

## SEMESTER V

CourseCode: CC9	Software Engineering		Credits: 4
LectureHours:(L) perweek: 5	TutorialHours: (T)perweek	LabPractice Hours: (P)perweek	Total:(L+T+P) perweek: 5
CourseCategory: Core	Year&Semester: III Year V Semester		AdmissionYear: 2023-2024
Pre-requisite	Basic Knowledge on Soft Computing		
<b>LearningObjectives:</b> (forteachers:whattheyhavetodointheclass/lab/field) <ul style="list-style-type: none"><li>To introduce the software engineering concepts</li><li>To understand the software VerificationandValidationTechniques</li><li>To know about the SoftwareDesign</li></ul>			
<b>Recap:</b> (notforexamination)Motivation/previouslecture/relevantportionsrequiredforthe course)[Thisisdoneduring2Tutorialhours)			
Units	Contents		RequiredHours
I	<b>Introduction to Software Engineering:</b> Some Definitions–Some Size factors–Qualityand Productivity Factors – Managerial Issues. <b>Planning a Software Project:</b> DefiningtheProblem– DevelopingaSolutionStrategy– PlanningtheDevelopmentProcess–Planningan Organizational Structure– Other PlanningActivities.		15
II	<b>SoftwareCostEstimation:</b> SoftwareCostFactors– SoftwareCostEstimationTechniques– Staffing- LevelEstimation– EstimatingSoftwareMaintenanceCosts.		15
III	<b>RequirementsDefinitions:</b> TheSoftwareRequirementsSpe cification–FormalSpecificationTechniques – Languages andProcessorsforRequirementsSpecification		15
IV	<b>SoftwareDesign:</b> FundamentalDesignConcepts– ModulesandModularizationCriteria – Design Notations – Design Techniques – Detailed Design Considerations– Real-Time and Distributed System Design – Test Plans – Milestones, Walkthroughs, andInspections-Design Guidelines		15

V	<p><b>Verification and Validation Techniques:</b> Quality Assurance–Static Analysis–Symbolic Execution–Unit Testing and Debugging–System Testing–Formal Verification. <b>Software Maintenance:</b> Enhancing Maintainability During Development–Managerial Aspects of Software Maintenance–Configuration Management– Source-Code Metrics – Other Maintenance Tools and Techniques.</p>	15
<p><b>Learning Resources:</b></p> <ul style="list-style-type: none"> <li> <b>Recommended Texts</b>  Software Engineering Concepts, Richard Fairley, Tata McGraw Hill Publishing Company Limited, New Delhi, 2017. </li> </ul> <p>Unit I : Chapters: 1.1 –1.4, 2.1-2.5</p> <p>Unit II : Chapters: 3.1 -3.4</p> <p>Unit III : Chapters: 4.1 – 4.3</p> <p>Unit IV : Chapters: 5.1 –5.9</p> <p>Unit V : Chapters: 8.1, 8.3–8.7, 9.1–9.5</p> <p><b>Reference Books</b></p> <ul style="list-style-type: none"> <li>R.S.Pressman, “Software Engineering– A practitioners approach”, Eighth Edition, McGraw Hill International editions, 2014.</li> <li>Ian Somerville, “Software Engineering”, Tenth Edition, Pearson Education, 2015.</li> <li>Managing and leading software projects, Richard E. (Dick) Fairley, IEEE Computer Society, John Wiley &amp; Sons Publications, 2009.</li> <li>Hans van Vliet, “Software Engineering: Principles and Practice”, Third Edition, John Wiley &amp; Sons, 2008.</li> <li>Rajib Mall, “Fundamentals of Software Engineering”, Fourth Edition, Prentice-Hall of India Pvt. Ltd., 2014.</li> <li>Hans van Vliet, “Software Engineering: Principles and Practice”, Third Edition, John Wiley &amp; Sons, 2008.</li> <li>Rajib Mall, “Fundamentals of Software Engineering”, Fourth Edition, Prentice-Hall of India Pvt. Ltd., 2014.</li> </ul> <p><b>Web resources:</b> Web resources from NDL Library, E-content from open source libraries</p>		

No.	Course Outcome
<b>CO1</b>	Get introduced to software engineering and its process models.
<b>CO2</b>	Understand the software requirements.
<b>CO3</b>	Able to explain the design concepts.
<b>CO4</b>	Know the quality concepts and Recognize the reviews.
<b>CO5</b>	Get familiar with software testing.

**MAPPING OF COs WITH POs**

	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>
<b>CO1</b>	<b>3</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>1</b>
<b>CO2</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>2</b>	<b>1</b>
<b>CO3</b>	<b>3</b>	<b>2</b>	<b>3</b>	<b>1</b>	<b>1</b>
<b>CO4</b>	<b>3</b>	<b>3</b>	<b>2</b>	<b>3</b>	<b>2</b>
<b>CO5</b>	<b>2</b>	<b>1</b>	<b>1</b>	<b>2</b>	<b>3</b>

