



ST. VINCENT PALLOTTI COLLEGE OF ENGINEERING & TECHNOLOGY, NAGPUR

(An autonomous institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

B. Tech. Scheme of Examination & Syllabus 2023-24

Computer Science and Engineering (Data Science)

SEMESTER VI

Sr No	Course Category	Course Code	Course Title	Hours per Week			Credits	Maximum Marks				No of Hours in ESE
				L	T	P		Mid Semester Examination	Continual Assessment	End Sem Examination	Total	
1.	PCC	23DS601T	Natural Language Processing	3	-	-	3	15	15	70	100	3
2.	PCC	23DS601P	Natural Language Processing Lab	-	-	2	1	-	25	25	50	-
3.	PCC	23DS602T	Computer Networks	3	-	-	3	15	15	70	100	3
4.	PCC	23DS603P	Data Center Management and Cloud Computing Lab	-	-	4	2	-	25	25	50	-
5.	PEC	23DS604T	Program Elective Course -II	3	-	-	3	15	15	70	100	3
6.	AEC	23AS601T	Economics & Management	2	-	-	2	7.5	7.5	35	50	1.5
7.	OE	23DS661O	Open Elective- III	3	-	-	3	15	15	70	100	3
8.	ELC	23DS605P	Project - I	-	-	4	2	-	50	50	100	-
9.	SEC	23DS641P	Career Development – VI	-	-	2	1	-	50	-	50	-
10.	MDM	23DS631M	Multidisciplinary Minor – IV	3	-	-	3	15	15	70	100	3
Total				17	-	12	23	82.5	232.5	485	800	-

Open Elective - III

23DS661O(i)	Android App Development
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Multidisciplinary Minor – IV

23DS631M	MDM-IV Data Modelling and SQL
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Program Elective Course - II

23DS604T(i)	Information Retrieval
23DS604T(ii)	IoT & cloud data analytics
23DS604T(iii)	Data Centric AI

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JULY 2025

Date of Release

NEP 1.0

Version

Applicable for
2025-26

**SIXTH SEMESTER**

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation			
						MSE	CA	ESE	Total
23DS601T	Natural Language Processing	3	-	-	3	15	15	70	100

Course Objectives	Course Outcomes
<p>This course is intended to</p> <ol style="list-style-type: none"> 1. Illustrate basics , leading trends and systems in natural language processing 2. Make them understand the concepts of morphology, syntax, semantics and pragmatics of the language. 3. Apply approaches to syntax and semantics in NLP 	<p>Students will be able to</p> <ol style="list-style-type: none"> 1. Demonstrate the concepts the basics of text processing 2. Apply current methods for statistical approaches to machine translation. 3. Analyze the concept of sentence framing 4. Demonstrate the NLP operations 5. Analyze the working of various NLP Application

Unit I	[9Hrs]
Introduction and Basic: Text Processing, Spelling Correction, Language Modeling, Advanced smoothing for language modeling, POS tagging	
Unit II	[9Hrs]
Sequential Models for Tagging -Maximum Entropy Models (MaxEnt), Conditional Random Fields(CRF), Introduction to Syntax, Syntax Parsing, Constituent Phrases, Maximum Spanning Tree, Dependency Parsing, Distributional Semantics.	
Unit III	[9Hrs]
Sentence Framing: Lexical Semantics, Lexical Semantics with WordNet, Topic Models, Latent Dirichlet Allocation, Entity Linking.	
Unit IV	[9Hrs]
NLP Operations: Information Extraction, Relation Extraction, Text Summarization, Text Classification.	
Unit V	[9Hrs]
NLP Applications: Sentiment Analysis, Aspect Based Sentiment Analysis and Opinion Mining, Audio & Speech Processing	

Text Books

S. N	Title	Authors	Edition	Publisher
1.	Speech and Language Processing: An Introduction to Natural Language Processing	Dan Jurafsky and James Martin	3rd edition	Pearson Publication
2.	Natural Language Processing with Python: Analysing Text with the Natural Language Toolkit	Steven Bird, Ewan Klein, Edward Loper	-	O'Reilly Publication

Reference Books

S. N	Title	Authors	Edition	Publisher
	Natural Language Understanding	Allen James, Lebanon	2nd Edition	Indian Publication .
	Foundations of Statistical Natural Language Processing	Manning, Christopher and Heinrich, Schutze	1999	MIT Press
	Statistical Language Learning	Charniack, Eugene,		MIT Press

		JULY 2025	NEP 1.0	Applicable for 2025-26
Chairman - BoS	Dean – Academics	Date of Release	Version	

**SIXTH SEMESTER**

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
23DS601P	Natural Language Processing Lab	-	-	2	1	CA	ESE	Total
						25	25	50

Course Objectives	Course Outcomes
This course is intended 1. Introduces students to in natural language processing 2. Make use of the concepts of NLP steps. 3. Analyze various approaches to syntax and semantics in NLP.	Students will be able to 1. Apply the fundamentals of NLP skills. 2. Implement solutions for extracting word meanings using stemming algorithms (including Porter) 3. Apply parsing and semantic similarity techniques using NLP approaches.

