

B.Tech (Computer Science and Engineering-Core)

SEMESTER: VI

COURSE MODULE			
COURSE			Credit s
Code	Title	Compo nent	
TCS-601	Compiler Design	DC	3
TCS-611	Software Engineering	DC	3
TCS-604	Computer Networks-I	DC	3
TCS-693	Full Stack Web Development	DC	3
	Discipline Specific Elective-III	DE/GE	3
PCS-601	Compiler Design Lab	DC	2
PCS-604	Computer Networks Lab	DC	2
PCS-693	Web Development Lab	DC	2
XCS-601	Career Skills	VA	1
PESE 600	Practical for Employability Skill Enhancement	SEC	1
SCS-601	MOOCS Seminar	VA	1
GP-601	General Proficiency	SE	1

DISCIPLINE SPECIFIC ELECTIVE-III

COURSE CODE	COURSE NAME
TCS-692	Large Language Models and Generative AI
TCS-651	Devops on cloud
TCS-675	Introduction to Virtual Reality
TCS-619	Network and system security
TCS-695	Security and Auditing
TCS-671	Bigdata Storage and Processing
TCS-680	Parallel Computer Architecture (Through SWAYAM)
TCS-681	GPU Architectures and Programming (Through SWAYAM)
TCS-682	Affective Computing (Through SWAYAM)

B.Tech (Computer Science and Engineering-AI/ML Specialization)

SEMESTER: VI

COURSE MODULE			
COURSE			Credit s
Code	Title	Compo nent	
TCS-601	Compiler Design	DC	3
TCS-611	Software Engineering	DC	3
TCS-682	Advanced Machine Learning	DC	3
TCS-693	Full Stack Web Development	DC	3
TCS-692	Large Language Models and Generative AI	DE/GE	3
PCS-682	Advanced Machine Learning Lab	DC	2
PCS-601	Compiler Design Lab	DC	2
PCS-693	Web Development Lab	DC	2
XCS-601	Career Skills	VA	1
PESE 600	Practical for Employability Skill Enhancement	SEC	1
SCS-601	MOOCS Seminar	VA	1
GP-601	General Proficiency	SE	1

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	
4. Relative Weight:	CIE	25	MSE	25	ESE
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:	After completion of the course the students will be able to:
	CO1 Understand the various phases and fundamental principles of compiler design like lexical, syntactical, semantic analysis, code generation and optimization.
	CO2 Compare and contrast various parsing techniques such as SLR, CLR, and LALR etc.
	CO3 Use annotated tree to design the semantic rules for different aspects of programming language.
	CO4 Implement lexical analyser and parser by using modern tools like Flex and Bison.
	CO5 Examine patterns, tokens & regular expressions for solving a problem in the field of data mining.
	CO6 Design a compiler for concise programming language.

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	<p>Unit 3:</p> <p>Syntax-Directed Translation: Syntax-Directed definitions; Constructions of Syntax Trees; Bottom-up evaluation of S-attributed definitions; L-attributed definitions; Top-down translation.</p> <p>Run-Time Environments: Source Language Issues; Storage Organization; Storage-allocation strategies, Storage-allocation in C; Parameter passing</p>	9
4	<p>Unit 4:</p> <p>Intermediate Code Generation: Intermediate Languages; Declarations; Assignment statements; Boolean Expressions; Case statements; Back patching; Procedure calls.</p> <p>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.</p>	9
5	<p>Unit 5:</p> <p>Code Optimization, Compiler Development: Code Optimization: Introduction; The principal sources of optimization; Peephole optimization; Optimization of basic blocks; Loops in flow graphs.</p> <p>Compiler Development: Planning a compiler; Approaches to compiler development; the compiler development environment; Testing and maintenance.</p>	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	1st Edition (Revised)	Cambridge University Press	2004
Kenneth Louden	C.	Compiler Construction: Principles and Practice	1 st Edition	Course Technology Inc.