**Strong – 3**

**Medium – 2**

**Low – 1**

rseCode: CC10		Ethical Hacking		Credits: 4
LectureHours:(L) perweek: 5		TutorialHours: (T)perweek	LabPractice Hours: (P)perweek	Total:(L+T+P) perweek: 5
CourseCategory: Core		Year&Semester: III Year V Semester		AdmissionYear: 2023-2024
Pre-requisite		Basic Knowledge in Ethical Hacking		
Links to the Course		NIL		
<b>LearningObjectives:</b> (forteachers:whatttheyhavetodointheclass/lab/field)				
TolearnabouttheEthicalHacking,Attackingmethodology,WebandNetworkhacking,Report writingand Mitigation. Onsuccessfulcompletionofthissubjectthestudentsshouldhaveunderstood basicof HackingandPenetration.				
<b>CourseOutcomes:</b> (forstudents:Toknowwhatttheyaregoingtolearn)				
CO1:.CO1:To understand Hacking,Attackingmethodology,WebandNetworkhacking				
CO2:Use Report writingand Mitigation				
CO3: To understand thebasicof Hackingand Penetration				
CO4: To Understand the concepts of attacking & Hijacking				
CO5:To know wireless and web hacking concepts				
<b>Recap:</b> (notforexamination)Motivation/previouslecture/relevantportionsrequiredforthe course)[Thisisdoneduring2Tutorialhours)				
Units	Contents			RequiredHours
I	IntroductionToHacking:IntroductiontoHacking– ImportantTerminologies–PenetrationTest– VulnerabilityAssessmentsversusPenetrationTest–Pre-Engagement – Rules of Engagement -Penetration Testing Methodologies – OSSTMM –NIST – OWASP– Categories of Penetration Test– Types of Penetration Tests–VulnerabilityAssessment Summary-Reports.			15
II	NetworkAttacks:VulnerabilityDataResources– ExploitDatabases–NetworkSniffing – Types of Sniffing - Promiscuous versus Nonpromiscuous Mode – MITMAttacks – ARP Attacks – Denial of Service Attacks -Hijacking Session with MITMAttack.			15

<b>III</b>	SSLStrip:StrippingHTTPSTraffic-DNSSpoofing– ARPSpoofingAttackManipulating the DNS Records – DHCP Spoofing –Remote Exploitation – AttackingNetworkRemote Services– OverviewofBruteForce Attacks–TraditionalBruteForce –AttackingSMTP– AttackingSQLServers– TestingforWeakAuthentication	<b>15</b>
<b>IV</b>	Wireless and Web Hacking-Wireless Hacking –	<b>15</b>
	Introducing Aircrack- Cracking theWEP – Cracking a WPA/WPA2 Wireless Network Using Aircrack-ng – Evil TwinAttack– CausingDenialofServiceon theOriginalAP– WebHacking.	
<b>V</b>	AttackingtheAuthentication– BruteForceandDictionaryAttacks– TypesofAuthentication – Log-In Protection Mechanisms – Captcha Validation Flaw – CaptchaRESET Flaw – Manipulating User-Agents to Bypass Captcha and Other Protection –Authentication Bypass Attacks – Testing for the Vulnerability – Automating It withBurp Suite – Session Attacks – SQL Injection Attacks – XSS (Cross- Site Scripting) -TypesofCross-SiteScripting– Cross- SiteRequestForgery(CSRF)– SSRFAttacks.	<b>15</b>
ExtendedProf essionalCom ponent(isapar tofindinternalco mponent only,Notto be included in the ExternalExa minationques tion paper)		
Skillsacquire dfrom the course		

**Learning Resources:**

- **Recommended Texts**
- Rafay Baloch, “Ethical Hacking and Penetration Testing Guide”, CRC Press, 2014.
- **Reference Books**
  - Kevin Beaver, “Ethical Hacking for Dummies”, Sixth Edition, Wiley, 2018.
  - Jon Erickson, “Hacking: The Art of Exploitation”, Second Edition, No Starch Press, 2007.
- **Web resources:** Web resources from NDL Library, E-content from open source libraries

**MAPPING OF COs WITH POs**

	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>
<b>CO1</b>	3	3	2	2	1
<b>CO2</b>	3	3	3	2	1
<b>CO3</b>	3	2	3	1	1
<b>CO4</b>	3	3	2	3	2
<b>CO5</b>	2	1	1	2	3

**Strong – 3**

**Medium – 2**

**Low – 1**

CourseCode: CC11	NetworkSecurity		Credits: 4
LectureHours:(L) perweek: 5	TutorialHours: (T)perweek	LabPractice Hours: (P)perweek	Total:(L+T+P) perweek: 5
CourseCategory: CC11	Year&Semester: III Year V Semester	AdmissionYear:	
Pre-requisite			
Linksto otherCourses			
<b>LearningObjectives:</b> (forteachers:whattheyhavetodointheclass/lab/field) <ul style="list-style-type: none"><li>• To know the objectives of information security</li><li>• Understand the importance and application of each of confidentiality, integrity, authentication and availability</li><li>• Understand various cryptographic algorithms</li><li>• Understand the basic categories of threats to computers and networks</li></ul>			
<b>CourseOutcomes:</b> (forstudents:Toknowwhattheyaregoingtolearn) <b>CO1:</b> Understand network security threats, security services, and countermeasures <b>CO2:</b> Understand vulnerability analysis of network security <b>CO3:</b> Acquire background on hash functions; authentication; firewalls; intrusion detection techniques. <b>CO4:</b> Gain hands-on experience with programming and simulation techniques for security protocols. <b>CO5:</b> Apply methods for authentication, access control, intrusion detection and prevention.			
<b>Recap:</b> (notforexamination)Motivation/previouslecture/relevantportionsrequiredforthe course)[Thisisdoneduring2Tutorialhours)			
Units	Contents		RequiredHours
I	Introduction: Security Goals – Attacks – Services and Mechanism – 642 Techniques.Mathematics of Cryptography: Integer Arithmetic – Modular Arithmetic – Matrices –Linear Congruence - Traditional Symmetric Key Ciphers: Instruction – SubstitutionCiphers – Transposition Ciphers – Stream and Block Ciphers. Introduction to ModernSymmetricKeyCiphers:Modern Block Ciphers–ModernStream Ciphers.		15
II	Data Encryption Standard (DES): Introduction – DES Structure – DES Analysis –Multiple DES – Security of DES. Advanced Encryption Standard (AES): Introduction –Transformations– KeyExpansion – Ciphers – Examples– Analysis ofAES.		15