Sr. No.	Title of the experiment
1	Demonstrate the basic of Text Processing
2	Implement the meaning of words using Stemming.
3	Demonstrate the concept of Sentence Tokenization
4	Implementation to remove stop words from sentences.
5	Demonstrate the concept of Porter stemming algorithm.
6	Implementation of parsing and semantics of detection of similar sentences
7	Demonstrate the concept of Part-of-Speech (POS) tagging
8	Demonstrate the concept of Semantic Analysis

Text Books

S.N	Title	Authors	Edition	Publisher
1	Speech and Language Processing: An Introduction to Natural Language Processing	Dan Jurafsky and James Martin	3rd edition	Pearson Publication
2	Natural Language Processing with Python: Analysing Text with the Natural Language Toolkit	Steven Bird, Ewan Klein, Edward Loper	-	O'Reilly Publication

Reference Books

S. N	Title	Authors	Edition	Publisher
1	Natural Language Understanding,	Allen James, Lebanon	2nd Edition	Indian Publication .
2	Foundations of Statistical Natural Language Processing	Manning, Christopher and Heinrich, Schutze	1999	MIT Press
3	Statistical Language Learning,	Charniack, Eugene,		MIT Press

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Chairman - BoS	Dean – Academics	Date of Release	Version	

**SIXTH SEMESTER**

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation			
						MSE	CA	ESE	Total
23DS602T	Computer Networks	3	-	-	3	15	15	70	100

Course Objectives	Course Outcomes
<p>This course is intended to</p> <ul style="list-style-type: none"> Understand fundamental concepts of data communication, layered architecture, and the TCP/IP protocol suite, data link layer mechanisms, analyze IP addressing and Evaluating routing algorithms 	<p>Students will be able to</p> <ol style="list-style-type: none"> Explain the TCP/IP and OSI models and compare their functional differences. Apply framing, addressing, error detection, and flow control techniques at the Data Link Layer. Perform IPv4 subnetting and explain ARP, ICMP, DHCP, NAT/PAT operations. Describe routing algorithms and differentiate between routing protocols such as RIP, OSPF, BGP, and IGMP. Analyze TCP/UDP functioning including connection establishment, sliding window, multiplexing, and congestion control and explain application-layer protocols.

Unit I [9Hrs]

TCP/IP model and its purpose, OSI vs TCP/IP differences, Data Link Layer basics: framing, addressing, services, Error detection: parity, CRC (concept only), Flow control: Stop-and-Wait, Sliding Window (simple examples), MAC & LAN Technologies: CSMA/CD, CSMA/CA, Ethernet, Wi-Fi, Switching basics

Unit II [9Hrs]

IP Addressing & Network Layer Protocols: IPv4 addressing, classes, Subnetting, IPv6 concepts ARP – simple working, ICMP – ping, traceroute, DHCP – IP allocation idea, NAT, PAT, Basic routing concepts: What is routing? Why needed? Static vs Dynamic routing

Unit III [9Hrs]

Routing Algorithms: Shortest Path concept, Dijkstra algorithm, Distance Vector Routing, Bellman–Ford algorithm, Link State vs Distance Vector Routing Protocols: RIP – basic operation OSPF – areas, LSAs, BGP – basic idea, IGMP – only concept

Unit IV [9Hrs]

Transport Layer: Ports, sockets, Multiplexing and demultiplexing, UDP and TCP, 3-way handshake, Sliding window concept, Congestion control, Connection management – TCP connection establishment and termination

Unit V [9Hrs]

Application Layer Protocols: DNS – name resolution, HTTP/HTTPS request/response, Email basics – SMTP, POP3, IMAP, FTP Modern Networking - SDN concept

Text Books

S.N	Title	Authors	Edition	Publisher
1	Computer Networks	ATanenbaum	5th	Pearson
2	Data communications and Networking	Behrouz A. Forouzan	3rd	McGraw-Hill
3	Computer Networking: A Top-Down Approach	Kurose & Ross	2nd	Pearson

