HSNC University Mumbai
(2022-2023)

Ordinances and Regulations

With Respect to

Choice Based Credit System
(CBCS)
For the Programmes Under

The Faculty of Science and Technology
For the Course

Computer Science

Curriculum – Third Year Undergraduate Programmes

Semester - V and Semester - VI

2022-2023

Part 2 - The Scheme of Teaching and Examination is as under:

Third Year Semester – V
Summary

Sr. No.	Choice Based Credit System			Subject Code	Remarks
1	**Core Course (Computer Science)**			US-TCS-501 US-TCS-502 US-TCS-503 US-TCS-504	
2	**Elective Course**	**Discipline Specific Elective (DSE) Course**			
		2.1	**Interdisciplinary Specific Elective (IDSE) Course**		
		2.2	**Dissertation/Project**		
		2.3	**Generic Elective (GE) Course**		
3	**Ability Enhancement Courses (AEC)**				
4	**Skill Enhancement Courses (SEC)**			US-TCS-505 US-TCS-506	

Third Year Semester V Internal and External Detailed Evaluation Scheme

Sr. No.	Subject Code	Subject Title	Periods Per Week					Credits	Internals				Total Marks
			Units	S.L.	L	T	P		SLE	CT + AT = 15 + 5	PA	SEE	
1	US-TCS-501	Linux Server Administration	3	20% *	3	0	-	3	10	20	10	60	100
2	US-TCS-502	DevOps	3	20% *	3	0	-	3	10	20	10	60	100
3	US-TCS-503	Information and Network Security	3	20% *	3	0	-	3	10	20	10	60	100
4	US-TCS-504	Data Warehousing and Mining	3	20% *	3	0	-	3	10	20	10	60	100
5	US-TCS-505 **OR** US-TCS-506	Software Project Management **OR** Digital Image Processing	3	20% *	3	0	-	2	10	20	10	60	100
6	US-TCS-5P1	Practical of US-TCS-501 and US-TCS-502	-	-	-	-	6	2				100 (60+40)	100
7	US-TCS-5P2	Practical of US-TCS-503 and US-TCS-504	-	-	-	-	6	2				100(60+40)	100
8	US-TCS-P505 **OR** US-TCS-P506	Practical of US-TCS-505 **OR** US-TCS-506	-	-	-	-	3	1				50 (30+20)	50
9	US-TCS-P507	Project Dissertation	-	-	-	-	3	1					50
	Total Lectures/ Credits							**20**	**Total Marks**				**800**

*One to two lectures to be taken for CONTINUOUS self –learning Evaluation.

Third Year Semester V - Units – Topics – Teaching Hours

Sr. No.	Subject Code & Title		Subject Unit Title	Hours/ Lectures	Total No. of hours/ lectures	Credit	Total Marks
1	US-TCS-501 Linux Server Administration	1	Introduction, Single-Host Administration, Linux Documentation	15	45L	3	100 (60+40)
		2	Networking and Security, Internet Services	15			
		3	Intranet Services	15			
2	US-TCS-502 DevOps	1	Introduction to DevOps, Version Control Systems	15	45L	3	100 (60+40)
		2	Introduction to Microservices, Continuous Integration and Continuous Deployment, Introduction to Docker	15			
		3	Puppet, Introduction to YAML, Introduction to Docker Swarm and Docker Stack, Introduction to Kubernetes	15			
3	US-TCS-503 Information and Network Security	1	Introduction, Classical Encryption Techniques, Public-Key Cryptography and RSA	15	45L	3	100 (60+40)
		2	Key Management, Message Authentication and Hash Functions, Digital Signatures and Authentication, Authentication Applications	15			
		3	Electronic Mail Security, IP Security, Web Security, Intrusion, Firewalls	15			
4	US-TCS-504 Data Warehousing and Mining	1	Data Warehousing, OLAP	15	45L	3	100 (60+40)
		2	Introduction to Data Mining, Data Pre-processing	15			
		3	Data Mining Techniques- Classification, Cluster Analysis, Association Rule Mining	15			
5	US-TCS-505 Software Project Management	1	Overview of SPM, Project Selection, The Project Manager, Managing conflicts and the Art of negotiation, Project Activity Planning	15			
		2	Risk Management, Budgeting and Cost Estimation, Project Time Planning and Networks, Resource Allocation	15	45L	2	100 (60+40)
	OR US-TCS-506 Digital Image Processing	3	Monitoring and Information Systems, Project Control, Project Auditing, Project Termination	15			
		1	Introduction to Image-processing System, 2D Signals and Systems, Convolution and Correlation, Image Transforms	15			
		2	Image Enhancement, Binary Image processing, Colour Image processing	15			

		3	Image Segmentation, Image Compression	15			
6	US-TCS-5P1	1	Practical of US-TCS-501	3	45x2=	2	100
		2	Practical of US-TCS-502	3	90 lectures per batch		(60+40)
7	US-TCS-5P2	1	Practical of US-TCS-503	3	45x2= 90 lectures per batch	2	100 (60+40)
		2	Practical of US-TCS-504	3			
8	US-TCS-P505 **OR** US-TCS-P506	1	Practical of US-TCS-505	3	45 lectures pe r batch	1	50
		2	Practical of US-TCS-506	3			
9	US-TCS-P507		Project Dissertation	3	45 lectures per batch	1	50
			TOTAL			**20**	**800**

- **Lecture Duration – 50 Minutes**
- **One Credit = 19.92 hours equivalent to 20 Hours**

L: Lecture: Tutorials   P: Practical Ct-Core Theory, Cp-Core Practical, SLE- Self learning evaluation CT-Commutative Test, SEE- Semester End Examination, PA-Project Assessment, AT- Attendance

Part - 3 Detailed Scheme Theory

Curriculum Topics along with Self-Learning topics to be covered, through self-learning mode along with the respective Unit. Evaluation of self-learning topics to be undertaken before the concluding lecture instructions of the respective UNIT.

Course Code: US-TCS-501 Linux Server Administration

Unit No.	Content	No. of Lectures
I	**1.1 Introduction:** History of Linux, Importance of Linux in Software Ecosystem, Installation Methods, Linux Structure- architecture, file system basics, init scripts, run levels, shutdown process, Technical Summary of Linux Distributions, Managing Software- Graphical Desktop: Session Management, Network Management, Installing and Updating Software, Text Editors, Multimedia applications; Command Line: Mode options, shells, basic commands, General purpose utilities, installing software, environment variables, Command aliases. **1.2 Single-Host Administration:** Managing Users and Groups, Booting and shutting down processes, File Systems, Core System Services, Process of configuring, compiling, Linux Kernel. **1.3 Linux Documentation:** man pages, GNU info, help command, More documentation sources	**15**

II	**Networking and Security:** **2.1** Understanding Linux Security, Uses of root, sudo command, working with passwords, Bypassing user authentication, Understanding ssh **2.2** Basic introduction to Networking, Network protocols: http, ftp etc., IP address, DNS, Browsers, Transferring files. **2.3** SSH, telnet, ping, traceroute, route, hostname, networking GUI. **2.4** TCP/IP for System Administrators, basic network Configuration, Linux Firewall (Netfilter), System and network security. **2.5 Internet Services:** Domain Name System (DNS), File Transfer Protocol (FTP), Apache web server, Simple Mail Transfer Protocol (SMTP), Post Office Protocol and Internet Mail Access Protocol (POP and IMAP), Secure Shell (SSH), Network Authentication, OpenLDAP Server, Samba and LDAP, Network authentication system (Kerberos), Domain Name Service (DNS), Security.		**15**
III	**Intranet Services:** Network File System (NFS), Samba, Distributed File Systems (DFS), Network Information Service (NIS), Lightweight Directory Access Protocol (LDAP), Dynamic Host Configuration Protocol (DHCP), MySQL, LAMP Applications File Servers, Email Services, Chat Applications, Virtual Private Networking.		**15**

Self-Learning topics

Sub-Unit	Topic
2.1	Understanding Linux Security, Uses of root, sudo command, working with passwords, Bypassing user authentication, Understanding ssh
2.2	Basic introduction to Networking, Network protocols: http, ftp etc., IP address, DNS, Browsers, Transferring files.
2.3	ssh, telnet, ping, traceroute, route, hostname, networking GUI.
-	Interview Questions/Programming Exercise(s)/Problem Solving Exercise(s) based on the syllabus topics from unit no. I, II and III.