<b>III</b>	Asymmetric Key Cryptography: Introduction – RSA Crypto System. Message Integrity and Message Authentication: Message Integrity – Random Oracle Model – Message Authentication.	<b>15</b>
<b>IV</b>	Cryptographic Hash Functions: Introduction – SHA – 512 – WHIRLPOOL. Digital Signature: Comparison – 1 Process – Services – Attacks on Digital Signature – Digital Signature Schemes.	<b>15</b>
<b>V</b>	Entity Authentication: Introduction – Passwords – Challenge Response – Zero Knowledge – Bio Metrics. Key Management: Symmetric Key Distribution – Kerberos – Symmetric Key Agreement – Public Key Distribution	<b>15</b>
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)		
<b>Learning Resources:</b> <ul style="list-style-type: none"> <li> <b>Recommended Texts</b> <p>Cryptography and Network Security – Behrouz A. Forouzan, The McGraw Hill, 2011.</p> <p>Unit I : Chapters 1, 2, 3 and 5</p> <p>Unit II : Chapters 6 and 7</p> <p>Unit III : Chapters 10 and 11</p> <p>Unit IV : Chapters 12 and 13</p> <p>Unit V : Chapters 14 and 15</p> </li> <li> <b>Reference Books</b> <ul style="list-style-type: none"> <li>Cryptography and Network Security – William Stallings, PHI, 2008.</li> <li>Cryptography and Network Security – Atul Kahate, McGraw Hill Education, 2013.</li> <li>Network Security The Complete Reference – Roberta Bragg, Mark Rhodes Ousley and Strassberg – McGraw Hill Education, 2003.</li> </ul> </li> <li> <b>Web resources</b> <p>Web resources from NDL Library, E-content from open source libraries</p> </li> </ul>		



**MAPPING OF COs WITH POs**

	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>
<b>CO1</b>	<b>3</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>1</b>
<b>CO2</b>	<b>2</b>	<b>3</b>	<b>3</b>	<b>1</b>	<b>2</b>
<b>CO3</b>	<b>3</b>	<b>1</b>	<b>3</b>	<b>3</b>	<b>3</b>
<b>CO4</b>	<b>2</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>2</b>
<b>CO5</b>	<b>2</b>	<b>2</b>	<b>1</b>	<b>2</b>	<b>3</b>

**Strong – 3**

**Medium – 2**

**Low – 1**

CourseCode: EC5	Biometric Systems		Credits: 3
LectureHours:(L) perweek: 4	TutorialHours: (T)perweek	LabPractice Hours: (P)perweek	Total:(L+T+P) perweek: 4
CourseCategory: EC5	Year&Semester: III Year V		AdmissionYear:
	Semester		
Pre-requisite	Basic Knowledge in Biometric Systems		
Linksto otherCourses	NIL		
<b>LearningObjectives:</b> (forteachers:whattheyhavetodointheclass/lab/field) <ul style="list-style-type: none"><li>To provide fundamental knowledge of Biometrics.</li><li>To equip the student with problem solving logics.</li><li>To enable the students to develop applications using Biometric</li></ul>			
<b>CourseOutcomes:</b> (forstudents:Toknowwhattheyaregoingtolearn) <b>CO1:</b> outline the basic concepts of Biometrics <b>CO2:</b> organize the concepts of facial scan and finger scan technology <b>CO3:</b> analyze Iris scan and voice scan <b>CO4:</b> assess the concept of physiological biometrics <b>CO5:</b> develop real-time applications using biometrics			
<b>Recap:</b> (notforexamination)Motivation/previouslecture/relevantportionsrequiredforthe course)[Thisisdone during2Tutorialhours)			
Units	Contents		RequiredHours
I	Introduction: Benefits of biometric versus traditional techniques – Key biometric termsandprocesses– Verificationandidentification–Enrollment andtemplatecreation		12
II	Biometric matching. Accuracy in biometric systems: False match rate– False non-match rate – Failure-to-enroll rate – Derived metrics – Equal error rate – Ability-to-verifirate		12
III	Physiologicalbiometrics:Fingerscan–Facialscan– Irisscan–Components–Working principles – Competing technologies – Strengths and weaknesses – AutomatedfingerprintIdentification systems.		12
IV	Behavioural biometrics signature scan– Keystroke scan– Components – Workingprinciples – Strengths and weaknesses. Biometric applications: Categorizing biometricapplications–Criminal identification– Citizenidentification–Surveillance		12

V	PC/networkaccess–Physicalaccess/timeandattendance–Customerfacingapplications–E-commerce/telephony–Retail/ATM/pointofsaleapplications.Biometricmarkets: Lawenforcement–governmentsector–Financialsector–Healthcare– travel and immigration– Biometricstandards.	12
ExtendedProfessionalComponent(isapartofinternalcomponent only,Notto be included in the ExternalExaminationquestion paper)		
Skillsacquiredfrom the course		

**LearningResources:**

• **RecommendedTexts**

- SamirNanavati,MichaelThieme,RajNanavati,“Biometrics–Identity VerificationinaNetworkedWorld”, Wiley-dreamtechIndiaPvtLtd,NewDelhi,2003.