Reference Books

S. N	Title	Authors	Edition	Publisher
1	Internetworking with TCP/IP	Douglas Comer	2nd	Pearson
2	Routing TCP/IP	Jeff Doyle	2nd	Cisco Press
3	OSPF: Anatomy of an Internet Routing Protocol	John Moy	2nd	Addison-Wesley

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**SIXTH SEMESTER**

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
						CA	ESE	Total
23DS603P	Data Center Management and Cloud Computing Lab	-	-	4	2	25	25	50

Course Objectives	Course Outcomes
<ol style="list-style-type: none">To provide hands-on experience with virtualization technologies.To enable students to configure and manage core AWS servicesTo introduce scalable cloud architectures,.To develop practical skills in DevOps tools,To implement serverless computing solutions.	<ol style="list-style-type: none">Configure and manage virtual machines using industry-standard virtualization tools.Deploy, secure, and manage applications on AWS.Implement scalable cloud architectures using Load Balancers and Auto Scaling Groups.Apply DevOps practices by using Git, GitHub, and CI/CD workflows for collaboration and automation.Develop, deploy, and test serverless applications using AWS Lambda and related cloud services.

Syllabus:- VM creation, configuration, and snapshots. User/group creation, policies, MFA, AWS CLI.

Web server hosting, SSH access, security configurations. Volume creation, mounting, S3 operations, versioning. ELB configuration, ASG setup, scaling policies. Lambda creation, triggers, CloudWatch logging.

Repository creation, branching, pull requests, GitHub Actions CI. Container management, Dockerfile creation, image publishing.

List of Experiments

1.	Introduction to Virtualization
2.	AWS IAM & Security Management
3.	Deploying EC2 Instances on AWS
4.	AWS Storage Management (EBS + S3)
5.	Auto Scaling & Load Balancing
6.	AWS Lambda – Serverless Computing
7.	DevOps with Git & GitHub
8.	Docker Container Deployment

Text Books

S.N	Title	Authors	Edition	Publisher
1	Mastering AWS Lambda	Ajay NS		Packt
2	Cloud Computing: A Hands-On Approach	Arshdeep Bahga, Vijay Madiseti		Universities Press

Reference Books

S. N	Title	Authors	Edition	Publisher
1	The DevOps Handbook	Gene Kim, Jez Humble, Patrick Debois, John Willis		IT Revolution Press

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**SIXTH SEMESTER**

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation			
						MSE	CA	ESE	Total
23DS604T(i)	PE-II Information Retrieval	3	-	-	3	15	15	70	100

Course Objective	Course Outcomes
This Course is intended to 1. Describe IR fundamentals and its applications. 2. Apply text preprocessing and indexing techniques for large documents. 3. Analyze classical retrieval models and ranking methods. 4. Evaluate search effectiveness using standard metrics. 5. Develop IR solutions using modern IR tools, NLP techniques, and recommender systems.	Students will be able to 1. Describe the working of an IR system and its major components. 2. Execute text processing tasks and construct simple indexing structures. 3. Apply retrieval models such as VSM, TF-IDF, and BM25 for ranking documents. 4. Evaluate the performance of IR systems using standard metrics. 5. Demonstrate modern IR applications including neural search and recommendation systems.

Unit I : Introduction to Information Retrieval	[9Hrs]
Basics of Information Retrieval, IR vs Database Retrieval, Applications: Search engines, chatbots, recommender systems, IR Pipeline, Text Processing: Tokenization, Stop-word removal, Stemming, Lemmatization, N-grams, Document Representation, Term Frequency (TF), Document Frequency (DF).	
Unit II : Text Processing and Indexing	[9Hrs]
Types of text data: structured, semi-structured, and unstructured, Need for efficient indexing in large-scale search systems Inverted Index and Posting List, Skip Pointers, Index construction techniques.	
Unit III : Retrieval Models and Ranking	[9Hrs]
Boolean Retrieval, Vector Space Model (VSM), Similarity Measures (Cosine, Jaccard), TF, DF, TF-IDF, BM25 ranking, Introduction to PageRank and Web Search, Boolean Retrieval Model for exact matching of documents.	
Unit IV : Evaluation and Feedback	[9Hrs]
Relevance: user relevance vs system relevance, Precision, Recall, F1-Score, Confusion matrix for IR, Basics of ROC and AUC Relevance feedback and Query expansion, User Interaction Models.	
Unit V : Modern IR Systems & Applications	[9Hrs]
NLP in IR, Word Embeddings (Word2Vec, GloVe), Concepts, Neural IR (BERT/RoBERTa basics), Recommender Systems Basics (Content-based, Collaborative Filtering), Search Tools Overview: Lucene, Elastic Search and Case Studies.	