Textbooks:
1) Unix Concepts and Applications by Sumitabha Das.
2) Official Ubuntu Book, 8th Edition, by Matthew Helmke & Elizabeth K. Joseph with Jose Antonio Rey and Philips Ballew, Prentice Hall
3) Linux Administration: A Beginner's Guide, Wale Soyinka, Seventh Edition, McGraw-Hill Education, 2016
4) Ubuntu Server Guide, Ubuntu Documentation Team, 2016

References:
1) Mastering Ubuntu Server, Jay LaCroix, PACKT Publisher, 2016

Online Resources:
1) Linux kernel Home: http://kernel.org
2) Open-Source Initiative: https://opensource.org/
3) The Linux Foundation: http://www.linuxfoundation.org/
4) NPTEL link: https://nptel.ac.in/courses/117106113

Unit No.	Content	No. of Lectures
I	**1.1** Introduction to DevOps, DevOps ecosystem, DevOps phases, Relationship between Agile and DevOps, DASA DevOps Principles, Challenges with the Traditional Approach, DevOps Approach to the challenges, Overview of DevOps Tools, Best Practices for DevOps, Categories of DevOps Tools. **1.2** Version Control Systems: Overview, Role of Version Control Systems, Git Installation, Overview of Git commands.	**15**
II	**2.1** Introduction to Microservices **2.2** Continuous Integration and Continuous Deployment, Its Importance, Overview and Features of Jenkins, Overview and the Features of Travis CI, Configuring Travis for continuous integration, Build Tools and Their Uses, Continuous Integration / Continuous deployment pipeline with Jenkins. **2.3** Introduction to Containerisation, Introduction to Docker, creating docker images using Docker file, Container life cycle.	**15**
III	**3.1** Puppet - DevOps configuration management tool, Architecture, Components, Applications, Puppet Installation, Puppet Coding Style, Puppet Manifest, Puppet Modules. Puppet Templates. **3.2** Introduction to YAML, Introduction to Docker Swarm and Docker Stack, Introduction to Kubernetes, Creating Kubernetes Cluster, creating service in Kubernetes, deploying an application using dashboard.	**15**

Self-Learning topics

Sub-Unit	Topic
1.2	Version Control Systems: Overview, Role of Version Control Systems, Git Installation, Overview of Git commands.
2.2	Continuous Testing with Selenium: Introduction to Selenium, Selenium WebDriver, Create Test case in Selenium WebDriver, Run Selenium Tests in Jenkins Using Maven.
-	Interview Questions/Programming Exercise(s)/Problem Solving Exercise(s) based on the syllabus topics from unit no. I, II and III.

Textbooks:
1. DevOps Bootcamp, Sybgen Learning
2. Karl Matthias & Sean P. Kane, Docker: Up and Running, O'Reilly Publication
3. Len Bass,Ingo Weber,Liming Zhu,"DevOps, A Software Architects Perspective", AddisonWesley Pearson Publication
4. John Ferguson Smart," Jenkins, The Definitive Guide", O'Reilly Publication
5. Mastering Puppet 5: Optimize enterprise-grade environment performance with Puppet, by Ryan Russell-Yates Packt Publishing (September 29, 2018)

References:
1. Sanjeev Sharma and Bernie Coyne," DevOps for Dummies", Wiley Publication
2. Httermann, Michael, "DevOps for Developers", Apress Publication
3. Joakim Verona, "Practical DevOps", Pack publication

Online Resources:
1. https://sybgen.com/devops/
2. NPTEL link: https://nptel.ac.in/courses/128106012

Course Code: US-TCS-503 Information and Network Security

Unit No.	Content	No. of Lectures
I	**1.1 Introduction:** Security Trends, The OSI Security Architecture, Security Attacks, Security Services, Security Mechanisms **1.2 Classical Encryption Techniques:** Symmetric Cipher Model, Substitution Techniques, Transposition Techniques, Steganography, Block Cipher Principles, The Data Encryption Standard, The Strength of DES, AES (round details not expected), Multiple Encryption and Triple DES, Block Cipher Modes of Operation, Stream Ciphers **1.3 Public-Key Cryptography and RSA:** Principles of Public-Key Cryptosystems, The RSA Algorithm	15
II	**2.1 Key Management:** Public-Key Cryptosystems, Key Management, Diffie-Hellman Key Exchange **2.2 Message Authentication and Hash Functions:** Authentication Requirements, Authentication Functions, Message Authentication Codes, Hash Functions, Security of Hash Functions and Macs, Secure Hash Algorithm, HMAC **2.3 Digital Signatures and Authentication:** Digital Signatures, Authentication Protocols, Digital Signature Standard **2.4 Authentication Applications:** Kerberos, X.509 Authentication, Public-Key Infrastructure	15
III	**3.1 Electronic Mail Security:** Pretty Good Privacy, S/MIME **3.2 IP Security:** Overview, Architecture, Authentication Header, Encapsulating Security Payload, Combining Security Associations, Key Management **3.3 Web Security:** Web Security Considerations, Secure Socket Layer and Transport Layer Security, Secure Electronic Transaction **3.4 Intrusion:** Intruders, Intrusion Techniques, Intrusion Detection Malicious Software: Viruses and Related Threats, Virus Countermeasures, DDOS **3.5 Firewalls:** Firewall Design Principles, Types of Firewalls	15

Self-Learning topics

Sub-Unit	Topic
3.4	**Intrusion:** Intruders, Intrusion Techniques, Intrusion Detection Malicious Software: Viruses and Related Threats, Virus Countermeasures, DDOS
3.5	**Firewalls:** Firewall Design Principles, Types of Firewalls
-	Interview Questions/Programming Exercise(s)/Problem Solving Exercise(s) based on the syllabus topics from unit no. I, II and III.

Textbooks:
1. Cryptography and Network Security: Principles and Practice 5th Edition, William Stallings, Pearson, 2010.

References:
1. Cryptography and Network Security, Atul Kahate, Tata McGraw-Hill, 2013.
2. Cryptography and Network, Behrouz A Fourouzan, Debdeep Mukhopadhyay, 2 nd Edition, TMH, 2011

Online Resources:
1. NPTEL link: https://nptel.ac.in/courses/106105031

Course Code: US-TCS-504 Data Warehousing and Mining

Unit No.	Content	No. of Lectures
I	**1.1 Data Warehousing:** Data warehousing Components, building a Data warehouse, Data Warehouse Architecture, DBMS Schemas for Decision Support, Data Extraction, Clean up, and Transformation Tools, Metadata, reporting, Query tools and Applications **1.2 Online Analytical Processing (OLAP)** – OLAP and OLTP, Concept Hierarchies, Characteristics of OLAP Systems, Typical OLAP Operations, Multidimensional Data Analysis.	15
II	**2.1 Introduction to Data Mining:** Data mining, Data Mining Goals, motivation and challenges**,** Stages of the Data Mining Process, Data Mining Techniques, Knowledge Representation Methods, Applications, Data Objects and Attribute Types: An Attribute, Nominal Attributes, Binary Attributes, Ordinal Attributes, Numeric Attributes, Discrete versus Continuous Attributes. **2.2 Data Pre-processing:** Data Pre-processing: An Overview**,** Data cleaning, Data Integration**,** Data reduction, Data Transformation and Data Discretization	15
III	**Data Mining Techniques** **3.1 Classification:** Basic Concepts, Decision Tree Classification, Nearest Neighbour Classification, Bayesian Classification, Rule Based Classification, Model Evaluation and Selection: Holdout Method, Random Sub Sampling, Cross Validation, evaluation metrics, confusion matrix. **3.2 Cluster Analysis:** Basic Concepts, A Categorization of Major Clustering Methods, Partitioning Methods: The Basic K-means Algorithm, Strengths and Weaknesses of K-means algorithm, Hierarchical methods: Agglomerative versus Divisive Hierarchical Clustering, Density-Based Methods: DBSCAN- The DBSCAN Algorithm, Strengths and Weaknesses, Evaluation of clustering, Outlier analysis. **3.3 Association Rule Mining:** Market Basket Analysis, Frequent item set, Closed Item sets, and Association Rules, Apriori Algorithm: Apriori Principle, Apriori Algorithm, Computational Complexity, Rule Generation, Confidence of association rule.	15

Self-Learning topics

Sub-Unit	Topic
2.1	Data mining, Data Mining Goals, motivation and challenges, Stages of the Data Mining Process, Applications.
2.1	Data Objects and Attribute Types: Attribute, Nominal Attributes, Binary Attributes, Ordinal Attributes, Numeric Attributes, Discrete versus Continuous Attributes.
-	Interview Questions/Programming Exercise(s)/Problem Solving Exercise(s) based on the syllabus topics from unit no. I, II and III.

Textbooks:
1. Jiawei Han, Micheline Kamber and Jian Pei"Data Mining Concepts and Techniques", Third Edition, Elsevier, 2011
2. Pang-Ning Tan, Michael Steinbach and Vipin Kumar "Introduction to Data Mining", Pearson Education, 2007.