• **ReferenceBooks**

1. JamesWayman,AnilJain,DavidMaltoni,DarioMaio(Eds),“BiometricSystems”,SpringerInternational Edition, 2004.
2. AnilKJain,PatrickFlynn,ArunARoss,“HandbookofBiometrics”,Springer,2008.
3. JohnRVacca,“BiometricTechnologiesandVerificationSystems”,ElsevierInc,2007.
4. RuudM.Bolle,SharathPankanti,NaliniK.Ratha,AndrewW.Senior,JonathanH.Connell,“Guideto Biometrics”, Springer, 2009.

- **Webresources**Web resources from NDL Library, E-content from open source libraries

**MAPPING OF COs WITH POs**

	PO1	PO2	PO3	PO4	PO5
CO1	2	2	3	3	2
CO2	3	3	1	3	1
CO3	2	3	3	2	1
CO4	3	3	3	1	3
CO5	3	2	2	3	1

**Strong – 3**

**Medium – 2**

**Low – 1**

CourseCode: EC6	CryptographyandNetworkSecurity Lab		Credits: 3
LectureHours:(L)	TutorialHours: (T)perweek	LabPractice Hours: (P)perweek: 4	Total:(L+T+P) perweek: 4
CourseCategory: Elective Course 3 (Generic / Discipline Specific)	Year&Semester: III Year & V Semester		AdmissionYear: 2023-2024
Pre-requisite	Basic knowledge on Cryptography and Network Security		
LearningObjectives:(forteachers:whattheyhavetodointheclass/lab/field) <ul style="list-style-type: none"><li>To gain practical expertise in coding</li></ul>			
CourseOutcomes:(forstudents:Toknowwhattheyaregoingtolearn)			
CO1:Understand network security threats, security services, and countermeasures			
CO2:Understand vulnerability analysis of network security			
CO3:Acquire background on hash functions; authentication; firewalls; intrusion detection techniques.			
CO4: Gain hands-on experience with programming and simulation techniques for security protocols.			
CO5: Apply methods for authentication, access control, intrusion detection and prevention.			
Recap:(notforexamination)Motivation/previouslecture/relevantportionsrequiredforthe course)[Thisisdoneduring2Tutorialhours)			
	List of Exercises:		RequiredHours

	<ol style="list-style-type: none"> <li>1. Write a C program that contains a string (char pointer) with a value \Hello World". The program should XOR each character in this string with 0 and displays the result.</li> <li>2. Write a C program that contains a string (char pointer) with a value \Hello World". The program should AND or XOR each character in this string with 127 and display the result.</li> <li>3. Write a Java program to perform encryption and decryption using Caesar Cipher algorithms.</li> <li>4. Write a Java program to perform encryption and decryption using Substitution Cipher algorithms.</li> <li>5. Write a Java program to perform encryption and decryption using Hill Cipher algorithms.</li> <li>6. Write a Java program to implement the DES algorithm logic.</li> <li>7. Write a C/JAVA program to implement the Blow Fish algorithm logic.</li> <li>8. Write a C/JAVA program to implement the Rijndael algorithm logic.</li> <li>9. Using Java Cryptography, encrypt the text "Hello world" using BlowFish. Create your own key using Java key tool.</li> <li>10. Write a Java program to implement RSA Algorithm.</li> </ol>	60
	<ol style="list-style-type: none"> <li>11. Calculate the message digest of a text using the SHA-1 algorithm in JAVA.</li> <li>12. Calculate the message digest of a text using the MD5 algorithm in JAVA.</li> </ol>	

**LearningResources:**

**LearningResources:**

**TEXT BOOKS :**

- 1.Security in Computing, Fourth Edition, by Charles P. Pfleeger, Pearson Education
2. Cryptography And Network Security Principles And Practice, Fourth or Fifth Edition, William Stallings, Pearson

**BOOKS FOR REFERENCE :**

- 1.Cryptography and Network Security: C K Shyamala, N Harini, Dr T R Padmanabhan, Wiley India, 1st Edition.
2. Cryptography and Network Security : ForouzanMukhopadhyay, McGraw Hill, 2"d Edition
3. Information Security, Principles and Practice: Mark Stamp, Wiley India.
4. Principles of Computer Sceurity: WM.Arthur Conklin, Greg White, TMH

- **Webresources:** Web resources from NDL Library, E-content from open source libraries

**MAPPING OF COs WITH POs**

	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>
<b>CO1</b>	<b>3</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>1</b>
<b>CO2</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>2</b>	<b>1</b>
<b>CO3</b>	<b>3</b>	<b>2</b>	<b>3</b>	<b>1</b>	<b>1</b>
<b>CO4</b>	<b>3</b>	<b>3</b>	<b>2</b>	<b>3</b>	<b>2</b>
<b>CO5</b>	<b>2</b>	<b>1</b>	<b>1</b>	<b>2</b>	<b>3</b>