Text Books

S.N	Title	Authors	Edition	Publisher
1.	Introduction to Information Retrieval.	Christopher D. Mannin	1st Edition	Cambridge University Press
2.	Search Engines: Information Retrieval in Practice.	Bruce Croft	1st Edition	Pearson Education

Reference Books

S. N	Title	Authors	Edition	Publisher
1.	Modern Information Retrieval: The Concepts and Technology Behind Search.	Ricardo Baeza-Yates	2nd Edition	Addison-Wesley
2.	Information Retrieval: Implementing and Evaluating Search Engines,	Stefan Büttcher	1st Edition	MIT Press

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**SIXTH SEMESTER**

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation			
						MSE	CA	ESE	Total
23AS601T	Economics & Management	2	-	-	2	7.5	7.5	35	50

Course Objectives	Course Outcomes
1. The course examines how the economics, business and industrial management practices are related and how business decision is taken.	1. Apply economic principles for business decisions by understanding production cost relationships 2. Assess impact of macroeconomics and government policies on business and economy. 3. Recognize key management, marketing, financial and HRM functions and their role in effective business decision-making

Unit I	[10Hrs]
Economics, Classification of economics, Industrial economics, Consumer demand, Law of Demand, Determinants of demand, Demand forecasting, Law of supply, Types of Elasticity of demand, Concept of Production, Factors of Production, types of cost, cost curves,	
Unit II	[10Hrs]
Market Structures-Perfect competition, Monopoly, and Monopolistic competition, Functions of central bank, Inflation, Deflation, Recession, National income, GDP, GNP, Liberalization, Privatization and Globalization	
Unit III	[10Hrs]
Definition of management, functions of management, Functions of human resources Management, Marketing Management, Functions of Marketing Management. Methods of pricing, advertising and sales promotion. Financial Management, functions of financial management, Sources of finance.	

Text Books

S. N	Title	Authors	Edition	Publisher
1.	Managerial Economics	D.N. Dwivedi	8th	Vikas Publishing
2.	Modern Economic Theory	K.K. Dewett	2005	S. Chand Publisher
3.	Industrial Management	Dr.I.K. Chopde, Dr.A.M. Sheikh	Revised edition	S. Chand Publisher

Reference Books

S. N	Title	Authors	Edition	Publisher
1.	Industrial Organization and Industrial economics	T.R. Banga, S.C. Sharma	2006	Khanna Publishers

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SIXTH SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation			
						MSE	CA	ESE	Total
23DS661O (i)	Open Elective – III Android App Development	3	-	-	3	15	15	70	100

Course Objectives	Course Outcomes
<p>This course is intended to</p> <ol style="list-style-type: none"> 1. Introduce students to the fundamentals of Android application development. 2. Provide an understanding of Android architecture and app components. 3. Familiarize students with basic UI design, navigation, and data handling concepts. 4. Create awareness about current trends such as Firebase, Material Design, and app deployment. 5. Motivate students from all branches to explore mobile solutions relevant to their domains. 	<p>Students will be able to</p> <ol style="list-style-type: none"> 1. Know the fundamentals of Android architecture and development tools 2. Design of user interfaces using layouts and interactive components. 3. Develop mobile apps using activities, intents, and data storage mechanisms. 4. Implement lists, media handling, and device sensors for practical application development. 5. Deploy Android apps and explore modern Android development trends.

Unit I :Introduction to Android [9Hrs]

Basics of Java/Kotlin, **Android Evolution & Architecture** : Linux Kernel, Android Runtime (ART), Application Framework, Features and Applications of Android, Android Studio Setup, **Project Structure Overview** : src, res, manifest, Gradle Scripts, AndroidManifest.xml and Gradle Basics, Running and Debugging on Emulator/Physical Device.

