



ST. VINCENT PALLOTTI COLLEGE OF ENGINEERING & TECHNOLOGY, NAGPUR


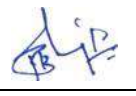
(An Autonomous institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

B. Tech. Scheme of Examination & Syllabus 2025-26

Computer Science and Business System

THIRD SEMESTER

Sr No	Course Category	Course Code	Course Title	Hours per Week			Credits	Mid-Sem Examination	Maximum Marks				Duration No. of Hrs for ESE
				L	T	P			Continual Assessment	End Sem Examination	Total	Min. Passing Marks	
1	PCC	25CB301T	Formal Language and Automata	3	-	-	3	20	20	60	100	45	3
2	PCC	25CB302T	Database management Systems	3	-	-	3	20	20	60	100	45	3
3	PCC	25CB302P	Database management Systems Lab	-	-	2	1	-	25	25	50	25	-
4	PCC	25CB303T	Data Structure and Algorithm	3	-	-	3	20	20	60	100	45	3
5	PCC	25CB303P	Data Structure and Algorithm Lab	-	-	2	1	-	25	25	50	25	-
6	PCC	25CB304T	Software Engineering	3	-	-	3	20	20	60	100	45	3
7	PCC	25CB304P	Software Design with UML Lab	-	-	2	1	-	25	25	50	25	-
8	PCC	25CB305T	Fundamental of Management and Business Strategy	3	-	-	3	20	20	60	100	45	3
9	MDM	25CB331M	Multidisciplinary Minor-I	2	-	-	2	10	10	30	50	23	1.5
Total				17	-	6	20	110	185	405	700	-	-

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B. Tech. Scheme of Examination & Syllabus 2025-26

COMPUTER SCIENCE AND BUSINESS SYSTEMS

THIRD SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation			
						MSE	CA	ESE	Total
25CB301T	Formal Language and Automata Theory	3	-	-	3	20	20	60	100

Course Objectives	Course Outcomes
<p>The course is intended</p> <ol style="list-style-type: none"> To provide introduction of fundamental concepts of formal languages, grammars and automata theory. To Classify automata by their power to recognize formal languages. To understand deterministic and non-deterministic machines. To study basic computational function related to finite automata 	<p>Student will be able to</p> <ol style="list-style-type: none"> Understand fundamentals of the automata and their power to recognize the formal Languages. Design finite state machine for regular expression and vice versa Design context free grammars for formal language and apply push down automata to solve problems. Design Turing Machine & its various representation. Solve computational problems regarding their decidability, computability and complexity

Unit I	[5Hrs]
Alphabet, languages and grammars, productions and derivation, Chomsky hierarchy of languages.	
Unit II	[10Hrs]
Regular languages and finite automata: Regular expressions and languages, deterministic finite automata (DFA) and equivalence with regular expressions, nondeterministic finite automata (NFA) and equivalence with DFA, regular grammars and equivalence with finite automata, properties of regular languages, Kleene's theorem, pumping lemma for regular languages, Myhill-Nerode theorem and its uses, minimization of finite automata.	
Unit III	[10Hrs]
Context-free grammars (CFG) and languages (CFL), Chomsky and Greibach normal forms, nondeterministic pushdown automata (PDA) and equivalence with CFG, parse trees, ambiguity in CFG, pumping lemma for context-free languages, deterministic pushdown automata, closure properties of CFLs.	
Unit IV	[10Hrs]
Context-sensitive languages: Context-sensitive grammars (CSG) and languages, linear bounded automata and equivalence with CSG. Turing machines: The basic model for Turing machines (TM), Turing recognizable (recursively enumerable) and Turing-decidable (recursive) languages and their closure properties, variants of Turing machines, nondeterministic TMs and equivalence with deterministic TMs, unrestricted grammars and equivalence with Turing machines, TMs as enumerators.	
Unit V	[10Hrs]
Undecidability: Church-Turing thesis, universal Turing machine, the universal and diagonalization languages, reduction between languages and Rice's theorem, undecidable problems about languages. Basic Introduction to Complexity: Introductory ideas on Time complexity of deterministic and nondeterministic Turing machines, P and NP, NP-completeness, Cook's Theorem, other NP-Complete problems.	

