Board of Studies in Computer Engineering

Final year of B. Tech Computer Engineering wef AY 2026-27																
SEM-VII																
Course Code	Couse Type	Title of Course	Teaching Scheme			Evaluation Scheme and Marks							Credits			
			TH	TU	PR	INSEM	ENDSEM	CCE	TW	PR	OR	TOTAL	TH	TU	PR	TOTAL
2301401	PCC	Deep Learning	3	-	-	20	60	20	-	-	-	100	3	-	-	3
2301402	PCC	Cyber Security	3	-	-	20	60	20	-	-	-	100	3	-	-	3
2301403	PCC	Deep Learning Lab	-	-	2	-	-	-	25	25	-	50	-	-	1	1
2301404	PCC	Cyber Security Lab	-	-	2	-	-	-	25	-	25	50	-	-	1	1
	PEC	Program Elective Course IV	3	-	-	20	60	20	-	-	-	100	3	-	-	3
	PEC	Program Elective Course V	2	-	-	20	30	-	-	-	-	50	2	-	-	2
2301407	RM	Research Methodology	3	-	-	20	60	20	-	-	-	100	3	-	-	3
2301408	HSSM - EEM	Banking, Financial Services and Insurance	2	-	-	-	-	50	-	-	-	50	2	-	-	2
2301409	PROJ	Project Work	-	-	8	-	-	-	100	-	50	150	-	-	4	4
Total			**16**	**00**	**12**	**100**	**270**	**130**	**150**	**25**	**75**	**750**	**16**	**-**	**6**	**22**

Elective -- IV		Elective – V	
Course Code	**Title of Course**	**Course Code**	**Title of Course**
2301405A	Computer Vision	2301406A	Operation Research
2301405B	Information Retrieval	2301406B	Unix Internals
2301405C	Business Intelligence and Analytics	2301406C	Compiler Design

BoS Chairman **Director**

Board of Studies in Computer Engineering

Final year of B. Tech Computer Engineering wef AY 2026-27														
SEM-VIII														
Course Code	Couse Type	Title of Course	Teaching Scheme			Evaluation Scheme and Marks						Credits		
			TH	TU	PR	INSEM	ENDSEM	CCE	TW	OR	TOTAL	TH	TU	PR	TOTAL
2301410	PCC*	Software Architecture and Design Patterns	3	-	-	-	60	40			100	3	-	-	3
	PEC*	Program Elective Course VI	3	-	-	-	60	40	-	-	100	3	-	-	3
2301412	HSSM-EEM*	Startup and Entrepreneurship	2	-	-	-	-	50	-	-	50	2	-	-	2
2301413	INTERNSHIP	Internship	-	-	24	-	-	-	200	100	300	-	-	12	12
Total			**08**	**00**	**24**	**-**	**120**	**130**	**200**	**100**	**550**	**08**	**-**	**12**	**20**

* Considering Internship of 6 months, these courses to be offered in online mode

Elective -- VI	
Course Code	**Title of Course**
2301411A	Blockchain
2301411B	Bioinformatics
2301411C	Digital Forensic

BoS Chairman **Director**

Final Year B. Tech. Computer Engineering
Pattern 2023 Semester: VII
2301401: Deep Learning

Teaching Scheme:	**Credit Scheme:**	**Examination Scheme:**
Theory: 03 hrs/week	**03**	**Continuous Comprehensive Evaluation: 20 Marks** **InSem Exam: 20 Marks** **EndSem Exam: 60 Marks**

Prerequisite Courses: - 2301311: Data Science and Big Data

Course Objectives:

- To understand the architecture of a neural network
- To study regularization techniques, batch normalization, and hyperparameter tuning.

Course Outcomes: On completion of the course, students will be able to–

	Course Outcomes	**Bloom's Level**
CO1	Describe the architecture of a forward and backward propagation neural network	2-Understand
CO2	Explain and analyze key deep learning concepts, optimization algorithms, hyperparameter tuning	2-Understand
CO3	Describe the fundamental concepts, architectures, and applications of Convolutional Neural Networks	2-Understand
CO4	Discuss the principles and architecture of Recurrent Neural Networks	2-Understand
CO5	Discuss the principles and techniques of deep reinforcement learning	2-Understand

COURSE CONTENTS

Unit I	**Introduction to Neural Networks**	**(07 hrs)**	**CO1**

Biological vs. artificial neurons, Perceptron, multilayer perceptron - back-propagation algorithm, Exclusive-OR (XOR) problem, Stochastic Gradient Descent Algorithm, types of activation functions, neural network as directed graph architecture of Neural Networks - three fundamentally different classes of network architectures, Single-Layer Feedforward Networks, Multilayer Feedforward Networks, Recurrent Networks

Unit II	**Restricted Boltzmann machine (RBM)**	**(06 hrs)**	**CO2**

Overfitting, Underfitting, Regularization (L1, L2, Dropout, DropConnect), Batch Normalization, Optimization Algorithms (Adam, RMSProp), Weight Initialization, Hyperparameter Tuning, What is deep learning, The basic building blocks of deep learning, Restricted Boltzmann machine

Unit III	**Convolutional Neural Networks (CNN)**	**(08 hrs)**	**CO3**

Convolutional Neural Networks (CNNs) – need, Convolution operation, 2D convolution, 2D convolution with stride, basic building blocks of CNNs, Max pooling, fully connected layers, CNN architectures, Introduction to Imagenet, LeNet architecture, AlexNet architecture, VGGNet architecture, ResNet architecture, Applications of CNN

Unit IV	**Recurrent Neural Networks**	**(08 hrs)**	**CO4**

Recurrent Neural Networks (RNNs), Back-propagation through time, Long Short-Term Memory (LSTM), Bidirectional LSTMs, Bidirectional RNNs, Gated RNN Architecture, Applications of RNN

Unit V	**Deep Reinforcement Learning**	**(07 hrs)**	**CO5**

Introduction of deep reinforcement learning, Markov Decision Process, basic framework of reinforcement learning, challenges of reinforcement learning, Dynamic programming algorithms for reinforcement learning, Q Learning and Deep Q-Networks, Deep Q recurrent networks, Simple reinforcement learning

for Tic-Tac-Toe.

Text Books

1. Ian Goodfellow, Yoshua Bengio and Aaron Courville, Deep learning, MIT Press, Available online: http://www.deeplearningbook.org, 2016
2. Charu Agarwal, Neural Networks and deep learning A Textbook, Springer Second Edition
3. Jacek M. Zurada, Introduction to Artificial Neural Systems, West Publishing Co
4. Josh Patterson & Adam Gibson, Deep Learning: A Practitioner's Approach, O'Reilly Media, Inc.

Reference Books

1. S. Haykin, Neural Networks and Learning Machines , Prentice Hall of India, 2010 2.
2. Satish Kumar, Neural Networks - A Class Room Approach, Second Edition, Tata McGraw-Hill, 2013 3.
3. B. Yegnanarayana, Artificial Neural Networks, Prentice- Hall of India, 1999
4. https://www.v7labs.com/blog/self-supervised-learning-guide
5. https://speechprocessingbook.aalto.fi/Self_supervised_learning.html

Guidelines for Continuous Comprehensive Evaluation of Theory Course		
Sr. No.	**Components for Continuous Comprehensive Evaluation**	**Marks Allotted**
1	Unit I - Quiz (10 marks and will be converted to 4 marks)	4
2	Unit II - Quiz (10 marks and will be converted to 4 marks)	4
3	Unit III - Presentation(10 marks will be converted to 4 marks)	4
4	Unit IV - Assignment (10 marks will be converted to 4 marks)	4
5	Unit V - Quiz (10 marks and will be converted to 4 marks)	4
	Total	**20**

Final Year B. Tech Computer Engineering
Pattern 2023 Semester: VII
2301402: Cyber Security

Teaching Scheme:	Credit Scheme:	Examination Scheme:
Theory: 03 hrs/week	03	Continuous Comprehensive Evaluation: 20 Marks InSem Exam: 20 Marks EndSem Exam: 60 Marks

Prerequisite Courses: - 2301216: Data Communications & Networking

Course Objectives:

- To understand the concepts of cryptography
- To understand the principles of cyber security
- To acquire knowledge of standard algorithms and protocols used to provide confidentiality, integrity and authenticity
- To enhance awareness about personal identifiable information, information management and cyber forensics

Course Outcomes: On completion of the course, students will be able to –

	Course Outcomes	Bloom's Level
CO1	Explain fundamental concepts and approaches in cyber security.	2-Understand
CO2	Elaborate the security protections and limitations provided by existing Data Encryption Techniques	2-Understand
CO3	Illustrate Public key Cryptography and its Management	2-Understand
CO4	Explain secure communication and perimeter-defense mechanisms	2-Understand
CO5	Identify Cyber Security framework and current trends	2-Understand

COURSE CONTENTS

Unit I	Introduction to cyber security	(06 hrs)	CO1

Authentication, Access Control and Cryptography, Threats, Harm, Vulnerabilities, Security Attacks : Active and passive Web attack: Browser Attacks, Web Attacks Targeting Users, Obtaining User or Website Data, Email Attacks, Network Vulnerabilities: Overview of vulnerability scanning, Open Port /Service Identification, Banner /Version Check, Traffic Probe, Vulnerability Probe, Vulnerability Examples

Unit II	Data Encryption Techniques and Standards	(08 hrs)	CO2

Encryption Methods: Symmetric, Asymmetric Cryptography, Substitution Techniques: Caesar Cipher, Monoalphabetic Ciphers, Play fair Cipher, Hill Cipher, Poly alphabetic Ciphers, Transposition Techniques, Block Ciphers, Stream Cipher, Data Encryption standards, Triple DES, Advanced Encryption standards

Unit III	Public Key and Management	(08 hrs)	CO3

Public Key Cryptography RSA Algorithm: Working, Key length, Security, Key Distribution, Deffie-Hellman Key Exchange, Elliptic Curve, Authentication methods, Message Digest, Kerberos, X.509 Authentication service. Digital Signatures: Implementation, Algorithms, Standards (DSS), Authentication Protocol.

