Minor Stream: Network Security

Course Code	Course Name	Level	L	T	P	C	CIE	SEE	Total	Pre-requisite
241CS032	Cyber Security Essentials	FC	2		1	3	50	50	100	-
241CS030	Information Security Analysis & Audit	FC	2			2	50	50	100	-
241CS023	Cloud Computing	FC	2		2	4	50	50	100	-
241CS024	Wireless Networks	IC	2		1	3	50	50	100	-
241CS025	Cloud IoT & Edge ML	AC	2		1	3	50	50	100	-
241CS028	Ethical Hacking	AC	2		2	4	50	50	100	-
241CS027	Digital Forensics	AC	2		1	3	50	50	100	-
241CS026	Block Chain Technologies	AC	2		2	4	50	50	100	CSE
241CS031	Cyber Laws	AC	2		1	3	50	50	100	-
241CS033	Secure Coding Techniques	AC	2		1	3	50	50	100	-
Total			**20**		**12**	**32**				

Cyber Security Essentials
(Common to CSE, IT, AIML & CSE (DS))

	L	T	P	C
Course Code: 241CS032	**2**	**0**	**1**	**3**

Course Outcomes:
At the end of the course, student will be able to:

CO1: Describe the basic concepts of Cyber security issues and challenges
CO2: Analyze the cybercrimes and cyber laws.
CO3: Demonstrate various privacy and security concerns on social media
CO4: Illustrate the concepts related to E-Commerce and digital payments.
CO5: Summarize tools and technologies to protect communication devices.

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1	3	1					2				
CO2	2	3		2	1			1	1		
CO3	1	2		2	1	1		1	1		1
CO4	1	2	3	1	1		1	1		1	1
CO5	2	1					3				

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2
CO1	2	
CO2	2	
CO3	3	
CO4	2	1
CO5	2	

UNIT – I
Introduction to Cyber security:
Defining Cyberspace and Overview of Computer and Web-technology, Architecture of cyberspace, Communication and web technology, Internet, World wide web, Internet infrastructure for data transfer and governance, Internet society, Regulation of cyberspace, Concept of cyber security, Issues and challenges of cyber security.

Practice:
1. Study on how to register a Cyber Crime Complaint through online.(https://cybercrime.gov.in/Webform/Crime_AuthoLogin.aspx)

UNIT – II
Cyber crime and Cyber law:
Classification of cyber crimes, Common cyber crimes- cyber crime targeting computers and mobiles, cyber crime against women and children, financial frauds, social engineering attacks, malware and ransomware attacks, zero day and zero click attacks, Legal perspective

of cyber crime, IT Act 2000 and its amendments, Cyber crime and offences, Organisations dealing with Cyber crime and Cyber security in India.

Practice:

1. Reporting on types of phishing emails.
2. Demonstration of email phishing attack and preventive measures

UNIT – III

Social Media Overview and Security

Introduction to Social networks. Types of Social media, Social media platforms, Social media monitoring, Hashtag, Viral content, Social media marketing, Social media privacy, Challenges, opportunities and pitfalls in online social network, Security issues related to social media, Laws regarding posting of inappropriate content.

Practice:

1. Basic checklist, privacy and security settings for popular Social media platforms.

UNIT – IV

E-Commerce and Digital Payments

Definition of E- Commerce, Main components of E-Commerce, Elements of E-Commerce security, E-Commerce threats, E-Commerce security best **Practice**s, Introduction to digital payments, Modes of digital payments- Banking Cards, Unified Payment Interface (UPI), e-Wallets, Unstructured Supplementary Service Data (USSD), Aadhar enabled payments, Digital payments related common frauds and preventive measures.

Practice:

1. Configuring security settings in Mobile Wallets and UPIs

UNIT – V

Digital Devices Security , Tools and Technologies for Cyber Security

End Point device and Mobile phone security, Password policy, Security patch management, Data backup, Downloading and management of third party software, Device security policy, Cyber Security best **Practice**s, Significance of host firewall and Ant-virus, Management of host firewall and Anti-virus, Wi-Fi security, Configuration of basic security policy and permissions.

Practice:

1.
    a. Setting and configuring two factor authentication in the Mobile phone.
    b. Security patch management and updates in Computer and Mobiles.

Text Books:

1 Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives by Sumit Belapure and Nina Godbole, Wiley India Pvt. Ltd, ISBN: 9788126521791.

2 Security in the Digital Age: Social Media Security Threats and Vulnerabilities by Henry A. Oliver, Create Space Independent Publishing Platform ISBN: 978-1516821020.

Reference Books:

1 Data Privacy Principles and Practice by Natraj Venkataramanan and Ashwin Shriram, CRC Press. ISBN: 978-1498721042

2 Information Security Governance, Guidance for Information Security Managers by W. KragBrothy, Wiley Publication, 1st Edition,. ISBN: 978-1933284736

3 Auditing IT Infrastructures for Compliance By Martin Weiss, Michael G. Solomon, Jones Bartlett Learning, 2nd Edition. ISBN: 978-1284090703

Web Links:

1 https://www.coursera.org/specializations/cyber-security.

2 https://www.nptel.ac.in/courses/106105031/.

3 CERT-In Guidelines- http://www.cert-in.org.in/

Information Security Analysis & Audit
(Common to CSE, IT, AIML & CSE (DS))

	L	T	P	C
Course Code: 241CS030	2	0	0	2

Course Outcomes:

At the end of the course, student will be able to:

CO1: Demonstrate fundamental concepts of information security and systems auditing
CO2: Analyze latest trend in management control framework
CO3: Identify security operations in management control framework.
CO4: Distinguish data evidence collection techniques.
CO5: Analyze data evidence evaluation in audit.

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	1									1
CO2	2	2					2				2
CO3	1	3		1		1		1			2
CO4	1	2					1	1		1	1
CO5	1	3		2	1		2	2			

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2
CO1	2	
CO2	2	
CO3	2	
CO4	1	
CO5	1	

UNIT – I
Overview of Information System Auditing: Effect of Computers on Internal Controls, Effects of Computers on Auditing, Foundations of information Systems Auditing, Conducting an Information Systems Audit.

UNIT – II
The management Control Framework-I: Introduction, Evaluating the planning Function, Leading Function, Controlling Function, Systems Development Management Controls, Approaches to Auditing Systems Development,Programming Management Controls, Data Resource Management Controls.

UNIT – III
The Management Control Framework-II: Security Management Controls, Operations management Controls Quality assurance Management Controls, Case Studies

UNIT – IV

Evidence Collection: Audit Software, Code Review, Test Data, and Code Comparison, Concurrent Auditing techniques, Interviews, Questionnaires, and Control Flowcharts. Performance Management tools- Case Studies.

UNIT – V

Evidence Evaluation: Evaluating Asset Safeguarding and Data Integrity, Evaluating System, Effectiveness, Evaluating System Efficiency, Information Systems Audit and Management: Managing the Information Systems Audit Function.

Text Books:

1 Information Systems Control and Audit, Ron Weber, Pearson Education, 1st Edition, ISBN-10. 9788131704721 ; ISBN-13. 978-8131704721.
2 Cryptography Engineering: Design Principles and Practical Applications ,Niels Ferguson, Bruce Schneier, and Tadayoshi Kohno, John Wiley & Sons, ISBN-10. 0470474246 · ISBN-13. 978-0470474242.

Reference Books:

1 Information System Audit and Assurance, D P Dube, TMH, New Delhi. ISBN: 978-0070585690
2 Computer Forensics, Computer Crime Investigation by John R. Vacca, Firewall Media, New Delhi. ISBN: 978-8170083412

Web Links:

1 https://www.coursera.org/learn/introduction-cybersecurity-cyber-attacks
2 https://computersecurity.stanford.edu/free-online-video[Free Online Videos]
3 CERT-In Guidelines- http://www.cert-in.org.in/

Cloud Computing

(Common to CSE, IT, AIML & CSE (DS))

	L	T	P	C
Course Code: 241CS023	2	0	2	4

Course Outcomes:

At the end of the course, student will be able to:

CO1: Explain basic concepts and terminologies of Cloud Computing and Virtualization.
CO2: Demonstrate Cloud deployment models, Service models and Architectures.
CO3: Analyze Cloud services, Applications and Capacity Planning.
CO4: Use different PaaS application frameworks to construct Cloud applications.
CO5: Develop web applications through Google, Microsoft and Amazon web services for Realtime application.

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2	2			1			1	1		1
CO2	2	2			1			1	1		1
CO3	3	1			1			2	1		1
CO4	2	2			1			2	1		1
CO5	2	2			1			2	1		1

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2
CO1	1	
CO2	1	
CO3	2	
CO4	2	
CO5	2	

UNIT – I

Fundamental Cloud Computing and Virtualization Cloud Computing: Origin and influences, Basic concepts and terminology, Goals and benefits, Risks and challenges, Roles and boundaries and Cloud characteristics.

Introduction to Virtualization: Characteristics, Taxonomy of virtualization technologies, Pros and cons of virtualization, Virtualization Technologies: Xen, VMware and Hyper-V.

Practice:

1. Introduction to Cloud Computing.
2. Overview of cloud computing concepts.
3. Hands-on: Setting up a free-tier account on AWS/Azure/GCP.

UNIT - II

Understanding Cloud Models and Architectures Cloud Models: NIST model, Cloud Cube model, Deployment models: Public, Private, Hybrid and Community; Service models: IaaS, PaaS and SaaS. Understanding Cloud Architecture: Exploring the Cloud Computing Stack, Composability, Infrastructure, Platforms, Virtual Appliances, Communication Protocols, Applications; Connecting to the Cloud: The Jolicloud Netbook OS and Chromium OS - The Browser as an Operating System.

Practice:

1. Virtual Machines and Computer Services.
    a. Creating and managing virtual machines.
    b. Hands-on: Launching and configuring EC2 instances on AWS.

UNIT – III

Understanding Cloud Services, Applications and Capacity Planning: Understanding Cloud Services and Applications Infrastructure as a Service (IaaS): IaaS workloads, Pods, aggregation, and silos; Platform as a Service (PaaS), Software as a Service (SaaS): SaaS characteristics, Open SaaS and SOA, Salesforce.com and CRM SaaS; Identity as a Service (IDaaS): Identity, Networked identity service classes, Identity system codes of conduct, IDaaS interoperability; Compliance as a Service (CaaS). Capacity Planning: Defining Baseline and Metrics: Baseline measurements, System metrics, Load Testing, Resource ceilings, Server and instance types; Network Capacity and Scaling.

Practice:

1. Storage Solutions.
    a. Exploring different storage options (S, EBS, Glacier).
    b. Hands-on: Implementing S3 buckets and managing data.

UNIT – IV

Exploring Platform as A Service (PaaS): PaaS Application Frameworks: Drupal, Eccentex AppBase 3.0, Long Jump, Squarespace, Wavemaker and Wolf Frameworks. Exploring Platform as a Service using Google Web Services: Surveying the Google Application Portfolio, Google Toolkit and Working with the Google App Engine. Exploring Platform as a Service using Microsoft Cloud Services: Exploring Microsoft Cloud Services, Microsoft Azure- Live Essentials, Live Home and Live for Mobile.

Practice:

1. Networking in the Cloud.
    a. Configuring virtual private clouds (VPC), subnets, and security groups.
    b. Hands-on: Setting up a VPC and deploying instances within it.

UNIT -V

Exploring Infrastructure As A Service (Iaas): Understanding Amazon Web Services, Amazon Web Service Components and Services, Working with the Elastic Compute Cloud (EC2): Amazon Machine Images, Pricing models, System images and software, Creating an account and instance on EC2; Working with Amazon Storage Systems: Amazon Simple Storage System (S3), Amazon Elastic Block Store (EBS) and CloudFront; Understanding Amazon Database Services: Amazon Simple DB, Amazon Relational Database Service (RDS) and Choosing a database for AWS.

Practice:

1. Database Services
    a. Understanding cloud-based database services (RDS, DynamoDB).
    b. Hands-on: Setting up and querying a relational database in AWS RDS.

Text Books:

1 Cloud Computing Bible, Barrie Sosinsky, Wiley India Pvt Ltd, ISBN-10. 0470903562 ; ISBN-13. 978-0470903568.
2 Cloud Computing- Concepts, Technology and Architecture, Thomas Erl and Ricardo Puttini, Pearson, ISBN 10: 0133387526 - ISBN 13: 9780133387520.

Reference Books:

1 Mastering Cloud Computing, Rajkumar Buyya, Christian Vecchiola and S Thamarai Selvi, McGraw Hill Education. ISBN: 978-0-12-411454-8.
2 Cloud Application Architectures, George Reese, O'Reilly. ISBN: 978 0596156367.
3 Enterprise Cloud Computing Technology Architecture Applications, Gautam Shroff, Cambridge university press; 1st edition. ISBN: 978-0521137355.

Web Links:

1 https://onlinecourses.nptel.ac.in/noc24_cs17/preview
2 https://docs.aws.amazon.com/
3 https://learn.microsoft.com/en-us/training/azure/

Wireless Networks

(Common to CSE, IT, AIML & CSE (DS))

	L	T	P	C
Course Code: 241CS024	**2**	**0**	**1**	**3**

Course Outcomes:
At the end of the course, student will be able to:

- **CO1:** Describe evolution of wireless networks and wireless communication technologies.
- **CO2:** Simulate Wireless Communication network for analyzing packet transmission using NS3.
- **CO3:** Discuss IEEE 802.11 Standards and Protocols.
- **CO4:** Explain evolution and architecture of cellular networks.
- **CO5:** Summarize Emerging Trends such as cognitive radio networks, VANETs.

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1	2	2			1			1	1		
CO2	2	1	2		2			1	1		
CO3	2	1			1			1	1		
CO4	2		2		2			1	1		
CO5	2	2	1								

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2
CO1	1	
CO2	2	
CO3	1	
CO4	1	
CO5	1	

UNIT – I

Introduction to Wireless Networks: Evolution of Wireless Networks, Basic Wireless Communication Concepts, Wireless Spectrum and Regulations, Wireless Network Architectures, Infrastructure Networks, Ad-Hoc Networks, Wireless Standards: IEEE 802.11, Bluetooth, Zigbee.

Practice:

1. Simulate an ad-hoc network using NS3.

UNIT – II

Wireless Communication Technologies: Radio Propagation Models, Modulation Techniques, Multiple Access Techniques: TDMA, FDMA, CDMA, OFDM Antennas and Diversity Techniques, MIMO (Multiple Input Multiple Output) Systems.

Practice:

1. Create multiple nodes, establish peer to peer connections, and analyze packet transmission using NS3.

UNIT – III

Wireless LANs and PANs: IEEE 802.11 Standards and Protocols, WI-FI Network Design and Deployment, Bluetooth and Zigbee Protocols, Security in Wireless LANs: WEP, WPA, WPA2, QoS (Quality of Service) in Wireless Networks.

Practice:

1. Simulate a basic GSM network using NS3.

UNIT – IV

Cellular Networks: Evolution from 1G to 5G, GSM, CDMA, and LTE Architectures,5G Network Architecture and Key Technologies, Handoff and Roaming, Cellular Network Planning and Optimization.

Practice:

1. Set up and configure a Wi-Fi network using Wireshark.
2. Explore the signal strength and coverage area of a Wi-Fi network.

UNIT – V

Emerging Trends and Future Directions: Internet of Things (IoT) and Wireless Sensor Networks (WSNs), Cognitive Radio Networks, Vehicular Ad-hoc Networks (VANETs), Wireless Mesh Networks, Security and Privacy Challenges in Wireless Networks.

Text Books:

1 Wireless Communications: Principles and Practice by Theodore S. Rappaport, Prentice Hall 2nd Edition, ISBN: 9780130422323.

2 Wireless Communications by Andrea Goldsmith, Cambridge University Press,ISBN: 9780521837163.

Reference Books:

1 Principles of Wireless Access and Localization by Kaveh Pahlavan and Prashant Krishnamurthy. Wiley-IEEE Press, ISBN: 9780470697085.

2 802.11 Wireless Networks: The Definitive Guide by Matthew S. Gast, O'Reilly Media 2nd Edition, ISBN: 9780596100520.

3 Wireless Communications, A. Molisch, Wiley, 2005Haykin & Moher, Modern Wireless Communications, Pearson (Indian Edition).

Web Links:

1 https://onlinecourses.nptel.ac.in/noc22_ee85/preview/

2 Wireshark Network Protocol Analyzer [Wireshark](https://www.wireshark.org/)

3 NS3 Network Simulator [NS3] (https://www.nsnam.org/)

Cloud IoT and Edge ML

(Common to CSE, IT, AIML & CSE (DS))

	L	T	P	C
Course Code: 241CS025	**2**	**0**	**1**	**3**

Course Outcomes:

At the end of the course, student will be able to:

- **CO1:** Explain technologies behind the communication and management of Fog and edge resources.
- **CO2:** Discuss techniques for storage and computation in Fog, edge, 5G and cloud
- **CO3:** Implement Internet of Everything (IoE) applications through Fog computing architecture.
- **CO4:** Illustrate optimization strategies in Fog and Edge Architectures.
- **CO5:** Summarize applications in Fog and Edge Computing.

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1	1	2			2			2	2		2
CO2	2	2			2			2	2		2
CO3	1	2	3		2			2	2		2
CO4	2	1	1	3	2			2	2		2
CO5	2	1	1		2			2	2		2

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2
CO1	1	
CO2	1	
CO3	1	
CO4		2
CO5		2

UNIT – I

Internet of Things (IoT) and New Computing Paradigms:

Introduction, Relevant Technologies, Fog and Edge Computing Completing the Cloud, Hierarchy of Fog and Edge Computing, Business Models, Edge Computing Platforms, Opportunities and Challenges.

Practice:

1. Building a Simple Edge Computing Application with Data Processing and Cloud Integration.

UNIT – II

Challenges in Federating Edge Resources:

Introduction, Methodology, Integrated C2F2T Literature by Modeling Technique, Integrated C2F2T Literature by Use Case Scenarios, Integrated C2F2T Literature by Metrics, Threads, Standards.

Practice:

1. Setting Up a Simple IoT Device with Edge Computing

UNIT – III

Orchestration of Network Slices in Fog, Edge, and Clouds:

Introduction, Background, Network Slicing, Network Slicing in Software, Defined Clouds, Network Slicing Management in Edge and Fog, Internet of Vehicles (IoV): Architecture, Protocols and Seven-layer security model architecture for Internet of Vehicles, IoV: Network Models, Challenges and future aspects.

Practice:

1. Implementing a Simple Network Slicing Scenario for Internet of Vehicles (IoV) Using Edge and Fog Computing.

UNIT – IV

Optimization Problems in Fog and Edge Computing:

Preliminaries, The Case for Optimization in Fog Computing, Formal Modeling Framework for Fog Computing, Metrics ,Further Quality Attributes ,Optimization Opportunities along the Fog Architecture, Optimization Opportunities along the Service Life Cycle , Toward a Taxonomy of Optimization Problems in Fog Computing.

Practice:

1. Optimizing Task Scheduling in Fog Computing

UNIT – V

Applications of Fog and Edge Computing:

Exploiting Fog Computing in Health Monitoring-Smart Surveillance Video Stream Processing at the Edge for Real - Time Human Objects Tracking-Fog Computing Model for Evolving Smart Transportation Applications - Testing Perspectives of Fog - Based IoT Applications - Legal Aspects of Operating IoT Applications in the Fog.

Practice:

1. Real-Time Human Object Tracking Using Fog Computing in a Smart Surveillance System

Text Books:

1 Fog and Edge computing: Principles and Paradigms ,Buyya, Rajkumar, and Satish Narayana Srirama, John Wiley & Sons, USA, 1st edition, ISBN-10. 1119524989 · ISBN-13. 978-1119524984, 2019.

2 Internet of Things –From Research and Innovation to Market Deployment, OvidiuVermesan, Peter Friess, "River Publishers, India, 1st edition, ISBN 10: 8793102941.

Reference Books:

1 Cloud computing: A hands-on approach, Bahga, Arshdeep, and Vijay Madisetti , CreateSpace Independent Publishing Platform, USA, 2nd edition. ISBN: 978-1494435141.

Web Links:

1 https://onlinecourses.nptel.ac.in/noc24_cs66/preview

Ethical Hacking

(Common to CSE, IT, AIML & CSE (DS))

	L	T	P	C
Course Code: 241CS028	**2**	**0**	**2**	**4**

Course Outcomes:

At the end of the course, student will be able to:

CO1: Describe the concepts and types of Ethical hacking.
CO2: Apply tools and techniques for Social Engineering.
CO3: Illustrate concepts of data security for various networking systems.
CO4: Analyze techniques to protect Web servers and Communication Systems.
CO5: Demonstrate ethical laws and tests related to ethical hacking.

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1	2	1						1	1		1
CO2	2	2		1	2			1	1		2
CO3	2	2		2				1	1		1
CO4	2	2			1			1	1		2
CO5	2	2					2	1	1		1

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PO	PSO1	PSO2
CO1		2
CO2		2
CO3		2
CO4		2
CO5		2

UNIT – I

Ethical Hacking

Types of Data Stolen From the Organizations, Elements of Information Security, Authenticity and NonRepudiation, Security Challenges, Effects of Hacking, Hacker – Types of Hacker, Ethical Hacker,Hacktivism - Role of Security and Penetration Tester, Penetration Testing Methodology, Networking &Computer Attacks – Malicious Software (Malware), Protection Against Malware, Intruder Attacks on Networks and Computers, Addressing Physical Security – Key Loggers and Back Doors.

Practice:

1. Create a social networking website login page using phishing techniques.
2. Sniffing tools to analyze traffic on a network and dissect information.

UNIT – II

Foot Printing And Social Engineering

Web Tools for Foot Printing, Conducting Competitive Intelligence, Google Hacking, Scanning, Enumeration, Trojans & Backdoors, Virus & Worms, Proxy & Packet Filtering, Denial of Service, Sniffer,Social Engineering – shoulder surfing, Dumpster Diving, Piggybacking.

Practice:

1. Social Engineering Countermeasures
2. Tools for Foot Printing

UNIT – III

Data Security

Physical Security – Attacks and Protection, Steganography – Methods, Attacks and Measures, Cryptography– Methods and Types of Attacks, Wireless Hacking, Windows Hacking, Linux Hacking.

Practice:

1. Write a code to demonstrate DoS attacks.
2. Windows ,Linux OS hacking.

UNIT – IV

Network Protection System & Hacking Web Servers

Routers, Firewall & Honeypots, IDS & IPS, Web Filtering, Vulnerability, Penetration Testing, Session Hijacking, Web Server, SQL Injection, Cross Site Scripting, Exploit Writing, Buffer Overflow, Reverse Engineering, Email Hacking, Incident Handling & Response, Bluetooth Hacking, Mobiles Phone Hacking.

Practice:

1. Write a script or code to demonstrate SQL injection attacks.
2. Setup a honey pot and monitor the honey pot on network.

UNIT – V

Ethical Hacking Laws And Tests

An introduction to the particular legal, professional and ethical issues likely to face the domain of ethical hacking, ethical responsibilities, professional integrity and making appropriate use of the tools and techniques associated with ethical hacking – Social Engineering, Host Reconnaissance, Session Hijacking, Hacking - Web Server, Database, Password Cracking.

Practice:

1. Study of Techniques uses for Web Based Password Capturing.
2. Study on how to register a Cyber Crime Complaint through online.
   (https://cybercrime.gov.in/Webform/Crime_AuthoLogin.aspx)

Text Books:

1 Hands-On Ethical Hacking and Network Defense, Corley, Michael T. Simpson, Kent Backman, James E., CENGAGE Learning, ISBN 10 1435486099 , ISBN 13 9781435486096.

2 Penetration Testing and Network Defense ,Whitaker & Newman , Cisco Press, Indianapolis, ISBN-10. 1587052083 · ISBN-13. 978-1587052088.

Reference Books:

1 Official Certified Ethical Hacker Review Guide,Steven DeFino, Barry Kaufman, Nick Valenteen,CENGAGE Learning. ISBN: 978-1435488533.