References:
1. Jiawei Han, Micheline Kamber and Jian Pei"Data Mining Concepts and Techniques", Third Edition, Elsevier, 2011

Online Resources:
1. NPTEL link: https://nptel.ac.in/courses/106105174

SKILL ENHANCEMENT COURSE
US-TCS-505 (Software Project Management) OR US-TCS-506 (Digital Image Processing)

Course Code: US-TCS-505 Software Project Management

Unit No.	Content	No. of Lectures
I	**1.1 Overview of Software Project Management:** The Definition of a "Project", Software Projects versus Other types of Projects, Project Management, Project goals, The Project life cycle, Project feasibility, Request for Proposal (RFP), The Business case. **1.2 Project Selection:** Project selection and criteria of choice, The nature of project selection models, Types of project selection models, Analysis under Uncertainty – The management of Risk, Project Portfolio Process, Project Proposals. **1.3 The Project Manager:** Project Management and Project Manager, Special demands on the Project Manager, Selecting the project manager. **1.4 Managing conflicts and the Art of negotiation:** Conflict, Types of conflicts, the conflict process, Negotiation, Nature of Negotiation, Partnering, Chartering and Scope change, Principles of Negotiation. **1.5 Project Activity Planning:** Initial Project Coordination and the Project Plan, Systems Integration, The Action Plan, The Work Breakdown Structure and Linear Responsibility Chart.	**15**
II	**2.1 Risk Management:** Risk, Risk Management, manage risk, IT Project Risk Management Process, IT Project Risk Management Framework, Risk Management Tools for identifying IT Project Risks, Risk assessment. **2.2 Budgeting and Cost Estimation:** Estimating Project Budgets, Improving the Process of Cost Estimation. **2.3 Project Time Planning and Networks:** Network diagrams, The critical path, Precedence Diagramming method (PDM), Gantt chart, Critical Path Method (CPM) and Time cost trade-off, Variability of Activity duration, PERT, Comparison of CPM and PERT. **2.4 Resource Allocation:** Critical Path Method-crashing a project, The resource allocation problem, Resource loading, Resource levelling, Constrained resource scheduling, multi-project scheduling and Resource allocation, Goldratt's critical chain.	**15**

III	**3.1 Monitoring and Information Systems:** Planning-Monitoring-Controlling Cycle, Earned Value Analysis. **3.2 Project Control:** The fundamental purposes of control, Three types of Control processes, Control of change and scope creep. **3.3 Project Auditing:** Purposes of evaluation, The Project Audit Life Cycle, Some essentials of an Audit/Evaluation. **3.4 Project Termination:** The varieties of Project termination, Terminate a project, The termination process, The final report – A Project History.	15

Self-Learning topics

Sub-Unit	Topic
1.2	**Project Selection:** Project selection and criteria of choice, The nature of project selection models, Types of project selection models, Analysis under Uncertainty – The management of Risk, Project Portfolio Process, Project Proposals.
1.3	**The Project Manager:** Project Management and Project Manager, Special demands on the Project Manager, Selecting the project manager.
2.2	**Budgeting and Cost Estimation:** Estimating Project Budgets, Improving the Process of Cost Estimation.
-	Interview Questions/Programming Exercise(s)/Problem Solving Exercise(s) based on the syllabus topics from unit no. I, II and III.

Textbooks:
  1. John M. Nicholas, "Project Management-Business and Technology", PHI, 2 nd edition

References:
  1. Jack Meredith and S. J. Mantel, "Project Management", Wiley, 8 th Edition.
  2. Jack T. Marchewka," Information Technology Project Management", Wiley, 4th Edition.

Online Resources:
  1. youtube.com/watch?v=uWPIsaYpY7U
  2. https://www.geeksforgeeks.org/software-engineering-software-project-management-spm/
  3. NPTEL link: https://nptel.ac.in/courses/106105218

Course Code: US-TCS-506 Digital Image Processing

Unit No.	Content	No. of Lectures
I	**1.1 Introduction to Image-processing System:** Introduction, Image Sampling, Quantization, Resolution, Human Visual Systems, Elements of an Image-processing System, Applications of Digital Image Processing **1.2 2D Signals and Systems:** 2D signals, separable sequence, periodic sequence, 2D systems, classification of 2D systems, 2D Digital filter **1.3 Convolution and Correlation:** 2D Convolution through graphical method, Convolution through 2D Z—transform, 2D Convolution through matrix analysis, Circular Convolution, Applications of Circular Convolution, 2D Correlation **1.4 Image Transforms:** Need for transform, image transforms, Fourier transform, 2D Discrete Fourier Transform, Properties of 2D DFT, Importance of Phase, Walsh transform, Hadamard transform, Haar transform, Slant transform, Discrete Cosine transform, KL transform	**15**
II	**2.1 Image Enhancement:** Image Enhancement in spatial domain, Enhancement trough Point operations, Histogram manipulation, Linear and nonlinear Gray Level Transformation, local or neighbourhood operation, Median Filter, Spatial domain High pass filtering, Bit-plane slicing, Image Enhancement in frequency domain, Homomorphic filter, Zooming operation, Image Arithmetic **2.2 Binary Image processing:** Mathematical morphology, Structuring elements, Morphological image processing, Logical operations, Morphological operations, Dilation and Erosion, Distance Transform **2.3 Colour Image processing:** Colour images, Colour Model, Colour image quantization, Histogram of a colour image	**15**
III	**3.1 Image Segmentation:** Image segmentation techniques, Region approach, Clustering techniques, Thresholding, Edge-based segmentation, Edge detection, Edge Linking, Hough Transform **3.2 Image Compression:** Need for image compression, Redundancy in images, Image-compression scheme, Fundamentals of Information Theory, Run-length coding, Shannon-Fano coding, Huffman Coding, Arithmetic Coding, Transform-based compression, Image-compression standard	**15**

Self-Learning topics

Sub-Unit	Topic
2.2	**Binary Image processing:** Mathematical morphology, Structuring elements, Morphological image processing, Logical operations, Morphological operations, Dilation and Erosion, Distance Transform
2.3	**Colour Image processing:** Colour images, Colour Model, Colour image quantization, Histogram of a colour image
-	Interview Questions/Programming Exercise(s)/Problem Solving Exercise(s) based on the syllabus topics from unit no. I, II and III.

Textbooks:

1. Digital Image Processing, S Jayaraman, S Esakkirajan, T Veerakumar, Tata McGraw-Hill Education Pvt. Ltd., 2009

References:
1. Digital Image Processing 3rd Edition, Rafael C Gonzalez, Richard E Woods, Pearson, 2008
2. Scilab Textbook Companion for Digital Image Processing, S. Jayaraman, S. Esakkirajan And T. Veerakumar, 2016 (https://scilab.in/textbook_companion/generate_book/125)

Online Resources:
1. https://nptel.ac.in/courses/117105135

Part - 4 Detailed Scheme Practical

Course Code: US-SCS-5P1

Practical I	Practical of US-TCS-501 + Practical of US-TCS-502	Total Credits: 2
Unit	Content	No. of Lectures
1, 2, 3	**Practical of US-TCS-501: Linux Server Administration** - *Practical shall be performed using any Linux Server (with 8GB RAM).* - *Internet connection will be required so that Linux server (command line mode) can be connected to Internet.* 1. Install DHCP Server in Ubuntu 16.04 2. Initial settings: Add a User, Network Settings, change to static IP address, Disable IPv6 if not needed, Configure Services, display the list of services which are running, Stop and turn OFF auto-start setting for a service if you don't need it, sudo Settings 3. Configure NTP Server (NTPD), Install and Configure NTPD, Configure NTP Client (Ubuntu and Windows) 4. SSH Server: Password Authentication Configure SSH Server to manage a server from the remote computer, SSH Client: (Ubuntu and Windows) 5. Install DNS Server BIND, Configure DNS server which resolves domain name or IP address, Install BIND 9, Configure BIND, Limit ranges you allow to access if needed. 6. Configure DHCP Server, Configure DHCP (Dynamic Host Configuration Protocol) Server, Configure NFS Server to share directories on your Network, Configure NFS Client. (Ubuntu and Windows Client OS) 7. Configure LDAP Server, Configure LDAP Server in order to share users' accounts in your local networks, Add LDAP User Accounts in the Open LDAP Server, Configure LDAP Client in order to share users' accounts in your local networks. Install phpLDAPadmin to operate LDAP server via Web browser. 8. Configure NIS Server in order to share users' accounts in your local networks, Configure NIS Client to bind NIS Server. 9. Install MySQL to configure database server, install phpMyAdmin to operate MySQL on web browser from Clients. 10. Install Samba to share folders or files between Windows and Linux.	45

1, 2, 3	**Practical of US-TCS-502: DevOps**	45
	1. Version Control System: Install Git, Git tools, Git Terminology, Git Commands, Git flow, Staging and Commits, undoing changes, inspecting changes, branching and merging, collaborating. (https://www.javatpoint.com/git) 2. Java and Tomcat Setup for Jenkins, GitHub Setup for Jenkins, Maven Setup, Jenkins Configuration and Management 3. Jenkins pipeline, Set up build jobs. 4. Maven & Jenkins Integration with Selenium. 5. Install and configure docker, create docker image using Docker file, start docker container, connect to docker container, Copy the website code to the container. 6. Use docker management commands to List the images, List the containers 7. Start and stop container, Remove container and image 8. Software Configuration Management and provisioning tools using Puppet. 9. Configure Kubernetes, Configure Kubernetes Dashboard. 10. Setup a Kubernetes Cluster, Access application using Kubernetes service. Deploy the website using Dashboard.	