Text Books

S.N	Title	Authors	Edition	Publisher
1	Introduction to Automata Theory, Languages, and Computation	John E. Hopcroft, Rajeev Motwani and Jeffrey D. Ullman.	3rd	Pearson Education India

Reference Books

S.N	Title	Authors	Edition	Publisher
1	Elements of the Theory of Computation,	Harry R. Lewis and Christos H. Papadimitriou	2nd	Prentice Hall
2	Automata and Computability,	Dexter C. Kozen.	2 nd	Springer
3	Introduction to the Theory of Computation,	Michael Sipser.	2nd	Course Technology
4	Introduction to Languages and the Theory of Computation,	John Martin	3rd	McGraw-Hill
5	Computers and Intractability: A Guide to the Theory of NP Completeness,	M. R. Garey and D. S. Johnson.	2nd	W. H. Freeman

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COMPUTER SCIENCE AND BUSINESS SYSTEMS

THIRD SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation			
						MSE	CA	ESE	Total
25CB302T	Database Management Systems	3	-	-	3	20	20	60	100

Course Objectives	Course Outcomes
<p>This course is intended :</p> <p>1: To understand the fundamental concepts of database systems, data models, and DBMS architecture.</p> <p>2: To develop skills in data modeling using ER/EER techniques and designing efficient relational schemas.</p> <p>3: To apply relational algebra and SQL/PL-SQL commands for data definition, manipulation, and complex query processing.</p> <p>4: To analyze normalization, query optimization, transaction processing, concurrency control, and recovery mechanisms for reliable database design.</p> <p>5: To explore and evaluate database security models, NoSQL databases, distributed systems, cloud databases, and modern data management technologies.</p>	<p>Students will be able to</p> <ol style="list-style-type: none"> 1. Explain core concepts of database systems, data models, DBMS architecture, and ER/EER modeling. 2. Apply relational algebra operations and SQL/PL-SQL constructs for data definition, manipulation, and retrieval. 3. Analyze functional dependencies and perform normalization to design efficient, consistent, and optimized relational schemas. 4. Evaluate transaction processing, concurrency control mechanisms, deadlock handling, and database recovery techniques. 5. Explore and compare database security models, NoSQL systems, distributed databases, and advanced data management technologies.

Unit I :	[9 Hrs]
Introduction to Databases, characteristics, advantages, DBMS vs File system. Database architecture: 3-level architecture, data abstraction, data independence. Data models: Hierarchical, Network, Relational and Object-oriented models. ER Model: Entity types, relationships, attributes, keys, ER diagrams. Enhanced ER (EER): Specialization, generalization, aggregation.	
Unit II :	[9 Hrs]
Relational Model Concepts. Relational Algebra: Selection, projection, joins, division, union, intersection. Integrity constraints: Primary key, foreign key, domain, referential constraints. SQL: DDL, DML, DCL, TCL. Advanced SQL: Joins, subqueries, nested queries, views, indexes, triggers. PL/SQL basics: Procedures, functions, cursors.	
Unit III :	[9 Hrs]
Functional dependencies, attribute closure. Armstrong's axioms. Normalization: 1NF, 2NF, 3NF, BCNF, 4NF, 5NF. Lossless and dependency-preserving decomposition. Query processing: RA expression evaluation, join strategies. Query optimization techniques.	
Unit IV :	[9 Hrs]
Storage and file organization: Heap, sequential, hashing. Indexing: B-tree and B+ tree indexing. Transaction processing: ACID properties. Concurrency control: Lock-based, timestamp-based protocols, MVCC. Deadlocks: Detection, prevention, recovery. Database recovery techniques: Checkpoints, log-based recovery.	
Unit V :	[9 Hrs]
Database security: Authentication, authorization, access control. Security models: DAC, MAC, RBAC. SQL injection and intrusion detection. NoSQL databases: Key-value, document, columnar, graph databases. CAP theorem, BASE properties. Distributed databases, cloud databases, data warehousing & OLAP.	