**Strong – 3**

**Medium – 2**

**Low – 1**

## SEMESTER VI

CourseCode: CC13	Internet of Things		Credits: 4
LectureHours:(L) perweek: 6	TutorialHours: (T)perweek	LabPractice Hours: (P)perweek	Total:(L+T+P) perweek: 6
CourseCategory: Core	Year&Semester: III Year VI Semester	AdmissionYear: 2023-2024	
Pre-requisite	Basic Knowledge on internet of things		
Linksto otherCourses	NIL		
<b>LearningObjectives:</b> (forteachers:whattheyhavetodointheclass/lab/field) <ul style="list-style-type: none"><li>To understand the basic perspective ofIoT, architecture of IoT, the applications of IoT and thesecurity features of IoT.</li></ul>			
<b>CourseOutcomes:</b> (forstudents:Toknowwhattheyaregoingtolearn) <b>CO1 :</b> Understand the basics of Devices, Gateways and Data Management in IoT. <b>CO2 :</b> Acquire knowledge on IoT applications in different domains and analyze their performance <b>CO3 :</b> Implement basic IoT applications on embedded platform <b>CO4:</b> Understand data analytics and its services <b>CO5:</b> To know the case studies and its IoT industry services.			
<b>Recap:</b> (notforexamination)Motivation/previouslecture/relevantportionsrequiredforthe course)[Thisisdoneduring2Tutorialhours)			
Units	Contents		RequiredHours
I	<b>Fundamentals OF Iot</b> -Evolution of Internet of Things - Enabling Technologies–IoTArchitectures: oneM2M, IoT World Forum (IoTWF) and Alternative IoT models–Simplified IoT Architecture and Core IoT Functional Stack --Fog, Edge and Cloud inIoT –Functional blocks of an IoT ecosystem – Sensors, Actuators, Smart Objects andConnectingSmart Objects		18
II	<b>IoT Protocols</b> - IoT Access Technologies: Physical and MAC layers, topology andSecurityofIEEE802.15.4,802.15.4g,802.15.4e,1901.2 a,802.11ahandLoRaWAN– NetworkLayer:IPversions,ConstrainedNodesandConstrainedNetworks–Optimizing IP for IoT: From 6LoWPAN to 6Lo, Routing over Low Power and LossyNetworks– ApplicationTransportMethods:SupervisoryControlandDataAcquisition Application LayerProtocols:CoAPandMQTT		18
III	<b>Design And Development</b> -Design Methodology - Embedded computing logic -Microcontroller, System on Chips -IoT system building blocks -Arduino -Board		18

	details, IDE programming-Raspberry Pi- Interfaces and Raspberry Pi with Python Programming.	
<b>IV</b>	<b>Data Analytics And Supporting Services-</b> Structured Vs Unstructured Data and Data in Motion Vs Data in Rest –Role of Machine Learning –No SQL Databases –Hadoop Ecosystem –Apache Kafka, Apache Spark –Edge Streaming Analytics and Network Analytics –Xively Cloud for IoT, Python Web Application Framework –Django –AWS for IoT –System Management with NETCONF-YANG106	<b>18</b>
<b>V</b>	<b>Case Studies/Industrial Applications-</b> Cisco IoT system -IBM Watson IoT platform–Manufacturing- Converged Plantwide Ethernet Model (CPwE)– Power Utility Industry–Grid Blocks Reference Model - Smart and Connected Cities: Layered architecture, Smart Lighting, Smart Parking Architecture and Smart Traffic Control	<b>18</b>

**Learning Resources:**

- **Recommended Texts**

IoT Fundamentals: Networking Technologies, Protocols and Use Cases for Internet of Things, David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton and Jerome Henry, Cisco Press, 2017

- **Reference Books**

1. Arshdeep Bahga, Vijay Madiseti, —Internet of Things—A hands-on approach, Universities Press, 2015
2. Olivier Hersent, David Boswarthick, Omar Elloumi, —The Internet of Things – Key applications and protocols, Wiley, 2012 (for Unit 2).
3. Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stamatis Karnouskos, Stefan Avesand, David Boyle, "From Machine-to-Machine to the Internet of Things -Introduction to a New Age of Intelligence", Elsevier, 2014.
4. Dieter Uckelmann, Mark Harrison, Michahelles, Florian (Eds), —Architecting the Internet of Things, Springer, 2011.

- **Web resources :** Web resources from NDL Library, E-content from open source libraries.

**MAPPING OF COs WITH POs**

	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>
<b>CO1</b>	<b>2</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>1</b>
<b>CO2</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>3</b>	<b>2</b>
<b>CO3</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>3</b>
<b>CO4</b>	<b>3</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>1</b>
<b>CO5</b>	<b>1</b>	<b>3</b>	<b>3</b>	<b>1</b>	<b>1</b>

**Strong – 3**

**Medium – 2**

**Low – 1**



CourseCode: CC14		Machine Learning		Credits: 4
LectureHours:(L) perweek: 6		TutorialHours: (T)perweek	LabPractice Hours: (P)perweek	Total:(L+T+P) perweek: 6
CourseCategory:Core		Year: IIISemester: VI		AdmissionYear: 2023-2024
Pre-requisite		Basic Knowledge on Machine Learning		
<b>LearningObjectives:</b> (forteachers:whattheyhavetodointheclass/lab/field) To provide strong foundation on fundamental concepts in Computing Intelligence To apply basic principles of Artificial Intelligence and solutions that require problem solving, influence, perception, knowledge representation and learning				
<b>CourseOutcomes:</b> (forstudents:Toknowwhattheyaregoingtolearn) <b>CO1:</b> Describe the fundamentals of artificial intelligence concepts and searching techniques. <b>CO2:</b> Develop the fuzzy logic sets and membership function and defuzzification techniques. <b>CO3:</b> Understand the concepts of Neural Network and analyze and apply the learning techniques <b>CO4:</b> Understand the artificial neural networks and its applications <b>CO5:</b> Understand the concept of Genetic Algorithm and Analyze the optimization problems using GAs.				
<b>Recap:</b> (notforexamination)Motivation/previouslecture/relevantportionsrequiredforthe course)[Thisisdoneduring2Tutorialhours)				
Units	Contents			RequiredHours
I	Introduction to AI: Problem formulation – AI Applications – Problems – State Space and Search – Production Systems – Breadth First and Depth First – Travelling Salesman Problem – Heuristic search techniques: Generate and Test – Types of Hill Climbing.			18
II	Fuzzy Logic Systems: Notion of fuzziness – Operations on fuzzy sets – T-norms and other aggregation operators – Basics of Approximate Reasoning – Compositional Rule of Inference – Fuzzy Rule Based Systems – Schemes of Fuzzification – Inferencing – Defuzzification – Fuzzy Clustering – fuzzy rule-based classifier.			18
III	Neural Networks: What is Neural Network, Learning rules and various activation functions, Single layer Perceptions, Back Propagation networks, Architecture of Back propagation (BP) Networks, Back propagation Learning, Variation of Standard Back propagation Neural Network, Introduction to Associative Memory, Adaptive Resonance theory and Self Organizing Map, Recent Applications			18
IV	Artificial Neural Networks: Fundamental Concepts – Basic Models of Artificial Neural Networks – Important			18