Course Code: US-SCS-5P2

Practical I	**Practical of US-TCS-503 + Practical of US-TCS-504**	**Total Credits: 2**
Unit	**Content**	**No. of Lectures**
1, 2, 3	**Practical of US-TCS-503: Information and Network Security**	**45**
	1. Write programs to implement the following Substitution Cipher Techniques: - Caesar Cipher - Monoalphabetic Cipher 2. Write programs to implement the following Substitution Cipher Techniques: - Vernam Cipher - Playfair Cipher 3. Write programs to implement the following Transposition Cipher Techniques: - Rail Fence Cipher - Simple Columnar Technique 4. Write program to encrypt and decrypt strings using - DES Algorithm - AES Algorithm 5. Write a program to implement RSA algorithm to perform encryption / decryption of a given string. 6. Write a program to implement the Diffie-Hellman Key Agreement algorithm to generate symmetric keys. 7. Write a program to implement the MD5 algorithm compute the message digest. 8. Write a program to calculate HMAC-SHA1 Signature 9. Write a program to implement SSL. 10. Configure Windows Firewall to block: - A port, A Program, A website	

1, 2, 3	**Practical of US-TCS-503: Data Warehousing and Mining**	**45**

	1. Perform the Extraction Transformation and Loading (ETL) process to construct the database in the SQL server.
	2. a. Create the Data staging area for the selected database.
	   b. Create the cube with suitable dimension and fact tables based on ROLAP, MOLAP and HOLAP model.
	3. a. Create the ETL map and setup the schedule for execution.
	   b. Execute the MDX queries to extract the data from the data warehouse.
	4. a. Import the data warehouse data in Microsoft Excel and create the Pivot table and Pivot Chart.
	   b. Import the cube in Microsoft Excel and create the Pivot table and Pivot Chart to perform data analysis.
	5. Apply the what – if Analysis for data visualization. Design and generate necessary reports based on the data warehouse data.
	6. Perform data Pre-processing task and demonstrate Classification, Clustering, and
	7. Association algorithm on data sets using data mining tool (WEKA/R tool/Python)
	8. Perform data clustering using clustering algorithm (K-means/K-medoids)
	9. Implement any one Hierarchical Clustering method.
	10. Implement Association Rule Mining algorithm (Apriori)
	Tools: IBM SPSS, Rapid Miner, Power BI, Oracle Data Miner	

Practical of Skill Enhancement: US-TCS-P505 OR US-TCS-P506

Practical I	US-TCS-P505 OR US-TCS-P506	Total Credits: 1
Unit	**Content**	**No. of Lectures**
1, 2, 3	**Practical of US-TCS-P505: Software Project Management**	**45**

	1. Study Basics of Software Engineering, SDLC, SDLC Team, Agile SCRUM Methodology and commonly done mistakes that lead to the Project Failure.
	2. <u>Group Activity I:</u> Form a SDLC Team (Minimum 6-8 members (randomly assigned by faculty), Assign different Roles and Responsibility [Product Owner (Faculty), Project Manager, Scrum Master, Team Leader, Network Engineer, Test, Quality Assurance Engineer, Database Engineer, Designer, Solution Architect].
	3. <u>Group Activity II:</u> Conduct regular SCRUM Meeting, Prepare Minutes of Meeting (M.O.M).
	4. Prepare Synopsis, Scope, SRS, Timeline, Tasks, Network Diagram, for approval from Product Owner (Faculty). Find critical path.
	5. Preparation of RFP including Measurable Organizational Value (MOV) for a project, Budget and Earned Value Analysis.
	6. <u>Group Activity III:</u> Formulate the Project Problem Statement and Perform the following:
	   o State the Problem
	   o Mention Objective
	   o Scope Statement
	   o Work Breakdown Structure	

	o Work Packages	
	7. Study of issue tracking, bug tracking and project management tool –JIRA and Excel.	

	8. Group Activity IV
	     o Project Time Planning and Network Diagram
	     o Activities, their predecessors and duration	

	9. Create Sprint using JIRA or Excel Sheet to implement Agile Scrum Methodology.	

	10. Group Activity V
	     o AOA diagram, AON diagram
	     o Calculate EFT, LST, LFT, Total Slack, Free Slack	

	11. Group Activity VI
	     o Resource Scheduling
	     o Resource Allocation Graph
	     o Crashing
	     o Risk Management	

	12. Generate various Project Management and Scrum reports like Product Backlog, Sprint Backlog, Changes Report, Burndown Chart, Daily Task List, Developer Performance Report, Time Sheet.	
1, 2, 3	**Practical of US-TCS-P506: Digital Image Processing** *Practical need to be performed using Scilab under Linux or Windows* 1. 2D Linear Convolution, Circular Convolution between two 2D matrices 2. Circular Convolution expressed as linear convolution plus alias 3. Linear Cross correlation of a 2D matrix, Circular correlation between two signals and Linear auto correlation of a 2D matrix, Linear Cross correlation of a 2D matrix 4. DFT of 4x4 gray scale image 5. Compute discrete cosine transform, Program to perform KL transform for the given 2D matrix 6. Brightness enhancement of an image, Contrast Manipulation, image negative 7. Perform threshold operation, perform gray level slicing without background 8. Image Segmentation 9. Image Compression 10. Binary Image Processing and Colour Image processing	**45**
	US-TCS-P507: Project Dissertation **NOTE: All Documents Need to Be Approved by The Product Owner (Faculty)** 1. Prepare Proforma for the Approval of the SDLC Team. 2. Prepare Project Synopsis. 3. Prepare Proforma for the Approval of the project synopsis. 4. Prepare Consent Letter of the Guide/Product Owner. 5. Prepare Minutes of Meeting for Kick-off meeting and all team scrum meetings. 6. Create Project Repository. 7. Prepare Project Charter (high-level objectives and key stakeholders). 8. Create Project Charter Approval Proforma. 9. Prepare Scope and RFP Approval Proforma. 10. Prepare and Submit various System Design including but not limited to Wireframe, HTML, DB Design, System Architecture, including all Program documentation (task document), System Document, relevant UML diagrams like Structural diagrams (Class Diagram, object diagram, Component diagram, Deployment diagram), Behavioural Diagrams (Use Case Diagram, Activity Diagram, State Machine Diagram, Sequence Diagram, Communication Diagram) etc. as per the project.	**45**

Part - 5 The Scheme of Teaching and Examination is as under:

Third Year Semester – VI
Summary

Sr. No.	Choice Based Credit System			Subject Code	Remarks
1	Core Course (Computer Science)			US-TCS-601 US-TCS-602 US-TCS-603 US-TCS-604	
2	Elective Course	Discipline Specific Elective (DSE) Course			
		2.1	Interdisciplinary Specific Elective (IDSE) Course		
		2.2	Dissertation/Project		
		2.3	Generic Elective (GE) Course		
3	Ability Enhancement Courses (AEC)				
4	Skill Enhancement Courses (SEC)			US-TCS-605 US-TCS-606	

Third Year Semester VI Internal and External Detailed Evaluation Scheme

Sr. No.	Subject Code	Subject Title	Periods Per Week					Credits	Internals				Total Marks
			Units	S.L.	L	T	P		SLE	CT + AT = 15 + 5	PA	SEE	
1	US-TCS-601	Wireless Sensor Networks and Mobile Communication	3	20%*	3	0	-	3	10	20	10	60	100
2	US-TCS-602	Cloud Computing	3	20%*	3	0	-	3	10	20	10	60	100
3	US-TCS-603	Machine Learning	3	20%*	3	0	-	3	10	20	10	60	100
4	US-TCS-604	Big Data and Analytics	3	20%*	3	0	-	3	10	20	10	60	100
5	US-TCS-605 OR US-TCS-606	Cyber Security and Forensics OR Game Programming	3	20%*	3	0	-	2	10	20	10	60	100
6	US-TCS-6P1	Practical of US-TCS-601 and US-TCS-602	-	-	-	-	6	2				100 (60+40)	100
7	US-TCS-6P2	Practical of US-TCS-603 and US-TCS-604	-	-	-	-	6	2				100(60+40)	100
8	US-TCS-P605 OR US-TCS-P606	Practical of US-TCS-605 OR US-TCS-606	-	-	-	-	3	1				50 (30+20)	50
9	US-TCS-P607	Project Implementation	-	-	-	-	3	1					50
	Total Lectures/ Credits							**20**	**Total Marks**				**800**