Unit IV	Secure Communication Protocols & Network Defense	(06 hrs)	CO4

IPsec overview – Purpose, SA, AH Protocol, ESP Protocol **VPN types**-site-to-site, remote TLS-VPN in one slide, **TLS / SSL fundamentals** – handshake & record concepts, **E-mail security** – PGP, NGFW S/MIME comparison, Secure Electronic Transaction, **Firewalls** Goals, packet, stateful. I**ntrusion Detection & Prevention** – signature, anomaly, NIDS/HIDS

Unit V	Governance, Ethics & Industry Perspectives	(08 hrs)	CO5

Cyber-security Framework, Purpose of risk & control frameworks, NIST CSF 2.0 – six functions, outcome categories, profiles, ISO/IEC 27001:2022 – clauses 4-10, Annex A control themes, certification cycle, Cyber Ethics & Legal Compliance IT Act 2000 structure and penalties, Indian case studies (e-payment fraud, data leak), GDPR principles, India's Digital Personal Data Protection Act 2023 – rights, penalties Ethical dilemmas, responsible disclosure, privacy vs surveillance
Emerging Trends: Zero-Trust, AI-driven defense, IoT security, quantum-ready crypto
Role landscape: SOC analyst, GRC specialist, cloud-security architect, red/blue/purple teams

Text Books

1. William Stallings, "Cryptography and Network Security: Principles and Practice", 7/e, Pearson,ISBN:9789332585225.https://pearsoned.co.in/web/books/9789332585225_Cryptography-and-Network-Security_William-Stallings.aspx
2. Dr. V.K. Pachghare, Cryptography and Information Security, PHI, ISBN 978-81-303- 5082-3
3. Nina Godbole,Sunit Belapure, Cyber Security, Wiley India, ISBN:978-81-345-2179-1
4. National Institute of Standards and Technology (NIST), "The NIST Cybersecurity Framework (CSF) 2.0", CSWP-29, NIST, DOI: 10.6028/NIST.CSWP.29.

Reference Books

1. Atul Kahate, "Cryptography and Network Security", McGraw Hill Publication, 2nd Edition, 2008, ISBN: 978-0-07-064823-4
2. Stuart McCLURE, Joel Scambray, George Kurtz, Hacking Exposed Network Security Secrets and Solutions, McGrow Hill, 2012 ISBN: 978-0-07-178028-5 Digital Ref:http://84.209.254.175/linux-pdf/Hacking-Exposed-7-Network-Security-Secrets.pdf

Guidelines for Continuous Comprehensive Evaluation of Theory Course

Sr. No.	Components for Continuous Comprehensive Evaluation	Marks Allotted
1	Unit I - Quiz (10 marks and will be converted to 4 marks)	4
2	Unit II - Assignment (10 marks will be converted to 4 marks)	4
3	Unit III - Assignment (10 marks will be converted to 4 marks)	4
4	Unit IV - Quiz (10 marks and will be converted to 4 marks)	4
5	Unit V - Quiz (10 marks and will be converted to 4 marks)	4
	Total	**20**

Final Year B. Tech Computer Engineering **Pattern 2023 Semester: VII** **2301403: Deep Learning Lab**		
Teaching Scheme:	**Credit Scheme:**	**Examination Scheme:**
Practical: 02 hrs/week	**01**	**Term Work: 25 Marks** **Practical Exam : 25 Marks**
Prerequisite Courses: - 2301311: Data Science and Big Data, 2301313: Data Science and Big Data Lab		

Course Objectives:

- Introduce foundational concepts and techniques in deep learning.
- Develop practical skills in implementing neural networks using modern frameworks.
- Analyze and compare deep learning models using suitable metrics and visualization tools.
- Apply advanced techniques like transfer learning, regularization, and RNNs for real-world problems.

Course Outcomes: On completion of the course, students will be able to –

	Course Outcomes	**Bloom's Level**
CO1	Implement and visualize simple neural networks such as perceptrons and MLPs for image or text data	3-Apply
CO2	Analyze model performance with techniques like regularization and activation functions	4-Analyze
CO3	Design, implement, and evaluate CNN, RNN, and LSTM-based architectures for classification problems	3-Apply
CO4	Use of pretrained models and hyperparameter tuning techniques to improve model accuracy in real-world applications	3- Apply

List of Laboratory Experiments / Assignments

Sr. No.	**Laboratory Experiments / Assignments**	**CO Mapped**
1	**Implement a Perceptron from Scratch** o Implement a single-layer perceptron using NumPy. o Train it on linearly separable data (e.g., AND/OR gate or synthetic dataset). o Visualize decision boundary.	CO1
2	**Build and Train a Feedforward Neural Network** o Use PyTorch or TensorFlow to build an MLP. o Train on MNIST or Fashion-MNIST dataset. o Tune hidden layers and activation functions. o Report accuracy and loss curves.	CO1
3	**Experiment with Regularization Techniques** o Train a model with and without L2 regularization. o Add Dropout and compare performance. o Visualize training/validation loss and accuracy.	CO2
4	**Visualize and Compare Activation Functions** o Train the same MLP using Sigmoid, Tanh, and ReLU. o Plot training speed, accuracy, and gradient flow. o Discuss vanishing/exploding gradient issues.	CO2
5	**Build a CNN for Image Classification** o Build a simple CNN (e.g., 2 conv layers + FC) for CIFAR-10 or MNIST. o Compare with MLP performance. o Use basic data augmentation	CO3
6	**Implement an RNN or LSTM for Text Classification**	CO3

	o Use IMDB sentiment classification dataset. o Implement an LSTM for binary classification. o Plot accuracy and visualize example predictions.	
7	**Transfer Learning with a Pretrained CNN** o Load a pretrained model (e.g., ResNet50 or VGG16). o Fine-tune it on a small custom dataset (e.g., cats vs dogs). o Freeze layers and experiment with performance.	CO4
8	**Hyperparameter Tuning and Model Comparison** o Choose any dataset and architecture. o Experiment with learning rate, batch size, number of layers, etc. o Use tools like TensorBoard or WandB to log results. o Write a short report comparing configurations.	CO4
9	**Micro Project** a. Handwritten Digit Recognition Web App b. Neural Network Playground c. Real-Time Object Classification d. Pet Classifier (Cats vs Dogs) e. Sentiment Analysis on Tweets f. Music Genre Classification g. Face Mask Detector **OR** **Any other of your choice**	CO1, CO2, CO3, CO4

Guidelines for Laboratory Conduction

Use of coding standards and Hungarian notation, proper indentation and comments.
Use of open-source software is to be encouraged.
Operating System recommended: - Linux or its derivative
Programming tools recommended: -

- Python 3.x
- PyTorch ,TensorFlow, Keras
- Jupyter Notebook or Google Colab (recommended for ease)
- Basic plotting (Matplotlib or Seaborn)
- OpenCV,
- Streamlit
- Flask
- Scikit-learn

Guidelines for Student's Lab Journal

The laboratory assignments are to be submitted by students in the form of a journal. Journal consists of Certificate, table of contents, and handwritten write-up of each assignment (Title, problem statement, theory concepts in brief, algorithm, flowchart, test cases and conclusions). Program codes with sample outputs shall be submitted in soft form

Guidelines for Term work Assessment

Continuous assessment of laboratory work shall be based on the overall performance of a student. Assessment of each laboratory assignment shall be based on rubrics that include R1- timely completion (10), R2- understanding of assignment (10) and R3- presentation/clarity of journal writing (10) (Coding standard, Indentation, Hungarian notation, input validation etc.)

Final Year B. Tech Computer Engineering **Pattern 2023 Semester: VII** **2301404: Cyber Security Lab**		
Teaching Scheme:	**Credit Scheme:**	**Examination Scheme:**
Practical: 02 hrs/week	**01**	**Term Work: 25 Marks** **Oral Exam : 25 Marks**

Prerequisite Courses: - 2301217 Data Communications & Networking

Course Objectives:

- To understand threats/vulnerabilities to networks and countermeasures.
- To provide understanding of cryptography and its applications.
- To explain various approaches to Encryption techniques.
- To understand the working of firewalls and IDs.

Course Outcomes: On completion of the course, students will be able to –

	Course Outcomes	**Bloom's Level**
CO1	Identify basic security attacks and services	2-Understand
CO2	Analyze the vulnerabilities and design a security solution	3-Apply
CO3	Implement symmetric and asymmetric key algorithms	3-Apply
CO4	Demonstrate network security applications and defenses	3-Apply

List of Laboratory Experiments / Assignments

Sr. No.	**Laboratory Experiments / Assignments**	**CO Mapped**
1	Implement & compare S-DES and S-AES. Measure avalanche effect.	CO1,CO3
2	Implement RSA (key-pair generation, encrypt, decrypt) Demonstrate a hybrid session: use Diffie–Hellman to agree on a session key, then protect a short text with that key under RSA.	CO1,CO3
3	**Threat & Risk Assessment with Mitigation Plan** Given the case-study brief of a small e-commerce startup, perform: asset-threat-vulnerability identification, qualitative risk matrix (likelihood × impact),selection of at least five technical and policy controls (map each to a NIST-CSF Category or ISO 27001 Annex A control). Submit the filled risk matrix and a two-page mitigation plan.	CO2
4	**Network Traffic Capture & Analysis** Capture a full TLS 1.3 handshake with Wireshark Annotate: ClientHello, ServerHello, key-share, Finished messages. Then run a scripted brute-force SSH login against a sandboxed host, recapture traffic, and use Wireshark filters to pinpoint the password-guess pattern	CO4
5	**Local Vulnerability Scan & Patch** Run the Dockerised OWASP Juice Shop, Launch OWASP ZAP (GUI) and scan the site. Save the HTML report**,**Pick one "High" finding and apply the official Juice-Shop config fix, Re-scan to confirm the issue is resolved or downgraded. Before/after ZAP reports and a screenshot highlighting the fixed finding	CO2,CO4

6	**Phishing & DoS Log Analysis** Analyse the GoPhish CSV, calculate open-rate and click-rate. Graph requests-per-second from the supplied mini-DoS Apache access log,highlight the spike window. spreadsheet or small plot and ≤ 100-word SOC-style summary of findings	CO1,CO2
7	**Host Firewall & IDS in a Box** Enable UFW (or Windows Defender FW) rules: allow HTTPS, block Telnet, rate-limit ICMP, screenshot rules. Run **Snort** in offline mode against web_attack.pcap, list the top three alerts **Submit:** rule screenshots, alert list, and 10 lines explaining each alert	CO4
8	**CTF Challenge** team (max 3) receives a ZIP with **five mini flags** (crypto puzzle, stego image, log forensics, etc.). Work for up to three hours. **Submit:** flag values and a one-page tactics summary describing tools and steps used.	CO1,CO2, CO4

Guidelines for Laboratory Conduction
Use of coding standards and Hungarian notation, proper indentation and comments. Use of open-source software is to be encouraged. Operating System recommended: - Linux or its derivative Programming tools recommended: - Open Source line gcc/g++,Python
Guidelines for Student's Lab Journal
The laboratory assignments are to be submitted by students in the form of a journal. Journal consists of Certificate, table of contents, and handwritten write-up of each assignment (Title, problem statement, theory concepts in brief, algorithm, flowchart, test cases and conclusions). Program codes with sample outputs shall be submitted in soft form
Guidelines for Term work Assessment
Continuous assessment of laboratory work shall be based on the overall performance of a student. Assessment of each laboratory assignment shall be based on rubrics that include R1- timely completion (10), R2- understanding of assignment (10) and R3- presentation/clarity of journal writing (10) (Coding standard, Indentation, Hungarian notation, input validation etc.)