2 The Basics of Hacking and Penetration Testing: Ethical Hacking and Penetration Testing Made Easy ,Patrick Engebretson, Syngress Basics Series – Elsevier. ISBN: 978-0124116443.

Web Links:

1 https://www.springboard.com/blog/cybersecurity/7-free-sources-to-learn-ethical-hacking-from-scratch/

2 https://hackernoon.com/top-resources-to-learn-ethical-hacking3

3 https://onlinecourses.nptel.ac.in/noc22_cs13/preview

Digital Forensics

(Common to CSE, IT, AIML & CSE (DS))

	L	T	P	C
Course Code: 241CS027	**2**	**0**	**1**	**3**

Course Outcomes:

At the end of the course, student will be able to:

CO1: Apply forensic analysis tools to recover evidence for identifying crime.
CO2: Discuss next-generation computer crime investigations.
CO3: Apply digital evidences for data acquisition.
CO4: Illustrate processing crimes and incident scenes through digital evidence.
CO5: Identify current computer forensic tools for various digital usages.

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1	2	3		3				2	1		1
CO2	2	2		3				2	1		1
CO3	2	3		3				1	1		1
CO4	2	2		3				2	1		1
CO5	2	2		3	3			3	1		1

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2
CO1	2	
CO2	2	
CO3	2	
CO4	2	
CO5	2	

UNIT – I

Computer forensics fundamentals, Benefits of forensics, computer crimes, computer forensics evidence and courts, legal concerns and private issues.

Practice:

1. Study of Computer Forensics and different tools used for forensic investigation

UNIT – II

Understanding Computing Investigations – Procedure for corporate High-Tech investigations, understanding data recovery work station and software, conducting and investigations.

Practice:

1. Live Forensics Case Investigation using Autopsy.

UNIT – III

Data acquisition- understanding storage formats and digital evidence, determining the best acquisition method, acquisition tools, validating data acquisitions, performing RAID data acquisitions.

Practice:

1. How to Recover Deleted Files using Forensics Tools?

UNIT – IV

Processing crimes and incident scenes, securing a computer incident or crime, seizing digital evidence at scene, storing digital evidence, obtaining digital hash, reviewing case.

Practice:

1. How to view last activity of your PC?
2. How to Collect Email Evidence in Victim PC?

UNIT – V

Current computer forensics tools- software, hardware tools, validating and testing forensic software.E-Mail investigations- investigating email crime and violations, understanding E-Mail servers, specialized E-Mail forensics tool.

Practice:

1. Study the steps for hiding and extract any text file behind an image file/ Audio file using Command Prompt.
1. Data extraction from call logs using Sleuth Kit.

Text Books:

1 Computer Forensics: Incident Response Essentials,Warren G. Kruse II and Jay G. Heiser, Addison Wesley, ISBN 13: 9780201707199.
2 Guide to Computer Forensics and Investigations,Nelson, B, Phillips, A, Enfinger, F, Stuart, C., "Thomson Course Technology, 2nd ed., ISBN: 0-619-21706-5.

Reference Books:

1 Computer Forensics, Computer Crime Scene Investigation, Vacca, J, Charles River Media, 2nd Ed, ISBN: 1-58450-389.
2 Digital Forensics, Andre Arnes, Wiley, 2018. ISBN: 978-1119262381.
3 The basics of digital Forensics (Latest Edition) – The primer for getting started in digital forensics by John Sammons – Elsevier Syngress Imprint ISBN: 978-1597496612.
4 Cybersecurity – Understanding of cybercrimes, computer forensics and Legal perspectives by Nina Godbole and Sunit Belapure – Wiley India Publication, ISBN: 9788126521791.
5 Practical Digital Forensics – Richard Boddington [PACKT] Publication, Open source community. ISBN: 9781785887109.

Web Links:

1 https://onlinecourses.swayam2.ac.in/cec20_lb06/preview
2 https://onlinecourses.swayam2.ac.in/nou24_cs05/preview
3 https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_01350155386128793 67592/

Block Chain Technologies
(Common to CSE, IT, AIML & CSE (DS))

	L	T	P	C
Course Code: 241CS026	**2**	**0**	**2**	**4**

Course Outcomes:
At the end of the course, student will be able to:

CO1: Demonstrate blockchain and crypto currency basics.
CO2: Compare and contrast permissioned and permissionless blockchains.
CO3: Explain different types of crypto currency wallets.
CO4: Explain how to compile and deploy smart contracts using Ethereum.
CO5: Illustrate Hyperledger fabric and use cases of block chain technologies.

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11
CO1	3	1									2
CO2	2	3	1	2							2
CO3	2	3	1	1							2
CO4	2	2	3	2							2
CO5	2	2	3	2							2

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2
CO1		2
CO2		2
CO3		2
CO4		3
CO5		3

UNIT – I

Introduction: Overview of Block chain, History of Blockchain, Real-world applications, Peer to Peer Network, Smart Contract, Wallet, Digital Currency, Ledgers, Types of Blockchain Platforms.

Practice:

1. Creating Merkle tree

UNIT – II

Consensus Mechanism: Permissioned Blockchain, Permisionless Blockchain, Different Consensus Mechanisms- Proof of Work, Proof of Stake, Proof of Activity, Proof of Burn, Proof of Elapsed Time, Proof of Authority, Proof of Importance, voting-based consensus algorithms, and federated consensus.

Practice:

1. Creation of Block.

UNIT – III

Crypto currency and Wallet: Types of Wallet, Desktop Wallet, App based Wallet, Browser based wallet, Metamask, Creating an account in Metamask, Use of faucet to fund wallet, transfer of cryptocurrency in meta mask, Merkle tree, hard and soft forks, network models and properties of secure state machine replication (SMR)

Practice:

1. Block chain Implementation Programming code

UNIT – IV

Smart contract and Ethereum: Overview of Ethereum, Writing Smart Contract in Solidity, Remix IDE , Different networks of ethereum, understanding blocks practically at blockhcain.com, how to compile and
deploy smart contract in remix

Practice:

1. Java code to implement blockchain in Merkle Trees

UNIT – V

Understanding Hyperledger Fabric: Hyperledger Fabric- Architecture, Identities and Policies, Membership and Access Control, Channels, Transaction Validation, Writing smart contracts using Hyperledger Fabric.

Use Cases: Cross border payments, Know Your Customer (KYC), Food Security, Block chain enabled Trade, Anti-Money Laundering (AML)

Practice:

1. Creating a Crypto-currency Wallet

Text Books:

1 Blockchain: Blueprint for a New Economy, Melanie Swan, O'Reilly, ISBN : 9781491920497.

2 Mastering Blockchain: Deeper insights into decentralization, cryptography, Bitcoin, and popular Blockchain frameworks by Imran Bashier, Packt publishing, ISBN: 9781787125445.

Reference Books:

1 Mastering Ethereum: Building Smart Contracts and DApps by Andrews ISBN:978-1491971949.

2 Mastering Bitcoin: Programming the Open Blockchain, by Andreas M. Antonpoulos, O'Reilly, ISBN: 9781491954362.

Web Links:

1 https://onlinecourses.swayam2.ac.in/aic21_ge01/

2 https://github.com/blockchainedindia/resources

3 https://github.com/HyperledgerHandsOn/trade-finance-logistics

Cyber Laws

(Common to CSE, IT, AIML & CSE (DS))

	L	T	P	C
Course Code: 241CS031	**2**	**0**	**1**	**3**

Course Outcomes:
At the end of the course, student will be able to:

CO1: Identify the needs of IT Act.
CO2: Summarize IT Act 2000 and its relevance.
CO3: Discuss digital signatures and E-governance.
CO4: Analyze traditional computer crime and early hacker.
CO5: Demonstrate Identity theft and Identity fraud.

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1	3						2	1			2
CO2	2	2					3			1	2
CO3	2	3		1	1	1	2	1	1		2
CO4	2	2				2	3	1			2
CO5	1	2					3				2

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2
CO1	2	
CO2	1	
CO3	2	
CO4	1	
CO5	1	

UNIT – I

The IT Act, 2000: A Critique: Crimes in this Millennium, Section 80 of the IT Act,2000 – A Weapon or a Farce?, Forgetting the Line between Cognizable and Non-Cognizable Officers, Arrest for "About to Commit" an Offence Under the IT Act.

Practice:

1. Create awareness on sections in IT Act 2000 and how they can be related to each illegal activity

UNIT – II

Cyber Crime and Criminal Justice: Penalties, Adjudication and Appeals Under the IT Act, 2000: Concept of Cyber Crime and, Hacking, Teenage Web Vandals, Cyber fraud and Cyber Cheating, Virus on Internet Deformation,Harassment and E-mail Abuse Cyber Pornography, Other IT Offences, Monetary Penalties, Adjudication and Appeals Under IT Act 2000, Network Service Providers, Jurisdiction and Cyber Crimes, Nature of Cyber Criminality Strategies to Tackle Cyber Crime and Trends, Criminal Justice in India and Implications.

Practice:

1. Installation and configuration of Computer Host Firewall to protect system from unauthorized activities.

UNIT – III

Digital Signatures, Certifying Authorities and E-Governance: Digital Signatures,Digital Signature Certificate,Certifying Authorities and Liability in the Event of Digital Signature compromise, E-Governance in the India. A Warming to Babudom,Are Cyber Consumers Covered under the Consumer Protection, Goods and Services,Consumer Complaint Defect in Goods and Deficiency in Services Restrictive and Unfair Trade Practices .

Practice:

1. Study on how to register a Consumer Complaint through online. (https://consumerhelpline.gov.in/)

UNIT – IV

Traditional Computer Crime: Early Hacker and Theft of Components: Traditional problems, Recognizing and Defining Computer Crime, Phreakers: Yesterday's Hackers, Hacking, Computers as Commodities, Theft of intellectual Property Web Based Criminal Activity, Interference with Lawful Use of Computers, Malware, DoS (Denial of Service) and DDoS (Distributed Denial of Service) Attacks, Ransomware and Kidnapping of Information, Theft of Information, Data Manipulation, and Web Encroachment , Dissemination of Contraband or Offensive materials, Online Gambling Online Fraud, Securities Fraud.

Practice:

1. Study on how to file a complaint against web based activity through online. (https://cybercrime.gov.in/)

UNIT – V

Identity Theft and Identity Fraud: Typologies of Internet Theft/Fraud, Prevalence and Victimology, Physical Methods of Identity Theft, Virtual and Internet Facilitated methods, Crimes facilitated by Identity theft/fraud, Organized Crime and Technology Protection of Cyber consumers in India Cyber-consumer act Consumer, Goods and service, consumer compliant, restricted and unfair trade Practices.

Practice:

1. Wi-Fi security management in computer and create awareness on illegal cyber activities.

Text Books:

1 Cyber Law Simplefied, VivekSood, Tata McGraw Hill, 4th edition, ISBN-10. 0070435065 , ISBN-13. 978-0070435063.

2 Computer Forensics and Cyber Crime, Marjie T. Britz, Pearson, 3rd edition, ISBN 10: 0132677717 - ISBN 13: 9780132677714.

Reference Books:

1 Cyber Laws Texts and Cases, Ferrera, CENGAGE India, 3rd sedition. ISBN: 978-8131517925

2 Cyber Law by PavanDuggal, Universal law publishing, 2nd edition. ISBN: 978-8131253663

Web Links:

1 http://www.cyberlawsindia.net/
2 http://meity.gov.in/content/cyber-laws5
3 https://www.coursera.org/learn/cyber-conflicts

Secure Coding Techniques

(Common to CSE, IT, AIML & CSE (DS))

	L	T	P	C
Course Code: 241CS033	**2**	**0**	**1**	**3**

Course Outcomes:
At the end of the course, student will be able to:

- **CO1:** Describe the objectives and services of Cyber security.
- **CO2:** Analyze importance of OWASP and Security risks.
- **CO3:** Outline importance of SDLC and Design Principles. .
- **CO4:** Summarize reasons and impact of Common security flaws in C and C++
- **CO5:** Apply secure coding best practices in Python programming language.

Mapping of Course Outcomes with Program Outcomes:

CO\PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1	3	2	2	2	1			3	3		
CO2	3	3	2	2	3			3	3		
CO3	3	2	2	2	3			3	3		
CO4	3	2	2	2	3			3	3		
CO5	3	2	2	2	2			3	3		

Mapping of Course Outcomes with Program Specific Outcomes:

CO\PO	PSO1	PSO2
CO1		1
CO2		3
CO3		3
CO4		3
CO5		3

UNIT – I

Network and Cyber Security Fundamentals: Network Basics, Network Components, Types of Networks, Networking Models, Introduction to Cyber Security, Why Cyber Security is important, Objectives and Services of Cyber Security, various Security Attacks, Types of Cyber threats, Cyber Security Challenges .

Practice:

1. Practical learning - Installation and working with Wireshark tool
2. Practical learning - Wireshark Lab: Ethernet and ARP

UNIT – II

OWASP Top 10-2021 : Importance of OWASP Top 10 , OWASP Top 10 Application Security Risks – 2021: Broken Access Control Risk Root Causes and its Mitigation, Cryptographic Failures Risk Root Causes and its Mitigation, Injection Risk Root Causes and its Mitigation , Vulnerable and Outdated Components Risk Root Causes and its Mitigation , Identification and Authentication Failures Risk Root Causes and its Mitigation, Software and Data Integrity Failures Risk Root Causes and its Mitigation, Security Misconfiguration Risk Root Causes and its Mitigation, Security Logging and Monitoring Failures Risk Root Causes and its Mitigation, Server-Side Request Forgery Risk Root Causes and its Mitigation .

Practice:

1. Practical learning – How to find and exploit different types of SQLi vulnerabilities.
2. Practical learning – Burp Suite Practice How to find vulnerabilities.

UNIT – III

Secure Coding Best Practices: Secure Design Principles, Password Management, Access Control, Error Handling and Logging, system Configuration, Threat Modeling, Cryptography Practices, Input and Output Sanitization, Tokenizing and Sandboxing, Static and dynamic testing, vulnerability scanning and penetration testing, Microsoft SDL Tool .

Practice:

1. Practical learning – How to conduct penetration testing
2. Practical learning – Microsoft SDL Tool Practice

UNIT – IV

Secure coding Practices in C/C++: Common security flaws in C and C++, Buffer Overflows and Code Injections: Stack Overflows attacks, Array indexing attacks Format strings attacks, Integer Overflows.

Practice:

1. Practical learning – How to handle Buffer Overflows risks
2. Practical learning – Practice to find Code Injections attacks

UNIT – V

Secure coding **Practice**s in Python: Basics of Python, Version of Python, Upgrade, update, patch, use a Virtual Environment Python, Sanitize inputs, String Formatting, Handle Python HTTP Requests Safely, Handling Data Deserialization Safely.

Practice:

1. Practical learning – Identifying supported HTTP methods with Burp Suite
2. Practical learning – How to prevent CSRF attacks with Burp Suite

Text Books:

1 Networking Fundamentals, Packt, Author: Gordon Davies, 2019 edition, ISBN 13: 9781838643508.
2 OWASP Handbook, ISBN-10. 1329427092.

Reference Books:

1 Secure coding in C and C++ by Robert C. Seacord, Pearson , Second Edition . ISBN: 978-0321822130 .
2 Secure Coding Guidelines for Python by Zádrapa Jan 2021

Web Links:

1 https://www.stealthlabs.com/blog/infographic-top-15-cybersecurity-myths-vs-reality/
2 https://www.microsoft.com/en-us/securityengineering/sdl/threatmodeling
3 https://www.checkpoint.com/cyber-hub/threat-prevention/what-is-sandboxing/

Minor Stream: Machine Intelligence

Course Code	Course Name	Level	L	T	P	C	CIE	SEE	Total	Pre-requisite
241AI007	Computer Vision	IC	2		1	3	50	50	100	DAP
241AI014	Soft Computing	IC	2		1	3	50	50	100	AI
241AI010	Natural Language Processing	AC	2		2	4	50	50	100	DAP
241AI011	Deep Learning	AC	2		2	4	50	50	100	DAP
241AI013	Recommender Systems	AC	2		2	4	50	50	100	-
241AI009	Reinforcement Learning	AC	2		2	4	50	50	100	DAP
241AI016	Prompt Engineering & GenAI	AC	2		1	3	50	50	100	ML
241AI015	AI Chatbot	IC	2			2	50	50	100	DAP
241AI017	Federated Machine Learning	AC	2			2	50	50	100	ML
241AI008	Expert Systems	AC	2		1	3	50	50	100	-
Total			**20**		**12**	**32**				

Computer Vision
(Common to CSE, IT, AIML & CSE (DS))

	L	T	P	C
Course Code: 241AI007	**2**	**0**	**1**	**3**

Course Outcomes:
At the end of the course, student will be able to:

- **CO1:** Explain the Fundamentals of Computer Vision and Comprehend Image Formation and Photometric Concepts.
- **CO2:** Apply the principles of feature detection and matching.
- **CO3:** Analyze basic methods of computer vision related to Structure and Motion.
- **CO4:** Evaluate Computational Photography Techniques and Achieve SuperResolution and Blur Removal and Synthesize Textures.
- **CO5:** Implement the design of a computer vision system for a 3D Reconstruction, Albedos, image based rendering views and depths.

Mapping of Course Outcomes with Program Outcomes:

CO/ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1	3	2	2		2			1	1		
CO2	2	2	1		2			1	1		
CO3	2	2	1		2			1	1		
CO4	2	2	1		2			1	1		
CO5	2	2	1		2			1	1		

Mapping of Course Outcomes with Program Specific Outcomes:

CO/ PO	PSO1	PSO2
CO1	1	
CO2	2	1
CO3	2	
CO4	1	2
CO5	1	2

UNIT – I
Introduction to Computer Vision and Transformation: What is computer vision, A brief history, Applications, Geometric Primitives, Photometric Image Formation, Digital Camera, Image Processing: Point Operators, Linear Filtering, Global Optimization.
Transformation: Orthogonal, Euclidean, Affine, Projective, etc., Fourier Transform, Convolution and Filtering, Image Enhancement, Restoration, Histogram Processing, Geometric Transformations.

Practice :
1. Implement contrast adjustment of an image. Implement Histogram processing and equalization.
2. Use of Fourier transform for filtering the image.

UNIT – II

Feature Detection and Matching:

Points and Patches, Edges, Lines, Segmentation: Active Contours, Split and Merge, Mean Shift and Mode Finding, Normalized Cuts, Feature detectors, Feature descriptors, Feature matching, Feature tracking.

Practice :

1. Implementing image processing operations in python/mat lab/openCV: Reading image, writing image, conversion of images, and complement of an image.
2. Write a program to display of color image.

UNIT – III

Structure and Motion:

Triangular, Twoframe Structure from Motion, Factorization, Bundle Adjustment, Constrained Structure and Motion.

Dense Motion Estimation: Translation Alignment, Parametric Motion, Spline Based Motion.

Practice :

1. Write a program to apply morphological algorithms on an image.
2. Write a program to perform segmentation on an image.

UNIT – IV

Image Stitching:

Motion Analysis, Motion Models, Global Alignment, Composing

Computational Photography: Photometric Calibration, High Dynamic Range Imaging, SuperResolution and Blur Removal, image Matting and Compositing, Texture Analysis and Synthesis.

Practice :

1. Utilization of Texture Analysis and Synthesis.
2. Performing/Implementing Blur Removal and Image Matting using python.

UNIT – V

3D Reconstruction & Recognition:

Shape From X, Active Range Finding, Surface Representation, point based Representation, Volumetric Representation.

Image based Rendering: View Interpolation, Layered Depth Images, Light Fields and Lumi graphs, Environment Mattes.

Recognition: Object detection, Face detection, Pedestrian detection, Face recognition, Eigenfaces, Active appearance and 3D shape models.

Practice :

1. Write a program to detect edges of an image using Operators.
2. Write a program to apply 2D DFT and DCT on an image and display the result.

Text Books:

1 Computer Vision: Algorithms and Applications, Richard Szeliski,Springer, ISBN-10. 1848829345 · ISBN-13. 978-1848829343.

2 Digital Image Processing, Rafael C. Gonzalez, Pearson Education; Fourth edition, ISBN 9789353062989, 2018

Reference Books:

1 Computer Vision - A modern approach, by D. Forsyth and J. Ponce, Prentice Hall ISBN:978-9332550117

2 Computer and Robot Vision, Haralick & Shapiro, Vol II, ISBN: 978-0201569438

3 Computer Vision and Image Processing, S. Nagabhushana, New Age International Pvt Ltd; First edition, ISBN: 978-8122416428

Web Links:

1 https://onlinecourses.nptel.ac.in/noc22_ee48/preview

2 https://www.geeksforgeeks.org/computer-vision/

Soft Computing
(Common to CSE, IT & AIML)

	L	T	P	C
Course Code: 241AI014	**2**	**0**	**1**	**3**

Course Outcomes:
At the end of the course, student will be able to:

CO1: Compare intelligent systems and knowledge based systems
CO2: Explain fuzzy sets and fuzzy operations
CO3: Discuss neuro systems and neural network applications
CO4: Apply genetic algorithm and operators
CO5: Compare and contrast Swarm Intelligence based algorithms

Mapping of Course Outcomes with Program Outcomes:

CO/ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1	2	2	2		1			1	1		2
CO2	2	2	3		2			2	2		2
CO3	2	2	3		1			2	2		2
CO4	2	2	3		1			2	2		2
CO5	2	2	3		1			2	2		2

Mapping of Course Outcomes with Program Specific Outcomes:

CO/ PSO	PSO1	PSO2
CO1		1
CO2		2
CO3		2
CO4		2
CO5		2

UNIT – I
Introduction to Intelligent systems and soft computing: Intelligent systems, Knowledgebased systems, Knowledge representation and processing, Soft computing techniques.

Practice:
1. Text summarization using a simple sequencetosequence model with LSTM (Long ShortTerm Memory) layers.
2. Apply networkx library to represent and process knowledge

UNIT – II
Fundamentals of fuzzy logic systems: Introduction , Background ,Evolution of fuzzy logic, Popular applications, Stages of development of an intelligent product, Use of fuzzy logic in expert systems, Fuzzy sets , Fuzzy logic operations

Practice:
1. Learn the fundamentals of the fuzzy logic ,experiment the basic operations of fuzzy logic (Virtual Labs)
2. Learn about the Fuzzy inference system (FIS) with an example (Virtual Labs)

UNIT – III

Fundamentals of artificial neural networks: Introduction Learning and acquisition of knowledge , Symbolic learning , Numerical learning, Features of artificial neural networks , Neural network topologies, Neural network activation functions, Neural network learning algorithms, Fundamentals of connectionist modeling

Practice:

1. Implement Neural Networks and Perceptron with an example (Virtual Labs) Virtual Labs
2. Study Multilayer Perceptron apply it for image classification

UNIT – IV

Genetic algorithms and evolutionary programming: Introduction, Genetic algorithms, Procedures of genetic algorithms, working of genetic algorithms, genetic algorithm operators, Issues in GAs.

Practice:

1. Implement a genetic algorithm for finding the maximum value of a function.
2. Implement Crossover and Mutation in genetic algorithms

UNIT – V

Swarm Intelligent systems: Introduction, Swarm Intelligence based algorithms – Ant Algorithms; Bee Algorithms; Particle Swarm Optimization, Background of Ant intelligent system, ant colony systems Importance, development, applications, working of ant colony systems, Artificial Bee Colony (ABC) Optimization Behavior of real bees, ABC Algorithm, Variations of ABC: Abcgbest and Abcgbestdist.