	Terminologies of ANNs – McCulloch-Pitts Neuron – Linear Separability – Hebb Network.	
<b>V</b>	Genetic Algorithm: Introduction – Biological Background – Genetic Algorithm Vs Traditional Algorithm – Basic Terminologies in Genetic Algorithm – Simple GA – General Genetic Algorithm – Operators in Genetic Algorithm.	<b>18</b>
<b>Learning Resources:</b> <ul style="list-style-type: none"> <li> <b>Recommended Texts</b> <ol style="list-style-type: none"> <li>1. S.N. Sivanandam and S.N. Deepa, “Principles of Soft Computing”, 2<sup>nd</sup> Edition, Wiley India Pvt. Ltd.</li> <li>2. Stuart Russell and Peter Norvig, “Artificial Intelligence - A Modern Approach”, 2<sup>nd</sup> Edition, Pearson Education in Asia.</li> <li>3. S. Rajasekaran, G. A. Vijayalakshmi, “Neural Networks, Fuzzy Logic and Genetic Algorithms: Synthesis &amp; Applications”, PHI.</li> </ol> </li> <li> <b>Reference Books</b> <ol style="list-style-type: none"> <li>1. F. Martin, Mcneill, and Ellen Thro, “Fuzzy Logic: A Practical approach”, AP Professional, 2000. Chin Teng Lin, C. S. George Lee,” Neuro-Fuzzy Systems”, PHI.</li> <li>2. Chin Teng Lin, C. S. George Lee,” Neuro-Fuzzy Systems”, PHI.</li> </ol> </li> <li> <b>Webresources</b> Web resources from NDL Library, E-content from open source libraries </li> </ul>		

**MAPPING OF COs WITH POs**

	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>
<b>CO1</b>	<b>2</b>	<b>1</b>	<b>3</b>	<b>1</b>	<b>3</b>
<b>CO2</b>	<b>2</b>	<b>1</b>	<b>3</b>	<b>3</b>	<b>3</b>
<b>CO3</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>1</b>	<b>2</b>
<b>CO4</b>	<b>1</b>	<b>2</b>	<b>2</b>	<b>3</b>	<b>2</b>
<b>CO5</b>	<b>3</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>1</b>

**Strong – 3**

**Medium – 2**

**Low – 1**

CourseCode: CC15	CyberSecurity - lab		Credits: 4
LectureHours:(L)	TutorialHours: (T)perweek	LabPractice Hours: (P)perweek: 6	Total:(L+T+P) perweek: 6
CourseCategory: Core	Year&Semester: III Year & VI Semester	AdmissionYear: 2023-2024	
Pre-requisite			
LearningObjectives:(forteachers:whattheyhavetodointheclass/lab/field) <div><ul style="list-style-type: none"><li>To gain practical expertise in coding</li></ul></div>			
Recap:(notforexamination)Motivation/previouslecture/relevantportionsrequiredforthe course)[Thisisdoneduring2Tutorialhours)			
	List of Exercises:		RequiredHours

	<ol style="list-style-type: none"> <li>1. Toimplementaprogramforencryptingaplaintestandd ecryptingaCiphertextusingCaesarCipher(ShiftCiph er)substitutiontechnique in“C”</li> <li>2. Writeaprogramin“C”toimplementtheHillciphersubs titutionalalgorithm.</li> <li>3. Writeaprogramin“C”toimplementtheVigenereCiph ersubstitutionalalgorithm.</li> <li>4. Writeaprogramin“C”toimplementtheRailFencetran spositiontechnique.</li> <li>5. Writeaprogramin“C”toimplementtheDataEncryptio nStandard(DES)algorithm</li> <li>6. Writeaprogramin“C”toimplementtheInternationaIE ncryptionAlgorithm(IDEA-SymmetrickeyBlock)</li> <li>7. Writeaprogramin“C”toimplementtheAdvancedEnc ryptionStandard(AES)technique</li> <li>8. Writeaprogramin“C”toimplementtheRSAAlgorith m.</li> <li>9. Writeaprogramin“C”toimplementtheDiffie- HellmanKeyExchangealgorithm.</li> <li>10. Writeaprogramin“C”toimplementtheMessageAuth enticationCodes.</li> <li>11. Writeaprogramin“C”toimplementtheHashfunctions .</li> <li>12. Writeaprogramin“C”toimplementtheDigitalSignatu reStandardstechnique.</li> <li>13. Writeaprogramin“C”toimplementtheHidingConfid entialInformationwithinImage.</li> <li>14. Writeaprogramin“C”toimplementFOSSbasedsecuri tymechanisms.</li> <li>15. Writeaprogramin“C”toimplementHashTableusingo penaddressing</li> <li>16. Writeaprogramin“C”toimplementownHashTablewi thopenaddressinglinearprobing</li> </ol>	<b>90</b>
	<ol style="list-style-type: none"> <li>17. Writeaprogramin CorJAVA toimplementownHash Table withseparatechaining</li> </ol>	

**Learning Resources:**

- **Recommended Texts**

1. William Stallings, “Cryptography and Network Security”, Pearson Education, 6th Edition, 2013.
2. Charles P. Pfleeger Shari Lawrence Pfleeger Jonathan Margulies, Security in Computing, 5<sup>th</sup> Edition, Pearson Education, 2015.

