

Graphic Era Hill University				
B.Tech. in Computer Science and Engineering				
Semester VI				
COURSE MODULE				
Code	Title	NEP Component	AICTE Component	Credits
TCS601	Compiler Design	DSC (PBL)	PCC	3
TCS611	Software Engineering	DSC	PCC	3
TCS614	Computer Networks-II	DSC	PCC	3
TCS693	Full Stack Web Development	DSC (PBL)	PCC	3
	Discipline Specific Elective-IV	DSE	PEC	3
PCS601	Compiler Design Lab	DSC	LC	1
PCS614	Computer Networks-II Lab	DSC	LC	1
PCS693	Web Development Lab	DSC	LC	1
XCS601	Career Skills	AEC	AEC	2
PESE600	Practical for Employability Skill Enhancement	SEC	SEC	1
SCS601	MOOCS Seminar	VAC	VAC	1
GP601	General Proficiency	SEC	SEC	1
Total				23

DISCIPLINE SPECIFIC ELECTIVE-IV

COURSE CODE	COURSE NAME
TCS645	AI in Creative Fields
TCS688	Quantum Machine Learning
TCS691	Image processing and Computer Vision
TCS651	Devops on Cloud
TCS671	Big Data Storage and Processing
TCS619	Network and system security
TCS692	Large Language Models and Generative AI
TCS 695	Security Audit and Compliance -II
TCS641	*Virtual Reality (Through Swayam)
TCS631	*Network programming and wireless technologies (Through Swayam)
TCS661	*Computer Graphics (Through Swayam)

Graphic Era Hill University				
B.Tech. in Computer Science and Engineering (AI and ML)				
Semester VI				
COURSE				Credits
Code	Title	NEP Component	AICTE Component	
TCS601	Compiler Design	DSC (PBL)	PCC	3
TCS611	Software Engineering	DSC	PCC	3
TCS666	Transformer Models and Applications	DSC	PCC	3
TCS693	Full Stack Web Development	DSC (PBL)	PCC	3
	Discipline Specific Elective-IV	DSE	PEC	3
PCS601	Compiler Design Lab	DSC	LC	1
PCS666	Transformer Models and Applications Lab	DSC	LC	1
PCS693	Web Development Lab	DSC	LC	1
XCS601	Career Skills-IV	AEC	AEC	2
PESE600	Practical for Employability Skill Enhancement	SEC	SEC	1
SCS601	MOOCS Seminar	VAC	VAC	1
GP601	General Proficiency	SEC	SEC	1
Total				23

DISCIPLINE SPECIFIC ELECTIVE-IV

COURSE CODE	COURSE NAME
TCS665	Generative Adversarial Networks (GANs)
TCS692	Large Language Models and Generative AI
TCS695	Security Audit and Compliance -II
TCS645	AI in Creative Fields
TCS688	Quantum Machine Learning
TCS684	Information Retrieval
TCS651	Devops on Cloud
TCS619	Network and system security
TCS631	*Network Programming and Wireless Technologies (Through Swayam)
TCS641	*Virtual Reality (Through Swayam)
TCS661	*Computer Graphics (Through Swayam)
TCS663	*Applied Accelerated Artificial Intelligence (Through Swayam)

Graphic Era Hill University				
B.Tech. in Computer Science and Engineering (AI and DS)				
Semester VI				
COURSE				Credits
Code	Title	NEP Component	AICTE Component	
TCS601	Compiler Design	DSC (PBL)	PCC	3
TCS611	Software Engineering	DSC	PCC	3
TCS663	Big Data Analytics: Tools and Techniques	DSC	PCC	3
TCS693	Full Stack Web Development	DSC (PBL)	PCC	3
	Discipline Specific Elective-IV	DSE	PEC	3
PCS601	Compiler Design Lab	DSC	LC	1
TCS663	Data Science Lab	DSC	LC	1
PCS693	Web Development Lab	DSC	LC	1
XCS601	Career Skills-IV	AEC	AEC	2
PESE600	Practical for Employability Skill Enhancement	SEC	SEC	1
SCS601	MOOCS Seminar	VAC	VAC	1
GP601	General Proficiency	SEC	SEC	1
Total				23

DISCIPLINE SPECIFIC ELECTIVE-VI

COURSE CODE	COURSE NAME
TCS665(E)	Generative Adversarial Networks (GANs)
TCS692	Large Language Models and Generative AI
TCS695	Security Audit and Compliance -II
TCS666(E)	Transformer Models and Applications
TCS645	AI in Creative Fields
TCS688	Quantum Machine Learning
TCS651	Devops on Cloud
TCS619	Network and System Security
TCS641	*Virtual Reality (Through Swayam)
TCS661	*Computer Graphics (Through Swayam)
TCS631	*Network programming and wireless technologies (Through Swayam)

Graphic Era Hill University				
B.Tech. in Computer Science and Engineering (Cyber Security)				
Semester VI				
COURSE				Credits
Code	Title	NEP Component	AICTE Component	
TCS601	Compiler Design	DSC (PBL)	PCC	3
TCS611	Software Engineering	DSC	PCC	3
TCS679	Network and System Security	DSC	PCC	3
TCS693	Full Stack Web Development	DSC (PBL)	PCC	3
	Discipline Specific Elective-IV	DSE	PEC	3
PCS601	Compiler Design Lab	DSC	LC	1
PCS679	Network and System Security Lab	DSC	LC	1
PCS693	Web Development Lab	DSC	LC	1
XCS601	Career Skills-IV	AEC	AEC	2
PESE600	Practical for Employability Skill Enhancement	SEC	SEC	1
SCS601	MOOCS Seminar	VAC	VAC	1
GP601	General Proficiency	SEC	SEC	1
Total				23