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

10. Details of the Course:

S. NO.	Contents	Contact Hours
1	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	10

	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	
2	<p>Unit 2:</p> <p>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:</p> <p>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: Halestad'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:</p> <p>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	<p>Unit 5:</p> <p>Software Maintenance and Software Project Management:</p> <p>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.</p> <p>Software Quality Assurance: SQA Plans, ISO 9000 models, SEI-CMM Model</p>	8
	Total	45

Textbooks:

Authors Name	Title	Edition	Publisher, Country	Year
Roger Pressman	S. SOFTWARE ENGINEERING: A PRACTITIONER'S APPROACH	7 th Edition	McGraw Hill Education	2009
Pratap K. Mohapatra	J. 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, Manodrioli, D.	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

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SEMESTER VI

Name of Department: - Computer Science and Engineering

1.	Subject Code:	TCS 604	Course Title:	Computer Networks - I		
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:	Fundamental of Computer & Introduction to Programming (TCS 101), Data Structures with C (TCS 302)				

9.	Course Outcome:	After completion of the course the students will be able to: CO1 Apply and Characterize computer networks from the viewpoint of components and from the viewpoint of services. CO2 Display good understanding of the flow of a protocol in general and a network protocol in particular CO3 Evaluate and select the most suitable Application Layer protocol (such as HTTP, FTP, SMTP, DNS, BitTorrent) as per the requirements of the network application and work with available tools to demonstrate the working of these protocols. CO4 Design a Reliable Data Transfer Protocol and incrementally develop solutions for the requirements of Transport Layer CO5 Describe the essential principles of Network Layers and use IP addressing to create subnets for any specific requirements CO6 Evaluate and select the appropriate technology to meet Data Link Layer requirements and design a framework to implementing TCP/IP protocol suite.
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10. Details of the Course:

Sl. No.	Contents	Contact Hours
1	Unit 1: Introduction: Computer Networks and the Internet, Overall view: As components and as services; What is a protocol, what is a network protocol, Access Networks and	9

	Physical Media, Circuit and Packet Switching, Internet Backbone, Delays: Processing, Queuing, Transmission and Propagation delays The Layered Architecture: Protocol Layering, The OSI Reference Model and the TCP/IP protocol stack, History of Computer Networking and the Internet	
2	Unit 2: Application Layer: Principles and Architectures of Network Applications, Client and Server processes, the idea of socket, Transport services available to Application Layer especially in the internet. Application Layer Protocols: The Web and http: Persistent and Non-persistent connections, http message format, cookies, proxy server, conditional GET File Transfer Protocol Email: smtp, mail message formats, mail access protocols: pop3, imap, MIME DNS: Services, How it works, Root, Top-Level and Authoritative DNS servers, Resource Records, DNS messages A simple introduction to p2p file distribution: BitTorrent	10
3	Unit 3: Transport Layer: Introduction and Services, The Transport layer in internet, Difference between Connection Oriented and Connectionless services UDP: Segment structure, checksum in UDP	6
4	Unit 4: Transport Layer2: The principles behind connection oriented data transfer, designing a connection oriented protocol, stop-and-wait, Go Back N, Selective Repeat TCP: Connection Establishment, TCP header, Sequence and acknowledgement numbers, Round Trip Time, Flow Control, Congestion Control	11
5	Unit 5: Network Layer I: Introduction, Packet Forwarding and Routing, Difference between Virtual Circuits and Datagram networks, The internals of a router: Input ports, output ports, switching architecture The Internet Protocol(IP), Datagram format, IP fragmentation, IPv4 addressing, subnets, CIDR, classful addressing, DHCP, Network Address Translation(NAT), Universal Plug and Play as a provider of NAT, Internet Control Message Protocol(ICMP), IPv6 Header, Moving from IPv4 to IPv6: tunnelling, A brief discussion on IP security (Note: Network Layer will continue with Routing Algorithms in Computer Networks II in the next semester)	8

		Total	44
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Textbooks:

Authors Name	Title	Edition	Publisher, Country	Year
Ross and Kurose	Computer Networking: “A Top Down Approach”	7 th Edition	Pearson/Addison-Wesley	2017

Reference Books:

Authors Name	Title	Edition	Publisher, Country	Year
Andrew Tanenbaum and David Wetherhall	Computer Networks	6 th Edition	Prentice Hall	2022
Peterson and Davie	Computer Networks: A System Approach	5 th Edition	Elsevier	2011
Forouzan	Data Communication and Networking	5 th Edition	McGraw Hill	2017
William Stallings	Data and Computer Communication	8 th Edition	Pearson Education	2007
Nader F. Mir	Computer and Communication Networks	1 st Edition	Pearson Education	2007