- **Reference Books**

1. Graham, J. Howard, R., Olson, R., Cyber Security Essentials, CRC Press, 2011.
2. George K. Kostopoulos, Cyber Space and Cyber Security, CRC Press, 2013.

**Web resources:** Web resources from NDL Library, E-content from open-source libraries

**MAPPING OF COs WITH POs**

	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>
<b>CO1</b>	3	2	3	2	1
<b>CO2</b>	3	3	3	3	1
<b>CO3</b>	2	3	3	2	2
<b>CO4</b>	3	2	2	3	2
<b>CO5</b>	2	3	4	2	3

Strong – 3

Medium – 2

Low – 1

CourseCode: EC7	Big Data Analytics		Credits: 3
LectureHours:(L) perweek: 5	TutorialHours: (T)perweek	LabPractice Hours: (P)perweek	Total:(L+T+P) perweek: 5
CourseCategory: Elective Course 3 (Generic / Discipline Specific)	Year&Semester: III Year VI Semester		AdmissionYear: 2023-2024
Pre-requisite	Basic Knowledge on Big data Analytics		
Linksto otherCourses	NIL		
<b>LearningObjectives:</b> (forteachers:whattheyhavetodointheclass/lab/field) <ul style="list-style-type: none"><li>To know the fundamental concepts of big data and analytics.</li><li>To explore tools and practices for working with big data.</li></ul>			
<b>Course Outcomes:</b> (for students: To know what they are going to learn) <b>CO1:</b> Work with big data tools and its analysis techniques. <b>CO2:</b> Analyze data by utilizing clustering and classification algorithms. <b>CO3:</b> Learn and apply different mining algorithms and recommendation systems for large Volumes of data. <b>CO4:</b> Perform analytics on data streams. <b>CO5:</b> Learn No SQL databases and management.			
Units	Contents		RequiredHours
I	<b>Data Explosion and Big Data Analytics:</b> An Overview: Introduction, Evolution of Database Technology and Big Data, Elements of Big Data, Big Data System Components, Big Data Analytics – Data Analytics. Types of Big Data Analytics, Applications of Big Data Technology, Challenges and Skills required with Big Data Technology.		15
II	<b>Analytical Theory:</b> Introduction about Classification Algorithms, Regression Techniques, Domain Specific Analytic Techniques: In Database Analytics, Text Analytics.  <b>Real – Time Analysis:</b> Introduction: Real-time System, Types of Real-time System, Characteristics of Real-time Systems, Real-time Processing Systems for Big Data: Introduction, Data Integration and Analytics, Big Data Engine-Hadoop, Real-time System Architecture, Real-time Data Analytics.		15
III	<b>Big Data: Hardware, Technology Foundations:</b> Introduction, Big Data Stack, Virtualization and Big Data.  <b>Understanding NoSQL and Hadoop Ecosystem:</b> Introduction, NoSQL: CouchDB, MongoDB, Hadoop Ecosystem – HDFS, HBase, Yarn.		15

IV	<p><b>High Dimensional Data: A Big Data Perspective:</b> Introduction – What is Dimensionality? Dimensionality Reduction: Approaches for Dimensionality Reduction, Dimensionality Reduction Techniques.</p> <p><b>User Interface and Visualization:</b> Desirable Properties, Visualization Techniques.</p> <p><b>R Programming Basics:</b> Introduction, Data Types, Data Structures and Operators – Basic Data Types in R, R Operators, Vectors, List, Factor, Arrays and Matrix, Data</p>	15
	Frame, R Programming Structure – Control Statements of R: if, if-else, if-else ladder, Switch-Case, Return, Loops and Loop Control Statements.	
V	<p><b>R Programming:</b> Input / Output: Import and Export Data, Handling Missing Values, Statistical Functions and Models of R, R Graphics and Data Visualization.</p> <p><b>Case Study:</b> K Means Clustering Algorithm Implementations, Decision Tree Algorithm Implementations, Association Rule Mining Algorithm Implementations, Naïve Bayes Classification Algorithm Implementation, Build the Regression models, Constructing Directed Graph using Adjacency matrix.</p>	15
<p><b>Learning Resources:</b></p> <p>1. Big Data Analytics – Concepts, Techniques, Tools and Technologies – First Edition, Dr.M.Thangaraj, Dr. S. Suguna, G. Sudha, PHI Learning Private Limited, Delhi, 2022.</p> <p><b>Unit I : Chapter 1</b>  <b>Unit II : Chapter 2.2.2, 2.2.4, 2.3.2, 2.3.2</b>  <b>Chapter 3 (3.1.1, 3.1.2, 3.2, 3.3.1 – 3.3.4, 3.4)</b>  <b>Unit III : Chapter 4 (4.1 – 4.3)</b>  <b>Chapter 5 (5.1, 5.2, 5.3.1 – 5.3.3)</b>  <b>Unit IV : Chapter 6.1, 6.3</b>  <b>Chapter 7.3</b>  <b>Chapter 8 (8.1 – 8.3)</b>  <b>Unit V : Chapter 8 (8.4 – 8.7)</b></p> <p><b>REFERENCE BOOKS:</b></p> <p>1. Data Mining Concepts and Techniques – Jiawei Han, Micheline Kamber &amp; Jain Pei, Morgan Kaufmann Publishers, Third edition 2012.</p> <p>2. DT Editorial Services, <i>Big Data Black Book: Covers Hadoop 2, MapReduce, Hive, Yarn, Pig, R and Data Visualization</i>, Publisher: Dreamtech Press India Pvt. Ltd, January 2016.</p>		