Practice:

1. Implement Particle Swarm Optimization algorithm
2. Implement ABC with GBest Algorithm:And GBestDist Algorithm

Text Books:

1 Soft Computing and Intelligent Systems Design Theory, Tools and Applications, Fakhreddine O. Karray and Clarence de Silva ISBN: 978-8131723241

2 Artificial Intelligence and Intelligent Systems, N. P. Padhy,Oxford University press. ISBN: 9780195671544

Reference Books:

1 Fuzzy Logic: A Pratical approach, F. Martin, , Mc neill, and Ellen Thro, AP Professional. ISBN: 978-0124859654

2 An Introduction to Genetic Algorithms, Melanie Mitchell, MIT Press. ISBN: 9780262280013

Web Links:

1 https://nptel.ac.in/courses/106105174/

2 https://www.kdnuggets.com/

3 https://www.import.io/post/datascientistsvsdataanalystswhythedistinctionmatters/

Natural Language Processing

(Common to CSE, IT AIML & CSE(DS))

L	T	P	C
2	0	2	4

Course Code: 241AI010

Course Outcomes:

At the end of the course, student will be able to:

CO1: Explain datasets for NLP tasks and context free grammar.
CO2: Explain Text preprocessing and stemming algorithms.
CO3: Explain feature engineering on text data
CO4: Apply similarity measures and word embedding models
CO5: Explain text summarization and semantic analysis.

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1	2	2	1		1						2
CO2	2	2	2		2						2
CO3	2	2	3		1						2
CO4	2	2	3		1						1
CO5	2	2	3		1						1

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2
CO1		1
CO2		2
CO3		2
CO4		2
CO5		2

UNIT – I

Overview of Natural Language Processing, Natural Language Processing and Python: Understanding Natural language Processing and applications, NLTK, Corpus and Dataset, understanding structure of sentence Defining Context free grammar, Morphological Analysis

Practice:

1. Word Analysis Learn about morphological features of a word by analysing it
2. Word Generation generate word forms from root and suffix information.

UNIT – II

Syntactic Analysis, Semantic analysis, Ambiguity resolution, Discourse integration, Preprocessing tokenization, stemming , lemmatization, Word tokenization and lemmatization

Practice:

1. Implement Porter Stemming Algorithm
2. NGrams learn to calculate bigrams from a given corpus and calculate probability of a sentence

UNIT – III

Feature engineering and NLP algorithms parsers, contextfree grammars, different types of parsers, POS tagging and different types of POS parsers.

Practice:

1. Morphology understanding the morphology of a word by the use of AddDelete table.
2. POS Tagging – calculate emission and transition matrix which will be helpful for tagging Parts of Speech

UNIT – IV

Basic statistical features of NLP: TFIDF, Vectorization Encoders and Decoders, Normalization, Advanced feature engineering and NLP algorithms Basics of Word2Vec

Practice:

1. Apply term frequency"(TFIDF) to Measures the importance of a word to a specific document
2. Implement word embedding using word2vec

UNIT – V

Rule Based system for NLP, Machine Learning for NLP problems, Applications of NLP Text Summarization, Sentiment Analysis

Practice:

1. Chunking understand the concept of chunking and get familiar with the basic chunk tag set.
2. Building Chunker the importance of selecting proper features for training a model and size of training corpus in learning how to do cunking.

Text Books:

1 Python Natural Language Processing , Thanaki J, Packt Publishing Ltd, ISBN-13 : 9781787121423.

2 Springer Handbook of Speech Processing, Jacob Benesty, M. M. Sondhi, Yiteng Huang Springer, ISBN-10. 3540491252 ; ISBN-13. 978-3540491255.

Reference Books:

1 Speech & language processing, Jurafsky D, Pearson Education India.

2 Foundations of Statistical Natural Language Processing, Christopher, D. Manning and Hinrich Schütze, MIT Press.

Web Links:

1 https://www.nltk.org/data.html

2 https://www.analyticsvidhya.com/blog/2017/01/ultimateguidetounderstandimplementnaturallanguageprocessingcodesinpython/

3 https://datahack.analyticsvidhya.com/contest/linguipediacodefestnaturallanguageprocessing1/?utm_source=ultimateguidetounderstandimplementnaturallanguageprocessingcodesinpython&utm_medium=blog

Deep Learning

(Common to CSE, IT, AIML & CSE (DS))

	L	T	P	C
Course Code: 241AI011	**2**	**0**	**2**	**4**

Course Outcomes:
At the end of the course, student will be able to:

- **CO1:** Demonstrate the basic statistical concepts in deep learning.
- **CO2:** Explain architecture and mathematical foundation for various deep neural networks.
- **CO3:** Illustrate the challenges and optimization strategies in Deep Learning.
- **CO4:** Build a convolutional neural network using different activation functions.
- **CO5:** Build and train RNN and LSTMs using sequence modelling.

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1		2	1		2			1	1		3
CO2		2	1		2			1	1		3
CO3		2		3	1			1	1		1
CO4	2	2	3		1			1	1		
CO5	1	2	3		1			1	1		

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2
CO1		2
CO2		2
CO3		2
CO4		2
CO5		2

UNIT-I

Deep Learning Concepts

Fundamentals about Deep Learning, Perception Learning Algorithms, Probabilistic modelling, Early Neural Networks, How Deep Learning different from Machine Learning, Scalars. Vectors, Matrixes, Higher Dimensional Tensors, Manipulating Tensors. Vector Data, Hyper parameters Vs Parameters - validation sets - Estimators, Bias, Variance , Overfitting and Underfitting, Introduction to Keras and TensorFlow and PyTorch.

Practice:

1. Installation and basic commands of scikit, TensorFlow and PyTorch
2. Implement Random Forest by using scikit, TensorFlow and PyTorch
3. Implement multilayer perceptron algorithm for MNIST Handwritten Digit Classification

UNIT-II

Neural Networks

About Neural Network, Building Blocks of Neural Network, Introduction to Neural Networks, Feed-forward Networks, Deep Feed-forward Networks - Learning XOR, Gradient Based learning, Hidden Units, Back-propagation and other Differential Algorithms, Data Pre-processing for neural networks, Feature Engineering.

Practice:

1. Design a neural network for classifying movie reviews (Binary Classification) using IMDB dataset.
2. a) Design a neural Network for classifying news wires (Multi class classification) using Reuters dataset
   b) Design a neural network for predicting house prices using Boston Housing Price dataset.

UNIT-III

Optimization Techniques

Optimizers – SGD (Stochastic Gradient Descent), Mini-batch Gradient Descent, MS prop (Root Mean Square Propagation),Adagrad (Adaptive Gradient Algorithm), Adadelta (Adaptive Delta), Adam (Adaptive Moment Estimation), Adamax (Adaptive Moment Estimation with Infinity Norm).

Activation Functions : sigmoid, tanh, ReLU, leaky ReLU, Soft Max, Linear Loss Functions - cross-entropy loss, the mean-squared error, the Huber loss, the hinge loss ,L2 loss , mean absolute loss Regularization – L1, L2 and drop out . Learning Rate, Normalization

Practice :

1. Implement word embeddings for IMDB dataset.
2. Implement one hot encoding of words or characters.
3. Consider Patient Dataset. Apply linear classification technique(SVM) to identify the rate of heart patients. Also apply the optimization techniques.
4. Write a Python program to construct a Bayesian network considering medical data. Use this model to demonstrate the diagnosis of heart patients using standard Heart Disease Data Set

UNIT-IV

Convolutional Neural Network

About CNN, Building a convolutional neural network, Input Layers, Convolution Layers, Pooling Layers, Dense Layers, Backpropagation Through the Convolutional Layer, Filters and Feature Maps, Backpropagation Through the Pooling Layers, Dropout Layers and Regularization, Batch Normalization,

Pre trained CNN: LeNet, Alex Net, VGG16, ResNet.

Practice :

1. Build a Convolution Neural Network for MNIST Handwritten Digit Classification.
2. a) Use a pre-trained convolution neural network (VGG16) for image classification
   b) Build a Convolution Neural Network for simple image (dogs and Cats) Classification
3. Student Portfolio Creation using GitHub, Hugging Face & Kaggle

UNIT – V

RNN

Recurrent Neural Networks ,Sequence-to-Sequence Modelling – Embedding - Recurrent Neural Networks - Bidirectional RNNs, Analysing Variable Length Inputs – Tackling seq2seq Problem – Beam Search and Global Normalization – Recurrent Neural Networks (RNN)– Hidden States – Perplexity – Character-level Language Models –Modern RNNs: Gated Recurrent Units (GRU), Long Short-Term Memory (LSTM).

Practice :

1. Implement a Recurrent Neural Network for IMDB movie review classification problem.
2. Implement Boosting algorithms using scikit, Tensorflow and PyTorch

Additional Practice

1. Assuming a set of documents that need to be classified, use the naïve Bayesian Classifier model toperform this task. Built-in Java classes/API can be used to write the program. Calculate the accuracy,precision, and recall for your data set.
2. Apply EM algorithm to cluster a Heart Disease Data Set. Use the same data set for clustering using kMeans algorithm. Compare the results of these two algorithms and comment on the quality ofclustering. You can add Java/Python ML library classes/API in the program.

Text Books:

1 Deep Learning, Ian Goodfellow, YoshuaBengio, Aaron Courville, MIT Press, ISBN: 9780262035613.

2 Deep learning: A practitioner's approach, Josh Patterson and Adam Gibson, O'Reilly Media, First Edition, ISBN 13 9781491914250.

Reference Books:

1 Fundamentals of Deep Learning, Designing nextgeneration machine intelligence algorithms, Nikhil Buduma, O'Reilly, Shroff Publishers. ISBN: 978-9352135608

2 Deep learning Cookbook, Practical recipes to get started Quickly, DouweOsinga, O'Reilly, Shroff Publishers. ISBN: 978-9352137572

Web Links:

1 https://onlinecourses.nptel.ac.in/noc20_cs62/preview

2 https://keras.io/datasets/

Recommender Systems

(Common to CSE, IT, AIML & CSE (DS))

	L	T	P	C
Course Code: 241AI013	**2**	**0**	**2**	**4**

Course Outcomes:

At the end of the course, student will be able to:

- **CO1:** Explain the basic concepts of Recommender systems
- **CO2:** Design and implememnt of Content based recommendation systems, hybrid recommendation
- **CO3:** Implementation of Collaborative filtering techniques
- **CO4:** Analyze attack resistant recommender systems and neighborhoodbased recommender systems
- **CO5:** Evaluate recommender systems effectively, assess their performance using appropriate analysis of design and metrics.

Mapping of Course Outcomes with Program Outcomes:

CO/ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1	3				1	2		1	1		
CO2	3		2		1			1	1		
CO3	3				1			1	1		
CO4	3	2			1			1	1		
CO5		3		2	1			1	1		

Mapping of Course Outcomes with Program Specific Outcomes:

CO/ PSO	PSO1	PSO2
CO1	2	
CO2	2	
CO3	2	
CO4	3	3
CO5	3	3

UNIT – I

Introduction and basic taxonomy of recommender systems : Traditional and nonpersonalized Recommender Systems Overview of data mining methods for recommender systems similarity measures Dimensionality reduction – Singular Value Decomposition (SVD).

Introduction : Overview of Information Retrieval, Retrieval Models, Search and Filtering Techniques: Relevance Feedback, User Profiles, Recommender system functions, Matrix operations, covariance matrices, Understanding ratings, Applications of recommendation systems, Issues with recommender system.

Practice :

1. Programs on Python, Numpy and Pandas.
2. Implement Data similarity measures using Python.

UNIT – II

ContentBased Recommendation Systems : Highlevel architecture of contentbased systems Item profiles, Representing item profiles, Methods for learning user profiles, Similaritybased retrieval, and Classification algorithms.

Hybrid recommendation approaches: Opportunities for hybridization, Monolithic hybridization design, parallelized hybridization design, pipelined hybridization design.

Practice :

1. Implement dimension reduction techniques for recommender systems
2. Implement Hybrid Recommendation

UNIT – III

Collaborative Filtering : A systematic approach, Nearestneighbor collaborative filtering (CF), userbased and itembased CF, components of neighborhood methods (rating normalization, similarity weight computation, and neighborhood selection.

Practice :

1. Implement collaborative filter techniques
2. Implement user profile learning

UNIT – IV

AttackResistant Recommender Systems : Introduction – Types of Attacks – Detecting attacks on recommender systems – Individual attack –Group attack – Strategies for robust recommender design Robust recommendation algorithms.

NeighborhoodBased Recommender Systems : Formal definition, components of neighborhood methods: Rating normalization, Similarity weight computation, neighborhood selection, dimensionality reduction, graphbased methods.

Practice :

1. Build Model for Attack resistant Social media recommender systems
2. Create an attack for tampering with recommender systems

UNIT – V

Evaluating Recommender System: Introduction, General properties of evaluation research, Evaluation designs: Accuracy, Coverage, confidence, novelty, diversity, scalability, serendipity, Evaluation on historical datasets, Offline evaluations, accuracy metrics in offline evaluation: RMSE, MAE, Limitations of evaluation metrics.

Practice :

1. Implement accuracy metrics like Receiver Operated Characteristic curves
2. Analyze evaluation metrics using KNearest Neighbors for Movie recommender systems

Text Books:

1 Recommender Systems: The Textbook, Charu C. Aggarwal, Springer. ISBN: 978-3319296579

2 Recommender Systems Handbook, Francesco Ricci, Lior Rokach, and Bracha Shapira, Springer, First Edition. ISBN: 978-1441995790

Reference Books:

1 Recommender Systems Handbook, Ricci F., Rokach L., Shapira D., Kantor B.P., Springer, 1st ed. ISBN: 978-0387858203

2 Recommender Systems For Learning, Manouselis N., Drachsler H., Verbert K., Duval E., Springer, 1st ed. ISBN: 978-1461443610

Web Links:

1 NPTEL, Websites etc. https://www.coursera.org/specializations/recommender systems.

2 MOOC on NPTEL :https://nptel.ac.in/courses/, NPTEL / Swayamwww.edx. com www.coursera.com

Reinforcement Learning

(Common to CSE, IT AIML & CSE(DS))

	L	T	P	C
Course Code: 241AI009	**2**	**0**	**2**	**4**

Course Outcomes:

At the end of the course, student will be able to:

CO1: Outline the basic concepts of Reinforcement learning.
CO2: Identify the appropriate learning tasks for Reinforcement learning techniques.
CO3: Implement adversarial training techniques to train GAN models.
CO4: Analyse the applications of VAEs in various domains.
CO5: Evaluate the ethical considerations and societal impact of reinforcement learning.

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1	2	2			2					1	
CO2	2	2			2					1	
CO3	3	2			2					1	
CO4	3	2	1		2					1	
CO5	2	1	1		2					1	

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2
CO1	2	
CO2	2	1
CO3	3	1
CO4	2	
CO5	3	1

UNIT – I

Introduction to Reinforcement Learning

Basics of reinforcement learning (RL), RL components: agents, environments, rewardsbased Markov Decision Processes (MDPs), Exploration vs. Exploitation dilemma, Basic algorithms: Qlearning, SARSA, MonteCarlo (MC) Learning.

Practice:

1. Installation of TensorFlow and implement the basic programs.
2. Installation of PYTORCH and implement the basic programs.

UNIT – II

Advanced Reinforcement Learning Techniques

Deep QNetworks (DQN), Policy Gradient methods, ActorCritic architectures, Advantage ActorCritic (A2C) and Proximal Policy Optimization (PPO)

Practice:

1. Model an agent learning to drive a car up a steep mountain by applying the correct amount of throttle and braking. (Policy Gradient Methods)
2. Use deep reinforcement learning to train an agent to play various Atari games, such as Breakout, Space Invaders, or PacMan.

UNIT – III

Generative Adversarial Networks (GANs)

Introduction to generative models, Basics of GANs: generator, discriminator, Training GANs: adversarial training, Variants of GANs: Conditional GANs, Wasserstein GANs, etc., data augmentation

Practice:

1. Train an agent to play Flappy Bird, a sidescrolling game where the agent controls the flight of a bird through a series of pipes.
2. Simulate a colony of ants foraging for food in a dynamic environment, where the agent learns to find and retrieve food while avoiding obstacles and predators

UNIT – IV

Variational Autoencoders (VAEs)

Introduction to autoencoders, Variational inference and latent variable models, Encoder and decoder architectures in VAEs, Training VAEsMaximizing Evidence Lower Bound(ELBO)

Practice:

1. Track Detection for Autonomous vehicles using VAE
2. Train a robotic arm to perform various tasks, such as reaching a target location or manipulating objects, using reinforcement learning.

UNIT – V

Advanced Topics in Reinforcement Learning

Modelbased RL and world models, multiagent reinforcement learning, Transfer learning and metalearning in RL

Practice:

1. Develop a trading agent that learns to make profitable trades in financial markets by analyzing historical data and adapting its trading strategy over time
2. Experiment with different strategies for solving the multiarmed bandit problem, where an agent must decide which arm of a slot machine to pull to maximize cumulative reward.

Text Books:

1 Reinforcement Learning An Introduction, R. S. Sutton and A. G. Bart,. MIT Press, ISBN 978-0262039246, 2018.

Reference Books:

1 Algorithms for Reinforcement Learning, Szepesvári, Csaba, United States: Morgan & Claypool. ISBN: 978-1627050278

2 Markov Decision Processes: Discrete Stochastic Dynamic Programming, Arman, Martin L., Germany, Wiley. ISBN: 978-0471727200

Web Links:

1 https://onlinecourses.nptel.ac.in/noc20_cs74/preview

2 https://www.coursera.org/learn/fundamentalsofreinforcementlearning

Prompt Engineering & GenAI

(Common to All, Except CSE, IT, AIML & CSE (DS))

	L	T	P	C
Course Code: 241AI016	**2**	**0**	**1**	**3**

Course Outcomes:

At the end of the course, student will be able to:

- **CO1:** Explain the importance of prompt engineering, distinguish between explicit, implicit, and creative prompts.
- **CO2:** Apply prompt engineering to improve NLP tasks, enhance creativity and diversity in AI-generated content.
- **CO3:** Evaluate the Finetuning Language Models for Optimal Output Managing Prompt Complexity and Length.
- **CO4:** Analyse the data preprocessing Techniques for language models.
- **CO5:** Evaluate the ethical considerations and societal impact of generative AI technologies.

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1	2	2			2			1	1		1
CO2	2	2			2			1	1		2
CO3	3	2			2			1	1		1
CO4	3	2	1		2			1	1		1
CO5	2	1	1		2			1	1		2

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2
CO1		2
CO2		1
CO3		1
CO4		2
CO5		1

UNIT – I

Introduction to Prompt Engineering: What is prompt engineering and why it matters, Prompt types: explicit, implicit, and creative prompts, Best Practices for Crafting Effective Prompts

Practice:

1. Write a python program for Prompt Clarity Evaluation.
2. Write a python program for prompt Relevance Assessment
3. Write a Python Program for Prompt Diversity Experiment

UNIT – II

Practical Applications of Prompt Engineering: Improving NLP Tasks with Custom Prompts, Enhancing Creativity and Diversity in AIGenerated Content, Addressing AI Ethics and Bias through Thoughtful Prompt Engineering, Personalization and Adaptability in AIGenerated Content

Practice:

1. Write a python program for Custom Prompt for NLP Task
2. Write a python program for Enhancing Creativity in AIGenerated Content
3. Write a python program for Addressing Bias in AIGenerated Content

UNIT – III

Advanced Prompt Engineering Techniques
Customising Prompts for Specific Use Cases, Finetuning Language Models for Optimal Output Managing Prompt Complexity and Length, Enhancing Control and Diversity in Generated Text

Practice:

1. write a python program for Customizing Prompts for Specific Use Cases
2. Finetuning Language Models for Optimal Output using python

UNIT – IV

Foundations of Generative AI
Neural Networks and Their Relevance in AI Language Generation, Deep Learning Architectures for Text Generation and its Implications for Prompt Engineering, Data Preprocessing Techniques for Language Models

Practice:

1. Write a python program for Training a Simple Text Generation Model using LSTM
2. Data Preprocessing Techniques for Language Models using python

UNIT – V

Advanced Topics inGenerative AI
Adversarial attacks and defences in generative models, Ethical considerations and societal impact of generative AI,LangChain Framework.

Practice:

1. Detecting and Mitigating Adversarial Attacks using python

Text Books:

1 Deep Learning, Ian Goodfellow, Yoshua Bengio, and Aaron Courville Version: 1st Edition, ISBN : 9780262035613.
2 Natural Language Processing with Python: Analyzing Text with the Natural Language Toolkit, Steven Bird, Ewan Klein and Edward Loper Version: 1st Edition, ISBN, 0596555717, 9780596555719.

Reference Books:

1 Markov Decision Processes: Discrete Stochastic Dynamic Programming, Puterman, Martin L., Germany: Wiley. ISBN: 978-0471727828
2 Generative Deep Learning: Teaching Machines to Paint, Write, Compose, and Play, Author: David Foster Version: 1st Editon 2019 ISBN: 978-1492041948
3 Interpretable Machine Learning: A Guide for Making Black Box Models Explainable" Christoph Molnar Version: 1st Edition 2019 ISBN: 978-1700895466

Web Links:

1 https://onlinecourses.nptel.ac.in/noc20_cs74/preview

AI Chatbots

(Common to All, Except CSE, IT, AIML & CSE (DS))

	L	T	P	C
Course Code: 241AI015	2	0	0	2

Course Outcomes:

At the end of the course, student will be able to:

CO1: Explore the benefits and challenges of deploying chatbots for business use cases.
CO2: Evaluate a fully functional and interactive chatbot using a commercial platform.
CO3: Deploy the finished chatbot for public use and interaction.
CO4: Distinguish between the NLP and NLU Tools
CO5: Demonstrate Microsoft Bot Framework, RASA and third-party API's

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2	2	3					1	1		
CO2	2	2	3		1			1	1		
CO3	1	1	2		1			1	1		
CO4	1	2			2			1	1		
CO5	2	2	2		2			1	1		1

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2
CO1	2	
CO2	2	
CO3		2
CO4	2	
CO5	3	

UNIT I

Introduction: Benefits from Chatbots for a Business, A Customer-Centric Approach in Financial Services, Chatbots in the Insurance Industry, Conversational Chatbot Landscape,

Identifying the Sources of Data: Chatbot Conversations, Training Chatbots for Conversations, Personal Data in Chatbots, Introduction to the General Data Protection Regulation (GDPR)

UNIT II

Chatbot Development Essentials: Customer Service-Centric Chatbots, Chatbot Development Approaches, Rules-Based Approach, AI-Based Approach, Conversational Flow, Key Terms in Chatbots, Utterance, Intent, Entity, Channel, Human Takeover, Use Case: 24x7 Insurance Agent

UNIT III

Building a Chatbot Solution: Business Considerations, ChatbotsVs Apps, Growth of Messenger Applications, Direct Contact Vs Chat, Business Benefits of Chatbots, Success Metrics, Customer Satisfaction Index, Completion Rate, Bounce Rate, Managing Risks in Chatbots Service, Generic Solution Architecture for Private Chatbots

UNIT IV

Natural Language Processing, Understanding, and Generation: Chatbot Architecture, Popular Open Source NLP and NLU Tools, Natural Language Processing, Natural Language Understanding, Natural Language Generation, Applications.

UNIT V

Introduction to Microsoft Bot, RASA, and Google Dialog flow: Microsoft Bot Framework, Introduction to QnA Maker, Introduction to LUIS, Introduction to RASA, RASA Core, RASA NLU, Introduction to Dialog flow
Chatbot Integration Mechanism: Integration with Third-Party APIs, Connecting to an Enterprise Data Store, Integration Module

Text Books:

1 Artificial Intelligence Based Chat Bot Design, Nazneen Akhter Shaikh, Khan Samrin Syed Zebanaaz, Saniya Raheen Patel, Lambert Publication ISBN: 978-6202786713

Reference Books:

1 Hands-On Chatbots and Conversational UI Development: Build Chatbots and Voice User Interfaces with Chatfuel, Dialogflow, Microsoft Bot Framework, Twilio, and Alexa Skills, Packt publication. ISBN: 9781788294669

Web Links:

1 https://onlinecourses.nptel.ac.in/noc22_ge29/preview
2 https://www.geeksforgeeks.org/nlp-vs-nlu-vs-nlg/
3 https://dev.botframework.com/

Federated Machine Learning

(Common to CSE,IT,AIML & CSE(DS))

L	T	P	C
2	0	0	2

Course Code: 241AI017

Course Outcomes:

At the end of the course, student will be able to:

CO1: Outline the Concepts of Federated Machine Learning
CO2: Explore the types of Federated machine Learning.
CO3: Apply Optimization techniques for Federated heterogeneous networks.
CO4: Apply clustering techniques on high dimensional data to group the similar entities.
CO5: Make use of ensemble learning techniques to improve the performance of a model.