Unit II :UI Development & Event Handling [9Hrs]

Layouts : Linear Layout, Relative Layout, Constraint Layout, ScrollView, **UI Components** : TextView, EditText, ImageView, Button, CheckBox, RadioButton, Spinner, ProgressBar, **User Feedback** : Toast, Snackbar, AlertDialog, **Event Handling** : onClick, onLongPress, Keyboard Events, **Styling & Theming Basics**, **Material Design Principles** : Colors, Typography, Icons, **Density-Independent Units (dp, sp, px) and Screen Size Adjustments.**

Unit III :Activities, Intents, and Menus [9Hrs]

Activity Lifecycle (Practical Use Cases), **Intents** :Explicit Intent, Implicit Intent (Dialer, Camera, Share Action), **Passing Data Between Activities** :Parcelable, Serializable, Intent Extras, **Navigation Concepts** : Backstack, Navigation Component Basics, **Menus in Android**: Options Menu, Context Menu, Popup Menu, **Permissions**: Runtime Permissions API, Camera, Storage, Internet

Unit IV :Data Storage & Lists [10Hrs]

Shared Preferences and Internal Storage , Local Databases : SQLite Database Basics, Room Database, **Cloud Storage Options**: Firebase Realtime Database / Firestore Basics, **RecyclerView** : Adapter, ViewHolder, LayoutManager, **Working with Media** : Loading Images (Glide/Picasso), Basic Video Handling

Unit V :Deployment & Modern Concepts [8Hrs]

Notifications & Broadcast Receivers, Sensors Overview : Accelerometer, GPS Example, **Google Maps API Integration , Debugging & Testing** : Logcat, Breakpoints, Basic Unit Testing, **APK Build & Release Signing, Modern Android Development Overview** :Jetpack Libraries, Material 3, Firebase Analytics, Cloud Messaging.

Text Books

S.N	Title	Authors	Edition	Publisher
1	Beginning Android Programming with Android Studio	J. F. DiMarzio	4	Wrox publication
2	Professional Android 4 Application Programming	Reto Meier	2	Wiley publication

Reference Books

S. N	Title	Authors	Edition	Publisher
1.	Android Programming for Beginners	by John Horton	2	Packt Publishing Pvt. Ltd.

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B. Tech. Scheme of Examination & Syllabus 2023-24

Computer Science and Engineering (DATA SCIENCE)

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation			
						MSE	CA	ESE	Total
23DS605P	Project - I	-	-	4	2	-	50	50	100

Course Objectives	Course Outcomes
<ul style="list-style-type: none">Project-I is designed to expose students to real-world industry problems and complex self-defined analytical challenges in the domain of Data Science. The course aims to enable students to apply advanced data analytics, machine learning, and data-driven decision-making techniques to practical scenarios. The project encourages innovation, critical thinking, teamwork, ethical practices, and structured problem-solving aligned with industry expectations and NEP guidelines.	<p>After successful completion of Project-I, students will be able to:</p> <ol style="list-style-type: none">Identify and formulate a real-world industry problem or a well-defined self-proposed problem suitable for data-driven investigation.Collect, preprocess, and manage structured or unstructured datasets using appropriate data engineering techniques while ensuring ethical and responsible data usage.Apply suitable data analytics, statistical methods, and machine learning techniques to derive meaningful insights and predictive models.Design, implement, and validate a functional analytical solution, model, or prototype using appropriate tools and programming frameworks.Interpret results, evaluate model performance using relevant metrics, and provide data-driven recommendations aligned with the problem objectives.Demonstrate professional project management skills including documentation, teamwork, version control, presentation, and technical reporting.

	[2Hrs]
Students shall undertake a Project-I based on Industry Problems or Self-Defined Data Science Problems. Projects may be Industry-sponsored, Internship-linked, Research-oriented, Startup / innovation-based, Problem statements from Kaggle / open datasets, Self-identified real-world analytical challenges	

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B. Tech. Scheme of Examination & Syllabus 2023-24 COMPUTER SCIENCE AND ENGINEERING (DATA SCIENCE)

SIXTH SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
						CA	ESE	Total
23DS641P	Career Development - VI	-	-	2	1	50	-	50

Course Objectives	Course Outcomes
<p>The sole objective of imparting aptitude training is to make students able to critically evaluate various real-life situations by resorting to an analysis of key issues and factors.</p> <p>This Aptitude Training helps them to demonstrate various principles involved in solving mathematical problems and thereby reducing the time taken for performing job functions.</p> <p>To categorize, apply and use thought process to distinguish between concepts of Quantitative methods.</p>	<ol style="list-style-type: none"> 1. Students shall solve real life problems comparison of various probabilities, Permutation and combinations to ascertain the best outcomes expected 2. Students shall draw conclusions or Understand geometrical terminology for angles, triangles, quadrilaterals and circles with the help of formulas. 3. The ability to analyze and interpret different forms of data, including tables, graphs, charts, and more. 4. Enable students to critically analyze material (information) to order to evaluate evidence, construct reasoned arguments, and communicate inferences and conclusions. 5. The ability to analyses visual information and solve problems based on visual reasoning.