3. Krishna Rungta (R-tutorial), *Learn R Programming in 1 Day (Complete Guide for Beginners)*, 1<sup>st</sup> Edition, 2019.
4. Insight into Data mining Theory and Practice, K.P. Soman, ShyamDiwakar and V. Ajay, Easter Economy Edition, Prentice Hall of India, 2006.
5. Introduction to Data Mining with Case Studies, G. K. Gupta, Easter Economy Edition, Prentice Hall of India, 2006

**Webresources:** Web resources from NDL Library, E-content from open-source libraries

#### MAPPING OF COs WITH POs

	PO1	PO2	PO3	PO4	PO5
<b>CO1</b>	3	3	3	2	1
<b>CO2</b>	3	3	3	3	1
<b>CO3</b>	3	3	3	2	2
<b>CO4</b>	3	3	2	3	1
<b>CO5</b>	3	3	2	2	3

Strong – 3

Medium – 2

Low – 1



CourseCode: EC8	Information Security		Credits: 3
LectureHours:(L) perweek: 5	TutorialHours: (T)perweek	LabPractice Hours: (P)perweek	Total:(L+T+P) perweek: 5
CourseCategory: Elective Course 3 (Generic / Discipline Specific)	Year&Semester: III Year VI Semester		AdmissionYear: 2023-2024
Pre-requisite	Basic Knowledge on Information Security		
<b>LearningObjectives:</b> (forteachers:whattheyhavetodointheclass/lab/field) To know the objectives of information security Understand the importance and application of each of confidentiality, integrity, authentication and availability Understand various cryptographic algorithms Understand the basic categories of threats to computers and networks			
<b>CourseOutcomes:</b> (forstudents:Toknowwhattheyaregoingtolearn) <b>CO1:</b> Understand network security threats, security services, and countermeasures <b>CO2:</b> Understand vulnerability analysis of network security <b>CO3:</b> Acquire background on hash functions; authentication; firewalls; intrusion detection techniques. <b>CO4:</b> Gain hands-on experience with programming and simulation techniques for security protocols. <b>CO5:</b> Apply methods for authentication, access control, intrusion detection and prevention.			
<b>Recap:</b> (notforexamination)Motivation/previouslecture/relevantportionsrequiredforthe course)[Thisisdoneduring2Tutorialhours)			
Units	Contents		RequiredHours
I	Introduction to Information Security : Security mindset, Computer Security Concepts (CIA), Attacks, Vulnerabilities and protections, Security Goals, Security Services, Threats, Attacks, Assets, malware, program analysis and mechanisms.		15
II	The Security Problem in Computing: The meaning of computer Security, Computer Criminals, Methods of		15
	Defense. Cryptography: Concepts and Techniques: Introduction, plain text and cipher text, substitution techniques, transposition techniques, encryption and decryption		

<b>III</b>	Symmetric and Asymmetric Cryptographic Techniques : DES, AES, RSA algorithms .Authentication and Digital Signatures : Use of Cryptography for authentication, Secure Hash function, Key management – Kerberos.	<b>15</b>
<b>IV</b>	Program Security : Non-malicious Program errors – Buffer overflow, Incomplete mediation, Time-of-check to Time-of- use Errors, Viruses, Trapdoors, Salami attack, Man-in-the- middle attacks, Covert channels. File protection Mechanisms, User Authentication Designing Trusted O.S: Security polices, models of security, trusted O.S design, Assurance in trusted O.S. Implementation examples.	<b>15</b>
<b>V</b>	Security in Networks : Threats in networks, Network Security Controls – Architecture, Encryption, Content Integrity, Strong Authentication, Access Controls, Wireless Security, Honeypots, Traffic flow security. Web Security: Web security considerations, Secure Socket Layer and Transport Layer Security, Secure electronic transaction.	<b>15</b>
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC/TRB/NET/UGC– CSIR/GATE/TNPSC/other to be solved (To be discussed during the Tutorial hour)	
Skills acquired from the course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferable Skill	

**Learning Resources:**

- **Recommended Texts**

1. Security in Computing, Fourth Edition, by Charles P. Pfleeger, Pearson Education
2. Cryptography And Network Security Principles And Practice, Fourth or Fifth Edition, William Stallings, Pearson

- **Reference Books**

1. Cryptography and Network Security: C K Shyamala, N Harini, Dr T R Padmanabhan, Wiley India, 1st Edition.
2. Cryptography and Network Security: Forouzan Mukhopadhyay, McGraw Hill, 2nd Edition
3. Information Security, Principles and Practice: Mark Stamp, Wiley India.

- **Web resources :**

Web resources from NDL Library, E-content from open source libraries

**MAPPING OF COs WITH POs**

	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>
<b>CO1</b>	3	3	3	2	1
<b>CO2</b>	3	3	3	3	1
<b>CO3</b>	3	3	3	2	2
<b>CO4</b>	3	3	2	3	1
<b>CO5</b>	3	3	2	2	3

Strong – 3

Medium – 2

Low – 1