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1	2	2									
CO2	2	2	3								
CO3	3	2	3		2						2
CO4	3	2	3								
CO5	2	2	2		2						2

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2
CO1		2
CO2		2
CO3		2
CO4		2
CO5		2

UNIT – I

Introduction to Federated learning:
Introduction to Federated learning, Privacy Preserving, Distributed Machine Learning, Threats to Federated Learning, Data Valuation

UNIT – II

Types of the Federated learning
Horizontal Federated learning ,Vertical Federated Learning, Federated Transfer learning

UNIT – III

Federated Optimization for heterogeneous networks:
Deep Networks from Decentralized data, Federated Multitask Learning, Personalized Federated Learning

UNIT – IV

Federated Learning Applications:
Recommendation in health care and Finance, Mobile keyboard prediction, Learning of out of vocabulary words.

UNIT – V

Adaptive personalized Federated learning :
Privacy Preserving Deep Learning, Advances and Open Problems.

Text Books:

1 Federated Learning, Qiang Yang, Yang Liu, Yong Cheng, yan Kang, Tianjian Chen, Han Yu, Morgan & Claypool Publishers, ISBN: 978-1681736976, 2019.
2 Handbook of Big data Privacy, KimKwang Raymond Choo, Ali Dehghantanha, Springer Nature Switzerland, ISBN: 978-3030385569, 2020.

Reference Books:

1 Machine Learning Probabilistic Approach, Kevin P. Murphy, MIT Press. ISBN: 9780262018029

Web Links:

1 https://www.deeplearning.ai/machinelearningyearning/
2 https://onlinecourses.nptel.ac.in/noc21_cs24/preview
3 https://www.udemy.com/course/machinelearning/

Expert Systems

(Common to CSE, IT, AIML & CSE (DS))

	L	T	P	C
Course Code: 241AI008	**2**	**0**	**1**	**3**

Course Outcomes:
At the end of the course, student will be able to:

CO1: Identify the major characteristics of expert systems.
CO2: Illustrate the various kinds of problems that expert systems can handle.
CO3: Recognize the types of errors attributed to uncertainty.
CO4: Describe the development stages of an expert system.
CO5: Utilize different knowledge representation methods.

Mapping of Course Outcomes with Program Outcomes:

CO/ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1			2	1			2	2		1	3
CO2		1	1		1			1			3
CO3			3		2	1			1		3
CO4	1	2	1	1	2				1	1	
CO5		2		1		3		1	2		3

Mapping of Course Outcomes with Program Specific Outcomes:

CO/ PO	PSO1	PSO2
CO1		2
CO2		2
CO3		2
CO4		3
CO5		3

UNIT – I

Introduction to Expert System, general stages in the development of an expert system,Major characteristics of Expert System,Types of applications of Expert Systems, relationship of Expert Systems to Artificial Intelligence and to KnowledgeBased Systems,Components of Expert System, Conventional Systems vs. Expert Systems, Benefits of using an Expert System.

Practice :

1. Building a RuleBased Expert System for Diagnosis
2. Implementing a Recommender System using KnowledgeBased Inference

UNIT – II

Architecture of Expert System, types of problems handled by expert systems,Utilization and functionality of expert systems,Rule Based Expert System, Non Production System,Expert System Development Life Cycle,Basic forms of inference: abduction; deduction; induction.

Practice :

1. Rule Based Expert System for Restaurant Recommendation
2. Basic Forms of Inference Demonstration

UNIT – III

The representation and manipulation of knowledge in a computer, Rulebased representations (with backward and forward reasoning), Knowledge Acquisition and Knowledge Representation , difficulties, in knowledge acquisition methods of knowledge acquisition, The meaning of uncertainty and theories devised to deal with it, Sources of uncertainty,types of errors attributed to uncertainty.

Practice :

1. RuleBased Representation with Forward Reasoning
2. Dealing with Uncertainty using Fuzzy Logic

UNIT – IV

Basic components of an expert system, How to select an appropriate problem,the development of an expert system, types of errors to expect in the development stages,Generation of explanations. Handling of uncertainties. Truth Maintenance Systems.

Practice :

1. Selecting an Appropriate Problem for an Expert System
2. Handling Uncertainty using Fuzzy Logic

UNIT – V

Building Expert Systems, Methodologies for building expert systems: knowledge acquisition and elicitation; formalisation; representation and evaluation. Knowledge Engineering tools,Case Study

Practice :

1. Knowledge Elicitation and Representation using Decision Trees
2. Knowledge Engineering Tool RuleBased System Development

Text Books:

1 Expert Systems Principles and Programming , J. Giarratano and G. Riley, 4th Edition, PWS Publishing Company, ISBN 10: 0534384471 - ISBN 13: 9780534384470.

2 Introduction to Expert Systems, P Jackson, Addison Wesley (2nd Edition), ISBN-13, 978-0201175783.

Reference Books:

1 Artificial Intelligence: A modern approach, Stuart Russel and Peter Norvig, Pearson Education Inc, 2nd ed, ISBN: 978-8120323827

Web Links:

1 https://onlinecourses.swayam2.ac.in/aic21_ge01/
2 https://www.geeksforgeeks.org/expertsystems/
3 https://github.com/mikeroyal/ExpertSystemsGuide

Minor Stream: Data Engineering

Course Code	Course Name	Level	L	T	P	C	CIE	SEE	Total	Pre-requisite
241CS012	NoSQL Databases	FC	2			2	50	50	100	-
241CS039	or Advanced Database Management	AC	2		1	3	50	50	100	DBMS
241CS034	Fundamentals of Data Science	IC	2		1	3	50	50	100	-
241AI026	Information Retrieval Systems	IC	2		1	3	50	50	100	-
241CS036	Business Intelligence & Analytics	IC	2		2	4	50	50	100	PPSC
241AI018	Mining Massive Data Sets	IC	2		1	3	50	50	100	DM
241CS037	Health Care Data Analytics	IC	2		2	4	50	50	100	-
241AI019	Data Visualization	AC	2		2	4	50	50	100	DAP
241CS038	Security & Privacy for Big Data Analytics	AC	2		1	3	50	50	100	-
241CS040	Social Networks & Semantic Web	AC	2		1	3	50	50	100	-
241CS014	Finance & Retail Analytics	AC	2		1	3	50	50	100	-
Total			**20**		**12/13**	**32/33**				

NoSQL Databases

(Common to CSE, IT, AIML & CSE(DS))

	L	T	P	C
Course Code: 241CS012	**2**	**0**	**0**	**2**

Course Outcomes:

At the end of the course, student will be able to:

- **CO1:** Compare the traditional relational databases and NoSQL.
- **CO2:** Explain the principles and architecture of document store databases.
- **CO3:** Design and implement key value database solutions.
- **CO4:** Illustrate the fundamental concepts and architecture of column family store databases.
- **CO5:** Optimize graph databases for performance and scalability.

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1	2	2									
CO2	2	2			2						
CO3	2	2	3		1						
CO4	2	2	3		1						
CO5	2	2	3		1						

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2
CO1		1
CO2		2
CO3		2
CO4		2
CO5		2

UNIT – I

Introduction to No SQL: Definition And Introduction, Traditional relational databases vs. NoSQL databases, Types of No SQL databases, Storing and Accessing Data in NoSql databases, Querying in NoSql databases, Evolution and motivation behind NoSQL databases, Characteristics, advantages, and challenges of NoSQL databases Performing Crud Operations, Creating Records, Accessing Data, Updating And Deleting Data

UNIT – II

Document Stores:
Introduction to MongoDB, Importance of NoSQL databases, Data types, Documents, nested Documents, CRUD Operations, Basic cursor methods: map, to Array, pretty, for Each, limit, count, sort, Columnar Databases, Indexing and Aggregation, MongoDB Node JS Drivers and CAP theorem.

UNIT – III

Key Value databases:
What Is a KeyValue Store, KeyValue Store Features, Suitable Use Cases, When Not to Use
Document Databases: What Is a Document Database, Features, Suitable Use Cases, When Not to Use NoSQL Data Bases

UNIT – IV

Column family stores:
What Is a ColumnFamily Data Store, Features, Suitable Use Cases, When Not to Use Graph **Databases:** What Is a Graph Database, Features, Suitable Use Cases, When Not to Use.

UNIT – V

Graph Database:
Graph Oriented Database Platform: Neo4j Graph Databases – Model relational data – Property graph model – Neo4j Graph Platform –Components – Features – Benefits of Neo4j – Setup Development Environment – Neo4j Sandbox –Neo4j Desktop – Cypher – Match – Graph node retrieval – Graph relations retrieval – Graph properties retrieval – Nodes – Relationships – Merge data into graph – Parameter constraints –Monitor query execution – Indexes – Relational Data.

Text Books:

1. Pramod J. Sadalage, Martin Fowler. NoSQL Distilled, Addison Wesley, ISBN-13: 9780321826626.
2. Dan McCreary and Ann Kelly, Making Sense of NoSQL, Manning Publications, ISBN 9781617291074.

Reference Books:

1. Shashank Tiwari, Professional NoSQL, Wrox Press, Wiley.
2. Gaurav Vaish, Getting Started with NoSQL, Packt Publishing.

Web Links:
1. https://nptel.ac.in/courses/106104135
2. https://www.geeksforgeeks.org/wheredoesmongodbstandinthecaptheorem/ https://www.geeksforgeeks.org/columnardatamodelofnosql/

Advanced Database Management

	L	T	P	C
Course Code: 241CS039	**2**	**0**	**1**	**3**

Course Outcomes:

At the end of the course, student will be able to:

CO1: Demonstrate advanced querying and decision support system.
CO2: Explain Complex queries including full outer joins, selfjoin, sub queries, and set theoretic queries.
CO3: Analyze the concepts of file organization, Query Optimization, Transaction management, and database administration techniques.
CO4: Evaluate different database designs and architecture.
CO5: Apply database functions of distributed databases.

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1	2	2			1			1			2
CO2	2	2			3			1	1		2
CO3	2	2		1	3			1			1
CO4	2	1			2			1	1		
CO5	3	2		1	3			1			1

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2
CO1	1	1
CO2	1	1
CO3	1	2
CO4		
CO5	2	2

UNIT – I

Advanced SQL :

SQL Data Types and Schemas, Integrity Constraints, Authorization, Embedded SQL, Dynamic SQL, Functions and Procedural, Constructs, Recursive Queries, Advanced SQL Features.

ObjectBased Databases and XML: Complex Data Types, Structured Types, and Inheritance in SQL, Table Inheritance, Array and Multi set Types in SQL, ObjectIdentity and Reference Types in SQL, Implementing OR Features, Persistent Programming Languages, ObjectOriented versus ObjectRelational, Structure of XML Data, XML Document Schema, Querying and Transformation, Application Program Interfaces to XML, Storage of XML Data, XML Applications.

Case Study: Accessing Databases from Programs using JDBC

UNIT – II

Query Processing and Query Optimization:

Measures of Query Cost, Selection Operation, Sorting, Join Operation, Other Operations, Evaluation of Expressions, Transformation of Relational Expressions, Estimating Statistics of Expression Results, Choice of Evaluation Plans, Materialized Views.

Case Study: Indexing and Query Processing

UNIT – III

Recovery System:

Failure Classification, Storage Structure, Recovery and Atomicity, LogBased Recovery, Recovery with Concurrent Transactions, Buffer Management, Failure with Loss of Nonvolatile Storage, Advanced Recovery Techniques, Remote Backup Systems.

Case Study: Query Evaluation Plans

UNIT – IV

DatabaseSystem Architectures :

Centralized and Client –Server Architectures, Server System Architectures, Parallel Systems, Distributed Systems, Network Types, Parallel Databases, I/O Parallelism, Inter query Parallelism, Intra query Parallelism, Intra operation Parallelism, Interoperation Parallelism, Design of Parallel Systems

Case Study: Building Web Applications using PHP & MySQL

UNIT – V

Distributed Databases :

Homogeneous and Heterogeneous Databases, Distributed Data Storage, Distributed Transactions, Commit Protocols, Concurrency Control in Distributed Databases, Availability, Distributed Query Processing, Heterogeneous Distributed Databases.

Case Study: Concurrency and Transactions.

Text Books:

1. Database System Concepts ,Silberchatz, Korth, Sudershan, Tata MC Graw Hills Publishing, , 5th Edition, ISBN10 9780071244763.
2. Database Management, System,Raghu Ramakrishnan, Johannes Gehrke, McGraw Hill, 3rd Edition, ISBN 10: 0072465638 - ISBN 13: 9780072465631.

Reference Books:

1. Database Management Systems ,Ramez Elmasri &Shamkant Navathe, Pearson Education Asia, 6th Edition
2. Advanced Database Systems ,Carlo Zaniolo, Stefano Ceri, Christos Faloustsos, R.T.Snodgrass, V.S.Subrahmanian, Morgan Kaufman Series.

Web Links:

1. https://nptel.ac.in/courses/106105175
2. https://nptel.ac.in/courses/106106093
3. https://archive.nptel.ac.in/courses/106/106/106106220/

Fundamentals of Data Science
(Common to CSE, IT, AIML & CSE(DS))

	L	T	P	C
Course Code: 241CS034	**2**	**0**	**1**	**3**

Course Outcomes:

At the end of the course, student will be able to:

CO1: Explain fundamental concepts of Data Science.
CO2: Implement Data Collection and Preprocessing Techniques.
CO3: Demonstrate Proficiency in Data Loading, Storage, and File Handling
CO4: Conduct Exploratory Data Analysis (EDA) using Visualization and Statistical Techniques.
CO5: Make use of Neo4j, Cypher tools to manage and analyze graph data.

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1	2	3							2	2	
CO2	2								1	2	
CO3	2	2	2						2	2	
CO4	2	2			2				2	1	
CO5	3								1	1	

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2
CO1	2	
CO2	1	
CO3	2	
CO4	2	
CO5	1	

UNIT – I

Introduction To Data Science: Definition and Scope of Data Science, History and Evolution of Data Science, Applications of Data Science, Data Science Lifecycle, Data Types and Structures, Tools and Technologies in Data Science.

Practice:

1. Importing and Exploring Datasets - Loading datasets using libraries and performing basic exploration.
2. Basic Data Structures - Working with data structures such as arrays, lists, data frames, and matrices

UNIT – II

Data Collection and Preprocessing: Data Collection Methods, Data Cleaning and Handling Missing Values, Data Transformation: Normalization and Standardization, Feature Engineering and Feature Scaling, Data Integration and Aggregation.

Practice:

1. Computing summary statistics like mean, median, mode, and standard deviation for a sample dataset.
2. Handling missing values and outliers in a dataset using techniques like imputation and filtering.

UNIT – III

Data Loading, Storage, and File Formats : Reading and Writing Data in Text Format, Reading Text Files in Pieces, Writing Data Out to Text Format, Manually Working with Delimited Formats, JSON Data, XML and HTML: Web Scraping, Binary Data Formats,Using HDF5 Format, Reading Microsoft Excel Files, Interacting with Databases, Storing and Loading Data in Mongo DB.

Practice:

1. Read data from a JSON file into a DataFrame using Pandas (pd.read_json) or R (jsonlite). Parse nested JSON structures and convert them into a flat table format.
2. Perform web scraping on an HTML page using BeautifulSoup in Python or rvest in R. Extract data from HTML tables and convert it into a DataFrame.

UNIT – IV

Exploratory Data Analysis (EDA): Descriptive Statistics, Data Visualization Techniques, Correlation and Covariance Analysis, Univariate, Bivariate, and Multivariate Analysis, Pattern Detection and Anomaly Identification**.**

Practice:

1. Plotting histograms and box plots to understand the distribution of a single variable.
2. Creating scatter plots and calculating correlation coefficients to study the relationship between two variables.

UNIT – V

Data Science Tools: Neo4j for dealing with graph databases, graph query language Cypher, libraries like nltk and SQLite for handling Text mining and analytics.

Practice:

1. Get hands-on experience with Neo4j to understand how to manage and query graph databases.

2. Practice writing Cypher queries to interact with graph data in Neo4j.

Text Books:

1	Python for Data Analysis ,Wes McKinney, O'REILLY, ISBN:978-1-449-31979-3, 1st edition, ISBN · 9781449319793.
2	Doing Data Science ,Rachel Schutt & O'neil, O'REILLY, ISBN:978-1-449-35865-5, 1st edition, ISBN: 9781449358655.

Reference Books:

1	Data Science from Scratch: First Principles with Python ,Joel Grus, O'Reilly Media. ISBN: 9781492041139.
2	Learning the Pandas Library: Python Tools for Data Munging ,Matt Harrison, Analysis, and Visualization , O'Reilly. ISBN: 9781787123137

Web Links:

1	https://onlinecourses.nptel.ac.in/noc24_cs68/preview
2	https://onlinecourses.nptel.ac.in/noc24_cs133/preview
3	https://www.geeksforgeeks.org/how-to-become-a-data-analyst-complete-roadmap/

Information Retrieval Systems
(Common to CSE, IT, AIML & CSE (DS))

	L	T	P	C
Course Code: 241AI026	**2**	**0**	**1**	**3**

Course Outcomes:
At the end of the course, student will be able to:

- **CO1:** Explain the Information Storage and Retrieval Systems
- **CO2:** Explain Basic Concepts of Data Structures and Implementation of Algorithms
- **CO3:** Apply retrieval systems for Signature Files, Searching and evaluation of Search Engines
- **CO4:** Evaluate retrieval systems for New Indices for Text and its classification.
- **CO5:** Implement retrieval systems for Stemming Algorithms, Thesaurus Construction and Web Search tasks.

Mapping of Course Outcomes with Program Outcomes:

CO/ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1	3	2	1		2			1	1		
CO2	2	3	1		2			1	1		
CO3	3	2	2		2		2	1	1		1
CO4	2	2	2	1	2		2	1	1		1
CO5	2	2	2	1	2		2	1	1		1

Mapping of Course Outcomes with Program Specific Outcomes:

CO/ PSO	PSO1	PSO2
CO1	1	
CO2	1	
CO3	2	1
CO4	2	2
CO5	2	2

UNIT – I

Introduction to Information Storage and Retrieval System
Introduction, Domain Analysis of IR systems and other types of Information Systems, IR System Evaluation. Retrieval process – Architecture – Boolean retrieval; IR Models: Taxonomy and characterization of IR models; Models for Browsing; Retrieval Evaluation: Performance evaluation
Processing Text: Text Statistics, Document Parsing, Tokenizing, Stopping, Stemming, Phrases, Document Structure, Link Extraction, more detail on Page Rank, Internationalization.

Practice :

1. To Find the Weights of specific Term in a given Documents Using Python.
2. Implement handson experience store, and retrieve information from www using semantic approaches.

UNIT – II

Introduction to Data Structures and Algorithms related to Information Retrieval: Basic Concepts, Data structures, Algorithms. Ngram data structure, PAT data structure.
Inverted Files: Introduction, Structures used in Inverted Files, Building Inverted file using a sorted array, Modifications to Basic Techniques.

Practice :

1. Implement how to analyze ranked retrieval of a very large number of documents with hyperlinks between them
2. Implement how Ngrams are used for detection and correction of spelling errors.

UNIT – III

Signature Files: Introduction, Concepts of Signature Files, Compression, Vertical Partitioning, Horizontal Partitioning.
Searching: Sequential searching – Pattern matching; Searching the Web: Characterizing the Web – Search engines – Browsing – Searching using hyperlinks.

Practice :

1. Implement Text Pattern Matching and Searching Algorithm using python.
2. Implement Compression of Text Files using python.

UNIT – IV

New Indices for Text: PAT Trees and PAT Arrays: Introduction, PAT Tree structure, algorithms on the PAT Trees, Building PAT trees as PATRICA Trees, PAT representation as arrays.
Text Classification: Test collections, Query logs, Averaging and interpolation, focusing on the top documents. Training, Testing, and Statistics: Significance tests, setting parameter values for Classification and Clustering.

Practice :

1. Implementation of various classification algorithm on text using python.
2. Implementation of various Clustering algorithm on text using python.

UNIT – V

Thesaurus Construction: Introduction, Features of Thesauri, Thesaurus Construction, Thesaurus construction from Texts, Merging existing Thesauri
APPLICATIONS & XML Retrieval – Multimedia IR – Parallel and Distributed IR – Digital Libraries – Social Media Retrieval – Contentbased Image Retrieval.

Practice :

1. Implement how to analyze ranked retrieval of a very large number of documents with hyperlinks between them.

2. Case Study on: Demonstrate Information visualization technologies like Cognition and perception in the Internet or Web search engine.

Text Books:

1 Introduction to Information Retrieval, Christopher D.Manning, Prabhakar Raghavan, Hinrich Schutze, Cambridge University Press, ISBN: 978-0-521-86571-5
2 Information Retrieval Data Structures and Algorithms, Frakes, W.B., Ricardo BaezaYates,Prentice Hall, ISBN: 978-0134638379
3 Modern Information Retrieval. BaezaYates Ricardo and Berthier RibeiroNeto., AddisonWesley, 2nd edition, ISBN: 978-8131709771

Reference Books:

1 Modern Information Retrieval, Ricardo BaezaYates, Neto, PEA. ISBN: 978-0321416919
2 Information Storage and Retrieval Systems: Theory and Implementation, Kowalski, Gerald, Mark Academic Press. ISBN: 978-0792379249
3 Information Retrieval: Algorithms and Heuristics, Grossman, OphirFrieder,2/e, Springer. ISBN: 978-1461375326

Web Links:

1 https://nptel.ac.in/courses/106101007
2 https://www.geeksforgeeks.org/what-is-information-retrieval/

Business Intelligence & Analytics

	L	T	P	C
Course Code: 241CS036	**2**	**0**	**2**	**4**

Course Outcomes:

At the end of the course, student will be able to:

CO1: Explain the Business Intelligence, Analytics and Decision Support system
CO2: List the technologies for Decision making, Automated decision systems
CO3: Explain sentiment analysis techniques
CO4: Illustrate Multicriteria Decision making systems, predictive modelling techniques
CO5: Evaluate and validate the performance of automated decision systems and expert systems.

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1	2	2	1	1	1				2	2	1
CO2	2	1	2	1	1				1	2	1
CO3	2	2	1	1	2				2	2	1
CO4	2	2	2	1	1				2	1	
CO5	2	1	1		1				2	1	

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2
CO1	2	
CO2	1	
CO3	2	
CO4	1	
CO5	1	

UNIT – I

An Overview of Business Intelligence, Analytics, and Decision Support: Information Systems Support for Decision Making, An Early Framework for Computerized Decision Support, The Concept of Decision Support Systems, A Framework for Business Intelligence, Business Analytics Overview, Brief Introduction to Big Data Analytics.

Practice:

1. Create interactive dashboards to visualize sales data and identify trends.

UNIT – II

Decision Making: Introduction and Definitions, Phases of the Decision, Making Process, The Intelligence Phase, Design Phase, Choice Phase, Implementation Phase, Decision

Support Systems Capabilities, Decision Support Systems Classification, Decision Support Systems Components.

Practice:

1. Build a predictive model to forecast future sales.

UNIT – III

Neural Networks and Sentiment Analysis : Basic Concepts of Neural Networks, Developing Neural NetworkBased Systems, Illuminating the Black Box of ANN with Sensitivity, Support Vector Machines, A Process Based Approach to the Use of SVM, Nearest Neighbor Method for Prediction, Sentiment Analysis Overview, Sentiment Analysis Applications, Sentiment Analysis Process,, Sentiment Analysis, Speech Analytics.