K. K. Wagh Institute of Engineering Education and Research, Nashik
(Autonomous from Academic Year 2022-23)

Final Year B. Tech. Computer Engineering **Pattern 2023 Semester: VII** **2301405A : Computer Vision**		
Teaching Scheme:	**Credit Scheme:**	**Examination Scheme:**
Theory: 03 hrs/week	**03**	**Continuous Comprehensive Evaluation: 20 Marks** **InSem Exam: 20 Marks** **EndSem Exam: 60 Marks**

Prerequisite Courses: - 2301203 : Computer Graphics

Course Objectives:

- To understand Human and computer vision.
- To understand image processing
- To study image segmentation and feature representation
- To study image understanding strategies

Course Outcomes: On completion of the course, students will be able to–

	Course Outcomes	**Bloom's Level**
CO1	Explain the principles of image formation, representation, and processing in computer vision systems	2-Understand
CO2	Explain various image preprocessing techniques	2-Understand
CO3	Illustrate different image segmentation techniques to support object representation	2-Understand
CO4	Apply classification techniques for object recognition	3-Apply
CO5	Explain image understanding control strategies	2- Understand

COURSE CONTENTS

Unit I	**Introduction**	**(07 hrs)**	**CO1**

Introduction: Motivation Human Vision Vs Computer Vision, Why computer vision is difficult? Image representation concepts and image analysis tasks, image Digitization, Digital image properties, Physics of colors, colors perceived by humans , color spaces ,palette images

Unit II	**Image Preprocessing Techniques**	**(07 hrs)**	**CO2**

Pixel brightness transformations , Local preprocessing , Image smoothing , Edge detectors , Canny Edge Detection

Unit III	**Segmentation**	**(08 hrs)**	**CO3**

Thresholding: Threshold detection methods, Optimal Thresholding, Hough Transforms, and Region based segmentation- Region merging, Region Splitting, and watershed segmentation.

Unit IV	**Object Recognition**	**(07hrs)**	**CO4**

Knowledge representation, Statistical Pattern Recognition-Classification Principles, Nearest neighbors,, classifier setting, Classifier Learning and SVM, Cluster Analysis

Unit V	**Image Understanding**	**(07hrs)**	**CO5**

Image understanding control strategies: Parallel and serial processing control, Hierarchical Control. Bottom up control, Model based control, Combined control, Non Hierarchical control. SIFT scale invariant feature transform , Patten Recognition methods –Classification based segmentation ,Contextual image classification Histogram of Oriented Gradients(HOG),

Text Books

1. Milan Sonka, Vaclav Hlavac, Roger Boyle, "Image Processing, Analysis, and Machine Vision", 4th Edition, Cengage Learning, USA, 2014

2. Forsyth and Ponce, “Computer Vision: A modern Approach” –PHI.
3. R. Szeliski, “Computer vision: algorithms and applications”, ISSN 1868-095X, 2nd Edition, Springer Nature Switzerland AG, 2022

Reference Books

1. R. Davies, “Computer & Machine Vision”, Fourth Edition, Academic Press, 2012.
2. Mark Nixon and Alberto S. Aquado, “Feature Extraction & Image Processing for Computer Vision” Third Edition, Academic Press, 2012.
3. Simon J. D. Prince, “Computer Vision: Models, Learning, and Inference”, Cambridge University Press,2012.
4. Rafael C. Gonzalez, Richard E. Woods, “Digital Image Processing”, 3rd Edition, Pearson, ISBN: 978-81-317-2695-2

Guidelines for Continuous Comprehensive Evaluation of Theory Course

Sr. No.	Components for Continuous Comprehensive Evaluation	Marks Allotted
1	Unit I - Quiz (10 marks and will be converted to 4 marks)	4
2	Unit II - Quiz (10 marks and will be converted to 4 marks)	4
3	Unit III – Quiz (10 marks will be converted to 4 marks)	4
4	Unit IV - Assignment (10 marks will be converted to 4 marks)	4
5	Unit V - Assignment (10 marks will be converted to 4 marks)	4
	Total	**20**

Strength of CO-PO/PSO Mapping

	PO												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	3	2	-	3	-	-	-	-	-	2	2	2	3
CO2	3	3	2	-	3	-	-	-	-	-	2	2	2	3
CO3	3	3	3	2	3	-	-	-	2	2	3	2	2	3
CO4	3	3	2	2	3	-	-	-	-	-	2	2	2	3
CO5	3	3	2	2	3	2	-	2	2	2	2	3	2	3
Average	3	3	2.5	2	3	2	-	2	2	2	2.5	2.5	2	3

Final Year B. Tech. Computer Engineering
Pattern 2023 Semester: VII
2301405B: Information Retrieval

Teaching Scheme:	**Credit Scheme:**	**Examination Scheme:**
Theory: 03 hrs/week	**03**	**Continuous Comprehensive Evaluation: 20 Marks** **InSem Exam: 20 Marks** **EndSem Exam: 60 Marks**

Prerequisite Courses: - 2300211A Probability & Statistics

Course Objectives:

- To build the foundations of information retrieval, and the design, analysis and implementation of IR systems.
- To learn how information retrieval principles are implemented in various digital information environments

Course Outcomes: On completion of the course, students will be able to–

	Course Outcomes	**Bloom's Level**
CO1	Explain the basic concepts of Data Retrieval and Information Retrieval and distinguish between them.	2-Understand
CO2	Apply the concepts of indexing and searching techniques to analyze information retrieval strategies.	3-Apply
CO3	Apply performance evaluation measures along with visualization concepts to assess and improve information retrieval effectiveness.	3-Apply
CO4	Analyze the components and functioning of distributed and multimedia information retrieval systems	4-Analyze
CO5	Evaluate the effectiveness of web search engine architectures and web scraping techniques for data extraction	5-Evaluate

COURSE CONTENTS

Unit I	**Introduction to Information Retrieval**	**(08 hrs)**	**CO1**

Basic Concepts of IR: Data Retrieval & Information Retrieval, Text mining and IR relation, IR system block diagram,
IR Models: Basic concepts, Boolean Model, Vector Model, Probabilistic Model.
Clustering Techniques: Rocchio's Algorithm, Single pass algorithm, Single Link algorithm.

Unit II	**Indexing and Searching Techniques**	**(06 hrs)**	**CO2**

Indexing: Inverted file, Suffix trees & suffix arrays, Signature Files, Scatter storage or hash addressing.
Searching Techniques: Boolean Search, sequential search, Serial search, cluster-based retrieval, Query languages, Types of queries, Patterns matching, structural queries.

Unit III	**Evaluation and Visualization of Information Retrieval System**	**(08 hrs)**	**CO3**

Performance evaluation: Precision and recall, MRR, F-Score, NDCG, user-oriented measures.
Visualization in Information System: Starting points, Query Specification, document context, User relevance judgment, Interface support for search process.

Unit IV	**Distributed and Multimedia IR**	**(08 hrs)**	**CO4**

Distributed IR: Introduction, Collection Partitioning, Source Selection, Query Processing,
Multimedia IR: Introduction, Data Modeling, Query Language, Background-Spatial Access Method, A Generic Multimedia Indexing Approach, One Dimensional Time Series, Two-Dimensional color Images, Automatic Feature Extraction, Trends and Research Issue.

Unit V	Web Searching	(06 hrs)	CO5

Introduction, Challenges, Web Characteristics, **Search Engines:** Centralized Architecture, Distributed Architecture, User Interfaces, Ranking, Crawling the web, Indices, Browsing, Meta-searchers, searching using Hyperlinks, Trends and Research Issues, **Introduction to Web Scraping:** Python for web scraping, Request, HTML parsing, Beautiful Soup.

Text Books

1. Ricardo Baeza-Yates, Berthier Riberio–Neto, Modern Information Retrieval, Pearson Education, ISBN: 81-297-0274-6.
2. C.J. Rijsbergen, Information Retrieval, (www.dcs.gla.ac.uk), Second Edition, ISBN:978-408709293.
3. Ryan Mitchell, Web Scraping with Python, O'reilly, second Edition, ISBN: 9781491985571.
4. Ricci F, Rokach L, Shapira B, Kantor P, Recommender Systems Handbook, Springer, ISBN:978-0-387-85819-7.
5. Norbert Fuhr, MouniaLalmas, Saadia Malik, Gabriella Kazai, Advances in XML Information Retrieval and Evaluation, Springer New York Publisher.

Reference Books

1. ChabaneDjeraba, Multimedia mining: A highway to intelligent multimedia documents, Kulwer Academic Publisher, ISBN: 1-4020-7247-3.
2. V. S. Subrahamanian, Satish K. Tripathi, Multimedia information System, Kulwer Academic Publisher.
3. Christopher D. Manning, Prabhakar Raghavan, and Hinrich Schütze, An Introduction to Information Retrieval, Cambridge University Press, 2008.
4. Marek Kowalkiewicz, Maria E. Orlowska, Tomasz Kaczmarek, Witold Abramowicz, Web Information Extraction and Integration, Springer New York Publisher.
5. David Grossman, Ophir Frieder, Information Retrieval - Algorithms and Heuristics, Springer International Edition, ISBN: 978-1-4020-3004-8.

Guidelines for Continuous Comprehensive Evaluation of Theory Course

Sr. No.	Components for Continuous Comprehensive Evaluation	Marks Allotted
1	Unit I - Assignment (10 marks and will be converted to 4 marks)	4
2	Unit II - Assignment (10 marks will be converted to 4 marks)	4
3	Unit III - Quiz (10 marks will be converted to 4 marks)	4
4	Unit IV - Quiz (10 marks and will be converted to 4 marks)	4
5	Unit V – Quiz (10 marks and will be converted to 4 marks)	4
	Total	**20**

Final Year B. Tech Computer Engineering
Pattern 2023 Semester: VII
2301405C: Business Intelligence and Analytics

Teaching Scheme:	**Credit Scheme:**	**Examination Scheme:**
Theory: 03 hrs/week	**03**	**Continuous Comprehensive Evaluation: 20 Marks** **InSem Exam: 20 Marks** **EndSem Exam: 60 Marks**

Prerequisite Courses: - 2301311: Data Science and Big Data

Course Objectives:

- To introduce the concepts and frameworks of Business Intelligence (BI), Business Analytics, and Decision Support Systems.
- To provide a comprehensive understanding of data warehousing, including architectures, ETL processes, and data integration techniques.
- To develop the ability to model business problems using various analytical and structural modeling techniques within a BI context.
- To equip students with skills to create and interpret business reports, visualizations, and performance management tools like dashboards and balanced scorecards.
- To familiarize students with modern BI tools such as Power BI and Tableau, and explore their applications in various business functions and industries.