DISCIPLINE SPECIFIC ELECTIVE-IV

COURSE CODE	COURSE NAME
TCS692	Blockchain Platforms
TCS696	Database security, identity and access management
TCS695	Security Audit and Compliance -II
TCS665(E)	Generative Adversarial Networks (GANs)
TCS666(E)	Transformer Models and Applications
TCS645	AI in Creative Fields
TCS688	Quantum Machine Learning
TCS691	Image Processing and Computer Vision
TCS651	Devops on Cloud
TCS671	Big Data storage and processing
TCS631	*Network programming and wireless technologies (Through Swayam)
TCS641	*Virtual Reality (Through Swayam)
TCS661	*Computer Graphics (Through Swayam)

GRAPHIC ERA HILL UNIVERSITY

SEMESTER VI

Name of Department: - Computer Science and Engineering

- 1.+ Subject Code: **TCS 601** Course Title: **Compiler Design**
2. Contact Hours: L: **3** T: **0** P: **0**
3. Examination Duration (Hrs): **Theory 3** **Practical 0**
4. Relative Weight: **CIE 25** **MSE 25** **ESE 50**
5. Credits: **3**
6. Semester: **VI**
7. Category of Course: **DSC**
8. Pre-requisite: Finite Automata and Formal Languages (TCS 402), Data Structures with C (TCS 302)

9. Course Outcome:	<p>After completion of the course the students will be able to:</p> <p>CO1 Understand the various phases and fundamental principles of compiler design like lexical, syntactical, semantic analysis, code generation and optimization.</p> <p>CO2 Compare and contrast various parsing techniques such as SLR, CLR, and LALR etc.</p> <p>CO3 Use annotated tree to design the semantic rules for different aspects of programming language.</p> <p>CO4 Implement lexical analyser and parser by using modern tools like Flex and Bison.</p> <p>CO5 Examine patterns, tokens & regular expressions for solving a problem in the field of data mining.</p> <p>CO6 Design a compiler for concise programming language.</p>
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10. Details of the Course:

SL. NO.	Contents	Contact Hours
1	Unit 1: Introduction, Lexical analysis: Compilers; Analysis of Source Program; The Phases of a Compiler; Cousins of the Compiler; The grouping of phases; Compiler- Construction tools Lexical analysis: The Role of Lexical Analyser; Input Buffering; Specifications of Tokens; Recognition of Tokens.	9
2	Unit 2:	9

	Syntax Analysis – 1: The Role of the Parser; Context-free Grammars; Writing a Grammar; Top-down Parsing; Bottom-up Parsing. Operator-Precedence Parsing; LR Parsers; Using ambiguous grammars; Parser Generators	
3	Unit 3: Syntax-Directed Translation: Syntax-Directed definitions; Constructions of Syntax Trees; Bottom-up evaluation of S-attributed definitions; L-attributed definitions; Top-down translation. Run-Time Environments: Source Language Issues; Storage Organization; Storage-allocation strategies, Storage-allocation in C; Parameter passing	9
4	Unit 4: Intermediate Code Generation: Intermediate Languages; Declarations; Assignment statements; Boolean Expressions; Case statements; Back patching; Procedure calls. Code Generation: Issues in the design of Code Generator; The Target Machine; Run-time Storage Management; Basic blocks and Flow graphs; Next-use information; A Simple Code Generator; Register allocation and assignment; The dag representation of basic blocks; Generating code from DAGs.	9
5	Unit 5: Code Optimization, Compiler Development: Code Optimization: Introduction; The principal sources of optimization; Peephole optimization; Optimization of basic blocks; Loops in flow graphs. Compiler Development: Planning a compiler; Approaches to compiler development; the compiler development environment; Testing and maintenance.	9
	Total	45

Text Books:

Authors Name	Title	Edition	Publisher, Country	Year
Alfred V Aho, Ravi Sethi, Jeffrey D Ullman	Compilers Principles, Techniques, and Tools,	Updated 2e, 2 nd Edition	Pearson Education India	2023

Reference Books:

Authors Name	Title	Edition	Publisher, Country	Year
Charles Fischer, Richard LeBlanc, Ron Cytron	Crafting a Compiler with C	1 st Edition	Pearson	1991
Andrew W. Appel	Modern Compiler Implementation in C	1 st Edition (Revised)	Cambridge University Press	2004
Kenneth C. Louden	Compiler Construction: Principles and Practice	1 st Edition	Course Technology Inc.	1997

GRAPHIC ERA HILL UNIVERSITY

SEMESTER VI

Name of Department: - Computer Science and Engineering

1. Subject Code: **TCS 611** Course Title: **Software Engineering**
2. Contact Hours: L: **3** T: **0** P: **0**
3. Examination Duration (Hrs): **Theory 4** **Practical 0**
4. Relative Weight: **CIE 25** **MSE 25** **ESE 50**
5. Credits: **3**
6. Semester: **VI**
7. Category of Course: **DSC**
8. Pre-requisite: Fundamental of Computer & Introduction to Programming (TCS101), Object Oriented Programming with C++ (TCS307)

9. Course Outcome:	<p>After completion of the course the students will be able to:</p> <p>CO1 Understand Software Development Life Cycle and importance of engineering the software.</p> <p>CO2 Development of efficient software requirement specification for desired product.</p> <p>CO3 Compare various software development methodologies and conclude on their applicability in developing specific type of product.</p> <p>CO4 Construct an efficient design specification document for attainment of user desired product.</p> <p>CO5 Develop applications using the concepts of various phases of software development life cycle.</p> <p>CO6 Study various software testing techniques and identify their relevance to developing a quality software.</p>
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10. Details of the Course:

S. NO.	Contents	Contact Hours
1	<p>Unit 1: Introduction: What is Software Engineering and its history, Software Crisis, Evolution of a Programming System Product, Characteristics of Software, Brooks' No Silver Bullet, Software Myths</p>	10

	<p>Software Development Life Cycles: Software Development Process, The Code-and-Fix model, The Waterfall model, The Evolutionary Model, The Incremental Implementation, Prototyping, The Spiral Model, Software Reuse, Critical Comparisons of SDLC models, An Introduction to Non-Traditional Software Development Process: Rational Unified Process, Rapid Application Development, Agile Development Process</p>	
2	<p>Unit 2: Requirements: Importance of Requirement Analysis, User Needs, Software Features and Software Requirements, Classes of User Requirements: Enduring and Volatile; Sub phases of Requirement Analysis, Functional and Non-functional requirements; Barriers to Eliciting User Requirements, The software requirements document and SRS standards, Requirements Engineering, Case Study of SRS for a Real Time System</p> <p>Tools for Requirements Gathering: Document Flow Chart, Decision Table, Decision Tree; Structured Analysis: DFD, Data Dictionary, Introduction to non-traditional Requirements Analysis Tools: FSM, Statecharts and Petrinets;</p>	9
3	<p>Unit 3: Software Design: Goals of Good Software Design, Design Strategies and Methodologies, Data Oriented Software Design, Structured Design: Structure Chart, Coupling, Cohesion, Modular Structure, Packaging; Object Oriented Design, Top-Down and Bottom-Up Approach, Design Patterns</p> <p>Software Measurement and Metrics: Various Size Oriented Measures: Halstead's Software Science, Function Point (FP) Based Measures, Cyclomatic Complexity Measures: Control Flow Graphs.</p> <p>Development: Selecting a Language, Coding Guidelines, Writing Code, Code Documentation</p>	8
4	<p>Unit 4: Testing: Testing Objectives, Unit Testing, Integration Testing, Acceptance Testing, Regression Testing, Testing for Functionality and Testing for Performance, Top-Down and Bottom-Up Testing Strategies: Test Drivers and Test Stubs, Structural Testing (White Box Testing), Functional Testing (Black Box Testing), Test Data Suit Preparation, Alpha and Beta Testing of Products. Static Testing Strategies: Formal Technical Reviews (Peer Reviews), Walk Through, Code Inspection, Compliance with Design and Coding Standards, Automated Testing</p>	10

5	Unit 5: Software Maintenance and Software Project Management: Software as an Evolutionary Entity, Need for Maintenance, Categories of Maintenance: Preventive, Corrective and Perfective Maintenance, Cost of Maintenance, Software Re-Engineering, Reverse Engineering. Software Configuration Management Activities, Change Control Process, Software Version Control, An Overview of CASE Tools. Estimation of Various Parameters such as Cost, Efforts, Schedule/Duration, Constructive Cost Models (COCOMO), Resource Allocation Models, Software Risk Analysis and Management. Software Quality Assurance: SQA Plans, ISO 9000 models, SEI-CMM Model	8
	Total	45

Textbooks:

Authors Name	Title	Edition	Publisher, Country	Year
Roger S. Pressman	SOFTWARE ENGINEERING: A PRACTITIONER'S APPROACH	7 th Edition	McGraw Hill Education	2009
Pratap K. J. Mohapatra	Software engineering: (a lifecycle approach)	--	New Age International, New Delhi.	2010

Reference Books:

Authors Name	Title	Edition	Publisher, Country	Year
Ian Sommerville	Software Engineering	8 th Edition	Addison Wesley	2006
Pankaj Jalote	An Integrated Approach To Software Engineering	--	Narosa	2005

Carlo Ghezzi, M. Jarayeri, D. Manodrioli,	Fundamentals of Software Engineering	2 nd Edition	PHI Publication.	2003
Rajib Mall	Fundamentals of Software Engineering	5 th Edition	PHI Publication.	2018
Pfleeger	Software Engineering.	3 rd Edition	Macmillan Publication	2006

GRAPHIC ERA HILL UNIVERSITY

SEMESTER VI

Name of Department: - Computer Science and Engineering

1. Subject Code: **TCS 693** Course Title: **Full stack web Development**
2. Contact Hours: L: **3** T: **0** P: **0**
3. Examination Duration (Hrs): **Theory 3** **Practical 0**
4. Relative Weight: **CIE 25** **MSE 25** **ESE 50**
5. Credits: **3**
6. Semester: **VI**
7. Category of Course: **DSC**
8. Pre-requisite: Programming in Java (TCS 408), Data Base Management Systems (TCS 503)

9. Course Outcome:	After completion of the course the students will be able to: CO1 Apply HTML and CSS effectively to create interactive websites CO2 Implement client-side scripting using JavaScript to design dynamic websites. CO3 Develop XML, AJAX and JQuery based web applications. CO4 Implement server-side scripting using PHP. CO5 Design PHP application with Database connectivity. CO6 Ability to design and deploy simple web applications using MVC architecture.
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10. Details of the Course:

Sl. No.	Contents	Contact Hours
1	Unit 1: HTML Introduction to HTML5, How HTML5 is different from previous HTML versions, Semantic elements of HTML5, HTML5 Tags and Syntax, HTML-formatted tables, Lists, Forms, Images and Icons, Hyperlink tag, Videos, Useful tags, Accessibility in HTML5, The W3C Markup Validation Service CSS Introduction and need of CSS, basic syntax and structure, types of CSS, background images, colors and properties, manipulating texts, using fonts, borders and boxes,	8

	padding, margin, positioning using CSS. Introduction to Bootstrap.	
2	Unit 2: JavaScript and jQuery Introduction to JavaScript, variables, functions, conditions, loops and repetition, Pop up boxes, Advance JavaScript: JavaScript and objects, DOM, Manipulation using DOM, forms and validations. Combining HTML, CSS and JavaScript. Introduction to jQuery and Ajax. Introduction to XML, uses of XML, XML DTD and Schema Validation. Introduction to JSON	8
3	Unit 3: PHP Introduction and basic syntax of PHP, decision and looping with examples, PHP and HTML, Arrays, Functions, Browser control and detection, String, Form processing, Files. Advance Features: Cookies and Sessions, Basic commands with PHP examples, Using PHP with databases	10
4	Unit 4: React JS Introduction and basic features of React, React vs Angular vsVue, JSX, Virtual DOM, Basic React app, Components: Functional and Class, Props and State, Event handling, React Forms, React Hooks, Router, Axios library for fetching data.	10
5	Unit 5: Concepts of effective web design: Web design issues including Browser, Bandwidth and Cache, Display resolution, Look and Feel of the Website, Page Layout and linking, Sitemap, Planning and publishing website, CMS Introduction to MongoDB	10
	Total	46

Textbooks:

Authors Name	Title	Edition	Publisher, Country	Year
Robin Nixon	Learning PHP, MySQL, JavaScript, CSS & HTML5	3 rd Edition	O'Reilly, International	2014
Azat Mardan	Full Stack JavaScript: Learn Backbone.js, Node.js and MongoDB.	2 nd Edition	Apress, International	2018

Reference Books:

Authors Name	Title	Edition	Publisher, Country	Year
Fritz Schneider, Thomas Powell	JavaScript – The Complete Reference	3 rd Edition	McGraw Hill, International	2017
Steven Holzener	PHP – The Complete Reference	1 st Edition	Mc-Graw Hill, International	2017
Robin Nixon	Learning PHP, MySQL & JavaScript: With jQuery, CSS & HTML5	1 st Edition	Shroff Publishers & Distributers Private Limited - Mumbai	2015
Paul Deitel, Harvey Deitel, Abbey Deitel	Internet & World Wide Web - How to Program	6 th Edition	Pearson Education, International	2020

GRAPHIC ERA HILL UNIVERSITY

SEMESTER VI

Name of Department: - Computer Science and Engineering

1. Subject Code: **TCS 651** Course Title: **DevOps on Cloud**
2. Contact Hours: L: **3** T: **1** P: **0**
3. Examination Duration (Hrs): **Theory 3 Practical 0**
4. Relative Weight: **CIE 25 MSE 25 ESE 50**
5. Credits: **3**
6. Semester: **VI**
7. Category of Course: **DSE**
8. Pre-requisite: Fundamental of Cloud Computing and Bigdata (TCS351)

9. Course Outcome:	After completion of the course the students will be able to: CO1 Define and understand ideas of DevOps. CO2 Describe and demonstrate how DevOps relate to working in the cloud. CO3 Describe and demonstrate how DevOps tools work together. CO4 Use a public/private cloud environment as a framework to examine the ideas of DevOps. CO5 Examine some use cases, deployment, test automation, continuous delivery, and the public/private cloud toolsets for DevOps.
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10. Details of the Course:

S. No.	Contents	Contact Hours
1	Unit 1: An introduction to DevOps, Gain insights of the DevOps environment, DevOps Vs Agile, DevOps Ecosystem.	9
2	Unit 2: Version Control with Git, Install GIT and work with remote repositories, GIT workflows, Branching and Merging in Git. Understand the importance of Continuous Integration, Introduction to Jenkins, Jenkins management. Build and automation of Test using Jenkins and Maven.	9
3	Unit 3: Continuous Testing, learn and Install Selenium, create test cases in Selenium, Integrate Selenium with Jenkins, Continuous Deployment.	10

4	Unit 4: Introduction to Docker, understanding images and containers, Docker Ecosystem, Introduction to Docker Networking, Monolith and Micro services, features of Micro services Architecture, Advantages of Micro services.	9
5	Unit 5: Introduction of Kubernetes, Kubernetes Architecture, Docker Swarm and Kubernetes, Application deployment using Docker and Kubernetes.	9
	Total	46

Text Books:

Authors Name	Title	Edition	Publisher, Country	Year
Kevin Behr, Gene Kim and George Spafford	The Visible Ops Handbook	1 st Edition	IT Process Institute	2004
Michael Hüttermann	DevOps for Developers	1 st Edition	Apress	2012
Eliyahu M. Goldratt, Jeff Cox Author, David Whitford	The Goal: A Process of Ongoing Improvement	1 st Edition	North River Pr	2012
Ethan Thorpe	Devops: a comprehensive beginners guide to learn devops step by step	1 st Edition	Independently Published	2019

Reference Books:

Authors Name	Title	Edition	Publisher, Country	Year
Jez Humble and David Farley	Continuous Delivery: Reliable Software Releases through	3 rd Edition	Addison-Wesley	2010

	Build, Test, and Deployment Automation (Addison-Wesley Signature Series (Fowler))			
Gene Kim	The Phoenix Project: A Novel about It, Devops, and Helping Your Business Win	3 rd Edition	It Revolution Press	2013