Practice:

1. Use a pretrained sentiment analysis model to classify the sentiment of text data.

UNIT – IV

Model Based Decision Making: Decision Support Systems modeling, Structure of mathematical models for decision support, Certainty, Uncertainty, and Risk, Decision modeling with spreadsheets,Mathematical programming optimization, Decision Analysis with Decision Tables and Decision Trees, MultiCriteria Decision Making With Pairwise Comparisons

Practice:

1. Evaluate different investment options considering potential risks and returns.

UNIT – V

Automated Decision Systems and Expert Systems: Automated Decision Systems, The Artificial Intelligence field, Basic concepts of Expert Systems, Applications of Expert Systems, Structure of Expert Systems, Knowledge Engineering, Development of Expert Systems.

Practice:

1. Develop a system to recommend products to customers based on their purchase history and preferences.

Text Books:

1 Ramesh Sharda, Dursun Delen, EfraimTurban, J.E.Aronson,TingPeng Liang, David King, “Business Intelligence and Analytics: System for Decision Support”, 10th Edition, Pearson Global Edition, ISBN: 978-. 0137025060.

Reference Books:

1 Data Analytics: The Ultimate Beginner's Guide to Data Analytics Paperback – 12 November by Edward Mize. ISBN: 9781925997576

Web Links:

1 https://onlinecourses.nptel.ac.in/noc24_cs65/preview
2 https://www.geeksforgeeks.org/what-is-business-intelligence/

Mining Massive Data Sets

	L	T	P	C
Course Code: 241AI018	**2**	**0**	**1**	**3**

Course Outcomes:

At the end of the course, student will be able to:

CO1: Handle massive data using Map Reduce.
CO2: Develop and implement algorithms for massive data sets and methodologies in the context of data mining.
CO3: Explain the algorithms for extracting models and information from large datasets
CO4: Develop recommendation systems.
CO5: Gain experience in matching various algorithms for particular classes of problems

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1	2	2		1	2						
CO2	2	1		1	1						
CO3	2	2		1	1						
CO4	2	3		2	2						
CO5	1	2		2	3						

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2
CO1		2
CO2		2
CO3		2
CO4		2
CO5		2

UNIT – I

Introduction: Data Mining Introduction Definition of Data Mining Statistical Limits on Data Mining, Map Reduce and the New Software Stack Distributed File Systems, Map Reduce, Algorithms Using Map Reduce.

Practice:
1. MapReduceWordCountHadoop Run a basic Word Count Map Reduce program to understand Map Reduce Paradigm
2. Demonstrate performing classification on data sets

UNIT – II

Similarity Search: Finding Similar Items Applications of Near Neighbor Search, Shingling of Documents, Similarity Preserving Summaries of Sets, Distance Measures. Streaming Data: Mining Data StreamsThe Stream Data Model , Sampling Data in a Stream, FilteringStreams

Practice:
1. To understand and implement similarity search techniques using shingling of documents and nearneighbor search algorithms.
2. To explore techniques for mining data streams, including sampling data and filtering streams to extract relevant information.

UNIT – III

Link Analysis PageRank, Efficient Computation of Page Rank, Link Spam
Frequent Item sets Handling Larger Datasets in Main Memory, Limited Pass Algorithms, Counting Frequent Items in a Stream. Clustering The CURE Algorithm, Clustering in Non Euclidean Spaces, Clustering for Streams and Parallelism

Practice:
1. To understand the PageRank algorithm for link analysis and implement efficient computation techniques.
2. To explore algorithms for mining frequent itemsets and handling large datasets in main memory and data streams.

UNIT – IV

Advertising on the Web Issues in OnLine Advertising, OnLine Algorithms, The Matching Problem, The Adwords Problem, Adwords Implementation. Recommendation Systems A Model for Recommendation Systems, Content Based Recommendations, Collaborative Filtering, Dimensionality Reduction, The NetFlix Challenge.

Practice:
1. To understand the implementation of AdWords and explore optimization techniques for online advertising.
2. To develop and evaluate a movie recommendation system using contentbased and collaborative filtering approaches.

UNIT – V

Mining Social Network Graphs Social Networks as Graphs, Clustering of Social Network Graphs, Partitioning of Graphs, Simrank, Counting Triangles

Practice:

1. To explore clustering and partitioning techniques for analyzing socialnetwork graphs.
2. To implement algorithms for counting triangles in socialnetwork graphs and analyze their significance.

Text Books:

1 Mining of Massive Datasets ,Jure Leskovec, Anand Rajaraman, Jeff Ullman,3rd Edition, ISBN-13: 978-1108476348.

2 Mining of Massive Datasets ,Anand Rajaraman and Jeffrey David Ullman, CUP, ISBN: 9781139924801.

Reference Books:

1 Jiawei Han & Micheline Kamber, Data Mining – Concepts and Techniques 3rd Edition Elsevier. ISBN: 978-9380931913.

2 Margaret H Dunham, Data Mining Introductory and Advanced topics, PEA. ISBN: 978-8177587852.

3 Ian H. Witten and Eibe Frank, Data Mining: Practical Machine Learning Tools and Techniques, Morgan Kaufmann. ISBN: 978-0123748560.

Web Links:

1 https://online.stanford.edu/courses/soeycs0007miningmassivedatasets
2 https://onlinecourses.nptel.ac.in/noc21_cs06/preview
3 https://www.coursera.org/in/articles/bigdataanalytics
4 https://www.javatpoint.com/datamining
5 https://www.cambridge.org/core/books/miningofmassivedatasets/C1B37BA2CBB8361B94FDD1C6F4E47922

Health Care Data Analytics

	L	T	P	C
Course Code: 241CS037	**2**	**0**	**2**	**4**

Course Outcomes:

At the end of the course, student will be able to:

CO1: Explain fundamentals of Healthcare Data Analytics.
CO2: Demonstrate the technologies for analyzing Biomedical Image
CO3: Apply predictive modeling techniques for Clinical Data
CO4: Apply predictive analysis techniques for genomic data
CO5: Illustrate NLP and Data mining for clinical text.

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1	2								2	2	1
CO2	2	2		1	2				1	2	
CO3	1				2				2	2	1
CO4	2			2	1				1	1	1
CO5	2	2			1				2	2	

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2
CO1	2	
CO2	1	
CO3	2	
CO4	1	
CO5	1	

UNIT – I

An Introduction to Healthcare Data Analytics: Healthcare Data Sources and Basic Analytics Advanced Data Analytics for Healthcare Applications and Practical Systems for Healthcare Resources for Healthcare Data Analytics Electronic Health RecordsComponents of EHR Coding Systems Benefits of EHR Barriers to Adopting EHR Challenges of Using EHR Data.

Practice:
Clean and explore a health care dataset to understand its structure and key attributes. Use the Diabetes dataset from the UCI Machine Learning Repository.

UNIT – II

Biomedical Image Analysis: Biomedical Imaging Modalities Object Detection Image Segmentation Image Registration Feature Extraction Mining of Sensor Data in Healthcare Mining Sensor Data in Medical Informatics Challenges in Healthcare Data Analysis Sensor Data Mining Applications.

Practice:

Build a model to predict if a patient will be readmitted to the hospital within 30 days.Use the Hospital Readmissions Reduction Program (HRRP) dataset.

UNIT – III

Predictive Models for Integrating Clinical and Genomic Data: Introduction Issues and Challenges Different Types of Integration Different Goals of Integrative Studies Validation Information Retrieval for Healthcare KnowledgeBased Information in Healthcare and Biomedicine Content of KnowledgeBased Information Resources Indexing Retrieval Evaluation Research Directions.

Practice:

Perform survival analysis on a dataset of cancer patients to estimate survival rates. Use the SEER Cancer Incidence dataset

UNIT – IV

Natural Language Processing and Data Mining for Clinical Text: Natural Language Processing Mining Information from Clinical Text Challenges of Processing Clinical Reports Clinical Applications Social Media Analytics for Healthcare Social Media Analysis for Detection and Tracking of Infectious Disease Outbreaks Social Media Analysis for Public Health Research Analysis of Social Media Use in Healthcare.

Practice:

Segment patients into different groups based on their health care utilization patterns. Use a dataset containing patient visit records, such as the National Hospital Ambulatory Medical Care Survey (NHAMCS).

UNIT – V

Advanced Data Analytics for Healthcare: Automated Decision Systems The Artificial Intelligence field Basic concepts of Expert Systems Applications of Expert Systems Structure of Expert Systems Knowledge Engineering Development of Expert Systems – Locationbased Analytics Cloud Computing Business Intelligence.

Practice:

Analyze health care costs and identify factors driving high costs. Use the Medical Expenditure Panel Survey (MEPS) dataset.

Text Books:

1 Chandan K. Reddy, Charu C. Aggarwal "Healthcare Data Analytics", CRC Press, ISBN 9780367575687.

Reference Books:

1 Analytics in HealthcareA Practical Introduction, Christo El Morr, Hossam AliHassan, 2019 ISBN: 9783030045067

Web Links:

1 https://onlinecourses.nptel.ac.in/noc22_hs40/preview
2 https://nptel.ac.in/courses/109107190

Data Visualization
(Common to CSE, IT, AIML & CSE (DS))

	L	T	P	C
Course Code: 241AI019	**2**	**0**	**2**	**4**

Course Outcomes:
At the end of the course, student will be able to:

CO1: Explain the various types of data and principles of data visualization
CO2: Apply visualization techniques to a problem and its associated dataset
CO3: Apply structured approach to create effective visualizations
CO4: Outline the valuable insights from the massive dataset using visualization.
CO5: Build visualization dashboard to support decision making

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1	2	2			1			1	1		2
CO2	2	2			2			1	1		2
CO3	2	2	3		1			1	1		2
CO4	2	2	3		1			1	1		1
CO5	2	2	3		1			1	1		1

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2
CO1		1
CO2		2
CO3		2
CO4		2
CO5		2

UNIT – I

Introduction to Visualization:
Introduction to Data Visualizations and Perception: Introduction to visualization and visual perception, visual representation of data, Gestalt principles, Information overload.

Practice :
1. Introduction to various Data Visualization tools
2. Basic Visualization in Python

UNIT – II

Visual Representations: Creating visual representations, visualization reference model, visual mapping, visual analytics, Design of visualization applications.

Practice :

1. Basic Visualization in R
2. Introduction to Tableau and Installation

UNIT – III

Classification of Visualization Systems: Classification of visualization systems, Interaction and visualization techniques misleading, Visualization of one, two and multidimensional data, text and text documents.

Practice :

1. Connecting to Data and preparing data for visualization in Tableau
2. Data Aggregation and Statistical functions in Tableau

UNIT – IV

Visualization of Groups: Visualization of groups, trees, graphs, clusters, networks, software, Metaphorical visualization. Various visualization techniques, data structures used in data visualization.

Practice :

1. Data Visualizations in Tableau

UNIT – V

Visualization of Volumetric Data And Evaluation of Visualizations: Visualization of volumetric data, vector fields, processes and simulations, Visualization of maps, geographic information, GIS systems, collaborative visualizations, evaluating visualizations

Practice :

1. Basic Dashboards in Tableau

Text Books:

1 Interactive Data Visualization: Foundations, Techniques, and Applications, Ward, Grinstein, Keim, Natick, A K Peters, Ltd, 2nd edition, ISBN-13. 978-1482257373.

Reference Books:

1 Visualization Analysis & Design, Tamara Munzner, AK Peters Visualization Series, 1st edition.
2 Interactive Data Visualization for the Web, Scott Murray, 2nd Edition.

Web Links:

1 https://elearn.nptel.ac.in/shop/iit-workshops/completed/data-visualization-with-r/?v=c86ee0d9d7ed
2 https://www.udemy.com/course/mastering-datavisualization/?couponCode=NVDIN35

Security & Privacy for Big Data Analytics

L	T	P	C
2	0	1	3

Course Code: 241CS038

Course Outcomes:

At the end of the course, student will be able to:

CO1: Explain the various sources of Big Data.
CO2: Make use of Big Data analytics principles to build security applications.
CO3: Identify security threats and vulnerabilities using security analytics
CO4: Develop algorithms for preprocessing Big Data other than the traditional approaches.
CO5: Design methodologies to extract data from structured and unstructured data for analytics.

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1	2	2			1				1	1	
CO2	2	2			2				1		
CO3	2	2		1	2				1	1	
CO4	2	1		1	2				1		
CO5	2	2		1	2				1	1	

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2
CO1	2	
CO2	2	
CO3	2	
CO4	2	
CO5	2	

UNIT – I

Introduction to Big Data Acquisition:
Big Data framework fundamental concepts of Big Data management and analytics Current challenges and trends in Big Data Acquisition.

UNIT – II

Introduction to Security Analytics: Introduction to Security Analytics – Techniques in Analytics – Analysis in everyday life – Challenges in Intrusion and Incident Identification – Simulation and Security Process, Analytical Softwares and tools, Malware Analysis – static and dynamic analysis Security Intelligence – Security Breaches.
Case Study: Malware analysis

UNIT – III

Applications of Security Analytics :
Access Analytics – Analysis of Log file Security analysis with text mining –Machine Learning and data mining applications for security: Intrusion detection and network anomaly detection. Big data analytics for security: Analyzing DDOS – Distributed Denial of Service attack: counter based method, and access pattern based method – Machine learning for Ransom ware detection and prevention
Case Study: Intrusion detection and network anomaly ditection

UNIT – IV

Data Analytics:

Predictive Analytics: Regression, Decision Tree, Neural Networks Descriptive Analytics: Association Rules, Sequence Rules, Survival Analysis: Survival Analysis Measurements, Kaplan Meir Analysis, Parametric Survival Analysis Social Network Analytics: Social Network LearningRelational Neighbor Classification.
Case Study: Implement neighbor classifications

UNIT – V

Big Data Privacy and Applications:

Data Masking – Privately Identified Information (PII) Privacy preservation in Big Data Popular Big Data Techniques and tools Map Reduce paradigm and the Hadoop system – Applications Social Media Analytics Recommender Systems Fraud Detection
Case Study: Implement fraud detection algorithm

Text Books:

1 Analytics in a Big Data World: The Essential Guide to Data Science and its Applications ,Bart Baesens, John Wiley & Sons, ISBN-13: 978-1118892701.
2 Information Security Analytics: Finding Security Insights, Patterns, and Anomalies in Big Data ,Mark Talabis, Robert McPherson, I Miyamoto and Jason Martin, Syngress Media, U.S., ISBN-13: 978-0128002070 ISBN-10: 0128002077.

Reference Books:

1 Related Technologies, Challenges and Future Prospects, Min Chen, Shiwen Mao, Yin Zhang, Victor CM Leung,Big Data: Springer,. ISBN 978-3-319-06244-0 ISBN 978-3-319-06245-7.
2 Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends ,Michael Minelli, Michele Chambers, AmbigaDhiraj ,John Wiley & Sons. 2013 ISBN 9781118147603.

Web Links:

1 https://archive.nptel.ac.in/courses/106/104/106104189/
2 https://www.techtarget.com/searchsecurity/definition/securityanalytics
3 https://iimskills.com/dataanalyticscoursesatnptel/
4 https://nptel.ac.in/courses/106104189

Social Networks & Semantic Web

	L	T	P	C
Course Code: 241CS040	**2**	**0**	**1**	**3**

Course Outcomes:

At the end of the course, student will be able to:

CO1: Summarize the concepts of semantic web and social network analysis.
CO2: Describe the knowledge representation on the Semantic web.
CO3: Make use of ontology engineering in social networks.
CO4: Identify the architectures and challenges in building social networks
CO5: Compare various survey methods of social networks.

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1	3	2		1					1		
CO2	2	3							1	1	
CO3	2	3	2								
CO4	2	2	3						1		
CO5	3	2	1						1	1	

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2
CO1		1
CO2		1
CO3		2
CO4		1
CO5		1

UNIT – I

Web Intelligence: Thinking and Intelligent Web Applications, The Information Age,The World Wide Web, Limitations of Today's Web, The Next Generation Web, Machine Intelligence, Artificial Intelligence, Ontology, Inference engines, Software Agents, BernersLee www, Semantic Road Map, Logic on the semantic Web.

Practice:

1. Plot the trend of Moore's law from 1970 to today. Then project processor performance for the year 2020 based on Moore's law.

UNIT – II

Knowledge Representation for the Semantic Web: Ontologies and their role in the semantic web, Ontologies Languages for the Semantic Web –Resource Description

Framework (RDF) / RDF Schema, Ontology Web Language (OWL), UML, XML/XML Schema.

Practice:

1. Why is it necessary to consider less powerful expressive languages for the Semantic Web?

UNIT – III

Ontology Engineering: Ontology Engineering, Constructing Ontology, Ontology Development Tools, Ontology Methods, Ontology Sharing and Merging, Ontology Libraries and Ontology Mapping, Logic, Rule and Inference Engines. Practice: Describe an ontology with the domain of your university faculty, with teachers, courses, and departments.

Practice:

1. Use an inference engine to validate your ontology and check for inconsistencies.

UNIT – IV

Semantic Web Applications, Services and Technology: Semantic Web applications and services, Semantic Search, elearning, Semantic Bioinformatics, Knowledge Base, XML Based Web Services, Creating an OWLS Ontology for Web Services, Semantic Search Technology, Web Search Agents and Semantic Methods

Practice:

1. Why would Semantic Web Services promote open Web standards and a distributed Web?

UNIT – V

Social Network Analysis and semantic web: What is social Networks analysis, development of the social networks analysis, Electronic Sources for Network Analysis – Electronic Discussion networks, Blogs and Online Communities, Web Based Networks, Building Semantic Web Applications with social network features.

Practice:

1. List three potential applications that would benefit from the Semantic Web environment.

Text Books:

1	Thinking on the Web – Berners Lee, Godel and Turing, Wiley inter science, ISBN-10. 0471768669 ; ISBN-13. 978-0471768661.
2	Social Networks and the Semantic Web, Peter Mika, Springer, ISBN-10. 1441943722 ; ISBN-13. 978-1441943729.

Reference Books:

1	Semantic Web Technologies, Trends and Research in Ontology Based Systems, J. Davies, R. Studer, P.Warren, John Wiley & Sons.
2	Semantic Web and Semantic Web Services Liyang Lu Chapman and Hall/CRC Publishers,(Taylor & Francis Group)
3	Information sharing on the semantic Web – Heiner Stuckenschmidt; Frank Van Harmelen, Springer Publications.
4	Programming the Semantic Web, T. Segaran, C. Evans, J. Taylor, O'Reilly, SPD.

Web Links:

1 https://onlinecourses.nptel.ac.in/noc20_cs78/preview
2 https://tinyurl.com/hhywdjx8
3 https://open.hpi.de/courses/semanticweb
4 https://core.ac.uk/download/pdf/36753454.pdf

Finance & Retail Analytics

	L	T	P	C
Course Code: 241CS014	**2**	**0**	**1**	**3**

Course Outcomes:
At the end of the course, student will be able to:

CO1: Demonstrate competencies in financial analysis and decision making.
CO2: Evaluate and model Risk on various financial assets
CO3: Apply retail analytics concepts and data analysis
CO4: Explain data integration and modeling techniques.
CO5: Recall and identify the importance of retail analytics, data collection and generation in retail business

Mapping of Course Outcomes with Program Outcomes:

CO/ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1	2	2	1			1	1		1		
CO2	2		1	2		1	1		1		
CO3	2	1		2		1	1		1		
CO4	2		1	2		1	1				
CO5	2	2	1			1	1				

Mapping of Course Outcomes with Program Specific Outcomes:

CO/ PSO	PSO1	PSO2
CO1	2	
CO2	2	
CO3	1	
CO4	1	
CO5	2	

UNIT – I
Corporate Finance Analysis:Basic corporate financial predictive modeling- Project analysis-cash flow analysis- cost of capital using sensitivity analysis, Indifference point and Financial Break even modelling, Capital Budget model-Payback, NPV, IRR, and MIRR. Bankruptcy Modeling Bahavior, t test, Ohlson logistic regression and Altman Z score.
Practice:
1.Evaluate the projected financials for a new investment project, considering different revenue growth scenarios.
Case Study: Analyze a real-world company's project financials and create predictive models based on different assumptions.

UNIT – II
Financial Market Analysis: Estimation and prediction of risk and return (bond investment and stock investment) – adjusting for stock splits, adjusting for mergers, plotting multiple series, data importing from web portal and data cleansing. Time series-examining nature of data, EWMOA, Value at risk, ARMA, ARCH and GARCH.

Practice:
Calculate the expected return and standard deviation of a stock based on historical returns using the **CAPM** (Capital Asset Pricing Model).

UNIT – III

Introduction to Retail Analytics: Meaning of Retail Analytics – Benefits of retail analytics Concept of product terminology – Types of retail analytics – Retail channel and formats,Commonly deployed analytics in retail.

Practice:
1: Write a brief explanation of what retail analytics entails and how data is used to drive decisions in retail
Case Study: Analyze a real-world example of a company using retail analytics to improve customer experience (e.g., Amazon, Walmart). Identify the key data points used and the resulting business impact.

UNIT – IV
Data: Data Collection - Data Management- Big Data Management - Data Generation Sources - Typical RSCA Process - Data in RSCA - Analytical Techniques in RSCA context - Data Analytics & Decision-Making Models - Applications of IoT in Retail.
Practice:
Perform a customer segmentation analysis using a dataset of customer purchases. Group customers based on their purchasing behavior, frequency, and value (RFM analysis - Recency, Frequency, Monetary).

UNIT – V
Retail Analytics Applications: Business Intelligence – Sales forecasting – Demand forecasting – Unified advanced retail analytics - Retail analytics techniques- Trends and statistics of retail analytics.

Text Books:

1 Financial analytics with R by Mark J. Bennett, Dirk L. Hugen, Cambridge university press. ISBN 978-1107150751
2 Haskell Financial Data Modeling and Predictive Analytics Paperback – Import, by Pavel Ryzhov.ISBN 978-1782169437

Reference Books:

1 Retail Analytics-Emmett Cox-Wiley-2019-ISBN 978-1118099841
2 Business Analysis Fundamentals -Haydn Thomas – Demonoid-Pearson-2018. ISBN: 978-3-030-50079-5

Minor Stream: Mobile Application Development

Course Code	Course Name	Level	L	T	P	C	CIE	SEE	Total	Pre-requisite
241IT012	Flutter Fundamentals	FC			2	2	50	50	100	-
241IT014	Web Technologies	FC	2		2	4	50	50	100	JP
241IT015	Software Testing	IC	2		1	3	50	50	100	ASE
241IT016	Software Project Management	IC	2		1	3	50	50	100	ASE
241IT017	Mobile Operating System	IC	2		1	3	50	50	100	-
241CS024	Wireless Networks	IC	2		1	3	50	50	100	-
241AI024	API & Micro Services	IC	2		2	4	50	50	100	JP
241CS025	Cloud IoT & Edge ML	AC	2		1	3	50	50	100	-
241CS028	Ethical Hacking	AC	2		2	4	50	50	100	-
241IT022	Software Quality Assurance	AC	2		1	3	50	50	100	ASE
Total			**18**		**14**	**32**				

Flutter Fundamentals

(Common to CSE, IT, AIML & CSE (DS))

	L	T	P	C
Course Code: 241IT012	**0**	**0**	**2**	**2**

Course Outcomes:

At the end of the course, student will be able to:

CO1:	Identify the steps to set up the Flutter development environment and recall the purpo of basic widgets and layout structures
CO2:	Demonstrate the use of fundamental Flutter widgets including images, buttons, icor lists, and forms.
CO3:	Design and develop user interfaces using responsive layouts and impleme navigation, gestures, and animations
CO4:	Integrate state management techniques (like Provider, BLoC, Riverpod) and hand real-time user input and data changes effectively
CO5:	Develop a complete Flutter application using backend integration with Firebase ai REST APIs, demonstrating optimization, testing, and deployment skills.