Course Outcomes: On completion of the course, students will be able to –

	Course Outcomes	**Bloom's Level**
CO1	Explain the fundamental concepts of business intelligence, business analytics, and decision support systems	2-Understanding
CO2	Compare various data warehousing architectures and their components	2-Understanding
CO3	Design BI models based on real-world data, incorporating relevant patterns and domain knowledge	3-Apply
CO4	Illustrate business reporting concepts, appropriate data visualizations, and implement basic performance measurement techniques	3-Apply
CO5	Compare features, use cases, and performance of Power BI and Tableau in business analytics	4-Analyze

COURSE CONTENTS

Unit I	**An Overview of Business Intelligence, Analytics, and Decision Support**	**(06 hrs)**	**CO1**

Business Intelligence (BI): Definition, framework, components, and process flow,
Business Analytics (BA): Types – Descriptive, Diagnostic, Predictive, Prescriptive,
Decision Support Systems (DSS): Introduction, characteristics, and evolution, Information Systems for Decision Making: Types (TPS, MIS, ESS, DSS), role in decisions, DSS Framework & Components: Gorry-Scott Morton model, classifications, capabilities.

Unit II	**Data Warehousing**	**(08 hrs)**	**CO2**

Data Warehousing Concepts – Definition, characteristics, benefits, and differences from OLTP, Data Warehousing Process Overview – Phases: planning, design, ETL, deployment, maintenance, Data Warehousing Architectures – Single-tier, two-tier, three-tier, OLAP types (ROLAP, MOLAP, HOLAP). Data Integration and ETL – Data extraction, transformation, loading techniques, data quality, Data Warehouse Development – Lifecycle approaches: top-down, bottom-up, hybrid, Implementation Issues – Cost, complexity, data quality, scalability, success factors, Data Warehouse Administration – Metadata

management, performance, backup, recovery, Security & Future Trends

Unit III	Modeling in Business Intelligence	(10 hrs)	CO3

Introduction to Models in BI – Definition, need for models, and their role in decision-making, Model Representation – How models represent real-world problems; abstraction techniques, Model Presentation – Techniques for presenting models (visual, mathematical, textual), Model Building – Steps in model creation, assumptions, and model design methodologies, Model Assessment & Quality – Evaluation metrics, accuracy, reliability, validation of models, Models and Patterns – Use of models to discover trends, relationships, and business patterns, Model Structures – Logical structures, algebraic models, graph models, and analytical models, Models and Data – Data generation, the role of time in modeling, and importance of data quality.

Unit IV	Business Reporting, Visual Analytics, and Business Performance Management	(06 hrs)	CO4

Business Reporting: Definition, purpose, and types of reports, Data and Information Visualization: Importance and objectives of visualization, Charts and Graphs: Common types—bar, line, pie, scatter, heat maps, tree maps, Performance Dashboards: Design, types, and key features of dashboards, Business Performance Management (BPM): Overview and role in organizations, Performance Measurement: KPIs, metrics, and measurement techniques, Balanced Scorecards: Four perspectives and strategic use,
Six Sigma: Concept, methodology, and role as a performance measurement system.

Unit V	Tools and Applications	(06 hrs)	CO5

Introduction to Business Analytics Tools: Overview of Power BI, Excel, and Tableau, Comparison: Power BI vs Excel vs Tableau – features and use cases, Power BI Ecosystem: Key components and their functions, Power BI Architecture and Workflow: Data ingestion, modeling, visualization, and sharing, Tableau Architecture and Workflow: Data connection, visualization, and dashboard creation, Applications of Business Intelligence: ERP, Operations, Inventory, HRM, CRM, Marketing, Logistics, Finance, Banking, Telecommunications, and Salesforce Management.

Text Books

1. Ramesh Sharda, Dursun Delen, EfraimTurban, J.E. Aronson,Ting-Peng Liang, David King, Business Intelligence and Analytics: System for Decision Support, 10th Edition, Pearson Global Edition, 2015
2. Grossmann W, Rinderle-Ma, Fundamental of Business Intelligence, Springer,
3. Thompson Carter, Data Visualization with Tableau and Power BI

Reference Books

1. Edward Mize, Data Analytics: The Ultimate Beginner's Guide to Data Analytics
2. Victor Finch, Data Analytics for Beginners: Your Ultimate Guide to Learn and Master Data Analysis. Get Your Business Intelligence Right – Accelerate Growth and Close More Sales,
3. Introduction to business Intelligence and data warehousing", IBM, PHI
4. Rick Sherman, Elsevier Inc., Business Intelligence Guidebook: From Data Integration to Analytics

Guidelines for Continuous Comprehensive Evaluation of Theory Course		
Sr. No.	**Components for Continuous Comprehensive Evaluation**	**Marks Allotted**
1	Unit I - Quiz (10 marks and will be converted to 4 marks)	4
2	Unit II - Quiz (10 marks will be converted to 4 marks)	4
3	Unit III - Written Test (10 marks will be converted to 4 marks)	4
4	Unit IV - Written Test(10 marks and will be converted to 4 marks)	4
5	Unit V - Presentation (10 marks and will be converted to 4 marks)	4
	Total	**20**

K. K. Wagh Institute of Engineering Education and Research, Nashik
(Autonomous from Academic Year 2022-23)

Final Year B. Tech. Computer Engineering **Pattern 2023 Semester: VII** **2301406A : Operation Research**		
Teaching Scheme:	**Credit Scheme:**	**Examination Scheme:**
Theory: 02 hrs/week	**02**	**InSem Exam: 20 Marks** **EndSem Exam: 30 Marks**

Prerequisite Courses: - 2301212 : Data Structure , 2301201: Discrete Structures

Course Objectives:

- To introduce the basic concepts, scope, and applications of Operations Research in Computer Science,
- To understand the model formulation and applications that is used in solving business decision problems.
- To introduce students to optimization approaches and fundamental solution.
- To apply decision-making strategies under uncertainty

Course Outcomes: On completion of the course, students will be able to–

	Course Outcomes	**Bloom's Level**
CO1	Solve linear programming problems using standard optimization techniques such as the graphical method and the simplex method.	3-Apply
CO2	Apply optimization techniques to transportation and assignment problems by identifying feasible solutions	3-Apply
CO3	Apply network analysis techniques to estimate project duration	3-Apply
CO4	Apply integer programming techniques	3-Apply
CO5	Use decision-making techniques like decision trees and expected value analysis to solve problems under uncertainty.	3-Apply

COURSE CONTENTS

Unit I	**Introduction to Operations Research and Linear Programming**	**(05 hrs)**	**CO1**

Definition, scope, and applications of OR in Computer Science ,Problem formulation and modelling ,Linear Programming Problem (LPP) formulation ,Graphical method for solving LPP,Simplex Method (standard form, iterative approach),Duality and economic interpretation

Unit II	**Transportation and Assignment Problems**	**(05 hrs)**	**CO2**

Introduction to Transportation Problems (TP), Initial basic feasible solutions (NW Corner, VAM),MODI Method for optimal solution, Degeneracy and Unbalanced TP, Hungarian Method for Assignment Problems ,

Unit III	**Network representation and Project Scheduling**	**(04 hrs)**	**CO3**

Network representation of projects, Critical Path Method (CPM), PERT with probabilistic time estimates.

Unit IV	**Goal and Integer Linear Programming**	**(05 hrs)**	**CO4**

Goal Programming formulation, Goal Programming Algorithm – weight method and preemptive method ,Introduction to integer linear programming , illustrative applications-captive budgeting ,set covering problem, integer programming algorithms-Branch and Bound algorithm

Unit V	**Decision Analysis and Game Theory**	**(05 hrs)**	**CO5**

Decision-making under uncertainty-AHP, decision making under risk-Decision Tree based expected value criteria, variations of expected value criteria, decision under uncertainty, Game theory- basic

terminologies, optimal solution of two person zero sum games, solution of mixed strategy games.

Text Books

1. Hamdy A. Taha "Operations Research" Pearson Education, 8th Edition, ISBN: 978 81-317-1104-0
2. Gillett, "Introduction to Operation Research", TMH, ISBN: 0070232458

Reference Books

1. S.D. Sharma, , Kedarnath, Ramnath & Co., "Operations Research" Meerut,2009, ISBN: 978-81-224-2288-7
2. Hrvey M. Wagner, Principles of Operations Research, Second Edition, Prentice Hall of India Ltd., 1980, ISBN: 10: 0137095767 ,13: 9780137095766 ..
3. V.K. Kapoor, Operations Research, S. Chand Publishers, New Delhi, 2004, ISBN: 9788180548543, 8180548546 .
4. R. Paneer Selvam, Operations Research, Second Edition, PHI Learning Pvt. Ltd., New Delhi, 2008, ISBN: 10: 8120329287,: 9788120329287.

Strength of CO-PO/PSO Mapping

	PO												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	3	2		2	-	-	-	-	-	2	2	2	3
CO2	3	3	2		2	-	-	-	-	-	2	2	2	3
CO3	3	3	3	2	2	-	-	-	2	2	3	2	2	3
CO4	3	3	2	2	2	-	-	-	-	-	2	2	2	3
CO5	3	3	2	2	2	2		2	2	2	2	3	2	3
Average	3	3	2.5	2	2	2		2	2	2	2.5	2.5	2	3

K.Wagh Institute of Engineering Education and Research, Nashik
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B. Tech. Final Year Computer Engineering
Pattern 2023 Semester: VII
2301406B : Unix Internals

Teaching Scheme:	Credit Scheme:	Examination Scheme:
Theory: 02 hrs/week	02	InSem Exam: 20 Marks EndSem Exam: 30 Marks

Prerequisite Courses: - 2301202: Operating Systems

Course Objectives:

- To understand the architecture, history, and core components of the UNIX operating system, including its file subsystem and system services.
- To study the structure and operations of the buffer cache in UNIX, including buffer management and disk I/O handling.
- To learn how UNIX represents and manages files internally using inodes and system calls for file operations like read, write, and mount.

Course Outcomes: On completion of the course, students will be able to–

	Course Outcomes	Bloom's Level
CO1	Explain the history, structure, and architecture of the Unix .	2- Understand
CO2	Describe the working of buffer cache in Unix.	2- Understand
CO3	Discuss the internal file representations in Unix.	2- Understand
CO4	Explain the use of system calls for file operations in Unix.	2- Understand
CO5	Explain the Linux operating systems and File systems.	2- Understand

COURSE CONTENTS

Unit I	Unix Kernel – An overview	(04 hrs)	CO1

History, Architecture of UNIX structure, User Perspective, Operating System Services, Assumptions About Hardware, Architecture of the Unix Operating Systems, Overview of File subsystems- Kernel stack representation for Write system call

Unit II	Buffer cache	(05 hrs)	CO2

Buffer Headers, Structure of Buffer Pool, Buffer Retrieval-Reading and Writing Disk locks Advantages and Disadvantages of Buffer Cache.