Text Books

S.N	Title	Authors	Edition	Publisher
1	Database System Concepts	Abraham Silberschatz, Henry F. Korth and S. Sudarshan	10 th	McGraw-Hill Education

Reference Books

S.N	Title	Authors	Edition	Publisher
1	Principles of Database and Knowledge – Base Systems	J. D. Ullman	7 th	McGraw-Hill, Inc
2	Fundamentals of Database Systems	R. Elmasri and S. Navathe	3 rd	Pearson Education
3	Foundations of Databases	Serge Abiteboul, Richard Hull, Victor Vianu	5 th	Addison-Wesley

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COMPUTER SCIENCE AND BUSINESS SYSTEMS

THIRD SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
						CA	ESE	Total
25CB302P	Database Management Systems Lab	-	-	2	1	25	25	50

Course Objectives	Course Outcomes
This course is intended 1. To Understand DDL and DML Commands 2. To design and implement databases with various constraints 3. To query and filter data from a database 4. To Aggregating Data with Functions 5. apply Advanced SQL Techniques	Students will be able to 1. Apply DDL and DML Commands 2. Implement database constraints 3. Find competency in using SQL clauses 4. Understand and apply Aggregate functions 5. Understand SQL injection and its prevention

Expt. No.	Title of the experiment
1	To study Data Definition Language (DDL) and Data Manipulation Language (DML) Commands in SQL.
2	To apply DDL and DML Commands on the created database.
3	To study and apply commands that involves Constraints (PRIMARY KEY, UNIQUE, NOT NULL, CHECK).
4	To study and apply LIKE, AND, BETWEEN, NOT BETWEEN, IN and NOT IN clause on the created database.
5	To study and apply Aggregate functions (Count, Sum, Avg, Min, Max) on the created database.
6	To study and apply SQL Joins (INNER JOIN, LEFT JOIN and RIGHT JOIN) on the created database.
7	To study and implement the concept of SQL working with Dates.
8	To study and apply Index creation through SQL.

Text Books

S.N	Title	Authors	Edition	Publisher
1.	Database System Concepts	Henry F. Korth, Abraham Silberschatz, S.Sudar	10 TH	Mcgraw Hill Educ

Reference Books

S.N	Title	Authors	Edition	Publisher
1	Learning SQL	Alan Beaulieu	3 RD	O'Reilly Publications
2	The Art of SQL	Stephane Faroult, Peter Robson	5 TH	O'Reilly Med

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THIRD SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation			
						MSE	CA	ESE	Total
25CB303T	Data Structure and Algorithm	3	--	--	3	20	20	60	100

Course Objectives	Course Outcomes
<ol style="list-style-type: none"> To understand the fundamental terminologies and concepts related to algorithm and data organization, including algorithm specification, recursion, performance analysis, and asymptotic notation To develop proficiency in programming style and refinement of coding, including time-space trade-offs, testing, and data abstraction. To acquire knowledge of linear & non linear data structures and to understand the various representations, operations, and applications of both data structures. Learn the searching and sorting algorithms used for various data structures, and to understand the basics of file organization Understand basics of graph terminology & representations, graph search, traversal algorithms & complexity analysis. 	<ol style="list-style-type: none"> Understand and explain the fundamental terminologies, concepts, and principles related to algorithm and data organization, Develop proficiency in programming using linear data structures Develop an understanding of non-linear data structures Demonstrate the ability to implement searching and sorting algorithms on various data structures, Demonstrate proficiency in implementing file organization and to understand the basics of graph terminologies and representations, graph search and traversal algorithms, and complexity analysis.

Unit I	[9Hrs]
Basic Terminologies and Introduction to Algorithm & Data Organization: Algorithm specification, Recursion, Performance analysis, Asymptotic Notation - The Big-O, Omega and Theta notation, Programming Style, Refinement of Coding - Time-Space Trade Off, Testing, Data Abstraction	
Unit II	[9Hrs]
Linear Data Structure: Array, Stack, Queue, Linked-list and its types, Various Representations, Operations & Applications of Linear Data Structures.	
Unit III	[9Hrs]
Non-linear Data Structure: Trees (Binary Tree, Threaded Binary Tree, Binary Search Tree, B & B+ Tree, AVL Tree, Splay Tree) and Graphs (Directed, Undirected), Various Representations, Operations & Applications of Non-Linear Data Structures.	
Unit IV	[9Hrs]
Searching and Sorting on Various Data Structures: Sequential Search, Binary Search, Comparison Trees, Breadth First Search, Depth First Search Insertion Sort, Selection Sort, Shell Sort, Divide and Conquer Sort, Merge Sort, Quick Sort, Heap sort, Introduction to Hashing.	
Unit V	[9Hrs]
Files & Graphs: Files: Organization (Sequential, Direct, Indexed Sequential, Hashed) and various types of accessing schemes. Graph: Basic Terminologies and Representations, Graph search and traversal algorithms and complexity analysis.	