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1	3	2	2	1	3	-	-	-	-	-	2
CO2	3	2	3	1	2	-	-	-	-	-	2
CO3	3	2	3	2	3	-	-	-	-	-	2
CO4	3	3	3	2	3	-	-	-	-	-	2
CO5	3	3	3	3	3	-	-	-	-	-	3

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2
CO1	-	2
CO2	-	2
CO3	-	2
CO4	-	2
CO5	-	2

Practice:

1.Introduction to Flutter

1. Setup Environment: Set up the Flutter development environment on both Windows and Mac OS.

2. First App: Create and run your first Flutter application in Android Studio.

3. Hello World: Create a simple "Hello World" Flutter application and run it on an Android emulator.

4. Understanding Structure: Modify the main Dart file to understand the structure of a Flutter app.

5. Hot Reload and Restart: Practice using the hot reload and hot restart features to see how changes reflect instantly.

2. Flutter Basics

1. Button Widgets: Create a Flutter app with various button widgets (Flat Button, Elevated Button, Icon Button).
2. Image Widget: Create an app that displays an image using the Image widget and customize its properties.
3. Icon Widgets: Use Icon widgets to display different icons in a Flutter app.
4. Counter App: Build a simple counter app that increases a number each time a button is pressed using set State.
5. Gesture Detector: Implement a gesture detector that changes the color of a container when tapped.

3.Flutter Basics Continued

1. List of Items: Create an app with a list of items where each item can be clicked to display a toast message.
2. Input Validation: Implement form input validation to ensure correct data entry.
3. Dialogs: Use Alert Dialog to show a dialog box when a button is pressed.

4.Introduction to Layouts

1. Basic Layouts: Create a layout using Column, Row, and Stack widgets.
2. Responsive Layout: Implement a responsive layout using the Flex widget.
3. Single and Multiple Child Widgets: Build a layout with a combination of single child and multiple child widgets.
4. Nested Layouts: Design a complex UI using nested layouts (e.g., rows inside columns).
5. Gesture Detection: Use Gesture Detector to detect various gestures (tap, double-tap).

5.Layouts Continued

1. Navigation: Implement navigation between two screens using the Navigator widget.
2. Grid View: Create a layout using Grid View to display items in a grid.
3. List View: Use List View to display a list of dynamic items.
Scrolling: Implement scrolling for a long list of items using List View and Scroll View

6.State Management (Basic)

1. Stateful and Stateless Widgets: Create a simple app to toggle between stateful and stateless widgets and observe the behavior.
2. Form Input and Display: Build an app with a form that takes user input and displays it on the same screen using set State.
3. Responsive Layout with Media Query: Create a responsive layout that adapts to different screen sizes using Media Query.
4. To-Do List App: Create a to-do list app where users can add and remove items dynamically.

7.Animation in Flutter

1. Animated Container: Create a simple animation using Animated Container.

2. Fade Transition: Implement a basic fade transition using Animated Opacity.
3. Physics-based Animation: Develop an app that uses a physics-based animation like Draggable.
4. Hero Animation: Implement a hero animation for navigating between screens.

8.Advanced Animations
1. Animated Builder: Use Animated Builder to create complex animations.
2. Animation Controller: Create animations with fine control using Animation Controller.
3. Staggered Animations: Implement staggered animations to animate multiple widgets in sequence.
4. Curved Animations: Use Curved Animation to create non-linear animations.

9.State Management (Advanced)
1. Provider Package: Use the Provider package for state management.
2. BLoC Pattern: Use the BLoC (Business Logic Component) pattern for managing state.
3. River pod: Explore and use the River pod package for state management.

10.Networking in Flutter
1. HTTP Requests: Use the http package to make GET and POST requests.
2. JSON Parsing: Parse JSON data received from an API.
3. Fetching Data: Fetch and display data from a remote API.
4. Handling Errors: Implement error handling for network requests.
5. REST API: Create an app that interacts with a REST API

11.Firebase Integration
1. Firebase Setup: Set up Firebase for a Flutter project.
2. Authentication: Implement user authentication using Firebase Auth.
3. Fire store: Use Fire store to store and retrieve data.
Firebase Storage: Upload and download files using Firebase Storage

12.Project Week
1. Project Planning: Plan a small project incorporating concepts learned.
2. Project Development: Develop the project with proper state management, layout, and networking.
3. Testing: Test the project for bugs and ensure all functionalities work as expected.
4. Optimization: Optimize the app for performance and responsiveness

Additional Practice:

1. Create a Flutter app that displays a list of items using List View. builder and allows users to add new items dynamically.
2. Develop a Flutter app that uses a Bottom Navigation Bar to navigate between different screens.
3. Create a Flutter app that implements basic form validation with input fields for name, email, and password.

Cornerstone Project:

PROJECT 1: Student Management System

Implementation mainly focuses on

- Add, update, delete student details
- Form input validation
- Display student list using ListView
- Search functionality
- Local database (SQLite) / Firebase integration

Documentation must contain

- Objective & problem definition
- Student data model
- Module explanation
- Screenshots
- Enhancements (sorting, profile images)

PROJECT 2: Dream Journal App

Implementation mainly focuses on

- Add, edit, delete journal entries
- Date-wise entry management
- Local storage (SQLite/SharedPreferences)
- Rich UI design

Documentation must contain

- Objective
- Data model
- Module explanation
- Screenshots
- Enhancements (image/audio support)

PROJECT 3: To-Do List

- Implementation mainly focuses on
- Add/remove tasks dynamically

- Mark tasks as completed
- State management using setState/Provider
- Persistent storage

Documentation must contain

- Objective
- Task model
- Module explanation
- Screenshots
- Enhancements (reminders)

PROJECT 4: Student Attendance App

Implementation mainly focuses on

- Mark attendance
- Store attendance using Firebase
- Calculate attendance percentage
- Prevent duplicate entries

Documentation must contain

- Objective
- Attendance data model
- Flow: Add → Mark → View
- Screenshots
- Enhancements (charts)

PROJECT 5: Medicine Reminder

Implementation mainly focuses on

- Schedule medicine reminders
- Notifications
- Time-based alerts
- Data storage

Documentation must contain

- Objective
- Reminder data model
- Flowchart

- Screenshots
- Enhancements (history tracking)

PROJECT 6: Weather Forecast Application

Implementation mainly focuses on

- Fetch data from weather API
- JSON parsing
- Display weather details
- Error handling

Documentation must contain

- Objective
- API flow
- JSON structure
- Screenshots
- Enhancements (location-based weather)

PROJECT 7: Calculator App

Implementation mainly focuses on

- Arithmetic operations
- Button widgets UI
- Input handling
- Stateful widget usage

Documentation must contain

- Objective
- Logic explanation
- Screenshots
- Enhancements (scientific mode)

PROJECT 8: Portfolio App

Implementation mainly focuses on

- Display personal profile
- Projects and skills section
- Navigation between pages
- Responsive UI

Documentation must contain

- Objective
- UI structure
- Module explanation
- Screenshots
- Enhancements (animations)

PROJECT 9: Recipe Finder App

Implementation mainly focuses on

- API integration
- Search recipes
- Display results using List/Grid view
- Favorites feature

Documentation must contain

- Objective
- API structure
- Module explanation
- Screenshots
- Enhancements (filters)

PROJECT 10: NoteHub – Notes Sharing App

Implementation mainly focuses on

- Create and share notes
- Firebase authentication
- Cloud storage
- Search notes

Documentation must contain

- Objective
- Database schema
- Module explanation
- Screenshots
- Enhancements (comments/likes)

PROJECT 11: Daily Habit Tracker

Implementation mainly focuses on

- Add daily habits
- Track completion status
- Progress visualization
- Local/Firebase storage

Documentation must contain

- Objective
- Habit data model
- Module explanation
- Screenshots
- Enhancements (graphs)

PROJECT 12: Study Planner App

Implementation mainly focuses on

- Schedule study tasks
- Calendar integration
- Notifications
- Task management

Documentation must contain

- Objective
- Planner data model
- Flowchart
- Screenshots
- Enhancements (progress tracking)

PROJECT 13: Smart Student Productivity Hub

Implementation mainly focuses on

- Combine To-Do, Notes, Planner
- Dashboard UI
- State management (Provider/BLoC)
- Firebase integration

Documentation must contain

- Objective
- System architecture

- Module explanation
- Screenshots
- Enhancements (analytics)

PROJECT 14: Campus Event Hub

Implementation mainly focuses on

- Display campus events
- Add/view event details
- Firebase backend
- Notifications

Documentation must contain

- Objective
- Event data model
- Flowchart
- Screenshots
- Enhancements (RSVP system)

PROJECT 15: Movie Review Application

Implementation mainly focuses on

- Fetch movie data from API
- Add reviews and ratings
- Display movie list
- Firebase integration

Documentation must contain

- Objective
- Data structure
- API flow
- Screenshots
- Enhancements (recommendations)

PROJECT 16: Simple Quiz App

Implementation mainly focuses on

- Multiple choice questions
- Score calculation
- Navigation between questions

- Timer (optional)

Documentation must contain

- Objective
- Question data model
- Flowchart
- Screenshots
- Enhancements (leaderboard)

Reference Books:

1 "Beginning Flutter: A Hands-On Guide to App Development" by Marco L. Napoli. **ISBN**: 9781119550822.

2 "Flutter in Action" by Eric Windmill, 2020. **ISBN: 9781617296147**

3 Flutter for Beginners: An introductory guide to building cross-platform mobile applications with Flutter and Dart 2 by Alessandro Biessek. **ISBN** 13: 9781800565999

Web Links:

1 https://flutter.dev/docs
2 https://dart.dev/guides
3 https://codelabs.developers.google.com/?cat=flutter

Note:

- Students must submit the Certificate of Completion offered by any Industry.
- The capstone project team size shall be four (4) students.
- Students may select any one of the above prescribed projects or a project of their own choice with the prior permission of the Course instructor.
- The SEE – Lab shall be evaluated for 50 marks based on project implementation, oral presentation, 10-minute video presentation, report and viva voce.
- The video presentation should consist of the working procedure of the project along with contribution of each student for a minimum of 2 minutes.
- Finally, the Source code of the capstone Project has to be pushed into the Students GitHub repository.

Web Technologies

(Common to CSE, IT, AIML & CSE (DS))

	L	T	P	C
Course Code: 241IT014	**2**	**0**	**2**	**4**

Course Outcomes:

At the end of the Course, Student will be able to:

CO1: Develop static web pages using HTML and CSS.
CO2: Apply JavaScript for Client side validations and Node.JS to learn server side applications using JavaScript.
CO3: Make use of Angular JS for developing dynamic and responsive web pages.
CO4: Utilize React JS for developing dynamic and responsive web pages.
CO5: Create and deploy secure, usable database driven web applications using PHP and MySQL/MongoDB.

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2		3					1	1		
CO2	3	2	2		2			1	1		
CO3	2	2	3		2			1			
CO4	2	3	2					1			
CO5	2		2		3			1	1		

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2
CO1	1	
CO2	1	
CO3	1	
CO4	1	
CO5	1	

UNIT1:

HTML, HTML5, CSS, CSS3 HTML: Basic Syntax, Standard HTML Document Structure, Basic Text Markup, HTML styles, Elements, Attributes, Heading, Layouts, HTML Media, Iframes, Images, Links, Lists, Tables, Forms, GET and POST method, HTML 5, Dynamic HTML. CSS: Cascading style sheets, Levels of Style Sheets, Style Specification Formats, Selector Forms, Box Model, Conflict Resolution, CSS3.

Practice:
Write a HTML program, that makes use of basic tags like <html>,<head>,<title>,<body>,<p>,<hr>,
,<h1> to <h6>, <b>, <i>, <u>, , <sub>, <super>, <pre> tags

UNIT 2:

JavaScript & XML Javascript - Introduction, Primitives, Variables – var, let, const, Operations and Expressions, Control Statements, Functions, Objects (Predefined - String, Number, Array, Date, Math, Random, RegExp, User Defined – Definition, Properties, Methods, Display,Accessors, Constructors), Events, Pattern Matching using Regular Expressions, Working with XML: Document type Definition (DTD), XML schemas, XSLT, XML and CSS, Document object model, Parsers - DOM and SAX .

Practice:

Write JavaScript programs on Event Handling :

a. Open a Window from the current window
b. Change color of background at each click of button or refresh of a page
c. Display calendar for the month and year selected from combo box
d. On Mouse over event

UNIT 3:

Node JS & Angular JS Node.js- Introduction, Advantages, Process Model, Modules, HTTP Module, File system, URL module, NPM, Events, Upload Files, Email. Angular JS – Introduction, Expressions, Modules, Directives, Model, Data Binding, Controllers, Scopes, Filters, Services, HTTP, Tables, Select, Events, Forms, Validation, API, W3.CSS, Includes, Routing, SQL, DOM, Application.

Practice:

Write a JavaScript to validate the following fields in a registration page created in

a. Name (start with alphabet and followed by alphanumeric and the length should not be less than 6 Characters)
b. Password (it allows alphanumeric, special symbols and should not be less than 6 characters)
c. E-mail (should not contain invalid email addresses)

UNIT 4:

React JS React JS – Introduction, Displaying “Welcome React”, Introducing JSX, Rendering Elements, Components and Props, State and Lifecycle, Handling Events, Conditional Rendering, Lists and Keys, Forms, Lifting State Up, Composition vs Inheritance, Thinking in React.

Practice:

Write a program to create a simple calculator Application using React JS

UNIT 5:

PHP PHP Programming - Introduction, Creating and Running PHP Script. Variables, Constants, Datatypes, Operators. Controlling Program Flow - Conditional and Loop statements, Arrays, Functions, Client-Server Scripting – XAMPP/LAMP Introduction, Running PHP Script in XAMPP, Super Globals, Working with Form Data, Database Connectivity – MySQL Introduction using XAMPP in Command Mode and GUI, Working with MySQL Queries, Integrating PHP and MySQL to work with Form Data. No SQL Database - MongoDB Introduction, Create and Drop Database, Create and Drop Collection, Data Types, Insert, Query, Update, Delete, Integrating PHP with MongoDB.

Practice:

Write a PHP program to demonstrate the use of Decision-making control structures using
a. If statement
b. If-else statement
c. Switch statement

Text Books:

1	Programming the World Wide Web, 7th Edition, Robet W Sebesta, Pearson, ISBN: 9789332518827.
2	Pro Mean Stack Development, Elad Elrom, Apress O'Reilly, 1st Edition, ISBN 978-1-4842-2043-6.
3	React Explained, Zac Gordon, OS Training, ISBN 1798752980, 2020.
4	MongoDB – The Definitive Guide, Kristina Chodorow, O'Reilly, 2nd Edition, ISBN: 9781449344689.

Reference Books:

1	Web Technologies, HTML, JavaScript, PHP, Java, JSP, XML and AJAX, Black book, Dream Tech, , 1st Edition.
2	An Introduction to Web Design, Programming, Paul S Wang, Sanda S Katila, Cengage Learning, 1st Edition

Web Links:

1	https://www.reactjs.org/docs/getting-started.html
2	https://www.university.mongodb.com/

Software Testing

(Common to CSE, IT, AIML & CSE(DS))

	L	T	P	C
Course Code: 241IT015	**2**	**0**	**1**	**3**

Course Outcomes:

At the end of the Course, Student will be able to:

CO1: Explain the fundamentals of software testing.
CO2: Summarize verification and validation activities.
CO3: Design the test cases using different testing strategies.
CO4: Outline the importance of static testing and various levels of software testing.
CO5: Discuss about various Automation Testing tools.

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1	2	3									
CO2	1	3									
CO3	3	2							1		
CO4	2		3								
CO5	3	2								1	

UNIT – I

Software Testing: Introduction, Evolution, Myths & Facts, Goals, Psychology, Definition, Model for testing, Effective Vs Exhaustive Software Testing.
Software Testing Terminology and Methodology: Software Testing Terminology, Software Testing Life Cycle, relate STLC to SDLC, Software Testing Methodology.

Practical Evaluation:

1.A program written in JAVA language for Matrix Addition 'Introspect the causes for its failure and
write down the possible reasons for its failure.
2."A program written in JAVA language for Matrix Multiplication fails" Introspect the causes for its failure and write down the possible reasons for its failure.

UNIT – II

Verification and Validation: Verification & Validation Activities, Verification, Verification of Requirements, High level and low-level designs, how to verify code, Validation.
Dynamic Testing I: Black Box testing techniques: Boundary Value Analysis, Equivalence class Testing, State Table based testing, Decision table-based testing, Cause-Effect Graphing based testing, Error guessing.

Practical Evaluation:

1. A Program demonstrates the next date in the calendar. Its input is entered in the form of with the following range: 1≤mm≤12 1≤dd≤31 1900≤yyyy≤2025 Its output would be the

next date or it will display ‘invalid date’. Design test cases for this program using BVC, robust testing, and worst-case testing methods.
2. A program reads three numbers, A, B, and C, with a range [1, 50] and prints the largest number. Design test cases for this program using equivalence class testing technique.

UNIT – III

DynamicTesting II: White-BoxTesting:need,Logiccoveragecriteria,Basispathtesting,Graphmatrices, Loop testing, data flow testing, mutation testing
Static Testing: Inspections, Structured Walkthroughs, Technical reviews.

Practical Evaluation:

1. Design, develop, code and run the program in any suitable language to solve the commission problem. Analyze it from the perspective of decision table-based testing, derive different test cases, execute these test cases, and discuss the test results.
2. Design, develop, code and run the program in any suitable language to solve the commission problem. Analyze it from the perspective of dataflow testing, derive different test cases, execute these test cases and discuss the test results.

UNIT – IV

Validationactivities: Unittesting,IntegrationTesting,Functiontesting,systemtesting,acceptancetesting.**Regression testing:** Progressives Vs regressive testing, Regression testability, Objectives of regression testing ,when regression testing done? Regression testing types, Regression testing techniques.

Practical Evaluation:

1. Write the test cases for any known application (e.g. Banking application)
2. Take any system (e.g. ATM system) and study its system specifications and report the various bugs.

UNIT – V

Software Testing Tools: Introduction to Testing, need for Automation, Categorization, Selection, Cost incurred in Testing tools, Guidelines for Automated testing, Introduction to list of tools like Win runner ,Load Runner ,JMeter, Selenium.

Practical Evaluation:

1. Case Study of any web testing tool (e.g., Selenium)
2. Write an Automation Script for LOGIN Form (Using Selenium Tool)

Text Books:

1 Software Testing, Principles and Practices, NareshChauhan, 2ndEdition, Oxford, ISBN · 9780199465873.

2 Software Testing Tools, Dr.KVKKPrasad, Dream tech press, ISBN 10: 8177225324, ISBN 13: 9788177225327.

Reference Books:

1 Software Testing- Yogesh Singh ,Cambridge.

2 Software Testing, Principles, techniques and Tools, MGL imaye ,TMH

3 Effective Methods for Software testing, Willian E Perry ,Wiley.

Web Links:

1 https://www.guru99.com/software-testing-lifecycle

2 http://www.softwaretestinghelp.com/what-is-verification-and-validation/

3 http://nptel.ac.in/courses/106105150/

4 http://www.cigniti.com/blog/top-3-regression-testing-types-how-to-execute

5 https://www.utest.com/search-result/tag/Tools

Software Project Management

(Common to CSE, IT, AIML & CSE (DS))

L T P C

Course Code: 241IT016 **2 0 1 3**

Course Outcomes:

At the end of the Course, Student will be able to:

CO1: Explain Software Project Management fundamentals and Planning activities.
CO2: Compare SDLC models in project framework.
CO3: Apply various Effort estimation techniques and tools in real time applications
CO4: Discuss various Risk categories, Project Monitoring Control and Resource Allocation.
CO5: Demonstrate the concept Software Quality.

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1	2	2	2	3					2		2
CO2	2	2	2	2					3		3
CO3	2	2	3	2					2		2
CO4	2	2	2	3					2		2
CO5	2	2	2	2					2	3	2

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2
CO1	2	
CO2	2	
CO3	2	
CO4	2	
CO5	2	

UNIT – I

SPM concepts- Definition – components of SPM – challenges and opportunities – tools and techniques – managing human resource and technical resource – costing and pricing of projects – training and development – project management techniques.

Case Study: Managing Human and Technical Resources in the Development of Microsoft Windows 10

UNIT – II

Software Measurements- Monitoring & measurement of SW development – cost, size and time metrics – methods and tools for metrics – issues of metrics in multiple projects. Activity planning– project schedules – sequencing and scheduling projects – Network planning model – AON and AOA-identifying critical activities.

Case Study: Activity Planning and Scheduling in the Development of the Boeing 787 Dreamliner's Software Systems

UNIT – III

Software Quality- Quality in SW development – quality assurance – quality standards and certifications – the process and issues in obtaining certifications – the benefits and implications for the organization and its customers – change management
Case Study: Achieving ISO 9001 Certification at Infosys

UNIT – IV

Risk Issues- The risk issues in SW development and implementation – identification of risks – resolving and avoiding risks – tools and methods for identifying risk management.
Case Study: Risk Management in the Development of the London Ambulance Service System

UNIT – V

SPM Tools- Software project management using Primavera & Redmine and case study on SPM tools.
Case Study: Using Primavera in the Construction of Dubai's Burj Khalifa

Text Books:

1. Software Engineering – Concepts and Practices: Ugrasen Suman, Cengage Learning, ISBN-13: 978-8131519301, ISBN-10: 8131519309.
2. Fundamentals of Software Engineering, Rajib Mall, Prentice Hall India, ISBN-13: 978-9388028028, ISBN-10: 9789388028028.

Reference Books:

1. Software Engineering: A Primer, Waman S Javadekar, Tata McGraw-Hill,. **SBN**-13. 978-0070667631
2. Software Engineering, Principles and Practices, Deepak Jain, Oxford University Press. **ISBN**-13. 978-0195694840

Web Links:

1. https://www.tutorialspoint.com/software_engineering/
2. https://www.coursera.org/learn/software-processes-and-agile-practices

Mobile Operating System
(Common to CSE, IT, AIML & CSE (DS))

	L	T	P	C
Course Code: 241IT017	**2**	**0**	**1**	**3**

Course Outcomes:

At the end of the course, student will be able to:

CO1: Classify types of Mobile Operating Systems.
CO2: Demonstrate characteristics of Real-Time Operating System
CO3: Analyze and understand Mobile Operating Systems and their components
CO4: Evaluate Mobile issues and development strategies
CO5: Design a case study of Mobile OS

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1:	2	2	2								
CO2:	2	2	2						1		
CO3:	2	2	2	1							
CO4:	3	2	3					1			
CO5:	2	2	3		1				1		2

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2
CO1:	1	
CO2:	2	
CO3:	1	
CO4:	1	
CO5:	2	

UNIT – I

Fundamentals of Operating System: Overview, Synchronization Mechanisms, Processes and Threads, Process Scheduling, Deadlocks: Detection, Prevention and Recovery – Models of Resources – Memory Management Techniques

Case Study: Process Scheduling in Windows vs. Linux

UNIT – II

Type of Mobile Operating Systems: Introduction, Type of Mobile OS Android OS (Google Inc.), Bada (Samsung Electronics), Black Berry OS (Research In Motion), iPhone OS / iOS (Apple), MeeGo OS (Nokia and Intel) Palm OS (Garnet OS),Windows Mobile (Windows Phone 7)

Case Study: Evolution of Android OS

UNIT – III

Real Time and Mobile Operating Systems:
Basic Model of Real Time Systems - Characteristics- Applications of Real Time Systems – Real Time Task Scheduling - Handling Resource Sharing - Mobile Operating Systems – Micro Kernel Design - Client Server Resource Access – Processes and Threads - Memory Management - File system through interfaces.

Case Study: Real-Time Operating Systems in Automotive Applications

UNIT – IV

Mobile Issues and Development Strategies: Issues facing Mobile devices, Securing mobile application development, Android Securable IPC Mechanism, Android Security Model, Intents, Activities, Services, Android Security tools

Case Study: Security Challenges in Mobile Banking Applications

UNIT – V

Advanced Topics in Mobile Operating Systems:
Mobile Application Development: Development Tools and IDEs, Platform-Specific Development, Cross-Platform Development
Future Directions in Mobile OS: Trends and Predictions, Potential Challenges and Solutions.

Case Study: Cross-Platform Mobile Application Development Using Flutter

Text Books:
1 Advanced Concepts in Operating Systems – Distributed, Database, and Multiprocessor Operating Systems Mukesh Singhal and Niranjan G. Shivaratri, Tata McGraw-Hill, ISBN-10. 0070472688 · ISBN-13. 978-0070472686.
2 Operating System Concepts ,Abraham Silberschatz; Peter Baer Galvin; Greg Gagne, Seventh Edition, John Wiley & Sons, ISBN, 8126509627, 9788126509621.