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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

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SEMESTER VI

Name of Department: - Computer Science and Engineering

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|----|-----------------------------|---|---------------|-----------------|
| 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

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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

	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	
3	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)	10
4	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	8
5	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	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

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SEMESTER VI

Name of Department: - Computer Science and Engineering

1.	Subject Code:	TCS 692	Course Title:	Large Language Models and Generative AI		
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:	Deep Learning				

Time	Module	Topic	Summary
1 hour		Introduction and Overview	
1 hour		Recurrent Neural Language Models	
1 hour		Transformer-based Language Models	Introduced in 2017 by Vaswani et al., Transformers have quickly become the most popular architecture for neural language modeling. They are the basis for recent large language models, e.g., GPT-3 and PaLM. This lecture gives the definition of a Transformer and overviews details, e.g., residual connections, layer normalization, and position embeddings.
1 hour	Neural Network Modeling	Efficient Attention	There is an ever-growing bag of tricks that speed up the computation of the attention mechanism in Transformer-based language models. This lecture overview those tricks and various generalizations of the transformer, which are becoming increasingly necessary to scale up Transformer LMs on academic hardware. We will also discuss multi-headed attention, sparse attention, and Transformer variants tailored for long documents. Where possible, we prove guarantees for the methods.
1 hour	Training, Fine Tuning and Inference	Transfer Learning	
1 hour		Parameter efficient finetuning	
1 hour		Quantization of LLM	
1 hour		Instruction Tuning	
		Reinforcement Learning from Human Feedback (RLHF)	
1 hour		In-context learning	
1 hour		Prompting and zero-shot inference	
2 hour		Retrieval Augmented Generation(RAG)	
1 hour		Induction-Augmented Generation Framework for	

		Answering Reasoning Questions	
1 hour		Chain-of-Thought Prompting Elicits Reasoning in Large Language Models	
1 hour	Code LMs	A Systematic Evaluation of Large Language Models of Code	
2 hours	Security and Misuse	Security and Misuse Harms, Ethical Concerns and Hallucination	Machine learning models are remarkably brittle, and prone to all kinds of exploits. Language models are no different: we will see how tampering with model inputs or training data can lead to arbitrarily bad outcomes. We will also discuss how language models could be exploited for nefarious purposes such as large-scale spam campaigns. On the other hand, language models could also prove useful as a defensive tool, e.g., for automated online content moderation or for dispelling misinformation.
1 hour		Bias and Toxicity in Large Language Models	
1 hour	Calibration of prompting LLMs	Noisy Channel Language Model Prompting for Few-Shot Text Classification	
1 hour		Prompt Engineering	
2 hours	Life Cycle	The Generative AI Life-cycle	So far, most of the course has been about models. But what would these models be without the right data? We will discuss the lifecycle of modern training sets for language models, to understand how design choices in the data collection and maintenance process influence the model's "world view". We will review emerging guidelines and best practices for managing and documenting machine learning datasets across their lifetime.

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SEMESTER VI

Name of Department: - Computer Science and Engineering

1.	Subject Code:	TCS 675	Course Title:	Introduction to Virtual Reality		
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:	NIL				
9.	Course Outcome:	After completion of the course the students will be able to:				
		CO1 Demonstrate an understanding of techniques, processes, technologies and equipment used in virtual reality				
		CO2 Identify appropriate design methodologies for immersive technology development, especially from a physiological perspective				
		CO3 Exploit the characteristics of human visual perception in Virtual Reality techniques				
		CO4 Create effective VR techniques for the Web				
		CO5 Effectively categorize the benefits/shortcomings of available VR technology platforms.				
		CO6 Use human factors to design and evaluate a VR application				