Unit I	[6Hrs]
Aptitude:- Permutation and Combinations:- Letter Arrangement, Number Arrangement, miscellaneous questions Probability:- Color balls, Dice Problems, coins Problems, Playing Cards Problem, Miscellaneous Imax:- Learn Start-up, True Entrepreneurship,	
Unit II	[6Hrs]
Aptitude: - Mensuration: - 2-Dimension Problems, 3-Dimension Problems, Area, Volume, Surface Area, Total Surface Area. Geometry: - Lines, Circle, Triangles Etc. Imax:- Personal Accountability, Innovation Lessons from our Ancestors	
Unit III	[6Hrs]
Aptitude:- Data Interpretation:- Tabular DI Bar Graph Line graph Pie Char	
Unit IV	[6Hrs]
Aptitude:- Logical Thinking (Syllogism) and Venn Diagram problem:- Some, No, All, Some Not, Very Few, Few, Possibility Problem Imax:- Interview Practice 1, Interview Practice 2, Interview Practice 3	
Unit V	[6Hrs]
Aptitude:- Non Verbal Reasoning:- Mirror Images, Water Images, Paper Cutting, Paper Folding, Fig Embedded Imax:- Interview Practice 4, Interview Practice 5, Interview Practice 6	

Text Books

S.N	Title	Authors	Edition	Publisher
1	Quantitative Aptitude By R. S. Aggarwal	R.S. Aggarwal		
2	Quantitative Aptitude	Shripad Deo		Allied Publication
3	A Modern Approach to Verbal & Non-Verbal Reasoning	R.S. Aggarwal		

Reference Books

S.N	Title	Authors	Edition	Publisher
1	Quantitative Aptitude for CAT by Arun Sharma	Arun Sharma		

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SIXTH SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation			
						MSE	CA	ESE	Total
23DS631M	MDM - IV Data Modeling and SQL	3	-	-	3	15	15	70	100

Course Objectives	Course Outcomes
<p>This course is intended to</p> <ol style="list-style-type: none"> 1. Introduce fundamental concepts of data modeling and database design. 2. Develop the ability to design conceptual, logical, and physical data models. 3. Build skills in relational SQL querying and database operations. 	<p>Students will be able to</p> <ol style="list-style-type: none"> 1. Describe essential data modeling concepts, modeling standards, and various data model types. 2. Implement physical data models and compare them with database structures and implementations. 3. Construct data warehouse schemas, including facts, dimensions, star/snowflake models, and SCD types. 4. Execute SQL queries using operators, joins, functions, subqueries, views, indexes, and transactions. 5. Design integrated data models and utilize introductory features of cloud database services.

Unit I	[9Hrs]
Introduction to Data Modeling, Importance of data modeling in database design, Data Modeling development life cycle, Types of data models , Data Modeling tools, Data Model standard, Naming standard of objects.	
Unit II	[10Hrs]
Physical Data Model, Database Vs data model , . Implementation of Physical data model in a database.Data Warehouse, Data Mart, Design of Data Warehouse & Data Mart. Difference Between OLAP Modeling & OLTP Modeling,	
Unit III	[10Hrs]
Design of Dimension & the Fact Tables. Inmon's or Kimball's approach. Snow Flake Modeling, Star Schema Modeling, Slowly Changing Dimensions. SQL Environment & Tools, SQL Syntax Rules, SQL Data Types, Query, Operators, Schemas,Constraints .	
Unit IV	[10Hrs]
Data Querying & Functions, Aggregate Functions, GROUP BY, HAVING JOINS, Set Operations, Subqueries, Views, Indexing, Transactions: ACID, COMMIT, ROLLBACK, Introductory query optimization.	
Unit V	[7Hrs]
Applied Data Modelling & SQL :Designing complete data models, end-to-end data modelling , Introduction to cloud databases: Azure SQL, AWS.	

Text Books

S.N	Title	Authors	Edit ion	Publisher
1.	Data Modeling and Database Design	Narayan S. Umanath, Richard W. Scamell		
2.	SQL in 10 Minutes	Ben Forta		Pearson

Reference Books

S. N	Title	Authors	Edition	Publisher
1.	Data Modeling Made Simple: A Practical Guide for Business & IT Professionals	Steve Hoberman	2	Technics Publications, 2009
2.	SQL: The Complete Reference	Groff & Weinberg	1	McGraw Hill

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