GRAPHIC ERA HILL UNIVERSITY

SEMESTER VI

Name of Department: - Computer Science and Engineering

1. Subject Code: **TCS 619** Course Title: **Network and System Security**
2. Contact Hours: L: **3** T: **1** P: **0**
3. Examination Duration (Hrs): Theory **3** Practical **0**
4. Relative Weight: CIE **25** MSE **25** ESE **50**
5. Credits: **3**
6. Semester: **VI**
7. Category of Course: **DSE**
8. Pre-requisite: Computer system security (TCS 591)

9. Course Outcome:	After completion of the course the students will be able to: CO1 Understand the basics of computer security CO2 Elaborate the cryptographic techniques. CO3 Discuss the transport layer security CO4 Find the pros and cons of various key distribution methods CO5 analyse the wireless Network security CO6 Find the level of system security
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10. Details of the Course:

S. NO.	Contents	Contact Hours
1	Unit 1: Introduction Computer Security Concepts, The OSI Security Architecture, Security Attacks, Security Services, Security Mechanisms, Models for network security, standards.	9
2	Unit 2: Cryptography Symmetric Encryption and Message Confidentiality Symmetric Encryption Principles, Symmetric Block Encryption Algorithms, Random and Pseudorandom Numbers, Stream Ciphers and RC4, Cipher Block Modes of Operation.	9

	<p>Public-Key Cryptography and Message Authentication 61 Approaches to Message Authentication, Secure Hash Functions, Message Authentication Codes, Public-Key Cryptography Principles, Public-Key Cryptography Algorithms, Digital Signatures</p>	
3	<p>Unit 3: Network security Application - I Key Distribution and User Authentication Symmetric Key Distribution Using Symmetric Encryption, Kerberos, Key Distribution Using Asymmetric Encryption, X.509 Certificates, Public-Key Infrastructure, Federated Identity Management Transport-Level Security Web Security Considerations, Secure Socket Layer and Transport Layer Security, Transport Layer Security, HTTPS, Secure Shell (SSH)</p>	10
4	<p>Unit 4: Network security Application - II Wireless Network Security IEEE 802.11 Wireless LAN Overview, IEEE 802.11i Wireless LAN Security, Wireless Application Protocol Overview, Wireless Transport Layer Security, WAP End-to-End Security Electronic Mail Security Pretty Good Privacy, S/MIME, DomainKeys Identified Mail, IP Security IP Security Overview, IP Security Policy, Encapsulating Security Payload, Combining Security Associations, Internet Key Exchange, Cryptographic Suites</p>	8
5	<p>Unit 5: System Security Intruders Intruders, Intrusion Detection, Password Management, Malicious Software Types of Malicious Software, Viruses, Virus Countermeasures, Worms, Distributed Denial of Service Attacks. Firewalls The Need for Firewalls, Firewall Characteristics, Types of Firewalls, Firewall Basing, Firewall Location and Configurations, Legal and Ethical Aspects Cybercrime and Computer Crime, Intellectual Property, Privacy, Ethical Issues</p>	10
	Total	46

Text Books:

Authors Name	Title	Edition	Publisher, Country	Year
W. Stallings	Network Security Essentials	6 th Edition	Prentice Hall, International	2017

Reference Books:

Authors Name	Title	Edition	Publisher, Country	Year
Shari Lawrence Pfleeger	Security in Computing	4 th Edition	Prentice Hall, International	2006

Name of Department:- Computer Science and Engineering

1. Subject Code: Course Title:
2. Contact Hours: L: T: P:
3. Semester: VII
4. Pre-requisite: TCS 514

5. Course Outcomes: After completion of the course students will be able to

1. Analyze Global and Centralized Routing protocols and utilize tools (such as NS2) to examine routing protocols of LS and DV types
2. Evaluate and select the appropriate technology to meet Data Link Layer requirements
3. Specify the devices, components and technologies to build a cost-effective LAN
4. Appreciate issues for supporting real time and multimedia traffic over public network
5. Describe the key benefited of SDN, in particular those benefits brought about by the separation of data and control planes.
6. Implement client server applications with TCP/UDP Socket Programming

6. Detailed Syllabus

UNIT	CONTENTS	Contact Hrs
Unit - I	Routing Algorithms: Introduction, global vs decentralized routing, The Link State(LS) Routing Algorithm, The Distance Vector (DV) Routing Algorithm, Hierarchical Routing, Routing in the Internet: RIP, OSPF, BGP; Introduction to Broadcast and Multicast Routing	9
Unit - II	Link Layer and Local Area Networks: Introduction to Link Layer and its services, Where Link Layer is implemented?, Error detection and correction techniques: Parity checks, Checksumming, CRC; Multiple Access protocols: Channel Partitioning, Random Access (Slotted Aloha, Aloha, CSMA), Taking Turns; Link Layer Addressing: MAC addresses, ARP, Ethernet, CSMA/CD, Ethernet Technologies, Link Layer Switches, Switches vs Routers, VLANS	10
Unit – III	Multimedia Networking: Introduction, Streaming Stored Audio and Video, Real Time Streaming Protocol(RTSP), Making the Best of the Best Effort Services, Protocols for Real Time Interactive Applications: RTP, RTCP, SIP, H.323; Providing multiple classes of service.	9
Unit – IV	Generalized forwarding and SDN Match , Action, Open flow, SDN Control Plane , SDN controller and SDN control Application , Open flow protocol, Data and control plane Interaction , SDN : PAST and FUTURE.	9
Unit – V	Network Programming: Sockets-Address structures, TCP sockets, creating sockets, bind, listen, accept, fork and exec function, close function; TCP client server: Echo server, normal startup, terminate and signal handling, server process termination, crashing and rebooting of server, host shutdown; Elementary UDP sockets: UDP echo server, lack of flow control with UDP	8
	Total	45