**One to two lectures to be taken for CONTINUOUS self –learning Evaluation.

Third Year Semester – VI Units – Topics – Teaching Hours

Sr. No.	Subject Code & Title		Subject Unit Title	Hours/ Lectures	Total No. of hours/ lectures	Credit	Total Marks
1	US-TCS-601 Wireless Sensor Networks and Mobile Communication	1	Introduction, Sensor Node Hardware and Network Architecture	15	45L	3	100 (60+40)
		2	MAC Protocols, Routing Protocols, Transport Control Protocols	15			
		3	Introduction, Wireless Transmission and Medium Access Control, Wireless Transmission, Telecommunication, Satellite and Broadcast Systems	15			
2	US-TCS-602 Cloud Computing	1	Introduction to Cloud Computing	15	45L	3	100 (60+40)
		2	Virtualization and Cloud Computing	15			
		3	AWS	15			
3	US-TCS-603 Machine Learning	1	What is Machine Learning, Main Challenges, Testing & Validating, Working with Real Data	15	45L	3	100 (60+40)
		2	Prepare the Data for Machine Learning Algorithms, Classification	15			
		3	Training Models	15			
4	US-TCS-604 Big Data and Analytics	1	Classification of Digital Data, Introduction to Big Data, Big Data Analytics, Introduction to NoSQL Databases	15	45L	3	100 (60+40)
		2	Introduction to MongoDB, Introduction to Cassandra, MapReduce Programming	15			
		3	Algorithms Using MapReduce, Introduction to HIVE, Introduction to Pig	15			
5	US-TCS-605 Cyber Security and Forensics	1	Information Security, Types of malwares, Types of vulnerabilities, Types of attacks and their common prevention mechanisms, Case-studies	15	45L	2	100 (60+40)
	OR	2	Phases of Ethical Hacking, Buffer Overflows, Privilege Escalation, Network hacking, Computer Forensics, Network Forensic, Cell Phone and Mobile Device Forensics	15			
		3	Internet Forensic - E-mail Forensics, Messenger Forensics, Social Media Forensics, Browser Forensics	15			
	US-TCS-606 Game Programming	1	Mathematics for Computer Graphics, DirectX Kickstart	15			
		2	DirectX Pipeline and Programming, Interpolation and Character Animation	15			
		3	Introduction to Rendering Engines, Unity Engine, Scripting, XR.	15			
6	US-TCS-6P1	1	Practical of US-TCS-601	3	45x2=	2	100

		2	Practical of US-TCS-602	3	90 lectures per batch		(60+40)
7	US-TCS-6P2	1	Practical of US-TCS-603	3	45x2=	2	100
		2	Practical of US-TCS-604	3	90 lectures per batch		(60+40)
8	US-TCS-P605 **OR** US-TCS-P606	1	Practical of US-TCS-605	3	45 lectures per batch	1	50
		2	Practical of US-TCS-606	3			
9	US-TCS-P607		Project Implementation	3	45 lectures per batch	1	50
			TOTAL			**20**	**800**

- **Lecture Duration – 50 Minutes = 0 .83 Hours. (45 Lectures equivalent to 33.75 hours)**
- **One Credit =19.92 hours equivalent to 20 Hours**

L: Lecture: Tutorials   P: Practical Ct-Core Theory, Cp-Core Practical, SLE- Self learning evaluation CT-Commutative Test, SEE- Semester End Examination, PA- Project Assessment, AT- Attendance

Part - 6 Detailed Scheme Theory

Curriculum Topics along with Self-Learning topics - to be covered, through self-learning mode along with the respective Unit. Evaluation of self-learning topics to be undertaken before the concluding lecture instructions of the respective UNIT.

Course Code: US-TCS-601 Wireless Sensor Networks and Mobile Communication

Unit No.	Content	No. of Lectures
I	**1.1 Introduction:** Introduction to Sensor Networks, unique constraints and challenges. Advantage of Sensor Networks, Applications of Sensor Networks, Mobile Ad hoc Networks (MANETs) and Wireless Sensor Networks, Enabling technologies for Wireless Sensor Networks. **1.2 Sensor Node Hardware and Network Architecture:** Single-node architecture, Hardware components & design constraints, Operating systems and execution environments, Introduction to TINYOS and NESC. Network architecture, Optimization goals and figures of merit, Design principles for WSNs, Service interfaces of WSNs, Gateway concepts.	15
II	**2.1 Medium Access Control Protocols:** Fundamentals of MAC Protocols, MAC Protocols for WSNs, Sensor-MAC Case Study. **2.2 Routing Protocols:** Data Dissemination and Gathering, Routing Challenges and Design Issues in Wireless Sensor Networks, Routing Strategies in Wireless Sensor Networks. **2.3 Transport Control Protocols:** Traditional Transport Control Protocols, Transport Protocol Design Issues, Examples of Existing Transport Control Protocols, Performance of Transport Control Protocols.	15
III	**3.1 Introduction, Wireless Transmission and Medium Access Control:** Applications, A short history of wireless communication. **3.2 Wireless Transmission:** Frequency for radio transmission, Signals, Antennas, Signal propagation, Multiplexing, Modulation, Spread spectrum, Cellular systems. **3.3 Telecommunication, Satellite and Broadcast Systems: GSM:** Mobile services, System architecture, Radio interface, Protocols, Localization And Calling, Handover, security, New data services; DECT: System architecture, Protocol architecture; ETRA, UMTS and IMT- 2000. Satellite Systems: History, Applications, Basics: GEO, LEO, MEO; Routing, Localization, Handover.	15

Self-Learning topics

Sub-Unit	Topic
1.1	Applications of Sensor Networks, Mobile Ad hoc Networks (MANETs) and Wireless Sensor Networks
2.1	Fundamentals of MAC Protocols, MAC Protocols for WSNs.
3.2	Frequency for radio transmission, Signals, Antennas, Signal propagation, Multiplexing, Modulation, Spread spectrum, Cellular systems
-	Interview Questions/Programming Exercise(s)/Problem Solving Exercise(s) based on the syllabus topics from unit no. I, II and III.

Textbooks:
1) Protocols and Architectures for Wireless Sensor Network, Holger Kerl, Andreas Willig, John Wiley and Sons, 2005
2) Wireless Sensor Networks Technology, Protocols, and Applications ,Kazem Sohraby, Daniel Minoli and TaiebZnati, John Wiley & Sons, 2007
3) Mobile communications, Jochen Schiller,2nd Edition, Addison wisely , Pearson Education,2012

References:

1) Fundamentals of Wireless Sensor Networks, Theory and Practice, Waltenegus Dargie, Christian Poellabauer , Wiley Series on wireless Communication and Mobile Computing, 2011

Online Resources:
1.   NPTEL link: https://nptel.ac.in/courses/106105160

Course Code: US-TCS-602 Cloud Computing

Unit No.	Content	No. of Lectures
I	**1.1 Introduction to Cloud Computing**, Characteristics and benefits of Cloud Computing, Basic concepts of Distributed Systems, Web 2.0, Service-Oriented Computing, Utility-Oriented Computing. **1.2 Elements of Parallel Computing**. Elements of Distributed Computing. Technologies for Distributed Computing. Cloud Computing Architecture. The cloud reference model. Infrastructure as a service. Platform as a service. Software as a service. Types of clouds.	15
II	**2.1 Characteristics of Virtualized Environments**. Taxonomy of Virtualization Techniques. Virtualization and Cloud Computing. Pros and Cons of Virtualization. **2.2 Virtualization using KVM**, Creating virtual machines, oVirt - management tool for virtualization environment. Open challenges of Cloud Computing	15
III	**3.1 Introduction to AWS** Services provided by AWS: EC2, Lambda, S3 **3.2** **Create AWS EC2 instance:** - Add storage, Tag instance, Review instance launch - Set up an Apache web server on your EC2 instance - Clean up your EC2 instance	15

Self-Learning topics

Sub-Unit	Topic
1.2	Basic concepts of Distributed Systems, Web 2.0, Service-Oriented Computing, UtilityOriented Computing.
1.2	Elements of Parallel Computing. Elements of Distributed Computing. Technologies for Distributed Computing
-	Interview Questions/Programming Exercise(s)/Problem Solving Exercise(s) based on the syllabus topics from unit no. I, II and III.

References:

1) Mastering Cloud Computing, Rajkumar Buyya, Christian Vecchiola, S Thamarai Selvi, Tata McGraw Hill Education Private Limited, 2013

2) AWS Cookbook, John Culkin, Mike Zazon, O'Reilly Media, Inc., 2021.