Text Books

S.N	Title	Authors	Edition	Publisher
1	Fundamentals of Data Structures	E. Horowitz, S. Sahni	2 nd edition	University Press
2	Data Structures and Algorithms	A. Aho, J. Hopperoft.	1 st edition	Pearson

Reference Books

S.N	Title	Authors	Edition	Publisher
1	The Art of Computer Programming: Fundamental Algorithms	Donald E. Knuth	1st edition	Cengage Learning
2	Introduction to Algorithms	Cormen, Leiserson	3 rd edition	The MIT Press

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COMPUTER SCIENCE AND BUSINESS SYSTEMS

THIRD SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
						CA	ESE	Total
25CB303P	Data Structure and Algorithm Lab	-	-	2	1	25	25	50

Course Objectives	Course Outcomes
<ol style="list-style-type: none">1. To understand the fundamental terminologies and concepts related to algorithm and data organization, including algorithm specification, recursion, performance analysis, and asymptotic notation2. To develop proficiency in programming style and refinement of coding, including time-space trade-offs, testing, and data abstraction.3. To acquire knowledge of linear & non linear data structures and to understand the various representations, operations, and applications of both data structures.4. Learn the searching and sorting algorithms used for various data structures, and to understand the basics of file organization5. Understand the basics of graph terminologies and representations, graph search and traversal algorithms, and complexity analysis.	<ol style="list-style-type: none">1. Understand and explain the fundamental terminologies, concepts, and principles related to algorithm and data organization,2. Develop proficiency in programming using linear data structures3. Develop an understanding of non-linear data structures4. Demonstrate the ability to implement searching and sorting algorithms on various data structures,5. Demonstrate proficiency in implementing file organization and to understand the basics of graph terminologies and representations, graph search and traversal algorithms, and complexity analysis.

List of Experiments:

Experiment No.	List of Experiment
1	To analyse recursion
2	To implement various searching algorithm
3	To understand & implement the concept of stack.
4	To implement operations on Queue.
5	To implement operations on non line
6	To implement sorting algorithms having worst case complexity of $O(n^2)$

Text Books

S.N	Title	Authors	Edition	Publisher
01	Fundamentals of Data Structures	E. Horowitz, S. Sahni	2 nd edition	University Press
02	Data Structures and Algorithms	A. Aho, J. Hopperoft.	1 st edition	Pearson

Reference Books

S.N	Title	Authors	Edition	Publisher
01	The Art of Computer Programming: Fundamental Algorithms	Donald E. Knuth	1st edition	Cengage Learning
02	Introduction to Algorithms	Cormen, Leiserson	3rd edition	The MIT Press

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COMPUTER SCIENCE AND BUSINESS SYSTEMS

THIRD SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation			
						MSE	CA	ESE	Total
25CB304T	Software Engineering	3	-	-	3	20	20	60	100

Course Objectives	Course Outcomes
1. To provide the idea of decomposing the given problem into Analysis, Designing, Implementation, Testing and Maintenance phases. 2. To provide an idea of using various process models in the software industry according to given circumstances. 3. To gain the knowledge of how Analysis, Design, Implementation, Testing and Maintenance processes are conducted in a software project.	CO1: Students will be able to decompose the given project in various phases of a lifecycle. CO2: Students will be able to choose appropriate process model depending on the user requirements. CO3: Students will be able to perform various life cycle activities like Analysis, Design, Implementation, Testing and Maintenance. CO4: Students will be able to know various processes used in all the phases of the product. CO5: Students can apply the knowledge, techniques, and skills in the development of a software product.