Text Book:

1. "Computer Networking A Top Down Approach, Kurose and Ross", 5th edition, Pearson

Reference Book:

1. Douglas E. Comer, Pearson , "Internetworking with TCP/IP Volume 1 and 2 " ; 6 edition

GRAPHIC ERA HILL UNIVERSITY

SEMESTER VI

Name of Department: Computer Science and Engineering

1. Subject Code: Course Title:
2. Contact Hours: L: T: P:
3. Examination Duration (Hrs): Theory Practical
4. Relative Weight: CIE MSE ESE
5. Credits:
6. Semester:
7. Category of Course:
8. Pre-requisite: Deep Learning

9. Course Outcomes:	After completion of the course, the students will be able to:
	CO1 Understand the foundational principles of language models and related techniques
	CO2 Apply advanced training and optimization techniques for large language models
	CO3 Evaluate methods for augmenting language models for Complex Tasks
	CO4 Evaluate applications of large language models in Code Generation and few-shot learning
	CO5 Analyse and assess ethical, security, and societal concerns of generative AI

10. **Details of the Course:**

Unit No.	Topics	Hours
1	Foundations of Language Models and Techniques: Introduction and Overview, Recurrent Neural Language Models, Transformer-based Language Models, Efficient Attention, Transfer Learning, Parameter Efficient Finetuning.	10
2	Advanced Training and Optimization Techniques: Quantization of LLM, Instruction Tuning, Reinforcement Learning from Human Feedback (RLHF), In-Context Learning, Prompting, and Zero-Shot Inference.	10
3	Augmenting Language Models for Complex Tasks: Retrieval Augmented Generation (RAG), Induction-Augmented Generation Framework for Answering Reasoning Questions, Chain-of-Thought Prompting Elicits Reasoning in Large Language Models	9
4	Applications in Code and Few-Shot Learning: A Systematic Evaluation of Large Language Models of Code, Noisy Channel Language Model Prompting for Few-Shot Text Classification, Prompt Engineering	8
5	Ethical and Security Considerations: Security and Misuse Harms, Ethical Concerns, and Hallucination, Bias and Toxicity in Large Language Models, The Generative AI Lifecycle.	8
	Total Lectures	45

GRAPHIC ERA HILL UNIVERSITY

SEMESTER VI

Name of Department: - Computer Science and Engineering

1. Subject Code: Course Title:
2. Contact Hours: L: T: P:
3. Examination Duration (Hrs): Theory Practical
4. Relative Weight: CIE MSE ESE
5. Credits:
6. Semester:
7. Category of Course:
8. Pre-requisite: Natural Language Processing (TSC564), Deep Learning (TCS464)

9. Course Outcome:	After completion of the course, the students will be able to: CO1: Define the fundamental concepts of transformer models and their key components like self-attention and multi-head attention. CO2: Describe the functionalities of positional encoding, layer normalization, and feed-forward networks in transformers. CO3: Implement basic transformer architectures using popular deep learning libraries relevant to engineering problems. CO4: Compare and contrast the strengths and weaknesses of various transformer applications in NLP tasks like machine translation and text summarization. CO5: Evaluate the scalability challenges associated with large transformer models and discuss approaches like model distillation for efficiency. CO6: Design and implement a simple transformer-based system for an engineering-related problem like sentiment analysis or text classification.
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10. Details of the Course:

Sl. No.	Contents	Contact Hours
1	UNIT 1: Introduction to Transformers, Building Blocks of Transformers Overview of transformer architecture, Self-attention mechanism: concept and advantages, Positional encoding and layer normalization, Detailed	10

	study of multi-head attention, The role of feed-forward networks in transformers, Masking and its uses in model training	
2	UNIT 2: Training Transformers Optimization and regularization techniques, Handling large datasets and batch processing, Strategies for effective training and convergence	8
3	UNIT 3: Applications in NLP Machine translation and text summarization, Text generation with GPT models, BERT and its variants for various NLP tasks	10
4	UNIT 4: Beyond NLP Vision Transformers (ViT) for image recognition, Transformer applications in audio processing, Cross-modality transformers for joint tasks	10
5	UNIT 5: Advanced Topics and Future Directions Scalability of transformers and big model issues, Efficient transformers and model distillation, Ethical considerations and biases in large models	8
	Total	46

Text Books:

Authors Name	Title	Edition	Publisher, Country	Year
Denis Rothman	Transformers for Natural Language Processing	1st Edition	MANNING Publications Co., USA	2021
Lewis Tunstall, Leandro von Werra, and Thomas Wolf	Natural Language Processing with Transformers	1st Edition	O'Reilly Media, Inc., USA	2020

Reference Books:

Authors Name	Title	Edition	Publisher, Country	Year
Aurélien Géron	Hands-On Transformers with Python	1st Edition	O'Reilly Media, Inc., USA	2021