Online Resources:
1) NPTEL link: https://nptel.ac.in/courses/106105167
2) https://nptel.ac.in/courses/106104182
3) https://docs.aws.amazon.com/efs/latest/ug/wt2-apache-web-server.html
4) https://www.guru99.com/aws-tutorial.html

Course Code: US-TCS-603 Machine Learning

Unit No.	Content	No. of Lectures
I	**1.1 Introduction:** Machine Learning, Use of Machine Learning, Types of Machine Learning Systems, Key tasks of Machine Learning, selecting right algorithm, Steps in developing machine learning application. **1.2 Main Challenges of Machine Learning:** Insufficient Quantity of Training Data, Non-representative Training Data, Poor-Quality Data, Irrelevant Features, Overfitting the Training Data, Underfitting the Training Data, Stepping Back **1.3 Testing & Validating:** Hyperparameter Tuning and Model Selection, Data Mismatch **1.4 Working with Real Data, look at the Big Picture:** Frame the Problem, select a Performance Measure, Check the Assumptions; Get the Data: Create the Workspace, Download the Data, take a quick look at data structure, create a test set, Discover and Visualize Data to gain insights.	**15**
II	**2.1** Prepare the Data for Machine Learning Algorithms: Data Cleaning, Handling Text and Categorical Attributes, Custom Transformers, Feature Scaling, Transformation Pipelines, Select and Train a Model: Training and Evaluating on a Training Set, Better Evaluation using Cross Validation, Fine Tune your Model. **2.2** Classification: MNIST, Training a Binary Classifier, Performance Measures: Cross Validation, Confusion Matrix, Precision & Recall, The ROC Curve; Multiclass Classification, Error Analysis, Error Analysis, Multilabel Classification, Multioutput Classification.	**15**
III	**Training Models:** • Linear Regression • Gradient Descent: Batch Gradient Descent, Stochastic Gradient Descent • Polynomial Regression • Learning Curves • Regularized Linear Models: Ridge Regression, Lasso Regression • Logistic Regression • Support Vector Machines • Decision Trees • Ensemble Learning & Random Forests • Dimensionality Reduction, PCA. • Unsupervised Learning Techniques: Clustering: K-means, Limits of K-means, Using clustering for image segmentation, Using clustering for Pre-processing, Using clustering for semi-supervised learning, DBSCAN.	**15**

Self-Learning topics

Sub-Unit	Topic
III	Linear Regression, Gradient Descent: Batch Gradient Descent, Stochastic Gradient Descent, Polynomial Regression, Learning Curves, Regularized Linear Models: Ridge Regression, Lasso Regression, Logistic Regression.
-	Interview Questions/Programming Exercise(s)/Problem Solving Exercise(s) based on the syllabus topics from unit no. I, II and III.

Textbooks:

1. Hands-on Machine Learning with Scikit-Learn, Keras, and TensorFlow Concepts, Tools, and Techniques to Build Intelligent Systems, Aurélien Géron, O Reilly, 2nd Edition.

References:

1. Machine Learning, Tom M. Mitchell, McGraw-Hill.
2. Machine Learning in Action, Peter Harrington, Manning Publications.
3. Machine Learning, An Algorithmic Perspective, Stephen Marsland, CRC Press, 2nd Edition.

Online Resources:

1. https://nptel.ac.in/courses/106106139

Course Code: US-TCS-604 Big Data and Analytics

Unit No.	Content	No. of Lectures
I	**1.1** Classification of Digital Data, Introduction to Big Data- Characteristics, Evolution, Definition, Challenges with Big Data, Need of Big Data, Non-definitional traits of Big Data, Traditional Business Intelligence (BI) versus Big Data, A Typical Data Warehouse Environment, A Typical Hadoop Environment. **1.2** What is Big Data Analytics, Classification of Analytics, Top Challenges facing Big Data, Importance of Big Data Analytics, Data Science, Terminologies used in Big Data Environments, BASE. **1.3** Introduction to NoSQL Databases, Introduction to Hadoop – Need of Hadoop not RDBMS, RDBMS versus Hadoop, Distributed Computing Challenges, History of Hadoop, Hadoop Overview, Use Case of Hadoop, Hadoop Distributors, HDFS (Hadoop Distributed File System), Processing Data with Hadoop, Managing Resources and Applications with Hadoop YARN (Yet Another Resource Negotiator), Interacting with Hadoop Ecosystem.	**15**
II	**2.1 Introduction to MongoDB:** MongoDB, Need of MongoDB, Terms used in RDBMS and MongoDB, Data Types in MongoDB, MongoDB Query Language. **2.2 Introduction to Cassandra:** Apache Cassandra – An Introduction, Features of Cassandra, CQL Data Types, CQLSH, Key spaces, CRUD (Create, Read, Update, and Delete) Operations, Collections, using a Counter, Time to Live (TTL), Alter Commands, Import and Export, Querying System Tables. **2.3 MapReduce Programming:** Introduction, Mapper, Reducer, Combiner, Partitioner, Searching, Sorting, Compression	**15**

III	**3.1 Algorithms Using MapReduce:** Matrix-Vector Multiplication by MapReduce, Relational-Algebra Operations, Computing Selections by MapReduce, Computing Projections by MapReduce, Union, Intersection, and Difference by MapReduce. **3.2 Introduction to HIVE:** What is Hive, HIVE Architecture, Hive Data Types, Hive File Format, Hive Query Language (HQL), User Defined Functions. **3.3 Introduction to Pig:** Pig, The Anatomy of Pig, Pig on Hadoop, Pig Philosophy, use case for Pig: ETL Processing, Pig Latin Overview, Data types in Pig, Running Pig, Execution Modes of Pig, HDFS Commands, Relational Operators, Eval function, Complex Data Types, Piggy Bank, User Defined Functions, Word Count Example using Pig, when to use Pig, Pig versus Hive, connecting to MongoDB NoSQL Database, Connecting to Cassandra NoSQL Database.	15

Self-Learning topics

Sub-Unit	Topic
2.1	What is MongoDB, Why MongoDB, Terms used in RDBMS and MongoDB, Data Types in MongoDB, MongoDB Query Language.
3.2	Introduction to HIVE: What is Hive, HIVE Architecture, Hive Data Types, Hive File Format, Hive Query Language (HQL), User Defined Functions.
-	Interview Questions/Programming Exercise(s)/Problem Solving Exercise(s) based on the syllabus topics from unit no. I, II and III.

Textbooks:

1. Big Data and Analytics, 2ed, Seema Acharya, Subhashini Chellappan, Wiley.

References:

1. Hadoop: The Definitive Guide, Tom White, O'Reilly Media, Inc.
2. Professional NoSQL By Shashank Tiwari, Wrox-John Wiley & Sons, Inc, 2011
3. Getting Started with NoSQL, Gaurav Vaish, Packt Publishing Ltd, 2013

Online Resources:

1. https://nptel.ac.in/courses/106104135
2. https://nptel.ac.in/courses/106104189

US-TCS-605 (Cyber Security and Forensics) **OR** US-TCS-606 (Game Programming)

Course Code: US-TCS-605 Cyber Security and Forensics

Unit No.	Content	No. of Lectures
I	**1.1 Information Security**: Attacks and Vulnerabilities Introduction to information security: Asset, Access Control, CIA, Authentication, Authorization, Risk, Threat, Vulnerability, Attack, Attack Surface, Malware, Security-Functionality-Ease of Use Triangle **1.2 Types of malwares**: Worms, viruses, Trojans, Spyware, Rootkits **1.3 Types of vulnerabilities**: OWASP Top 10: cross-site scripting (XSS), cross site request forgery (CSRF/XSRF), SQL injection, input parameter manipulation, broken authentication, sensitive information disclosure, XML External Entities, Broken access control, Security Misconfiguration, Using components with known vulnerabilities, Insufficient Logging and monitoring, OWASP Mobile Top 10, CVE Database **1.4 Types of attacks and their common prevention mechanisms**: Keystroke Logging, Denial of Service (DoS /DDoS), Waterhole attack, brute force, phishing and fake WAP, Eavesdropping, Man-in-the-middle, Session Hijacking, Clickjacking, Cookie Theft, URL Obfuscation, buffer overflow, DNS poisoning, ARP poisoning, Identity Theft, IoT Attacks, BOTs and BOTNETs **1.5 Case-studies:** Recent attacks – Yahoo, Adult Friend Finder, eBay, Equifax, WannaCry, Target Stores, Uber, JP Morgan Chase, Bad Rabbit	15
II	**2.1 Phases of Ethical Hacking:** Reconnaissance/foot-printing/Enumeration, Scanning, Sniffing: Vulnerability assessment and Penetration Testing, Covering your tracks: Steganography, Event Logs alteration **2.2** Buffer Overflows, Privilege Escalation, Network hacking - ARP Poisoning, Password Cracking, WEP Vulnerabilities, MAC Spoofing, MAC Flooding, IP Spoofing, SYN Flooding, Smurf attack **2.3 Computer Forensics:** Introduction to Computer Forensics and standard procedure, Incident Verification and System Identification, Recovery of Erased and damaged data, Disk Imaging and Preservation, Data Encryption and Compression, Automated Search Techniques, Forensics Software **2.4 Network Forensic:** Introduction to Network Forensics and tracking network traffic, Reviewing Network Logs, Network Forensics Tools, Performing Live Acquisitions, Order of Volatility, Standard Procedure **2.5 Cell Phone and Mobile Device Forensics:** Overview, Acquisition Procedures for Cell Phones and Mobile Devices	15
III	**Internet Forensic: 3.1 Introduction** to Internet Forensics, World Wide Web Threats, Hacking and Illegal access, Obscene and Incident transmission, Domain Name Ownership Investigation, Reconstructing past internet activities and events **3.2 E-mail Forensics:** e-mail analysis, e-mail headers and spoofing, Laws against e-mail Crime, **3.3 Messenger Forensics:** Yahoo Messenger **3.4 Social Media Forensics:** Social Media Investigations **3.5 Browser Forensics:** Cookie Storage and Analysis, Analysing Cache and temporary internet files, Web browsing activity reconstruction	15