Reference Books:
1 Understanding the Linux kernel ,Daniel P Bovet and Marco Cesati,, O'Reilly, 3rd edition. **ISBN**: 0-596-00565-2
2 Mobile Application Security, Himanshu Dwivedi, Chris Clark, David Thiel, Tata McGraw Hill, 1st Edition. **ISBN**-13. 978-0071633567

Web Links:

1 developer.android.com
2 wiki.linuxfoundation.org/realtime/

Wireless Networks
(Common to CSE, IT, AIML & CSE (DS))

	L	T	P	C
Course Code: 241CS024	**2**	**0**	**1**	**3**

Course Outcomes:
At the end of the course, student will be able to:

- **CO1:** Describe evolution of wireless networks and wireless communication technologies.
- **CO2:** Simulate Wireless Communication network for analyzing packet transmission using NS3.
- **CO3:** Discuss IEEE 802.11 Standards and Protocols.
- **CO4:** Explain evolution and architecture of cellular networks.
- **CO5:** Summarize Emerging Trends such as cognitive radio networks, VANETs.

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1	2	2			1			1	1		
CO2	2	1	2		2			1	1		
CO3	2	1			1			1	1		
CO4	2		2		2			1	1		
CO5	2	2	1								

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2
CO1	1	
CO2	2	
CO3	1	
CO4	1	
CO5	1	

UNIT – I
Introduction to Wireless Networks: Evolution of Wireless Networks, Basic Wireless Communication Concepts, Wireless Spectrum and Regulations, Wireless Network Architectures, Infrastructure Networks, Ad-Hoc Networks, Wireless Standards: IEEE 802.11, Bluetooth, Zigbee.

Practice:
1. Simulate an ad-hoc network using NS3.

UNIT – II
Wireless Communication Technologies: Radio Propagation Models, Modulation Techniques, Multiple Access Techniques: TDMA, FDMA, CDMA, OFDM Antennas and Diversity Techniques, MIMO (Multiple Input Multiple Output) Systems.

Practice:
1. Create multiple nodes, establish peer to peer connections, and analyze packet transmission using NS3.

UNIT – III

Wireless LANs and PANs: IEEE 802.11 Standards and Protocols, WI-FI Network Design and Deployment, Bluetooth and Zigbee Protocols, Security in Wireless LANs: WEP, WPA, WPA2, QoS (Quality of Service) in Wireless Networks.

Practice:

1. Simulate a basic GSM network using NS3.

UNIT – IV

Cellular Networks: Evolution from 1G to 5G, GSM, CDMA, and LTE Architectures,5G Network Architecture and Key Technologies, Handoff and Roaming, Cellular Network Planning and Optimization.

Practice:

1. Set up and configure a Wi-Fi network using Wireshark.
2. Explore the signal strength and coverage area of a Wi-Fi network.

UNIT – V

Emerging Trends and Future Directions: Internet of Things (IoT) and Wireless Sensor Networks (WSNs), Cognitive Radio Networks, Vehicular Ad-hoc Networks (VANETs), Wireless Mesh Networks, Security and Privacy Challenges in Wireless Networks.

Text Books:

1	Wireless Communications: Principles and Practice by Theodore S. Rappaport, Prentice Hall 2nd Edition, ISBN: 9780130422323.
2	Wireless Communications by Andrea Goldsmith, Cambridge University Press,ISBN: 9780521837163.

Reference Books:

1	Principles of Wireless Access and Localization by Kaveh Pahlavan and Prashant Krishnamurthy. Wiley-IEEE Press, ISBN: 9780470697085.
2	802.11 Wireless Networks: The Definitive Guide by Matthew S. Gast, O'Reilly Media 2nd Edition, ISBN: 9780596100520.
3	Wireless Communications, A. Molisch, Wiley, 2005Haykin & Moher, Modern Wireless Communications, Pearson (Indian Edition).

Web Links:

1	https://onlinecourses.nptel.ac.in/noc22_ee85/preview/
2	Wireshark Network Protocol Analyzer [Wireshark](https://www.wireshark.org/)
3	NS3 Network Simulator [NS3] (https://www.nsnam.org/)

API & Micro Services

(Common to CSE, IT, AIML & CSE (DS))

	L	T	P	C
Course Code: 241AI024	**2**	**0**	**2**	**4**

Course Outcomes:
At the end of the course, student will be able to:

CO1: Apply Dependency Injection principles using Constructor and Setter Injection.
CO2: Analyze Spring Boot fundamentals and Spring AOP
CO3: Apply transaction management and custom repository implementation
CO4: Explain web services using SOAP and REST
CO5: Evaluate the importance of exception handling and data validation in RESTful services

Mapping of Course Outcomes with Program Outcomes:

CO/ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1	2	2	3		1			1	1		
CO2	3	2	2		1			1	1		
CO3	2	2	2		1			1	1		
CO4	2	2	2		1			1	1		
CO5	2	2	3		1			1	1		

Mapping of Course Outcomes with Program Specific Outcomes:

CO/ PSO	PSO1	PSO2
CO1	2	
CO2	1	
CO3	2	
CO4	1	
CO5	1	

UNIT – I
Spring 5 Basics: Why Spring, What is Spring Framework, Spring Framework - Modules,Configuring IoC container using Java-based configuration, Introduction To Dependency Injection, Constructor Injection, Setter Injection, What is Auto Scanning

Practice:
1. Setting up Spring Framework
   a. Create a new Spring project using Spring Initializr.
   b. Configure the project structure and dependencies.
   c. Write a simple "Hello World" application using Spring
2. Spring Modules
   a. Explore Spring Framework modules (e.g., Core, Data Access, Web).
   b. Implement a simple data access application using Spring JDBC.
   c. Create a web application using Spring MVC.

UNIT – II

Spring Boot: Creating a Spring Boot Application, Spring Boot Application Annotation,What is Auto wiring, Scope of a bean, Logger, Introduction to Spring AOP, Implementing AOP advices, Best Practices: Spring Boot Application

Practice:

1. Creating a Spring Boot Application with Auto Wiring and Logging
    a. Create a new Spring Boot project using Spring Initializr.
    b. Define two classes: Employee and EmployeeService.
    c. Annotate EmployeeService with @Service and Employee with @Component.
    d. Use @Autowired to inject Employee into EmployeeService.
    e. Configure logging using Logback.
    f. Write a test class to verify auto-wiring and logging.
2. Implementing AOP Advices in Spring Boot
    a. Create a new Spring Boot project using Spring Initializr.
    b. Define two classes: Student and StudentService.
    c. Annotate StudentService with @Service and Student with @Component.
    d. Implement AOP advice using @Aspect and @Before.
    e. Apply AOP advice to StudentService methods.
    f. Write a test class to verify AOP functionality.

UNIT – III

Spring Data JPA with Boot: Limitations of JDBC API, Why Spring Data JPA, Spring Data JPA with Spring Boot, Spring Data JPA Configuration, Pagination and Sorting, Query Approaches, Named Queries and Query, Why Spring Transaction, Spring Declarative Transaction, Update Operation in Spring Data JPA, Custom Repository Implementation, Best Practices-Spring Data JPA

Practice:

1. Setting up Spring Data JPA with Spring Boot
    a. Create a new Spring Boot project.
    b. Add Spring Data JPA dependency.
    c. Configure database connection properties.
    d. Create an entity class (e.g., User).
    e. Create a repository interface (e.g., UserRepository).
    f. Test CRUD operations
2. Pagination and Sorting with Spring Data JPA
    a. Create a repository interface with pagination methods.
    b. Use Pageable and Sort to implement pagination and sorting.
    c. Test pagination and sorting functionality.
    d. Implement custom sorting using @Query

UNIT – IV

Web Services: Why Web services, SOA-Service Oriented Architecture, What are Web Services, Types of Web Services, SOAP based Web Services, REST ful Web Services, How to create REST ful Services

Practice:

1. Creating a Simple RESTful Web Service
   a. Create a new Spring Boot project.
   b. Define a resource class (e.g., User).
   c. Create a REST controller (e.g., UserController).
   d. Implement CRUD operations.
   e. Test using Postman or curl.
2. SOAP-based Web Service with Spring Boot
   a. Create a new Spring Boot project.
   b. Define a service interface (e.g., UserService).
   c. Implement service using @Service.
   d. Create a WSDL file.
   e. Test using SoapUI.

UNIT – V

Spring REST: Spring REST - An Introduction, Creating a Spring REST Controller, @RequestBody and Response Entity, Parameter Injection, Usage of @PathVariable, @RequestParam and @MatrixVariable, Exception Handling, Data Validation, Creating a REST Client, Versioning a Spring REST endpoint, Enabling CORS in Spring REST, Securing Spring REST endpoints

Practice:

1. Creating a Simple Spring REST Controller
   a. Create a new Spring Boot project.
   b. Define a resource class (e.g., User).
   c. Create a REST controller (e.g., UserController).
   d. Implement CRUD operations.
   e. Test using Postman or curl.
2. Using @RequestBody and Response Entity
   a. Create a REST controller.
   b. Use @RequestBody to accept JSON data.
   c. Use Response Entity to return HTTP responses.
   d. Test using Postman or curl.

Note: The student must Complete & Submit Spring5 Basics with Spring Boot, Spring DataJPA with Boot and Spring REST Certificate Course offered by Infosys Spring Board at the end of the Practice Session.

Text Books:

1 Spring in action, 5th Edition, Author: Craig Walls, Ryan Breidenbach, Manning, ISBN: 978-1617294945

Web Reference:

1 Dependency Injection in spring-javat point
2 Auto wiring in Spring- javat point
3 https://docs.spring.io/spring-boot/docs/2.0.x/reference/html/using-boot-using-spring boot application-annotation.html

4 Auto wiring in Spring – javat point,https://www.baeldung.com/spring-bean-scopes
5 Spring Boot Logging|How does logging works inspring boot with example (educba.com)
6 Spring AOP Tutorial|Aspect Oriented Programming-javat point
7 Spring Boot Best Practices(javaguides.net)
8 Introduction to Spring Data JPA | SpringHow
9 https://asbnotebook.com/spring-data-jpa-crud-example/ ,https://www.bezkoder.com/spring-boot-jpa-crud-rest-api/
10 Pagination and Sorting using Spring Data JPA – Paging And Sorting Repository (javaguides.net)
11 https://www.javaguides.net/2018/11/spring-data-jpa-query-creation-from-method-names.html,https://www.javaguides.net/2022/02/spring-data-jpa-namedqueries-example.html
12 https://javadeveloperzone.com/spring/spring-declarative-transaction-management/
13 https://javadeveloperzone.com/spring/spring-declarative-transaction-management/
14 https://javabeat.net/spring-data-custom-repository/
15 https://www.jrebel.com/blog/jpa-application-performance-best-practices
16 https://www.javatpoint.com/service-oriented-architecture,https://www.javatpoint.com/web-services-tutorial
17 https://www.javatpoint.com/soap-web-services,https://www.javatpoint.com/restful-web-services
18 RESTful Web Services - javatpoint
19 https://www.javatpoint.com/restful-web-services-spring-boot
20 https://www.javatpoint.com/restful-web-services-spring-boothttps://dzone.com/articles/lifecycle-of-a-request-response-process-for-a-spri
21 https://www.ibm.com/docs/en/was/8.5.5?topic=applications-defining-uri-patterns-resources-in-restful
22 https://www.baeldung.com/exception-handling-for-rest-with-spring
23 https://howtodoinjava.com/spring-boot2/resttemplate/spring-restful-client-resttemplate-example/
24 https://www.javatpoint.com/restful-web-services-versioning

Web Links:

1 https://infyspringboard.onwingspan.com/en/app/toc/lex_auth_012966890562117632 72_shared/ overview[Spring5BasicswithSpringBoot]
2 https://infyspringboard.onwingspan.com/en/app/toc/lex_4313461831752789500_shared/overvi ew[Spring DataJPAwithBoot]
3 https://infyspringboard.onwingspan.com/en/app/toc/lex_auth_012731900963905536190_shared/overview[SpringREST]

Cloud IoT and Edge ML

(Common to CSE, IT, AIML & CSE (DS))

	L	T	P	C
Course Code: 241CS025	**2**	**0**	**1**	**3**

Course Outcomes:

At the end of the course, student will be able to:

- **CO1:** Explain technologies behind the communication and management of Fog and edge resources.
- **CO2:** Discuss techniques for storage and computation in Fog, edge, 5G and cloud.
- **CO3:** Implement Internet of Everything (IoE) applications through Fog computing architecture.
- **CO4:** Illustrate optimization strategies in Fog and Edge Architectures.
- **CO5:** Summarize applications in Fog and Edge Computing.

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1	1	2			2			2	2		2
CO2	2	2			2			2	2		2
CO3	1	2	3		2			2	2		2
CO4	2	1	1	3	2			2	2		2
CO5	2	1	1		2			2	2		2

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2
CO1	1	
CO2	1	
CO3	1	
CO4		2
CO5		2

UNIT – I

Internet of Things (IoT) and New Computing Paradigms:

Introduction, Relevant Technologies, Fog and Edge Computing Completing the Cloud, Hierarchy of Fog and Edge Computing, Business Models, Edge Computing Platforms, Opportunities and Challenges.

Practice:

1. Building a Simple Edge Computing Application with Data Processing and Cloud Integration.

UNIT – II

Challenges in Federating Edge Resources:

Introduction, Methodology, Integrated C2F2T Literature by Modeling Technique, Integrated C2F2T Literature by Use Case Scenarios, Integrated C2F2T Literature by Metrics, Threads, Standards.

Practice:

1. Setting Up a Simple IoT Device with Edge Computing

UNIT – III

Orchestration of Network Slices in Fog, Edge, and Clouds:

Introduction, Background, Network Slicing, Network Slicing in Software, Defined Clouds, Network Slicing Management in Edge and Fog, Internet of Vehicles (IoV): Architecture, Protocols and Seven-layer security model architecture for Internet of Vehicles, IoV: Network Models, Challenges and future aspects.

Practice:

1. Implementing a Simple Network Slicing Scenario for Internet of Vehicles (IoV) Using Edge and Fog Computing.

UNIT – IV

Optimization Problems in Fog and Edge Computing:

Preliminaries, The Case for Optimization in Fog Computing, Formal Modeling Framework
for Fog Computing, Metrics ,Further Quality Attributes ,Optimization Opportunities along
the Fog Architecture, Optimization Opportunities along the Service Life Cycle , Toward a
Taxonomy of Optimization Problems in Fog Computing.

Practice:

1. Optimizing Task Scheduling in Fog Computing

UNIT – V

Applications of Fog and Edge Computing:

Exploiting Fog Computing in Health Monitoring-Smart Surveillance Video Stream Processing at the Edge for Real - Time Human Objects Tracking-Fog Computing Model for
Evolving Smart Transportation Applications - Testing Perspectives of Fog - Based IoT Applications - Legal Aspects of Operating IoT Applications in the Fog.

Practice:

1. Real-Time Human Object Tracking Using Fog Computing in a Smart Surveillance System

Text Books:

1 Fog and Edge computing: Principles and Paradigms ,Buyya, Rajkumar, and Satish Narayana Srirama, John Wiley & Sons, USA, 1st edition, ISBN-10. 1119524989 · ISBN-13. 978-1119524984, 2019.

2 Internet of Things –From Research and Innovation to Market Deployment, OvidiuVermesan, Peter Friess, "River Publishers, India, 1st edition, ISBN 10: 8793102941.

Reference Books:

1 Cloud computing: A hands-on approach, Bahga, Arshdeep, and Vijay Madisetti , CreateSpace Independent Publishing Platform, USA, 2nd edition. ISBN: 978-1494435141.

Web Links:

1 https://onlinecourses.nptel.ac.in/noc24_cs66/preview

Ethical Hacking
(Common to CSE, IT, AIML & CSE (DS))

	L	T	P	C
Course Code: 241CS028	**2**	**0**	**2**	**4**

Course Outcomes:
At the end of the course, student will be able to:

CO1: Describe the concepts and types of Ethical hacking.
CO2: Apply tools and techniques for Social Engineering.
CO3: Illustrate concepts of data security for various networking systems.
CO4: Analyze techniques to protect Web servers and Communication Systems.
CO5: Demonstrate ethical laws and tests related to ethical hacking.

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1	2	1						1	1		1
CO2	2	2		1	2			1	1		2
CO3	2	2		2				1	1		1
CO4	2	2			1			1	1		2
CO5	2	2					2	1	1		1

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PO	PSO1	PSO2
CO1		2
CO2		2
CO3		2
CO4		2
CO5		2

UNIT – I
Ethical Hacking
Types of Data Stolen From the Organizations, Elements of Information Security, Authenticity and NonRepudiation, Security Challenges, Effects of Hacking, Hacker – Types of Hacker, Ethical Hacker,Hacktivism - Role of Security and Penetration Tester, Penetration Testing Methodology, Networking &Computer Attacks – Malicious Software (Malware), Protection Against Malware, Intruder Attacks on Networks and Computers, Addressing Physical Security – Key Loggers and Back Doors.

Practice:
1. Create a social networking website login page using phishing techniques.
2. Sniffing tools to analyze traffic on a network and dissect information.

UNIT – II
Foot Printing And Social Engineering
Web Tools for Foot Printing, Conducting Competitive Intelligence, Google Hacking, Scanning, Enumeration, Trojans & Backdoors, Virus & Worms, Proxy & Packet Filtering,

Denial of Service, Sniffer,Social Engineering – shoulder surfing, Dumpster Diving, Piggybacking.

Practice:

1. Social Engineering Countermeasures.
2. Tools for Foot Printing.

UNIT – III

Data Security

Physical Security – Attacks and Protection, Steganography – Methods, Attacks and Measures, Cryptography– Methods and Types of Attacks, Wireless Hacking, Windows Hacking, Linux Hacking.

Practice:

1. Write a code to demonstrate DoS attacks.
2. Windows ,Linux OS hacking.

UNIT – IV

Network Protection System & Hacking Web Servers

Routers, Firewall & Honeypots, IDS & IPS, Web Filtering, Vulnerability, Penetration Testing, Session Hijacking, Web Server, SQL Injection, Cross Site Scripting, Exploit Writing, Buffer Overflow, Reverse Engineering, Email Hacking, Incident Handling & Response, Bluetooth Hacking, Mobiles Phone Hacking.

Practice:

1. Write a script or code to demonstrate SQL injection attacks.
2. Setup a honey pot and monitor the honey pot on network.

UNIT – V

Ethical Hacking Laws And Tests

An introduction to the particular legal, professional and ethical issues likely to face the domain of ethical hacking, ethical responsibilities, professional integrity and making appropriate use of the tools and techniques associated with ethical hacking – Social Engineering, Host Reconnaissance, Session Hijacking, Hacking - Web Server, Database, Password Cracking.

Practice:

1. Study of Techniques uses for Web Based Password Capturing.
2. Study on how to register a Cyber Crime Complaint through online. (https://cybercrime.gov.in/Webform/Crime_AuthoLogin.aspx).

Text Books:

1 Hands-On Ethical Hacking and Network Defense, Corley, Michael T. Simpson, Kent Backman, James E., CENGAGE Learning, ISBN 10 1435486099 , ISBN 13 9781435486096.

2 Penetration Testing and Network Defense ,Whitaker & Newman , Cisco Press, Indianapolis, ISBN-10. 1587052083 · ISBN-13. 978-1587052088.

Reference Books:

1 Official Certified Ethical Hacker Review Guide,Steven DeFino, Barry Kaufman, Nick Valenteen,CENGAGE Learning. ISBN: 978-1435488533.

2 The Basics of Hacking and Penetration Testing: Ethical Hacking and Penetration Testing Made Easy ,Patrick Engebretson, Syngress Basics Series – Elsevier. ISBN: 978-0124116443.

Web Links:

1 https://www.springboard.com/blog/cybersecurity/7-free-sources-to-learn-ethical-hacking-from-scratch/

2 https://hackernoon.com/top-resources-to-learn-ethical-hacking3

3 https://onlinecourses.nptel.ac.in/noc22_cs13/preview

Software Quality Assurance

(Common to CSE, IT, AIML & CSE (DS))

	L	T	P	C
Course Code: 241IT022	**2**	**0**	**1**	**3**

Course Outcomes:

At the end of the course, student will be able to:

CO1: Know role of software quality and its challenges.
CO2: Implement quality plans in software development.
CO3: Apply strategies in project life cycle
CO4: Implement necessary testing techniques for quality assurance.
CO5: Choose quality metrics for quality assurance.

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1	3				1						
CO2	3	1		1							
CO3	1	3		1							
CO4	3		1								3
CO5		1									3

Mapping of Course Outcomes with Program Specific Outcomes:

	PSO1	PSO2
CO1	2	
CO2	1	
CO3	1	
CO4	2	
CO5	1	

UNIT – I

Introduction to software Quality and Assurance: The software quality challenge, Software quality, Software quality factors Management and its role in software quality assurance.

Case Study: NASA's Mars Climate Orbiter

UNIT – II

Components of SQA: The components of the software quality assurance system – overview

Pre-project Software Quality Components: Contract review, Development and quality plans.

Case Study: Boeing 787 Dreamliner Development

UNIT – III

SQA Components in the Project Life Cycle and Strategies: Integrating quality activities in the project life cycle, Reviews, Software testing – strategies

Case Study: Agile Development at Spotify

UNIT – IV

Software Testing – Implementation: Software Quality Implementation, Assuring the quality of software maintenance components, Assuring the quality of external participants' contributions, CASE tools and their effect on software quality.

Case Study: Google's Software Maintenance and External Contributions

UNIT – V

Software Quality Infrastructure Components: Procedures and work instructions, Staff training and certification, Corrective and preventive actions, Documentation control

Software Quality Metrics

Software Quality metrics, Cost of Quality.