10. **Details of the Course:**

S.NO	Contents	Contact Hours
1	<p>Unit 1:</p> <p>Introduction: Goals, VR definitions, Birds-eye view (general, hardware, software, sensation and perception), Defining Elements of Virtual Reality, Applications of VR, Technical framework, Mixed and Augmented Reality</p> <p>Depth Perception: Monocular and Binocular Cues, Panoramas Motion Perception, Frame rates and displays</p>	9
2	<p>Unit 2:</p> <p>Degrees of Freedom: VR input devices Relative and Absolute Degrees of Freedom, Six DOF</p> <p>Selection and Manipulation in VR: Isomorphic and Non-Isomorphic, Egocentric and Exocentric Interaction techniques, Selection with HMDs</p>	9
3	<p>Unit 3:</p> <p>Bring Virtual Reality to the web: Introduction to Aframe, Transformations and Textures using Afrane, Afrane animations, Illumination, Inteaction with objects, Building a complete scene using Aframe</p>	9
4	<p>Unit 4:</p> <p>Navigation in Virtual Reality: Position, Orientation, Maneuvering, Exploration, Travel characteristics, Wayfinding in VR</p> <p>Menus and Text in VR: 2D menus, 3D menus, Tool Belt Menu, CUbic Menu, Tangible Interfaces, Gestural Commands, Voice Commands, Text Input</p> <p>Haptics: Human Haptics, Kinesthetic system, Motor system, Haptic Devices and Interfaces</p>	9
5	<p>Unit 5:</p> <p>VR Design Principles: Feedback and Constraints, Temporal Compliance and its solutions, Spatial compliance, Nuling compliance, Sensory dimensions, Constraints: Artificial and Physically realistic constraints</p> <p>Human Factors for Developing VR Applications, Evaluation and Testing of VR systems</p>	9
	Total	45

Text Books:

Authors Name	Title	Edition	Publisher, Country	Year
Steven M. LaValle	Virtual Reality	1 st Edition	Cambridge University Press	2023

Reference Books:

Authors Name	Title	Edition	Publisher, Country	Year
Kay M. Stanney, Kelly S. Hale	Handbook of Virtual Environments: Design, Implementation, and Applications,	2 nd Edition	CRC Press Inc.	2014

GRAPHIC ERA HILL UNIVERSITY

SEMESTER VI

Name of Department: - Computer Science and Engineering

1. Subject Code:	TCS 671	Course Title:	Big data Storage and Processing		
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 Big data (TCS-351), Big data Visualization (TCS-571)				
9. Course Outcome:	After completion of the course the students will be able to:				
	CO1	Understand the concepts and significance of big data, including its capture, management, organization, and analysis			
	CO2	Utilize the HDFS command line interface to interact with the file system, manage data nodes, and work with the data flow.			

	<p>CO3 Describe the concept of MapReduce, its features, types, and formats, and comprehend the workflow of a MapReduce job.</p> <p>CO4 Set up a Hadoop cluster, considering system requirements, and understand the different installation mode</p> <p>CO5 Analyse and manage big data using Hadoop ecosystem tools and techniques, such as HDFS, MapReduce, and NoSQL databases.</p> <p>CO6 Apply critical thinking and problem-solving skills to address technological challenges associated with big data and propose appropriate solutions.</p>
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10. Details of the Course:

S. No.	Contents	Contact Hours
1	Unit 1: Big Data Overview: Understanding Big Data, Capturing Big Data, benefitting from big data, management of big data, Big Data Architecture and Characteristics, Organizing big data, Technological Challenges from big data.	10
2	Unit 2: Hadoop Distributed File System (HDFS), HDFS design, HDFS concepts: Data node, name node, Command line interface, File system, Data flow, limitations	10
3	Unit 3: Hadoop I/O: Data integrity, compression, serialization, File based data structures, Concept of Map Reduce, features, types, and formats, Working of Map Reduce: Shuffle and sort, Task execution, Job tracker, task tracker	9
4	Unit 4: Setting up a Hadoop cluster: Basic system requirements, installation and cluster formation, Modes of installation: the standalone, pseudo-distributed, and distributed, purpose of different modes of installations and applications	9
5	Unit 5: Hadoop Eco System and YARN: Hadoop ecosystem components, schedulers, fair and capacity, Hadoop 2.0 Features NoSQL Databases: - RDBMS Vs. NoSQL, Types of No SQL Databases, Architecture of NoSQL Databases, CAP Theorem,	8
	Total	46

Text Books:

Authors Name	Title	Edition	Publisher, Country	Year
Tom White	Hadoop: A definitive guide	3 rd Edition	O'Reilly, International	2012

Reference Books:

Authors Name	Title	Edition	Publisher, Country	Year
Fei Hu	Big Data: Storage, Sharing and Security,	1 st Edition	CRC Press, Taylor, and Francis.	2016