Unit III	Internal representations of files	(05 hrs)	CO3

File systems algorithms, Inodes, Structure of a regular files, Directories, Conversion of Path Name to Inode, Super Block-Inode Assignment to a New file, Allocation of disk blocks.

Unit IV	Systems calls for the file systems	(05 hrs)	CO4

System Calls for the File System, Open, Read, Write, Lseek, Close, Files Creation, Change Directory and Change Root, STAT and FSTAT, Pipes, Mounting and Unmounting file systems, Link, Unlink.

Unit V	Introduction to Linux Kernel	(05 hrs)	CO5

Introduction, Linux Versus Other Unix-Like Kernels, Characteristics of Linux, Linux Versus Other Unix-Like Kernels, Segmentation and Paging In Linux, Introduction to Ext2 and Ext3 file systems

Text Books

1. Maurice J. Bach, "The Design of the Unix Operating System", Pearson Education, 2002.
2. Daniel P. Bovet & Marco Cesati, "Understanding the Linux Kernel", O'REILLY, Shroff Publishers & Distributors Pvt. Ltd, 2006

Reference Books
1. Uresh Vahalia, "UNIX Internals: The New Frontiers", Prentice Hall, 2000. John Lion, "Lion's Commentary on UNIX", 6th edition, Peer-to-Peer Communications, 2004. 2. M. Beck et al, “Linux Kernel Programming”, Pearson Education Asia, 2002

Final Year. B. Tech. Computer Engineering
Pattern 2023 Semester: VII
2301406C : Compiler Design

Teaching Scheme:	**Credit Scheme:**	**Examination Scheme:**
Theory: 02 hrs/week	**02**	**InSem Exam: 20 Marks** **EndSem Exam: 30 Marks**

Prerequisite Courses: - 2301312: Theory of Computation

Course Objectives:

- To introduce the phases and structure of a compiler and the role of lexical analysis.
- To understand syntax analysis, parsing techniques, and error handling in context-free grammars.
- To learn intermediate code generation using syntax-directed definitions and three-address code.
- To study run-time environments, storage management, and basic code generation techniques and to explore code optimization methods, including peephole optimization and data flow analysis.

Course Outcomes: On completion of the course, students will be able to–

	Course Outcomes	**Bloom's Level**
CO1	Explain functions of various phases of the compiler	2- Understand
CO2	Construct parsing table for a given grammar	3- Apply
CO3	Identify appropriate translations to generate intermediate code for the programming language construct	3- Apply
CO4	Apply stack and heap allocation techniques to manage storage and generate simple target code.	3- Apply
CO5	Make use of code optimization methods to enhance the performance and efficiency of code execution	3- Apply

COURSE CONTENTS

Unit I	**Introduction to Compilers**	**(04 hrs)**	**CO1**

Structure of a compiler: Lexical Analysis, Role of Lexical Analyzer, Input Buffering, Specification of Tokens, Recognition of Tokens, Lex, Finite Automata, Regular Expressions to Automata, Minimizing DFA.

Unit II	**Syntax Analysis**	**(06 hrs)**	**CO2**

Role of Parser, Grammars, Error Handling, Context-free grammars, Writing a grammar, Top-Down Parsing, General Strategies Recursive Descent Parser, Predictive Parser-LL(1) Parser-Shift Reduce Parser-LR Parser- LR (0) Item Construction of SLR Parsing Table -Introduction to LALR Parser, Error Handling and Recovery in Syntax Analyzer-YACC.

Unit III	**Intermediate Code Generation**	**(05 hrs)**	**CO3**

Syntax Directed Definitions, Evaluation Orders for Syntax Directed Definitions, Intermediate Languages: Syntax Tree, Three Address Code, Types and Declarations, Translation of Expressions, Type Checking.

Unit IV	**Run-Time Environment and Code Generation**	**(04 hrs)**	**CO4**

Storage Organization, Stack Allocation Space, Access to Non-local Data on the Stack, Heap Management – Issues in Code Generation – Design of a simple Code Generator.

Unit V	**Code Optimization**	**(05 hrs)**	**CO5**

Principal Sources of Optimization: Peep-hole optimization, DAG- Optimization of Basic Blocks-Global Data Flow Analysis, Efficient Data Flow Algorithm.

Text Books
1. A.V. Aho, Monica, R.Sethi, J.D.Ullman, “Compilers, Principles, Techniques and Tools”, Second Edition, Pearson Education/Addison Wesley, 2009. 2. Dick Grune, Bal, Jacobs, Langendoen, “ Modern Compiler Design”, Wiley, ISBN 81-265-0418-8
Reference Books
1. Compiler Construction-Principles and Practice, Kenneth C Louden, Cengage Learning. 2. Lex & yacc – John R. Levine, Tony Mason, Doug Brown, O’reilly

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Final Year B. Tech. Computer Engineering
Pattern 2023 Semester: VII
2301407: Research Methodology

Teaching Scheme:	**Credit Scheme:**	**Examination Scheme:**
Theory: 03 hrs/week	**03**	**Continuous Comprehensive Evaluation: 20 Marks** **InSem Exam: 20 Marks** **EndSem Exam: 60 Marks**

Prerequisite Courses: - 2301213: Software Engineering

Course Objectives:

- Understand the fundamental principles, process, and ethics of research.
- Develop the ability to identify research problems and formulate hypotheses.
- Learn various research designs and appropriate sampling techniques.
- Apply statistical tools and techniques for data collection and analysis.
- Acquire skills for interpreting results and writing effective research reports

Course Outcomes: On completion of the course, students will be able to–

	Course Outcomes	**Bloom's Level**
CO1	Explain the fundamental concepts, ethics, and paradigms of scientific research and intellectual property.	2 - Understand
CO2	Analyze existing literature to identify research gaps and construct a well-defined research hypothesis.	3 - Apply
CO3	Design an appropriate research strategy using sampling methods and measurement techniques for a given problem.	4 - Analyze
CO4	Apply statistical tools to process, summarize, and interpret primary and secondary data effectively.	3 - Apply
CO5	Prepare a structured research report and evaluate the significance of results using suitable statistical methods.	5 - Evaluate

COURSE CONTENTS

Unit I	**Understand the research process**	**(06 hrs)**	**CO1**

Evolution of research methodology: Meaning, nature, scope, and significance of research
Research paradigm: Objectives of research, Motivation for research, Postulates underlying scientific investigations, Types of research, Research process and workflow: Principles of ethics, ethical considerations in research, Intellectual Property Rights (IPR)

Unit II	**Problem identification and hypothesis formulation**	**(06 hrs)**	**CO2**

Selecting an area for research; Problem identification; Literature search; Understanding reported research; Fitting the pieces; Ascertaining current state of knowledge; Sources of information; Recording literature search findings; Defining the problem; Hypothesis formulation

Unit III	**Research design**	**(08 hrs)**	**CO3**

Type of research designs, pitfalls and advantages; Research approaches; Principles of experimental design; Design of experiments; Characteristics of good research design; Universe, population, and sample; Sampling concepts, principles, and techniques; Sample design (random, pseudo random, cluster, stratified, multi-stage); Sampling considerations (size, design, selection, measurements); Measures, Measurements, Metrics, and Indicators; Measurement scales and direct measurements

Unit IV	Data processing and Data analysis	(08 hrs)	CO4
Data collection techniques (observation, interviewing, questionnaires, web-based, group techniques, experimentation, surveys); Sources of errors; Primary and secondary data; coding and summarization of data, quantification of qualitative data (content analysis); Computation of indirect metrics; Role of descriptive statistics; Measures of central tendency, dispersion, skewness, kurtosis; plots and correlations; Inferential statistics, hypothesis testing, Type I and Type II errors, Power of tests;			
Unit V	**Methods, tools, and techniques & Reporting research**	**(08 hrs)**	**CO5**
Reliability and validity; Probability theory and theoretical distributions; Parametric statistics, Simple linear models (ANOVA, correlation and Regression, ANACOVA), Multivariate analysis, Stepwise regression; Nonparametric statistics, Sign test, Paired ranking test, Pearson Correlation, Mann-Whitney U Test, Chi-square test, Dissemination of research findings; Reporting and interpretation of results; cautions in interpretations, Type of reports, Typical report outlines, use of diagrams, tables, and charts;			

Text Books

1. Kothari C.R., Research Methodology (2nd Ed.), New Age International, (2004); ISBN(13): 978-81-224-1522-3
2. Kumar, Ranjit, Research Methodology (3rd Ed); Sage Publications, 2011; IBSN: 978-1- 8492-0301-2

Reference Books

1. Berkman, Elliot T., A Conceptual Guide to Statistics Using SPSS, Sage Publications, 2011; ISBN: 978-1-4129-7406-6.

E resources

'History of the Scientific Methods' by Martin Shuttleworth, https://explorable.com/history-of-the-scientific-method.

Useful websites / Video

1. Lecture series on Research Methodology https://youtu.be/GSeeyJVD0JU
2. Formulating and clarifying the research topic https://youtu.be/wBA4U4wjWkA

Guidelines for Continuous Comprehensive Evaluation of Theory Course		
Sr. No.	**Components for Continuous Comprehensive Evaluation**	**Marks Allotted**
1	Unit I - Assignment (10 marks and will be converted to 4 marks)	4
2	Unit II - Assignment (10 marks will be converted to 4 marks)	4
3	Unit III - Quiz (10 marks will be converted to 4 marks)	4
4	Unit IV - Quiz (10 marks and will be converted to 4 marks)	4
5	Unit V - Quiz (10 marks and will be converted to 4 marks)	4
	Total	**20**

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Final Year B. Tech. Computer Engineering
Pattern 2023 Semester: VII
2301408: Banking, Financial Services and Insurance

Teaching Scheme:	Credit Scheme:	Examination Scheme:
Theory: 02 hrs/week	02	Continuous Comprehensive Evaluation: 50 Marks

Prerequisite Courses: -

Course Objectives:

- To understand how the Indian financial and banking systems work.
- To learn the basics of investing and where to invest through banks.
- To know about different types of insurance and safe government investment options
- To learn how to check a person's financial status and credit score.

