, inheritance.	**09**

V	**Hadoop Eco System Frameworks**: Applications on Big Data using Pig, Hive and HBase **Pig** - Introduction to PIG, Execution Modes of Pig, Comparison of Pig with Databases, Grunt, Pig Latin, User Defined Functions, Data Processing operators,	**09**
	Hive - Apache Hive architecture and installation, Hive shell, Hive services, Hive metastore, comparison with traditional databases, HiveQL, tables, querying data and user defined functions, sorting and aggregating, Map Reduce scripts, joins & subqueries. **HBase** – Hbase concepts, clients, example, Hbase vs RDBMS, advanced usage, schema design, advance indexing, Zookeeper – how it helps in monitoring a cluster, how to build applications with Zookeeper. IBM Big Data strategy, introduction to Infosphere, BigInsights and Big Sheets, introduction to Big SQL.	

Reference books:

1. Michael Minelli, Michelle Chambers, and Ambiga Dhiraj, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses", Wiley,2013
2. Dirk deRoos, Chris Eaton, George Lapis, Paul Zikopoulos, Tom Deutsch, “Understanding Big Data Analytics for Enterprise Class Hadoop and Streaming Data”, McGrawHill,2017
3. Thomas Erl, Wajid Khattak, Paul Buhler, “Big Data Fundamentals: Concepts, Drivers and Techniques”, Prentice Hall,2016
4. Bart Baesens “Analytics in a Big Data World: The Essential Guide to Data Science and its Applications”, John Wiley & Sons,2014
5. Arshdeep Bahga, Vijay Madisetti, “Big Data Science & Analytics: A HandsOn Approach “, VPT,2018
6. Tom White, "Hadoop: The Definitive Guide", O'Reilly,2012
7. Eric Sammer, "Hadoop Operations", O'Reilly,2012
8. Deepak Vohra, “Practical Hadoop Ecosystem: A Definitive Guide to Hadoop-Related Frameworks and Tools”, Apress,2016
9. E. Capriolo, D. Wampler, and J. Rutherglen, "Programming Hive", O'Reilly,2012
10. Lars George, "HBase: The Definitive Guide", O'Reilly,2012

IOE085	Natural Language Processing	
Course Outcome (CO)		**Bloom's Knowledge Level (KL)**
At the end of course , the student will be able :		
CO 1	To learn the fundamentals of natural language processing	K_1 , K_2
CO 2	To understand the use of CFG and PCFG in NLP	K_1 , K_2
CO 3	To understand the role of semantics of sentences and pragmatic	K_2
CO 4	To Introduce Speech Production And Related Parameters Of Speech.	K_1 , K_2
CO 5	To Show The Computation And Use Of Techniques Such As Short Time Fourier Transform, Linear Predictive Coefficients And Other Coefficients In The Analysis Of Speech.	K_3, K_4

DETAILED SYLLABUS		**3-0-0**
Unit	**Topic**	**Proposed Lecture**
I	**INTRODUCTION:** Origins and challenges of NLP – Language Modeling: Grammar-based LM, Statistical LM – Regular Expressions, Finite-State Automata – English Morphology, Transducers for lexicon and rules, Tokenization, Detecting and Correcting Spelling Errors, Minimum Edit Distance **WORD LEVEL ANALYSIS :** Unsmoothed N-grams, Evaluating N-grams, Smoothing, Interpolation and Backoff – Word Classes, Part-of-Speech Tagging, Rule-based, Stochastic and Transformation-based tagging, Issues in PoS tagging – Hidden Markov and Maximum Entropy models.	**08**
II	**SYNTACTIC ANALYSIS:** Context Free Grammars, Grammar rules for English, Treebanks, Normal Forms for grammar – Dependency Grammar – Syntactic Parsing, Ambiguity, Dynamic Programming parsing – Shallow parsing – Probabilistic CFG, Probabilistic CYK, Probabilistic Lexicalized CFGs – Feature structures, Unification of feature structures.	**08**
III	**SEMANTICS AND PRAGMATICS:** Requirements for representation, First-Order Logic, Description Logics – Syntax-Driven Semantic analysis, Semantic attachments – Word Senses, Relations between Senses, Thematic Roles, selectional restrictions – Word Sense Disambiguation, WSD using Supervised, Dictionary &Thesaurus, Bootstrapping methods – Word Similarity using Thesaurus and Distributional methods.	**08**
IV	**BASIC CONCEPTS of Speech Processing :** Speech Fundamentals: Articulatory Phonetics – Production And Classification Of Speech Sounds; Acoustic Phonetics – Acoustics Of Speech Production; Review Of Digital Signal Processing Concepts; Short-Time Fourier Transform, Filter-Bank And LPC Methods.	**08**
V	**SPEECH-ANALYSIS**: Features, Feature Extraction And Pattern Comparison Techniques: Speech Distortion Measures– Mathematical And Perceptual – Log–Spectral Distance, Cepstral Distances,	**08**
	Weighted Cepstral Distances And Filtering, Likelihood Distortions, Spectral Distortion Using A Warped Frequency Scale, LPC, PLP And MFCC Coefficients, Time Alignment And Normalization – Dynamic Time Warping, Multiple Time – Alignment Paths. **SPEECH MODELING** : Hidden Markov Models: Markov Processes, HMMs – Evaluation, Optimal State Sequence – Viterbi Search, Baum-Welch Parameter Re-Estimation, Implementation Issues.	

Reference books:

1. Daniel Jurafsky, James H. Martin, "Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech", Pearson Publication, 2014
2. Steven Bird, Ewan Klein and Edward Loper, "Natural Language Processing with Python", First Edition, OReilly Media, 2009
3. Lawrence Rabiner And Biing-Hwang Juang, "Fundamentals Of Speech Recognition", Pearson Education, 2003.
4. Daniel Jurafsky And James H Martin, "Speech And Language Processing: An Introduction To Natural Language Processing, Computational Linguistics, And Speech Recognition", Pearson Education, 2002
5. Frederick Jelinek, "Statistical Methods Of Speech Recognition", MIT Press, 1997
6. Breck Baldwin, "Language Processing with Java and LingPipe Cookbook", Atlantic Publisher, 2015
7. Richard M Reese, "Natural Language Processing with Java", OReilly Media, 2015
8. Nitin Indurkhya and Fred J. Damerau, "Handbook of Natural Language Processing, Second Edition, Chapman and Hall/CRC Press", 2010
9. Tanveer Siddiqui, U.S. Tiwary, "Natural Language Processing and Information Retrieval, Oxford University Press", 2008