GRAPHIC ERA HILL UNIVERSITY

Syllabus: TCS 695 Security Audit and Compliance -II

S. No.	Contents	Contact Hours
1	Introduction to Network Security : OSI and TCP/IP Model , ITU Security Architecture, Zero trust model, LAN management, Operating system basics, Web Security, Digital Signature, Digital Certificate, Public Key Infrastructure PKI & SSL Basics	9
2	Secured Network Communication: Firewalls, Types of firewalls, Intrusion Detection Systems (IDS) and Intrusion Prevention Systems (IPS), Network-based vs. host-based IDS/IPS, Signature-based vs. anomaly-based detection, Virtual Private Networks (VPN), Types of VPNs (e.g., site-to-site, remote access), VPN protocols (e.g., IPSec, SSL/TLS)	11
3	Wireless Security : IEEE 802.11 Wireless LAN Overview, Wi-Fi Protected Access (WPA/WPA2/WPA3), Wireless Intrusion Prevention Systems (WIPS)	8
4	Identity and Access Management IAM : IAM Basics: Identity Management, Access Management, Privilege Access Management, IDM: Identity lifecycle, password management, access certification, Registration, proofing, and establishment of identity, Directory services, Traditional vs hybrid modern application architecture, Access Management: Factors of authentication, Single/Multi-Factor Authentication (MFA), Accountability, Session management	10
5	Active Directory Services : Microsoft Active Directory: Definition and history of Active Directory. The role of Active Directory in IDAM. Domain Controllers (DCs): Purpose and function. Organizational Units (OUs), Domains, and Forests: Structure and hierarchy. Group Policy Objects (GPOs) basics, Active Directory vs Azure AD	7
	Total	45

GRAPHIC ERA HILL UNIVERSITY

SEMESTER VI

Name of Department: - Computer Science and Engineering

1. Subject Code: **TCS679** Course Title: **Network and System Security**
2. Contact Hours: L: **3** T: **1** P: **0**
3. Examination Duration (Hrs): Theory **3** Practical **0**
4. Relative Weight: CIE **25** MSE **25** ESE **50**
5. Credits: **3**
6. Semester: **VI**
7. Category of Course: **DSE**
8. Pre-requisite: Computer system security (TCS 591)

9. Course Outcome:	After completion of the course the students will be able to: CO1 Understand the basics of computer security CO2 Elaborate the cryptographic techniques. CO3 Discuss the transport layer security CO4 Find the pros and cons of various key distribution methods CO5 analyse the wireless Network security CO6 Find the level of system security
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10. Details of the Course:

S. NO.	Contents	Contact Hours
1	Unit 1: Introduction Computer Security Concepts, The OSI Security Architecture, Security Attacks, Security Services, Security Mechanisms, Models for network security, standards.	9
2	Unit 2: Cryptography Symmetric Encryption and Message Confidentiality Symmetric Encryption Principles, Symmetric Block Encryption Algorithms, Random and Pseudorandom Numbers, Stream Ciphers and RC4, Cipher Block Modes of Operation.	9

	<p>Public-Key Cryptography and Message Authentication 61 Approaches to Message Authentication, Secure Hash Functions, Message Authentication Codes, Public-Key Cryptography Principles, Public-Key Cryptography Algorithms, Digital Signatures</p>	
3	<p>Unit 3: Network security Application - I Key Distribution and User Authentication Symmetric Key Distribution Using Symmetric Encryption, Kerberos, Key Distribution Using Asymmetric Encryption, X.509 Certificates, Public-Key Infrastructure, Federated Identity Management Transport-Level Security Web Security Considerations, Secure Socket Layer and Transport Layer Security, Transport Layer Security, HTTPS, Secure Shell (SSH)</p>	10
4	<p>Unit 4: Network security Application - II Wireless Network Security IEEE 802.11 Wireless LAN Overview, IEEE 802.11i Wireless LAN Security, Wireless Application Protocol Overview, Wireless Transport Layer Security, WAP End-to-End Security Electronic Mail Security Pretty Good Privacy, S/MIME, DomainKeys Identified Mail, IP Security IP Security Overview, IP Security Policy, Encapsulating Security Payload, Combining Security Associations, Internet Key Exchange, Cryptographic Suites</p>	8
5	<p>Unit 5: System Security Intruders Intruders, Intrusion Detection, Password Management, Malicious Software Types of Malicious Software, Viruses, Virus Countermeasures, Worms, Distributed Denial of Service Attacks. Firewalls The Need for Firewalls, Firewall Characteristics, Types of Firewalls, Firewall Basing, Firewall Location and Configurations, Legal and Ethical Aspects Cybercrime and Computer Crime, Intellectual Property, Privacy, Ethical Issues</p>	10
	Total	46

Text Books:

Authors Name	Title	Edition	Publisher, Country	Year
W. Stallings	Network Security Essentials	6 th Edition	Prentice Hall, International	2017

Reference Books:

Authors Name	Title	Edition	Publisher, Country	Year
Shari Lawrence Pfleeger	Security in Computing	4 th Edition	Prentice Hall, International	2006

GRAPHIC ERA (DEEMED TO BE UNIVERSITY), DEHRADUN

SEMESTER VI

Name of Department: - Computer Science and Engineering

1. Subject Code: **TCS 663** Course Title: **Big Data Analytics: Tools and Techniques**
2. Contact Hours: L: **3** T: **1** P: **0**
3. Examination Duration (Hrs): Theory **4** Practical **0**
4. Relative Weight: CIE **25** MSE **25** ESE **50**
5. Credits: **3**
6. Semester: **VI**
7. Category of Course: **DSE**
8. Pre-requisite: Introduction to Big Data (TCS-462), Big Data Visualization (TCS-571), Data Base Management Systems (TCS-503), Programming in Java (TCS-408),

9. Course Outcome:	<p>After completion of the course the students will be able to:</p> <p>CO1: Investigate Hadoop related tools for Big Data Analytics and perform basic Hadoop Administration</p> <p>CO2: Analyse the technological foundations for Big data with Hadoop and design of Hadoop distributed file system</p> <p>CO3: Understand the concept of MapReduce workflow</p> <p>CO4: Develop program using Hive and Apache Pig for large data processing</p> <p>CO5: Outline the theory of big data, and explain applications of big data</p> <p>CO6: Build Big Data Analytics application to solve real world problem</p>
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10. Details of the Course:

Sl. No.	Contents	Contact Hours
1	Unit 1: Introduction to Hadoop: Introduction to Hadoop, Distributed Computing Challenges, Hadoop Features, Hadoop Distributed File	9

	System (HDFS), Hadoop Versions, Hadoop Installation, HDFS basic commands, Overview of Hadoop Ecosystem, RDMS vs Hadoop	
2	Unit 2: Introduction to MapReduce Programming: Introduction to MapReduce Framework, Mapper, Reducer, Combiner, Partitioner, Searching, Sorting, Compression, Sample programs on MapReduce, Techniques to optimize MapReduce Jobs	8
3	Unit 3: Hive and Apache Pig Hive: Introduction to Hive, Hive Architecture, Hive Data Types, Hive Query Language, User Defined Functions, Sample Programs Apache Pig: Introduction to Pig, Pig Latin Overview, Data Types in Pig, Pig Operators, User Defined Functions, Sample Programs	8
4	Unit 4: Spark: Introduction to Spark, Features of Spark, Spark Architecture, Spark Components, Spark RDD, Spark in-built functions, Sample Programs	9
5	Unit 5: Apache Flume, Sqoop and Big Data Applications Flume: Introduction to Apache Flume, Flume Architecture, Data Flow, Environment, Sample Exercise Sqoop: Introduction to Sqoop, Sqoop Features, Sqoop Architecture, Sqoop integration with Hadoop, Data import and export using Sqoop, Sqoop vs Flume, Sample Exercise Big Data Applications: Healthcare, Agriculture, Education, Media and Entertainment, Travel, Retail, etc.	8
	Total	42

Text Books:

Authors Name	Title	Edition	Publisher, Country	Year
<u>Subhashini</u> <u>Chellappan Seema</u> <u>Acharya</u>	Big Data and Analytics	2 nd	Wiley, India	2019
DT Editorial Services	Big Data	1 st	Dreamtech Press, New Dehli	2016
Raj Kamal	Big Data Analytics, Introduction to Hadoop, Spark, and Machine-Learning	1 st	McGraw Hill Education, American	2019

Reference Books:

Authors Name	Title	Edition	Publisher, Country	Year
<u>Tom White</u>	<u>Hadoop: The Definitive Guide</u>	4 th	O'Reilly, United Kingdom	2015
<u>Michele Chambers,</u> <u>Michael</u> <u>Minelli , Ambiga</u> <u>Dhiraj</u>	<u>Big Data, Big Analytics: Emerging Business Intelligence and Analytic</u>	1 st	Wiley, India	2013

GRAPHIC ERA Hill UNIVERSITY, DEHRADUN

SEMESTER VI

Name of Department: - Computer Science and Engineering

1. Subject Code: **TCS 663** Course Title: **Big Data Analytics: Tools and Techniques**
2. Contact Hours: L: **3** T: **1** P: **0**
3. Examination Duration (Hrs): Theory **4** Practical **0**
4. Relative Weight: CIE **25** MSE **25** ESE **50**
5. Credits: **3**
6. Semester: **VI**
7. Category of Course: **DSE**
8. Pre-requisite: Introduction to Big Data (TCS-462), Big Data Visualization (TCS-571), Data Base Management Systems (TCS-503), Programming in Java (TCS-408),

9. Course Outcome:	<p>After completion of the course the students will be able to:</p> <p>CO1: Investigate Hadoop related tools for Big Data Analytics and perform basic Hadoop Administration</p> <p>CO2: Analyse the technological foundations for Big data with Hadoop and design of Hadoop distributed file system</p> <p>CO3: Understand the concept of MapReduce workflow</p> <p>CO4: Develop program using Hive and Apache Pig for large data processing</p> <p>CO5: Outline the theory of big data, and explain applications of big data</p> <p>CO6: Build Big Data Analytics application to solve real world problem</p>
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Sl. No.	Contents	Contact Hours
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	System (HDFS), Hadoop Versions, Hadoop Installation, HDFS basic commands, Overview of Hadoop Ecosystem, RDMS vs Hadoop	
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5	Unit 5: Apache Flume, Sqoop and Big Data Applications Flume: Introduction to Apache Flume, Flume Architecture, Data Flow, Environment, Sample Exercise Sqoop: Introduction to Sqoop, Sqoop Features, Sqoop Architecture, Sqoop integration with Hadoop, Data import and export using Sqoop, Sqoop vs Flume, Sample Exercise Big Data Applications: Healthcare, Agriculture, Education, Media and Entertainment, Travel, Retail, etc.	8
	Total	42

Text Books:

Authors Name	Title	Edition	Publisher, Country	Year
<u>Subhashini</u> <u>Chellappan Seema</u> <u>Acharya</u>	Big Data and Analytics	2 nd	Wiley, India	2019
DT Editorial Services	Big Data	1 st	Dreamtech Press, New Dehli	2016
Raj Kamal	Big Data Analytics, Introduction to Hadoop, Spark, and Machine-Learning	1 st	McGraw Hill Education, American	2019

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Authors Name	Title	Edition	Publisher, Country	Year
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<u>Michele Chambers,</u> <u>Michael</u> <u>Minelli , Ambiga</u> <u>Dhiraj</u>	<u>Big Data, Big Analytics: Emerging Business Intelligence and Analytic</u>	1 st	Wiley, India	2013