Course Outcomes: On completion of the course, students will be able to –

	Course Outcomes	Bloom's Level
CO1	Explain how the Indian financial and banking systems work, including digital banking.	2-Understand
CO2	Explain good investment options based on basic investment ideas.	2-Understand
CO3	Describe different types of insurance and saving schemes.	2-Understand
CO4	Check and understand a person's financial condition using credit rating.	4- Analyze
CO5	Demonstrate basic communication, networking, and selling skills needed for a career in the BFSI sector.	3-Apply

COURSE CONTENTS

Unit I	Indian Financial and Banking Systems	(05 hrs)	CO1

Indian Financial Systems, Types of Banks, Bank Operations, Bank Accounts: Types, Opening a Bank Account, Bank Account Operations, KYC, Banking Instruments, Digital Methods of Banking, Payment Wallets

Unit II	Taxation and Investment Basics	(05 hrs)	CO2

Taxes, Tax Planning, General Principles of Investing, Interest Rates, Banking Products, Banking Products: Retail, Banking Products: Loans, Working with Loans, Loan: Process Flow 1, Legal Check, Default of Loans

Unit III	Financial Evaluation and Insurance	(05hrs)	CO3

Financial Analysis of an Individual, Credit Information Companies, Credit Rating, Credit Cards, Insurance, Insurance Instruments, General Insurance, Life Insurance, Home Insurance and Motor Insurance

Unit IV	Securities, Mutual Funds, and Investment Opportunities	(04 hrs)	CO4

Stocks, Share Market, Risk, Mutual Funds, Equity Mutual Funds, Debt Securities, Investing in Mutual Funds, Systematic Investment Planning, Investment Opportunities: Post Office Schemes, Investment Opportunities: Government Bonds, Investment Opportunities: Others, Microfinance, Commercial Microfinance

Unit V	Sales, Customer Service, and Careers in BFSI	(05 hrs)	CO5
Modern Marketing, Prospecting Customers & Networking, Non-Verbal Communication and Body Language, Communication Skills: Listening, Communication Skills, Questioning and Data Gathering,Education & Financial Analysis as First Step of Sales Process, Sale of Financial Products, Customer Service in Banking, Customer Grievances, Career in Banking, Applying for Various Bank Positions, Zero Tolerance Policies			

Text Books

- Bank Management & Financial Services – *Peter S. Rose, Sylvia C. Hudgins*, McGraw-Hill Education, ISBN: 978-0078034671 (9th Edition)
- Principles of Corporate Finance – *Richard A. Brealey, Stewart C. Myers, Franklin Allen, Alex Edmans*, McGraw-Hill Education, ISBN: 978-1265074159 (14th Edition, 2022)

Reference Books

- Fundamentals of Risk Management: Understanding, Evaluating and Implementing Effective Risk Management – *Paul Hopkin*, Kogan Page, ISBN: 978-0749479619 (4th Edition, 2017)
- Financial Markets and Institutions – *Frederic S. Mishkin, Stanley G. Eakins*, Pearson Education, ISBN: 978-1292215006 (9th Edition)

Strength of CO-PO PSO Mapping

	PO												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	3	-	-	3	-	-	-	-	-	-	-	-	-
CO2	3	-	3	3	-	-	-	-	-	-	-	-	-	-
CO3	3	-	-	3	-	-	-	-	-	-	-	-	-	-
CO4	-	-	-	-	-	3	-	-	-	-	-	-	-	-
CO5	-	-	-	-	-		-	3	3	3	-	-	-	-
Average	3	3	3	3	3	3	-	3	3	3	-	-	-	-

Guidelines for Continuous Comprehensive Evaluation of Theory Course

Sr. No.	Components for Continuous Comprehensive Evaluation	Marks Allotted
1	The marks obtained in the End Exam and CCE Exam conducted by MKCL will be considered as the CCE marks for this course.	50
	Total	**50**

Final Year B. Tech. Computer Engineering
Pattern 2023 Semester: VII
2301409 : Project Work

Teaching Scheme:	Credit Scheme:	Examination Scheme:
Practical: 08 hrs/week	04	Term Work: 100 Marks Oral Exam : 50 Marks

Course Objectives:

- To enable students to apply engineering principles and select appropriate technologies for developing innovative project solutions.
- To promote hands-on learning through system design, implementation, and testing in real-world project environments.
- To develop teamwork, problem-solving, and communication skills essential for successful project completion and technical presentation.

Course Outcomes: On completion of the course, students will be able to–

	Course Outcomes	Bloom's Level
CO1	Select suitable technologies and tools for project implementation.	3 – Apply
CO2	Design and implement the system using appropriate UML diagrams.	3 – Apply
CO3	Perform testing and validation of the implemented system.	4 – Analyze
CO4	Analyze performance with existing systems and present results using data tables and comparative study.	4 – Analyze

Guidelines for Project Phase–II

In continuation with the work carried out during Phase I (Research Seminar), students are expected to implement the proposed solution and evaluate its performance. The focus should be on system development, testing, result analysis, and conclusion.

Technology & Tools: Finalize suitable technologies/tools in consultation with the guide and justify the selection.

Environment Setup: Install and configure all tools/libraries. Maintain documentation of versions used.

System Design (UML): Prepare relevant UML diagrams (Use Case, Class, Sequence, etc.) aligned with the actual system.

Implementation & Testing: Complete development and perform Unit, Integration, and System Testing. Maintain a test case report.

Result Generation: Collect measurable outputs (accuracy, speed, etc.). Present data in tables and graphs.

Performance Discussion: Compare with existing systems. Analyze and represent improvements using charts and data tables.

Validation & Conclusion: Validate using datasets or applications. Summarize key findings, limitations, and future scope.

Guidelines for Final Report Submission

General Instructions

- Report should follow standard formatting prescribed by the institute.
- Each group member must submit **hard copies** of the report.
- Report must be **duly signed** by the guide, HoD, Principal.

Report Structure

- Title Page, Certificate (Guide and HoD),Acknowledgement Abstract, Table of Contents, List of Figures & Tables

Chapters

1. Introduction
2. Literature Survey
3. System Design (UML Diagrams)
4. Implementation Details
5. Testing & Results

6. Performance Analysis & Discussion
7. Conclusion and Future Scope

- **References**

Follow **IEEE format** for citations.

- **Appendices**

Include code snapshots, test logs, installation steps, user manuals, etc.

- **Tools Recommended**
  - *Report Writing*: LaTeX, MS Word
  - *Reference Management*: Mendeley, Zotero
  - *Plagiarism Detection*: PaperRater, DupliChecker, Viper

Evaluation and Continuous Assessment

The project evaluation is conducted through continuous reviews and assessments as per IQAC guidelines, ensuring steady progress and maintaining quality.

Term Work (100 Marks):

Assessment includes continuous project reviews (Project Review I and II), documentation (project report, user manual, installation guide, product specifications), plagiarism report, and any publication, participation, patent, or copyright related to the project.

Oral Examination (50 Marks):

Assessment based on project presentation, defense, and understanding of the work.

Text Books

1. **Sharon J. Gerson, Steven M. Gerson**, *Technical Writing: Process and Product*, Pearson Education, 4th Edition.
2. **Andrea J. Rutherford**, *Basic Communication Skills for Technology*, Pearson Education, 2nd Edition.
3. **Lesikar**, *Basic Business Communication*, Tata McGraw-Hill, 1st Edition.

Reference Books

1. **Ian Sommerville**, *Software Engineering*, Pearson Education, 10th Edition.
2. **Roger S. Pressman**, *Software Engineering: A Practitioner's Approach*, McGraw-Hill.

Strength of CO-PO / PSO Mapping

	PO												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO2	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO4	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO5	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Average	3	3	3	3	3	3	3	3	3	3	3	3	3	3

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(Autonomous from Academic Year 2022-23)

Final Year B. Tech. Computer Engineering
Pattern 2023 Semester: VIII
23014010: Software Architecture and Design Patterns

Teaching Scheme:	Credit Scheme:	Examination Scheme:
Theory: 03 hrs/week	03	Continuous Comprehensive Evaluation: 40 Marks EndSem Exam: 60 Marks

Prerequisite Courses: - 2301213: Software Engineering

Course Objectives:

- Introduce principles and techniques of software architecture and its role in software development.
- Enable students to identify and apply design patterns for robust and reusable software design.
- Explore architectural styles, quality attributes, and design principles.
- Develop analytical skills to evaluate software architectures.
- Apply suitable patterns and architecture in real-world projects.

Course Outcomes: On completion of the course, students will be able to–

	Course Outcomes	Bloom's Level
CO1	Explain the fundamental concepts and quality attributes of software architecture	2 – Understand
CO2	Identify appropriate architectural styles for given software requirements	3 - Apply
CO3	Apply design principles and software design patterns to develop reusable solutions	3 - Apply
CO4	Analyze and evaluate architectural designs for performance, scalability, and maintainability	4 - Analyze
CO5	Design and document a software system using suitable architecture and design patterns	5 - Evaluate

COURSE CONTENTS

Unit I	Introduction to Software Architecture	(06 hrs)	CO1

Definition and importance, Role of software architecture in software engineering, Architecture vs Design, Architectural structures and views, Architectural drivers (functional and non-functional requirements), Quality attributes: Performance, Modifiability, Security, Usability

Unit II	Architectural Styles and Patterns	(08 hrs)	CO2

Layered, Client-Server, Pipe-and-Filter, Microservices, Event-driven, Service-Oriented, Model-View-Controller (MVC), Broker, Blackboard, Shared Repository, Selection and trade-offs between styles

Unit III	Design Principles and Patterns	(08 hrs)	CO3

SOLID Principles, Creational Patterns: Singleton, Factory, Abstract Factory, Builder, Prototype
Structural Patterns: Adapter, Composite, Proxy, Decorator, Bridge, Façade
Behavioral Patterns: Strategy, Observer, Command, State, Template Method, Iterator

Unit IV	Architectural Documentation and Evaluation	(06 hrs)	CO4

Views and beyond approach (4+1 view model), Architecture Description Languages (ADLs), Documenting interfaces and components, ATAM (Architecture Trade-off Analysis Method), CBAM,

Case studies of well-known architectures

Unit V	Applying Patterns in System Design	(08 hrs)	CO5

Pattern-oriented software architecture, Integrating multiple patterns, Refactoring to patterns, Anti-patterns in software architecture, Applying architecture and design patterns in real-world applications (Web, Cloud, IoT)

Text Books

1. Bass, Len, Clements, Paul, and Kazman, Rick, *Software Architecture in Practice*, 3rd Edition, Addison-Wesley, 2012
2. Eric Gamma et al., *Design Patterns: Elements of Reusable Object-Oriented Software*, Pearson Education, 1994

Reference Books

1. Martin Fowler, *Patterns of Enterprise Application Architecture*, Addison-Wesley
2. Frank Buschmann et al., *Pattern-Oriented Software Architecture*, Wiley
3. Mary Shaw and David Garlan, *Software Architecture: Perspectives on an Emerging Discipline*, Prentice Hall