Case Study: Toyota's Software Quality in Automotive Systems

Text Books:

1 Software Quality Assurance, Daniel Galin, Pearson Publication, ISBN, 0201709457, 9780201709452.

Reference Books:

1 Kshirsagar Naik and Priyadarshi Tripathy, Software Testing & Quality Assurance Theory and Practice, Wiley Student edition. **ISBN**-13. 978-0471789116

2 William E. Perry, Effective Methods for Software Testing, WILLEY, 3rd Edition**ISBN**-13, 978-8126508938

3 Alan C. Gillies, "Software Quality: Theory and Management", International Thomson Computer Press. **ISBN** 0 412 4513 0

Web Links:

1 https://www.geeksforgeeks.org/software-engineering-software-quality-assurance/

2 https://nptel.ac.in/courses/106105218

Minor Stream in Cyber Security Industry Integrated Program- L&T#

Course Code	Course Name	Level	L	T	P	C	CIE	SEE	Total	Pre-requisite
241CS032	Cyber Security Essentials	FC	2		1	3	50	50	100	-
241CS030	Information Security Analysis & Audit	FC	2			2	50	50	100	-
241CS042	Linux Administration	IC			3	3	50	50	100	-
241IT003	Cryptography & Network Security	AC	2		1	3	50	50	100	-
241CS043	Secure Networking	AC			3	3	50	50	100	-
241CS044	Application Security	AC			3	3	50	50	100	-
241CS045	Ethical Hacking & Penetration Testing	AC			3	3	50	50	100	-
241CS046	Cyber Forensic	AC			3	3	50	50	100	-
241CS047	Malware Analysis & Governance, Risk & Compliance	AC			3	3	50	50	100	-
241CS031	Cyber Laws	AC	2		1	3	50	50	100	-
241CS033	Secure Coding Techniques	AC	2		1	3	50	50	100	-
Total			**10**		**22**	**32**				

Minor Stream: Agile Methodology with DevOps Programming
(Industry Integrated Program - L&T)

Course Code	Course Name	Level	L	T	P	C	CIE	SEE	Total	Pre-requisite
241CS048	IT Infrastructure Management	FC			3	3	50	50	100	-
241CS049	Web Engineering	FC			2	2	50	50	100	-
241CS050	Intro to Azure& AWS DevOps	FC			3	3	50	50	100	-
241CS051	Intro to Google Cloud DevOps	FC			3	3	50	50	100	-
241CS052	Cloud fundamentals& DevOps	IC			3	3	50	50	100	-
241CS053	Agile with DevOps fundamentals & Usage	IC			3	3	50	50	100	-
241IT016	Software Project Management	IC	2		1	3	50	50	100	ASE
241CS054	Agile based project automation with DevOps	AC			3	3	50	50	100	-
241CS055	DevOps Container Services	AC			3	3	50	50	100	-
241CS056	CI &CD (Continuous Integration & Continuous Development)	AC			3	3	50	50	100	-
241CS057	Object Oriented Software Engineering	AC			3	3	50	50	100	-
Total			2		**30**	**32**				

Minor Stream in Cloud Infrastructure (Certification Programs - CISCO, Red hat, Oracle, AWS, Google & Microsoft)

Course Code	Course Name	Level	L	T	P	C	CIE	SEE	Total	Pre-requisite
241CS068	Enterprise Linux Fundamentals	FC			2	2	50	50	100	-
241CS058	Linux System Administration	FC			3	3	50	50	100	-
241CS059	Introduction to Cloud Networking	FC	1		3	4	50	50	100	-
241CS060	Routing & Switching Essentials	FC			3	3	50	50	100	-
241CS061	Advanced Cloud Networking	FC	1		3	4	50	50	100	-
241CS074	Introduction to Cloud Computing Core Concepts	IC			3	3	50	50	100	-
241CS062	Cloud Architecture & Platform Services	IC			3	3	50	50	100	-
241CS063	Enterprise Cloud Infrastructure	IC			3	3	50	50	100	-
241CS069	Cloud Security	IC	1		3	4	50	50	100	-
241CS064	Machine Learning Services on Cloud	IC			3	3	50	50	100	-
Total			**3**		**29**	**32**				

Enterprise Linux Fundamentals
(Common to CSE, IT, AIML & CSE (DS))

	L	T	P	C
Course Code: 241CS068	**0**	**0**	**2**	**2**

Practice:

1. **Installation and Basic Commands**
   a. Install RHEL: Set up RHEL on your system, configure installation options, and create user accounts.
   b. Execute Basic Commands: commands like `ls`, `cd`, `pwd`, and `man'.

2. **File Management and Text Editing**
   a. File and Directory Management: Explore `mkdir`, `cp`, `mv`, and `rm`.
   b. ext Editing: Use `nano` or `vim` to create and modify text files.

3. **Advanced Command Line Operations**
   a) Redirection and Pipes: Understand `>`, `>>`, `|`.
   b) Wildcards: Learn about `*`, `?`.

4. **User and Group Management**
   a. User Accounts: Create, modify, and delete users.
   b. Groups and Permissions: Understand ownership and permissions.

5. **Process and Service Management**
   a. Process Management: Explore `ps`, `top`, and `kill`.
   b. Services**: Start, stop, and manage services (daemons).

6. **Network Configuration and Security**
   a. Network Interfaces: Configure network settings (`ifconfig`, `ip`).
   b. Firewalls and Security: Learn about `firewalld` and network services.

7. **File System Permissions**
   a. File Permissions: Master `chmod`, `chown`.
   b. Access Control Lists (ACLs): Understand extended permissions.

8. **Software Packages and Updates**
   a. Package Management: Use `yum` or `dnf` to install, update, and remove software.
   b. Repositories and Dependencies: Explore package sources.

9. **Server Analysis and Support**
   a. Performance Analysis: Use tools like `top`, `htop`, and system logs.
   b. Seeking Support: Understand how to get help from Red Hat or the community.

10. **Network Services Configuration**
    a. Static IP Addresses: Configure networking.

11. **Remote Administration with SSH**
    a. SSH: Secure remote access using key-based authentication.
    b. Secure Communication: Understand encryption.

12. **System Maintenance and Security**
    a. Maintenance Tasks: Perform backups, log rotation, and routine maintenance.
    b. Security Updates: Regularly apply patches and keep the system secure.

Additional Practice

1. **Basic Shell Commands Practice**
   Objective: Familiarize yourself with basic shell commands by performing file operations, navigating directories, and manipulating text files.
   Skills: Command-line proficiency, file management, text processing.
2. **User and Group Management**
   Objective: Learn to manage users and groups on a Linux system by adding, modifying, and removing users, and setting permissions.
   Skills: User account management, permission setting, group policies.
3. **Package Management**
   Objective: Learn to use the package manager of your Linux distribution to install, update, and remove software packages.
   Skills: Familiarity with apt, yum, or pacman, software lifecycle management.

Text books:

1 Redhat Enterprise Linux 9, Vishesh kumar, Gitanjali Mehra

Reference Books:

1 The Linux Command Line: A complete Introduction 1st Edition by William E. Shotts
2 Linux command Line and Shell Scripting Bible 4th Edition by Richard Blum, Christine Bresnahan
3 Linux Administration: A Beginner's Guide, Eighth Edition by Wale Soyinka
4 Red Hat System Administration I (RH 124) by Red Hat Press

Web Links:

1 https://www.redhat.com/en/topics/linux
2 https://www.freecodecamp.org/news/manage-users-and-groups-in-rhel/
3 https://access.redhat.com/documentation/en-us/red_hat_enterprise_linux/9/html-single/configuring_and_managing_networking/index
4 https://access.redhat.com/documentation/en-us/red_hat_enterprise_linux/9/html/configuring_basic_system_settings/managing-file-system-permissions_configuring-basic-system-settings
5 https://www.cyberciti.biz/faq/redhat-network-interface-configuration/
6 https://www.koenig-solutions.com/red-hat-enterprise-linux-diagnostics-troubleshooting-training-certification

Linux System Administration
(Common to CSE, IT, AIML & CSE (DS))

	L	T	P	C
Course Code: 241CS058	**0**	**0**	**3**	**3**

Practice:

1. **Bash Scripting Basics**
   a. Learn basic Bash scripting syntax and commands.
   b. Write a simple Bash script.

2. **Advanced Bash Scripting**
   a. Explore functions, loops, and conditionals in Bash.
   b. Automate directory backup with timestamped archive file.

3. **Regular Expressions and Text Processing**
   a. Understand regular expressions and their use in text processing.
   b. Parse log files and extract information using regular expressions.

4. **Cron Jobs and Scheduled Tasks**
   a. Learn and understand the importance of Cron Jobs
   b. Exercise: Schedule a cron job to clean up temporary files.

5. **Systemd Timers and At Command**
   a. Compare systemd timers with cron jobs.
   b. Use systemd timers for recurring tasks and at command for one-time tasks.

6. **Log Analysis with Syslog and Journalctl**
   a. Analyze system logs using syslog and journalctl.
   b. Troubleshoot common system issues using log analysis tools.

7. **Time Synchronization and Secure File Transfer**
   a. Configure NTP for time synchronization.
   b. Set up SSH for secure file transfer using SCP or SFTP.

8. **Performance Monitoring and Tuning**
   a. Monitor system performance with tools like top, iotop, or vmstat.
   b. Identify bottlenecks and optimize system performance.

9. **SELinux Policies and Contexts**
   a. Configure SELinux for enhanced security.
   b. Troubleshoot SELinux denials and configure policies.

10. **Network Configuration with NFS or Samba**
    a. Set up network storage using NFS or Samba.
    b. Verify connectivity and access permissions for NAS.

11. **Firewall Management**
    a. Manage server firewalls with firewalld or iptables.
    b. Define rules for traffic management and ensure network security.

12. **Container Deployment with Docker or Podman**
    a. Deploy containers using Docker or Podman.
    b. Create containerized applications and manage container images.

Additional Practice:

1. **Disk Usage Analysis Script**
   Objective: Write a script that analyzes disk usage by directories and outputs a report of the top 5 directories consuming the most disk space.
   Skills: Bash scripting, disk usage commands (du, sort, head), output formatting
2. **System Backup and Recovery**
   Objective: Set up an automated system backup process using tools like rsync or tar, and test system recovery from the backup.
   Skills: Backup tools, cron scheduling, disaster recovery planning
3. **File System Management**
   Objective: Experiment with different Linux file systems (e.g., ext4, xfs, btrfs) by creating, mounting, and managing file system volumes, and compare their performance and features.
   Skills: File system operations, performance benchmarking, feature comparison

Reference Books:

1 The Linux Command Line: A Complete Introduction 1st Edition by William E. Shotts
2 Advanced Bash Scripting Guide – Volume 1: An in-depth exploration of the art of shell scripting by Mendel Cooper
3 Linux Debugging and Performance Tuning: Tips and Techniques by Steve Best
4 Podman in Action: Secure, rootless containers for Kubernetes, microservices, and more by Daniel Walsh

Web Links:

1 https://www.gnu.org/software/bash/manual/
2 https://hackersvanguard.com/establishing-persistence-systemd-timers/
3 https://www.pcmatic.com/blog/how-to-secure-your-linux-server/
4 https://access.redhat.com/documentation/en-us/red_hat_enterprise_linux/4/html/reference_guide/index
5 https://docs.azul.com/prime/RHEL-Performance-Tuning-Options
6 https://access.redhat.com/documentation/en-us/red_hat_enterprise_linux/8/html-single/building_running_and_managing_containers/index

Introduction to Cloud Networking
(Common to CSE, IT, AIML & CSE (DS))

	L	T	P	C
Course Code: 241CS059	**1**	**0**	**3**	**4**

Practice:

1. a. Navigate the IOS by Using Tera Term for Console Connectivity
   b. Working with network topologies.
2. a. Basic Switch and End Device Configuration
   b. Unicasting vs Multicasting vs Broadcasting
3. a. Understand and explore Half duplex and full duplex devices.
   b. Accessing Network settings in Windows and Linux OS
4. a. Install and work with Cisco Packet tracer
   b. Design a Communications System
5. a. Install and configure Wireshark.
   b. Use Wireshark to Monitor Network Traffic
6. a. View Wired and Wireless NIC Information
   b. Use Wireshark to Examine Ethernet Frames
7. a. View Network Device and Switch MAC Addresses
   b. Build a Switch and Router Network
8. a. Calculate IPv4 Subnets
   b. Design and Implement a FLSM Addressing Scheme
9. a. Design and Implement a VLSM Addressing Scheme
   b. Identify and configure IPv6 Addresses
10. a. Use Ping and Traceroute to Test Network Connectivity
    b. Understand and observe DNS Resolution
11. a. Research Network Security Threats
    b. Configure Network Devices with SSH
12. a. SSH vs Telnet connections
    b. Secure Network Devices

Additional Practice:

1. Test Network Latency with Ping and Traceroute
2. Troubleshoot Connectivity Issues
3. Design and Build a Small Network

Text Books:

1 CCNA Routing and Switching study guide, Todd Lammle

Reference Books:

1 CCNA 200-301 Official Cert Guide Network Simulator, Wendell Odom & Sean Wilkins from Cisco Press

Web Links:

1 https://learningnetwork.cisco.com/s/ccna
2 https://netacad.com

Routing & Switching Essentials
(Common to CSE, IT, AIML & CSE (DS))

	L	T	P	C
Course Code: 241CS060	**0**	**0**	**3**	**3**

Practice:

1. a. Basic Switch Configuration
   b. Connecting switches to network
2. a. Switch cabling and topology
   b. Configure Basic Router Settings
3. a. Connecting router to network
   b. Router connections and setup
4. a. Static routing configuration
   b. Configure and setup dynamic routing
5. a. Understanding Dynamic Trunking Protocol
   b. Configure VLANs and Trunking
6. a. Implement VLANs and Trunking
   b. Implement Inter-VLAN Routing
7. a. Configuring Inter-VLAN using Router on Stick
   b. Working with router sub interfaces
8. a. Implementing Etherchannel
   b. Configure and Setup Spanning Tree Protocol
9. a. Port security in switches
   b. Configuring DHCPv6
10. a. Implementing DHCPv4
    b. Switch Security Configuration
11. a. Remote connections to switches.
    b. Configure a Wireless Network
12. a. Configure IPv4 and IPv6 Static and Default Routes
    b. Wireless security setup and implementation

Additional Practice:

1. Troubleshoot Inter-VLAN Routing
2. Troubleshoot IPv4 and IPv6 Static and Default Routes
3. Troubleshoot wireless issues

Textbooks:

1 CCNA Routing and Switching study guide, Todd Lammle

Reference Books:

1 CCNA 200-301 Official Cert Guide Network Simulator, Wendell Odom & Sean Wilkins from Cisco Press

Web Links:

1 https://learningnetwork.cisco.com/s/ccna
2 https://netacad.com

Advanced Cloud Networking
(Common to CSE, IT, AIML & CSE (DS))

	L	T	P	C
Course Code: 241CS061	**1**	**0**	**3**	**4**

Practice:

1. a. Understanding challenges in Routing Information Protocol
   b. Static vs Dynamic vs Default routes
2. a. Understanding Router IDs, AS numbers and Routing tables
   b. Configure Single-Area OSPFv2
3. a. Configure Multi area OSPFv2
   b. Implementing OSPFv3 with IPv6
4. a. Configure and setup EIGRP
   b. OSPF stages and troubleshooting
5. a. Troubleshooting EIGRP issues
   b. OSPF vs EIGRP vs BGP protocols
6. a. Analyze Social Engineering Attack vector
   b. Explore DNS Traffic
7. a. Configure and Verify Extended IPv4 ACLs
   b. Configure NAT for IPv4
8. a. Research Broadband Internet Access Technologies
   b. Research Network Monitoring Software
9. a. Use Tera Term to Manage Router Configuration Files
   b. Use TFTP, Flash, and USB to Manage Configuration Files
10. a. Research Password Recovery Procedures
    b. Understanding software defined networking
11. a. Quality of Service mechanisms for secure remote access
    b. Enterprise network design and implementation
12. a. Configuring eBGP and VPN in Cisco routers
    b. Network documentation methodologies

Additional Practice:

1. Configure CDP, LLDP, and NTP
2. Install GNS3 and create routing topologies
3. Troubleshooting routing issues

Textbooks:

1 CCNA Routing and Switching study guide, Todd Lammle

Reference Books:

1 CCNA 200-301 Official Cert Guide Network Simulator, Wendell Odom & Sean Wilkins from Cisco Press

Web Links:

1 https://learningnetwork.cisco.com/s/ccna
2 https://netacad.com

Introduction to Cloud Computing Core Concepts
(Common to CSE, IT, AIML & CSE (DS))

	L	T	P	C
Course Code: 241CS074	**0**	**0**	**3**	**3**

Practice:

1. a. Calculate Total Cost of Ownership
   b. Use AWS Pricing calculator to estimate multiple pricing models.
2. a. Differentiate between AWS and customer responsibilities using Shared Responsibility Model
   b. User Management using Identity and Access Management
3. a. Securing IAM user accounts.
   b. IPv4 and IPv6 implementation in cloud
4. a. Design Virtual Private Cloud
   b. Configure NAT gateway.
5. a. Implementing Internet Gateway in AWS Cloud
   b. Working with bastion host.
6. a. Create and manage Private & Public subnets.
   b. Secure VPC using Security Groups
7. a. Implement Network Access Control lists to control traffic.
   b. Build VPC and launch a web server.
8. a. Launch EC2 instances in two different regions and connect.
   b. Create multiple VPCs and peer them using VPC peering.
9. a. Create and trigger AWS Lambda functions.
   b. Use AWS lambda to automate EC2 instance behavior.
10. a. Website deployment using AWS Elastic Beanstalk
    b. Working with Elastic Block Storage
11. a. Creating and working with EC2 snapshots.
    b. Configure autoscaling for application deployed in AWS Cloud
12. a. Load balance application deployed in AWS Cloud
    b. Basic implementation of Infrastructure as Code using AWS CloudFormation

Additional Practice:

1. Working with Elastic File System
2. Working with S3 Buckets and Objects
3. Build a database server

Textbooks:

1 AWS Certified Cloud Practitioner study guide, Ben Piper & David Clinton

Reference Books:

1 AWS Certified Cloud Practitioner cert guide, Anthony J Sequeira, by Pearson Education

Web Links:

1 https://skillbuilder.aws/
2 https://aws.amazon.com/training/awsacademy/

Cloud Architecture & Platform Services
(Common to CSE, IT, AIML & CSE (DS))

	L	T	P	C
Course Code: 241CS062	**0**	**0**	**3**	**3**

Practice:

1. a. Introduction to Virtualization.
   b. Oracle virtual box installation and setup ubuntu.
   c. Operating systems introduction and Linux commands.
   d. Networking fundamentals & Storage classes.

2. Basics of Cloud Computing.
   a. Cloud introduction & overview.
   b. Azure global infrastructure.
   c. Cloud deployment models & services.

3. Virtual Machines.
   a. Microsoft Azure account creation.
   b. Azure VM's exploration.
   c. Ubuntu VM creation and working.
   d. Static website hosting using linux os.

4. Virtual Networking.
   a. Virtual Network setup.
   b. Virtual Network peering with different regions.
   c. Nat gateway setup.
   d. Security groups creation.

5. Storage Accounts.
   a. Introduction to storage.
   b. Storage Accounts creation.
   c. Static website hosting in SA.
   d. Working with file shares.

6. Load Balancers.
   a. Setting up Regional Load Balancer among different vm's.
   b. Setting up Global Load Balancer among different Regions.

7. Auto Scaling.
   a. Creating auto scale set vm for the application by using load balancers.

8. Monitoring.
   a. Monitor the resources using azure monitor.
   b. Creating notifications using notification services.

9. App Services & Databases.

    a. Creation of serverless service apps.
    b. Creating SQL database.
    c. Creating cosmos database.

10. Active Directory.

    a. IAM user's creation.
    b. Accessing services with AD.

11. Backup & Site recovery.

    a. Data backup concepts & implementation.
    b. Site recovery with Azure.

12. ARM Templates.

    a. Creation of vm's with arm templates.
    b. Creation of vnet's with arm templates.

Web Links:

1 https://azure.microsoft.com/en-in/get-started/azure-portal

Enterprise Cloud Infrastructure
(Common to CSE, IT, AIML & CSE (DS))

	L	T	P	C
Course Code: 241CS063	**0**	**0**	**3**	**3**

Practice:

1. a. Introduction to Cloud Computing and Oracle Cloud Infrastructure (OCI).
   b. Understanding Cloud Service Models: IaaS, PaaS, SaaS.

2. a. Oracle Cloud Global Infrastructure: Regions and Availability Domains.
   b. Core Concepts: Tenancy, Compartments, and Resource Management.

3. a. Networking in Oracle Cloud: Virtual Cloud Networks (VCNs).
   b. Configuring and Managing Subnets, Gateways, and Route Tables.

4. a. Identity and Access Management (IAM) in Oracle Cloud.
   b. Implementing Policies and Managing Access.

5. a. Compute Services: Managing Virtual Machines and Bare Metal Instances.
   b. Auto Scaling and Load Balancing in Oracle Cloud.

6. a. Storage Solutions in Oracle Cloud: Block, Object, and File Storage.
   b. Configuring and Managing Storage Volumes.

7. a. Database Services: Oracle Autonomous Database, Oracle DB Systems.
   b. Backup, Recovery, and High Availability in Oracle Databases.

8. a. Security in Oracle Cloud: Understanding Security Zones and Policies.
   b. Data Encryption and Key Management in OCI.

9. a. Monitoring and Logging in Oracle Cloud.
   b. Setting Up Alerts and Notifications for Resource Management.

10. a. Oracle Cloud Identity and Security Operations.
    b. Implementing Multi-Factor Authentication (MFA) and Secure Access.

11. a. Managing and Orchestrating Cloud Resources with Terraform on OCI.
    b. Automating Infrastructure Deployment using OCI Resource Manag.

12. a. Oracle Cloud Governance: Budgets, Cost Management, and Tags.
    b. Using Oracle Cloud Advisor for Resource Optimization.

Additional Practice:

1. Configuring and Managing an Oracle Autonomous Database.
2. Implementing a Secure VCN in Oracle Cloud.
3. Automating Resource Deployment with Terraform on Oracle Cloud.

Textbooks:

1. **Oracle Cloud Infrastructure Foundations**, Rohit Gupta, by Packt Publishing.

Reference Books:

1. **Oracle Cloud Infrastructure Architect Associate**, Roopesh Ramklass, by Oracle Press.

Web Links:

1. https://www.oracle.com/cloud/
2. https://cloud.oracle.com/tryit

Cloud Security
(Common to CSE, IT, AIML & CSE (DS))

	L	T	P	C
Course Code: 241CS069	**1**	**0**	**3**	**4**

Practice:

1. a. Analyze cloud security design principals
   b. Implementation of shared responsibility model in cloud
2. a. Understanding attack vectors on cloud resources
   b. Case studies on Cloud security and compliance
3. a. Securing access to cloud resources.
   b. Configuring IAM Authentication
4. a. Authorize with Identity and Access Management
   b. Amazon S3 Cross-Account Resource-Based Policy
5. a. Using Resource-Based Policies to Secure an S3 Bucket
   b. Implementing IAM assume role in AWS.
6. a. Securing infrastructure in cloud.
   b. Testing IAM policies with IAM policy simulator
7. a. Using AWS Cloud Trail to log and track actions.
   b. Threat Intelligence with Amazon guard Duty
8. a. Setting up private and public subnets.
   b. Securing VPC Resources by Using Security Groups
9. a. Working with Network Access Control Lists
   b. Best practices for protecting data in Amazon S3
10. a. Understanding client-side and server-side encryption
    b. Encrypting Data at Rest by Using AWS KMS
11. a. Monitoring and Alerting CloudWatch
    b. Using Amazon Inspector to assess application vulnerabilities.
12. a. Securing web applications in AWS using Web Application Firewall
    b. Protecting cloud resources from DDoS attacks using AWS Shield

Additional Practice:

1. Remediating an Incident by Using AWS Config and Lambda
2. Best practices for handling an incident
3. Responding to and Managing an Incident

Textbooks:

1 AWS Certified security study guide, Marcello Zillo Neto, Gustavo AA Santana, by Sybex Press

Reference Books:

1 AWS Certified Security exam guide, Stuart Scott, by O'REILLY press

Web Links:

1 https://skillbuilder.aws/
2 https://aws.amazon.com/training/awsacademy/

Machine Learning Services on Cloud
(Common to CSE, IT, AIML & CSE (DS))

	L	T	P	C
Course Code: 241CS064	**0**	**0**	**3**	**3**

Practice:

1. a. Solving business problems with machine learning
   b. Exploring Machine Learning challenges
2. a. Machine Learning with AWS Sagemaker
   b. Formulating Machine Learning problems
3. a. Creating and Importing data with Amazon Sagemaker
   b. Encoding categorical data
4. a. Training a Model with AWS Services
   b. Creating a Forecast with Amazon Forecast
5. a. Video analysis with Amazon Rekognition
   b. Labelling images with Amazon Ground Truth
6. a. Facial Recognition with AWS Services
   b. Understanding common Natural Language Processing tasks.
7. a. Applying ML to an NLP problem.
   b. Extracting text from web
8. a. Implementing sentiment analysis
   b. Understanding types of information extraction
9. a. Implementing information extraction
   b. Working with entities
10. a. Implementing topic modelling with Amazon Comprehend
    b. Implementing topic modelling NTM
11. a. Detecting and translating languages
    b. Transcribing and vocalizing text with AWS Services
12. a. Implementing a multi-lingual solution
    b. Using LLMs to perform NLP tasks

Additional Practice:

1. NLP with Amazon Comprehend and Polly
2. Create a chatbot using Amazon Lex
3. Creating a Linear Regression Model Using Amazon Code Whisperer

Textbooks:

1. AWS Certified Machine Learning study guide, S Subramanian, by Sybex Press

Reference Books:

1. AWS Certified Machine learning Speciality certification guide, Somanath Nanda, Weslley Moura, by O'REILLY press

Web Links:

1 https://skillbuilder.aws/
2 https://aws.amazon.com/training/awsacademy/