Self-Learning topics

Sub-Unit	Topic
I	Types of malwares, OWASP Top 10, OWASP Mobile Top 10, Case-studies
II	Attacks, Cell Phone and Mobile Device Forensics
III	Social Media Forensics, Browser Forensics
-	Interview Questions/Programming Exercise(s)/Problem Solving Exercise(s) based on the syllabus topics from unit no. I, II and III.

References:

1. Certified Ethical Hacker Study Guide v9, Sean-Philip Oriyano, Sybex; Study Guide Edition, 2016
2. CEH official Certified Ethical Hacking Review Guide, Wiley India Edition, 2007
3. Guide to computer forensics and investigations, Bill Nelson, Amelia Philips and Christopher Steuart, course technology, 5th Edition, 2015.
4. Incident Response and computer forensics, Kevin Mandia, Chris Prosise, Tata McGrawHill, 2nd Edition, 200

Online Resources:

- https://onlinecourses.nptel.ac.in/noc22_cs13/preview
- https://onlinecourses.swayam2.ac.in/cec20_lb06/preview
- http://www.pentest-standard.org/index.php/PTES_Technical_Guidelines
- https://www.owasp.org/index.php/Category:OWASP_Top_Ten_2017_Project
- https://www.owasp.org/index.php/Mobile_Top_10_2016-Top_10
- https://www.owasp.org/index.php/OWASP_Testing_Guide_v4_Table_of_Contents
- https://www.owasp.org/index.php/OWASP_Secure_Coding_Practices__Quick_Reference_Guide
- https://cve.mitre.org/
- https://access.redhat.com/blogs/766093/posts/2914051
- http://resources.infosecinstitute.com/applications-threat-modeling/#gref
- http://www.vulnerabilityassessment.co.uk/Penetration%20Test.html

Course Code: US-TCS-506 Game Programming

Unit No.	Content	No. of Lectures
I	**Mathematics for Computer Graphics, DirectX Kickstart:** **1.1 Cartesian Coordinate system:** The Cartesian XY-plane, Function Graphs, Geometric Shapes, Polygonal Shapes, Areas of Shapes, Theorem of Pythagoras in 2D, Coordinates, Theorem of Pythagoras in 3D, 3D Polygons, Euler's Rule **1.2 Vectors:** Vector Manipulation, multiplying a Vector by a Scalar, Vector Addition and Subtraction, Position Vectors, Unit Vectors, Cartesian Vectors, Vector Multiplication, Scalar Product, Example of the Dot Product, The Dot Product in Lighting Calculations, The Dot Product in Back-Face Detection, The Vector Product, The Right-Hand Rule, deriving a Unit Normal Vector for a Triangle Areas, Calculating 2D Areas **1.3 Transformations:** 2D Transformations, Matrices, Homogeneous Coordinates, 3D Transformations, Change of Axes, Direction Cosines, rotating a Point about an Arbitrary Axis, Transforming Vectors, Determinants, Perspective Projection, Interpolation **1.4 DirectX:** Understanding GPU and GPU architectures. How they are different from CPU Architectures? Understanding how to solve by GPU?	**15**
II	**DirectX Pipeline and Programming:** **2.1 Introduction to DirectX 11:** COM, Textures and Resources Formats, The swap chain and Page flipping, Depth Buffering, Texture Resource Views, Multisampling Theory and MS in Direct3D, Feature Levels **2.2 Direct3D 11 Rendering Pipeline:** Overview, Input Assembler Stage (IA), Vertex Shader Stage (VS), The Tessellation Stage (TS), Geometry Shader Stage (GS), Pixel Shader Stage (PS), Output merger Stage (OM) Understanding Meshes or Objects, Texturing, Lighting, Blending. **Interpolation and Character Animation:** **2.3 Trigonometry:** The Trigonometric Ratios, Inverse Trigonometric Ratios, Trigonometric Relationships, The Sine Rule, The Cosine Rule, Compound Angles, Perimeter Relationships **2.4 Interpolation:** Linear Interpolant, Non-Linear Interpolation, Trigonometric Interpolation, Cubic Interpolation, Interpolating Vectors, Interpolating Quaternions **2.5 Curves:** Circle, Bezier, B-Splines **2.6 Analytic Geometry:** Review of Geometry, 2D Analytic Geometry, Intersection Points, Point in Triangle, and Intersection of circle with straight line.	**15**
III	**3.1 Introduction to Rendering Engines:** Understanding the current market Rendering Engines. Understanding AR, VR and MR.Depth Mappers, Mobile Phones, Smart Glasses, HMD's **3.2 Unity Engine:** Multi-platform publishing, VR + AR: Introduction and working in Unity, 2D, Graphics, Physics, Scripting, Animation, Timeline, Multiplayer and Networking, UI, Navigation and Pathfinding, XR, Publishing. **3.3 Scripting:** Scripting Overview, Scripting Tools and Event Overview **3.4 XR:** VR, AR, MR, Conceptual Differences. SDK, Devices	**15**

Self-Learning topics

Sub-Unit	Topic
1.1	The Cartesian XY-plane, Function Graphs, Geometric Shapes, Polygonal Shapes, Areas of Shapes, Theorem of Pythagoras in 2D, Coordinates, Theorem of Pythagoras in 3D, 3D Polygons, Euler's Rule.
1.2	Vectors
2.3	The Trigonometric Ratios, Inverse Trigonometric Ratios, Trigonometric Relationships, The Sine Rule, The Cosine Rule, Compound Angles, Perimeter Relationships
-	Interview Questions/Programming Exercise(s)/Problem Solving Exercise(s) based on the syllabus topics from unit no. I, II and III.

Textbooks:
1. Mathematics for Computer Graphics, John Vince, Springer-Verlag London, 5th Edition, 2017
2. Mathematics for 3D Game Programming and Computer Graphic, Eric Lengyel, Delmar Cengage Learning, Delmar Cengage Learning, 2011
3. Introduction to 3D Game Programming With Directx® 11, Frank D Luna, Mercury Learning and Information, 2012.

References:
1. Computer Graphics, C Version, Donald Hern and Pauline Baker, Pearson Education, 2nd Edition, 1997
2. HLSL Development Cookbook, Doron Feinstein, PACKT Publishing, 2013

Online Resources:
1. https://docs.unity3d.com/Manual/index.html - Free
2. NPTEL link: https://onlinecourses.nptel.ac.in/noc19_ge32/preview

Part - 7 Detailed Scheme Practical

Course Code: US-SCS-6P1

Practical I	Practical of US-TCS-601 + Practical of US-TCS-602	Total Credits: 2
Unit	**Content**	**No. of Lectures**
1, 2, 3	**Practical of US-TCS-601: Wireless Sensor Networks and Mobile Communication** *Practical experiments require software tools like INET Framework for OMNeT++, NetSim, TOSSIM, Cisco packet tracer 6.0 and higher version.* **1.** Understanding the Sensor Node Hardware. (For Eg. Sensors, Nodes (Sensor mote), Base Station, Graphical User Interface.) **2.** Exploring and understanding TinyOS computational concepts: - Events, Commands and Task. - nesC model - nesC Components **3.** Understanding TOSSIM for - Mote-mote radio communication - Mote-PC serial communication **4.** Create and simulate a simple adhoc network **5.** Understanding, Reading and Analyzing Routing Table of a network. **6.** Create a basic MANET implementation simulation for Packet animation and Packet Trace. **7.** Implement a Wireless sensor network simulation. **8.** Create MAC protocol simulation implementation for wireless sensor Network. **9.** Simulate Mobile Adhoc Network with Directional Antenna **10.** Create a mobile network using Cell Tower, Central Office Server, Web browser and Web Server. Simulate connection between them.	**45**
1, 2, 3	**Practical of US-TCS-602: Cloud Computing** 1. Study and implementation of Infrastructure as a Service. 2. Installation and Configuration of virtualization using KVM. 3. Study and implementation of Infrastructure as a Service 4. Study and implementation of Storage as a Service 5. Study and implementation of identity management 6. Study Cloud Security management 7. Write a program for web feed. 8. Study and implementation of Single-Sing-On. 9. User Management in Cloud. 10. Case study on Amazon EC2/Microsoft Azure/Google Cloud Platform	**45**