Strength of CO-PO PSO Mapping

COs	PO												PSO	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	2	-	-	-	-	-	-	-	-	-	2	-	-
CO2	2	3	2	2	-	-	-	-	-	-	-	2	-	-
CO3	3	3	3	-	2	-	-	-	-	-	-	2	3	3
CO4	3	3	2	3	3	-	-	-	-	-	-	3	3	3
CO5	3	2	3	2	2	-	-	-	-	-	-	3	3	3
Average	2.8	2.6	2.5	2.33	2.33	-	-	-	-	-	-	2.4	3	3

K.K.Wagh Institute of Engineering Education and Research, Nashik
(Autonomous from Academic Year 2022-23)

Final Year B. Tech. Computer Engineering
Pattern 2023 Semester: VIII
2301411A: Blockchain

Teaching Scheme:	**Credit Scheme:**	**Examination Scheme:**
Theory: 03 hrs/week	**03**	**Continuous Comprehensive Evaluation: 40 Marks** **EndSem Exam: 60 Marks**

Prerequisite Courses: -

Course Objectives:
- To understand working of blockchain systems
- To securely interact with bitcoin and Ethereum
- To understand design, build, and deploy smart contracts and distributed applications.
- To integrate ideas from blockchain technology into real world applications

Course Outcomes: On completion of the course, students will be able to–

	Course Outcomes	**Bloom's Level**
CO1	Describe the basic concept of Distributed Systems and Cryptography	2-Understand
CO2	Explain design principles of Bitcoin	2-Understand
CO3	Demonstrate the ability to deploy simple smart contracts using Solidity on the Ethereum blockchain	3-Apply
CO4	Compare the working of different blockchain platforms	3-Apply
CO5	Illustrate the real-world applications of blockchain technology across diverse domains	2-Understand

COURSE CONTENTS

Unit I	**Distributed Systems and Cryptography**	**(07 hrs)**	**CO1**

Distributed Systems: Client-Server vs Peer-to-peer, CAP Theorem, Two Generals Problem & Byzantine Generals problem, Distributed Consensus, FLP Theorem, CFT vs BFT, Turing Complete Programming, Turing Halting Problem
Cryptography: Symmetric and Asymmetric key cryptography, Hash function, Asymmetric Encryption with ECC, Digital Signature – DSA

Unit II	**Bitcoin Blockchain**	**(07 hrs)**	**CO2**

Bitcoin Blockchain: History and Problems of Digital Currencies, The Bitcoin Network, Transactions and UTXO Model, Merkle Trees, Proof of Work, Rewards and Fees, Construction of Bitcoin Blockchain, Soft Forks and Hard Forks, Bitcoin vs General Blockchain, Altcoins, General Properties of Blockchain, Problems with Bitcoin

Unit III	**Ethereum Blockchain**	**(08 hrs)**	**CO3**

Ethereum Blockchain: History and Need of Ethereum, Ethereum Clients, Addresses and Wallets, Smart Contracts Concept, Smart Contract Examples, Transaction Structure, Ethereum Virtual Machine, Gas Calculations and Ether, Tokens, Oracles, Decentralized Applications (DApps) , Proof of Work vs Proof of Stake vs Proof of Authority, Solidity Programming

Unit IV	**Blockchain Types and Platforms**	**(07 hrs)**	**CO4**

Blockchain Types and Platforms: Public vs Private Blockchains, Properties of Blockchains, Limitations of Blockchains, Layers of Blockchain: Application Layer, Execution Layer, Semantic Layer, Propagation Layer, Consensus Layer
Comparison of Major Blockchain Platforms – Hyperledger Project , IOTA, Quorum, Corda

Unit V	Real World Applications of Blockchain	(07 hrs)	CO5

Study following Real World Applications of Blockchain:
1. Cryptocurrency and International Payments
2. Centralized vs Decentralized Exchanges
3. Supply Chain Traceability/Transparency
4. E-governance
5. Voting
6. Insurance
7. Healthcare
8. Land Records
9. Social Media

Text Books

1. Antonopoulos, “Mastering Bitcoin: Unlocking Digital Cryptocurrencies”, O’Reilly Publications First Edition 2014, ISBN -9781449374044
2. Antonopoulos, “Mastering Ethereum” O’Reilly Publications First Edition 2018, ISBN-9781491971949
3. Imran Bashir, “Mastering Blockchain: Distributed Ledger Technology, Decentralization and Smart Contracts Explained”, Second Edition, Packt Publishing, 2018

Reference Books

1. Bikramaditya Singhal, Gautam Dhameja, Priyansu Sekhar Panda, "Beginning Blockchain A Beginner’s Guide to Building Blockchain Solutions",2018
2. Chris Dannen, "Introducing Ethereum and Solidity", Foundations of Crypto currency and Blockchain Programming for Beginners
3. Daniel Drescher, "Blockchain Basics", A Non -Technical Introduction in 25Steps.
4. Ritesh Modi, “Solidity Programming Essentials”, Packt Publishing,2018
5. Chandramouli Subramanian, Asha A George, Abhilash K A and Meena Karthikeyan, “Blockchain Technology”, Universities Press, ISBN-9789389211634

Guidelines for Continuous Comprehensive Evaluation of Theory Course

Sr. No.	Components for Continuous Comprehensive Evaluation	Marks Allotted
1	Unit I - Quiz (10 marks and will be converted to 5 marks)	5
2	Unit II - Quiz (10 marks will be converted to 5 marks)	5
3	Unit III - Assignment (10 marks)	10
4	Unit IV - Assignment (10 marks)	10
5	Unit V - Assignment (10 marks)	10
	Total	**40**

Final Year B. Tech Computer Engineering
Pattern 2023 Semester: VIII
2301411B: Bioinformatics

Teaching Scheme:	Credit Scheme:	Examination Scheme:
Theory: 3 hrs/week	03	Continuous Comprehensive Evaluation: 40 Marks EndSem Exam: 60 Marks

Course Objectives:

- To introduce students to the field of Bioinformatics and its relevance to computing.
- To develop skills in applying algorithmic techniques to biological data.
- To familiarize students with biological sequence analysis and genome assembly problems.
- To understand probabilistic models such as HMMs for biological inference.
  To explore phylogenetic analysis and RNA structure modeling using computational methods.

Course Outcomes: On completion of the course, students will be able to–

	Course Outcomes	Bloom's Level
CO1	**Understand** basic concepts of bioinformatics, biological databases, and their application	2-Understand
CO2	**Understand** principles and tools for pairwise and multiple sequence alignment	2-Understand
CO3	**Understand** protein structure prediction methods and functional domain analysis using bioinformatics tools and databases	2-Understand
CO4	**Apply** computational methods for gene and promoter prediction	3-Apply
CO5	**Apply** phylogenetic tree construction and analysis techniques in molecular evolution	3-Apply

COURSE CONTENTS

Unit I	Introduction to Bioinformatics and Biological Databases	(06 hrs)	CO1

Definition and scope of bioinformatics, distinction between bioinformatics and computational biology, historical milestones, applications, limitations.
Types of biological databases (sequence, structure, expression, pathways), flat file vs. relational databases. Major sequence databases: GenBank, EMBL, DDBJ. Protein databases: UniProt, Swiss-Prot, TrEMBL, PDB. Data formats and information retrieval tools: Entrez, SRS, BLAST UI.

Unit II	Sequence Alignment Techniques	(08 hrs)	CO2

Pairwise sequence alignment: global (Needleman-Wunsch) and local (Smith-Waterman) alignment. Concepts of homology, similarity, identity. Scoring systems: substitution matrices (PAM, BLOSUM), gap penalties. Heuristic alignment tools: BLAST and FASTA. Multiple sequence alignment (MSA): progressive alignment, ClustalW, Statistical significance and e-values.

Unit III	Protein Structure & Function Prediction	(08hrs)	CO3

Overview of protein structure: primary, secondary, tertiary, and quaternary levels. Introduction to protein structure representation and visualization using **PDB format**. Protein structure classification systems: **SCOP**, **CATH**. Secondary structure prediction methods and tools. Concept of **homology modeling** and protein threading. Use of databases such as **InterPro**, **Pfam**, and **Prosite** for motif detection..

Unit IV	**Gene and Promoter Prediction**	**(06hrs)**	**CO4**

Overview of gene prediction challenges in prokaryotes and eukaryotes, Approaches to gene finding: signal, content, and similarity-based, Tools for gene prediction: Glimmer, GENSCAN, Promoter prediction and regulatory element analysis, Applications in genome annotation and feature mapping.

Unit V	**Molecular Phylogenetics and Evolutionary Analysis**	**(08hrs)**	**CO5**

Basics of molecular phylogenetics, importance in evolutionary biology, Phylogenetic tree terminology: rooted vs. unrooted, cladograms vs. phylograms, Tree construction algorithms: UPGMA, Neighbor-Joining, Parsimony, Maximum Likelihood, Tree evaluation techniques: bootstrapping, branch support, Software tools: MEGA, PHYLIP, Clustal Omega, Applications in species classification and comparative genomics.

Text Books

1. Jin Xiong, *Essential Bioinformatics*, Cambridge University Press, 2006
2. Phillip Compeau & Pavel Pevzner, *Bioinformatics Algorithms: An Active Learning Approach*, 2nd ed., Active Learning Publishers, 2015

Reference Books

1. Neil C. Jones & Pavel A. Pevzner, *An Introduction to Bioinformatics Algorithms*, MIT Press, 2004
2. Andreas D. Baxevanis & B. F. Francis Ouellette, *Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins*, Wiley-Interscience, 2004

Strength of CO-PO PSO Mapping

	PO												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	2	2	2	2	-	-	-	2	3	-	-	3	2
CO2	3	3	2	3	3	-	-	-	2	3	-	-	3	3
CO3	3	3	3	3	3	-	-	-	2	3	-	-	3	3
CO4	3	3	2	3	3	-	-	-	2	3	-	-	3	3
CO5	3	3	2	3	2	-	-	-	2	3	-	-	3	3
Average	3	2.8	2.2	2.8	2.6	-	-	-	2	3	-	-	3	2.8

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Final Year B. Tech Computer Engineering
Pattern 2023 Semester: VIII
2301411C: Digital Forensic

Teaching Scheme:	Credit Scheme:	Examination Scheme:
Theory: 03 hrs/week	03	Continuous Comprehensive Evaluation: 40 Marks EndSem Exam: 60 Marks

Course Objectives:

- To understand the fundamental concepts of digital forensics, cybercrime, forensic investigation processes
- To explore digital evidence collection methods
- To understand forensic techniques for data acquisition, recovery, and analysis of digital evidence.
- To identify cyber threats such as password attacks, web and wireless vulnerabilities, and log analysis using appropriate forensic tools.
- To develop expertise in specialized forensic domains, including mobile forensics, email forensics, forensic reporting, and legal compliance in digital investigations.

Course Outcomes: On completion of the course, students will be able to–

	Course Outcomes	Bloom's Level
CO1	Understand the fundamental concepts of digital forensics	2-Understand
CO2	Identify digital evidence collection, first responder procedures, and forensic investigation techniques	2-Understand
CO3	Explain system and network forensic techniques to acquire, analyze, and recover digital evidence	2-Understand
CO4	Describe forensic methodologies to investigate cyber threats	2-Understand
CO5	Illustrate forensic techniques to mobile device investigations, email forensics	2-Understand

COURSE CONTENTS

Unit I	Introduction to Digital Forensics	(06 hrs)	CO1

Definition of Computer Forensics, Cyber Crime and Evolution of Computer Forensics, Objectives of Computer Forensics, Roles of a Forensics Investigator, Foundations of digital Forensics, Language of Computer Crime Investigation, Digital Evidence of Courtroom, Cybercrime Law: United State Perspective, Indian Perspective, Indian IT Act, conductive Digital Investigation, Handling a Digital Crime Scene: Principles, Preservation, Modus Operandi, Motive, and Technology.

Unit II	Digital Evidence and Investigation Process	(08 hrs)	CO2

Digital Forensics Investigation Process: Assessment Phase, Data Acquisition, Data Analysis, Reporting, Digital Evidence and Investigation Process, First Responder Toolkit and Challenges in Digital Forensics. Types of Investigations and Techniques in Digital Forensics, Violent Crime and Digital Evidence, Digital Evidence as Alibi, Gender Offenders on the Internet, Computer Intrusions

Unit III	System and Network Forensics	(08hrs)	CO3
Understanding Storage Media and File Systems, Boot Processes (Linux, Mac OS, Windows 10), Types of File Systems., Windows Forensics. Volatile and Non-Volatile Information, Deleted File Recovery. Static & Live Data Acquisition (FTK Imager, RAM Dump Analysis). Recovering Deleted Files and Partitions (Autopsy, EnCase, FTK Imager), Network Forensics, OSI Layers and Network Components in Forensics. Packet Sniffing & Analysis using Wireshark, TCPDump, Ettercap Website Penetration: WHOIS, nslookup.			
Unit IV	**Cyber Threats and Attack Investigations**	**(06hrs)**	**CO4**
Log and Event Analysis (Autopsy, Hashdeep, Bulk Extractor, Foremost) Application Password Cracking (John the Ripper, Rainbow Tables, PDF File Analysis) Wireless and Web Attacks. WiFi Packet Capture & Cracking (Aircrack-ng),SQL Injection, Website Copier (HTTRACK), Netcraft, Nikto, Image Metadata Extraction (Imago), Wayback Machine			
Unit V	**Specialized Forensics**	**(08hrs)**	**CO5**
Email Forensics Investigation, Mobile Device Forensics and Investigation Preparation, Cloud Forensics & Virtual Environments**,** Investigative Reports & Expert Witness, Cyber Regulations and Compliance, Demonstration of Forensic Tools.			

Text Books

1. B. Nelson, A. Phillips, and C. Steuart, Guide to Computer Forensics and Investigations,5th ed. Cengage Learning, 2018.
2. D. K. Mishra and A. Gupta, Cyber Crime and Digital Forensics, 1st ed. Wiley, 2021.

Reference Books

1. C. P. Pfleeger, S. L. Pfleeger, and J. Margulies, Security in Computing, 5th ed. Pearson, 2015.
2. R. McKemmish, Computer Forensics: An Essential Guide for Accountants, Lawyers, and Managers, 1st ed. Australian Government - Australian High Tech Crime Centre, 2008.

Guidelines for Continuous Comprehensive Evaluation of Theory Course

Sr. No.	Components for Continuous Comprehensive Evaluation	Marks Allotted
1	Unit I - Quiz (10 marks and will be converted to 4 marks)	4
2	Unit II - Assignment (10 marks will be converted to 4 marks)	4
3	Unit III - Assignment (10 marks will be converted to 4 marks)	4
4	Unit IV - Quiz (10 marks and will be converted to 4 marks)	4
5	Unit V - Quiz (10 marks and will be converted to 4 marks)	4
	Total	**20**

Final Year B. Tech. Computer Engineering
Pattern 2023 Semester: VIII
2301412: Startup and Entrepreneurship

Teaching Scheme:	**Credit Scheme:**	**Examination Scheme:**
Theory: 02 hrs/week	**02**	**Continuous Comprehensive Evaluation: 50 Marks**

Prerequisite Courses: -

Course Objectives:

- To understand the architecture of a neural network
- To study regularization techniques, batch normalization, and hyperparameter tuning.

Course Outcomes: On completion of the course, students will be able to–

	Course Outcomes	**Bloom's Level**
CO1	Survey the Government support programs for promoting entrepreneurship encompassing various features aimed at fostering entrepreneurial growth and innovation	2-Understand
CO2	Interpret the diverse strategies for personal and business growth essential to foster success and advancement as an entrepreneur	3-Apply
CO3	Build the systematic and comprehensive approach to articulate a clear and inspiring company's vision statement	3-Apply
CO4	Develop project management skills to efficiently plan and execute projects	3-Apply
CO5	Predict and cater to own learning needs relating to the assigned task/work by accessing appropriate learning resources	4-Analyze

COURSE CONTENTS

Unit I	**Government Programmes for Entrepreneurship**	**(06 hrs)**	**CO1**

What is Skill India initiative? Micro Enterprises, MUDRA, Atal Innovation Mission (AIM), Start Up India Initiative, startup India Seed Fund Scheme, Aspire - Small Business Ideas for Rural Areas in India, Dairy Entrepreneurship Development Scheme (DEDS), Venture Capital Assistance Scheme, The Software Technology Park (STP) scheme
Micro, Small and Medium Enterprises Development, What Is Credit Guarantee? Showcasing

Unit II	**Strategies for growth**	**(05 hrs)**	**CO2**

The 4 Types of Entrepreneurships, Success Strategies for Entrepreneurs, Strategies for Personal Growth as an Entrepreneur, Strategies for Personal Growth as an Entrepreneur, Six Entrepreneurial and business growth strategy examples
Growth from external sources- Types of Franchisees, Joint Ventures, Economies of Scale,Merger or Acquisition, Pros and cons mergers, Reasons that Cause Failure of Mergers and Acquisitions

Unit III	**Developing a company vision**	**(05 hrs)**	**CO3**

What is a vision statement? Vision statement Why does a company have to have a vision? Dual Components of the Company Vision, Envisioned Future, Vision statement sound mystical, How To Use & Communicate Your Vision, Measure Progress Toward Your Vision, Vision statement templates and resources

Unit IV	**Interview- Marker Movement**	**(04 hrs)**	**CO4**

What's your enterprise called? How the ideation Process?

Unit V	**Case Study**	**(04 hrs)**	**CO5**

Cases on New Service Development, Cases on the Service Encounter Triad, Cases on Supporting Facility & Process Flows

Text Books

1. Dr. J. Augustin Jacob, Royal Technical Publication, ISBN: 9789392571107
2. Sekar Manickam ISBN13 9789359114798Ebook

Reference Books

1. https://www.efmdglobal.org/wp-content/uploads/The-Entrepreneurs-Guide-to-Building-a-Successful-Business-2017.pdf

Guidelines for Continuous Comprehensive Evaluation of Theory Course (As per ilike Course of MKCL)		
Sr. No.	**Components for Continuous Comprehensive Evaluation**	**Marks Allotted**
	Total	**20**

Final Year B. Tech. Computer Engineering
Pattern 2023 Semester: VIII
2301413: Internship

Teaching Scheme:	Credit Scheme:	Examination Scheme:
Practical: 24 hrs/week	12	Term Work: 200 Marks Oral Exam: 100 Marks

Course Objectives:

- To bridge the gap between theoretical knowledge and practical application.
- To expose students to real-world engineering problems, professional ethics, and software development processes.
- To develop job-readiness, problem-solving, and collaborative project experience

Course Outcomes: On completion of the course, students will be able to–

	Course Outcomes	Bloom's Level
CO1	Apply core computing concepts to develop or support real-world software/hardware systems.	3-Apply
CO2	Work effectively as part of a professional engineering team.	4-Analyze
CO3	Make Use of modern tools, technologies, and programming practices in a work setting.	3-Apply
CO4	Explain industry workflow and code versioning systems.	2-Understand
CO5	Develop communication, documentation, and presentation skills.	3-Apply
CO6	Demonstrate professionalism, ethics, and workplace responsibility.	2-Understand

Guidelines

An internship bridges the gap between classroom knowledge and real-world application.
It allows students to apply theoretical concepts in live projects, gaining hands-on experience.
Working in a professional environment helps build problem-solving, teamwork, and communication skills.
Internships expose students to industry tools, practices like Agile/DevOps, and coding standards.
Duration: Internship is to be completed in semester 8
Internship work Identification: Student may choose to undergo Internship at Industry/Govt. Organizations/NGO/MSME/Rural Internship/ Innovation/IPR/Entrepreneurship. Student may choose either to work on innovation or entrepreneurial activities resulting in start-up or undergo internship with industry/NGO's/Government organizations/Micro/Small/ Medium enterprises to make themselves ready for the industry.
Students must register at Internshala. Students must get Internship proposals sanctioned from college authority well in advance.
Pre-Internship Phase

- Orientation & Workshop:
  - Resume writing, GitHub profile setup
  - Interview prep (HR + technical)
  - Workplace ethics and expectations
- Company Allotment: Based on interviews or placement cell matching or any other

1. Internship Phase
- Working under industry mentor
- Weekly deliverables (based on role):
  - Coding modules, testing scripts, database design, UI development, etc.
- Tools/Technologies: Git, Docker, Python, Java, React, AWS, etc. (depends on project)

2. Academic Supervision:
- Faculty supervisor assigned to each intern.
- Bi-weekly reporting by student (logbook/email/report).
- Monthly mentor check-ins between faculty and industry supervisor.

Guidelines for Final Report Submission

Final Submission Requirements

- Internship Report (Template provided by department)
  - Introduction, company overview, project summary
  - Logs
  - Technologies used, results, screenshots
  - Reflections and learning outcomes
- Certificate of Completion from industry
- Code/Project Repository Link (e.g., GitHub)
- PPT for Final Viva

Regulations & Policies

- Attendance: Full attendance at workplace (minimum 90%).
- Plagiarism: Any copied reports/codes will be penalized.
- Leave: Only with mentor/faculty approval; medical proof required.
- Discipline: Adherence to company and college codes.

Links:

[1] https://www.aicte-india.org/sites/default/files/AICTE%20Internship%20Policy.pdf
[2] https://internship.aicte-india.org/

Strength of CO-PO / PSO Mapping														
	PO												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO2	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO4	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO5	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Average	3	3	3	3	3	3	3	3	3	3	3	3	3	3