Course Code: US-SCS-6P2

Practical II	Practical of US-TCS-603 + Practical of US-TCS-604	Total Credits: 2
Unit	Content	No. of Lectures
1, 2, 3	**Practical of US-TCS-603: Machine Learning** 1. Write a python code to load and prepare the data. Perform following operations: • Convert text values to numbers • Select relevant parameters using the correlation • Remove or fill missing values • Remove outliers 2. Create a scatterplot for visualization and train a linear model for making a prediction. 3. Build a classifier for the MNIST dataset that achieves over 97% accuracy on the test set. 4. Implement linear regression algorithm and polynomial regression using python. 5. Implement logistic regression algorithm using python. 6. Implement Gradient descent algorithm using python. 7. Create and train the Support Vector Machine (SVM). 8. Implement Classification using Decision tree classifier. 9. Implement Dimensionality reduction algorithms. 10. Implement Clustering using k-means and DBSCAN algorithms.	45
1, 2, 3	**Practical of US-TCS-604: Big Data Analytics** 1. Install and configure HDFS. Implement the following file management tasks in Hadoop System (HDFS): Adding files, Listing Files, retrieving files, Deleting files. 2. To run a Word Count MapReduce program to understand MapReduce Paradigm: To count words in a given file, to view the output file. 3. To run a Char Count MapReduce program to understand MapReduce Paradigm: To count char in a given file, to view the output file. 4. Setup MongoDB environment in your system and use mongoDB query language to create database, update and insert in database. 5. Import Dataset and perform CRUD operation using mongoDB. 6. Install and Setup Cassandra and create, alter & Drop Keyspace in Cassandra. Perform CQL to insert and update data in Cassandra. 7. Create & Drop INDEX in Cassandra. Implement Cassandra collections. 8. Install PIG. Write Pig Latin scripts sort, group, join, project, and filter your data. 9. Perform Data processing by implementing the Pig Latin Scripts to find Word Count. 10. Install HIVE. Use Hive to create, alter, and drop databases, tables, views, functions, and indexes.	45

Practical of Skill Enhancement: US-TCS-P605 OR US-TCS-P606

Practical III	US-TCS-P605 OR US-TCS-P606	Total Credits: 1
Unit	Content	No. of Lectures

1, 2, 3	**Practical of US-TCS-P605: Cyber Security and Forensics**
	
	1. Use Google and Whois for Reconnaissance
	2. a) Use CrypTool to encrypt and decrypt passwords using RC4 algorithm
	  b) Use Cain and Abel for cracking Windows account password using Dictionary attack and to decode wireless network passwords
	3. a) Run and analyze the output of following commands in Linux –
	    ifconfig, ping, netstat, traceroute
	  b) Perform ARP Poisoning in Windows
	4. Use NMap scanner to perform port scanning of various forms – ACK, SYN, FIN, NULL, XMAS
	5. a) Use Wireshark (Sniffer) to capture network traffic and analyze
	  b) Use HPING 3 to launch DoS attack
	6. Create a simple keylogger using python
	7. Creating a Forensic Image using FTK Imager/Encase Imager:
	- Creating Forensic Image
	- Check Integrity of Data - Analyze Forensic Image
	8. Data Acquisition:
	- Perform data acquisition using:
	- USB Write Blocker + Encase Imager
	- SATA Write Blocker + Encase Imager
	- Falcon Imaging Device
	9. Recovering and Inspecting deleted files
	- Check for Deleted Files
	- Recover the Deleted Files
	- Analysing and inspecting the recovered files
	Perform this using recovery option in ENCASE and also Perform manually through command line
	10. Email Forensics
	- Mail Service Providers
	- Email protocols
	- Recovering emails
	- Analyzing email header
	11. Web Browser Forensics
	- Web Browser working
	- Forensics activities on browser
	- Cache / Cookies analysis
	- Last Internet activity
		45

1, 2, 3	**Practical of US-TCS-P606: Game Programming**	**45**
	1. Setup DirectX 11, Window Framework and Initialize Direct3D Device 2. Buffers, Shaders and HLSL (Draw a triangle using Direct3D 11) 3. Texturing (Texture the Triangle using Direct 3D 11) 4. Lightning (Programmable Diffuse Lightning using Direct3D 11) 5. Specular Lightning (Programmable Spot Lightning using Direct3D 11) 6. Loading models into DirectX 11 and rendering. Perform following Practical using online content from the Unity Tutorials Web--sites: https://unity3d.com/learn/tutorials/s/interactive-tutorials 7. https://unity3d.com/learn/tutorials/s/2d-ufo-tutorial 8. https://unity3d.com/learn/tutorials/s/space-shooter-tutorial 9. https://unity3d.com/learn/tutorials/s/roll-ball-tutorial 10. https://unity3d.com/learn/tutorials/topics/vr/introduction?playlist=22946	
	US-TCS-P607: Project Implementation	**45**
	NOTE: All Documents Need to Be Approved by The Product Owner (Faculty) 1. Prepare Sprint Document using Excel or JIRA. 2. Prepare Weekly Task Allocation Document for a particular sprint. 3. Implement Object Oriented Analysis, Object Oriented Analysis and Object-Oriented implementation by using Object Oriented languages. 4. Each student should Create and update their daily Timesheet. 5. Prepare Task document for each module with Functional/Non-Functional requirement that needs to be implemented, Wireframe for the module and database design. 6. Prepare change document for approval in case of any change in requirement. 7. Prepare Quality Control Checkpoint document 8. Create all possible Test Scenarios and Test Case (Both Manual and Automated) 9. Deploy the project on cloud and perform system testing. 10. Prepare report for Coding conventions and programming principles used for project implementation.	

Project Dissertation Semester V and Project Implementation Semester VI Guidelines

1. The project can be done in group of 3 - 5 students. However, the length and depth of the project should be justified for the projects done in group.
2. A big project can be modularized and different modules can be assigned as separate project to different students.
3. A learner can choose any topic which is covered in Semester I- semester VI or any other topic with the prior approval from head of the department/ project in charge.
4. The project can be application oriented/web-based/database/research based.
5. It has to be an implemented work; just theoretical study will not be acceptable.
6. A learner can choose any programming language, computational techniques and tools which have been covered during BSc course or any other with the prior permission of head of the department/ project guide.
7. A project guide should be assigned to a learner. He/she will assign a schedule for the project and hand it over to a learner. The guide should oversee the project progress on a weekly basis by considering the workload of 3 lectures as assigned.
8. The quality of the project will be evaluated based on the novelty of the topic, scope of the work, relevance to the computer science, adoption of emerging techniques/technologies and its real-world application.

9. Approval of the project proposal is mandatory. y. If approved, the student can commence working on it, and complete it. Use the latest versions of the software packages for the development of the project.
10. Chapter 1 to 5 should be submitted in Semester V in spiral binding. These chapter have also to be included in Semester VI report. Semester VI report has to be hard bound with golden embossing. Students will be evaluated based on the dissertation in semester V and dissertation and viva voce in Semester VI.
11. The Project should be certified by the concerned Project guide and Head of the department.
12. A learner has to make a presentation of working project and will be evaluated as per the Project evaluation scheme.

Semester V	Project Dissertation	ABSTRACT one/two short paragraphs (100-150 words total), summarising the project work Acknowledgements Table of Contents Table of Figures Chapter – 1 Introduction, Motivation Chapter – 2 Literature Survey / Related Work Chapter – 3 Objective Chapter – 4 Problem Statement Formulation Chapter – 5 System Design
Semester VI	Project Implementation	Chapter - 1 to Chapter - 5 Chapter – 6 Methodology Chapter – 7 Implementation & Testing Chapter – 8 Experimental Setup Chapter – 9 Results & Discussions Chapter – 10 Conclusion & Future Scope REFERENCES Self-attested copy of Plagiarism Report from any open-source tool.

Project Dissertation - Evaluation Scheme:

Presentation	Quality of Literature Survey	Problem Statement Formulation	Viva	Documentation
10 Marks	10 Marks	10 Marks	10 Marks	10 Marks

Project Implementation - Evaluation Scheme:

Presentation	Working of the Project	Quality of the Project	Viva	Documentation
10 Marks	10 Marks	10 Marks	10 Marks	10 Marks

(Certified Journal & Project Document is compulsory for appearing at the time of Practical & Project Presentation)