Unit I : Introduction to Software Engineering [9 Hrs]

Basic Concept of Life Cycle Models -Software Development Life Cycle (SDLC) , Different models and Milestone-Waterfall model ,V –model ,RAD model ,Spiral Model, Iterative model, Incremental model, Programming in the Small vs. programming in the large, Engineering approach to software development, ,role of Software Engineering towards successful Execution of large software projects, Emergence of Software engineering as a discipline.

Unit II : Software project Management [9 Hrs]

software project planning – identification of activities and resources, concepts of feasibility study, software cost estimation models and concepts of software engineering economics, techniques of software project control and reporting, introduction to the concepts of risk and its mitigation

Unit III : Software Requirements Analysis [9 Hrs]

Introduction to Software Requirements Specifications (SRS) and requirement elicitation techniques; techniques for requirement modeling – decision tables, event tables, state transition tables
Software Quality and Reliability: Internal and external qualities; process and product quality; principles to achieve software quality.

Unit IV : Object Oriented Analysis, Design and Construction: [9 Hrs]

Concepts the principles of abstraction, modularity, specification, encapsulation and information hiding Class Responsibility Collaborator (CRC) model; quality of design; design measurements; concepts of design patterns

Unit V : Software Testing [9 Hrs]

Introduction to Faults and Failures, basic testing concepts, Concepts of Verification and validation
 Black box and White Box tests, testing use cases; transaction based testing, testing for non-functional requirements – volume, performance and efficiency

Text Books

S.N	Title	Authors	Edition	Publisher
1	Software Engineering	Ian Sommerville	9 th edition	Pearson

Reference Books

S.N	Title	Authors	Edition	Publisher
1	Fundamentals of Software Engineering	Carlo Ghezzi, Jazayeri Mehdi, Mandrioli Dino	2 nd edition	Pearson
2	Software Requirements and Specification: A Lexicon of Practice, Principles and Prejudices	Michael Jackson	1 st edition	ACM Press/Addison-Wesley Publishing Co.

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THIRD SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
						CA	ESE	Total
25CB304P	Software Design with UML Lab	-	-	2	1	25	25	50

Course Objectives	Course Outcomes
<ol style="list-style-type: none"> To develop the ability to create requirement models using UML use-case diagrams and class notations based on user requirements. To enable students to design object-oriented system architectures using UML structural and behavioral diagrams such as class, object, and sequence diagrams. To build foundational understanding of Java implementation concepts related to translating UML designs into functional software. To introduce students to design patterns and demonstrate their application in object-oriented system design. To develop the skill to evaluate OO designs using design heuristics, patterns, and established modeling guidelines. 	<p>After completing the lab, students will be able to:</p> <ol style="list-style-type: none"> Explain and apply UML concepts for modeling object-oriented systems. Identify and document software requirements using appropriate UML diagrams. Create UML-based structural and behavioral models including class, use-case, sequence, and activity diagrams. Analyze and apply design patterns to improve the quality and flexibility of software design. Implement UML design solutions using Java and apply structural patterns to solve design problems.

Expt. No.	Title of the experiment
1	To implement the different UML diagram along with diagrammatic representation.
2	Implement Package diagram model and dynamic model in UML.
3	To Install Star UML Software and draw the Use case diagram of Banking System.
4	Demonstrate the class diagram of Banking System of Bank System ALong with their Operations in UML.
5	To Implement the Object diagram in Star UML software.
6	Draw the Activity diagram of Library system in UML.
7	Demonstrate the Concept the Component Diagram Model in UML .
8	To illustrate the concept of Deployment model in UML.

Text Books

S.N	Title	Authors	Edition	Publisher
1	<i>The Unified Modelling Language User Guide.</i>	Grady Booch, James Rumbaugh, Ivar Jacobson,		Pearson Education

Reference Books

S.N	Title	Authors	Edition	Publisher
1	<i>Object-Oriented Software Engineering: using UML, Patterns, and Java.</i>	Bernd Bruegge and Allen H. Dutoit		Pearson Education
2	<i>Design Patterns: Elements of Reusable Object-Oriented Software.</i>	Erich Gamma, Richard Helm, Ralph Johnson, and John M. Vlissides.		Pearson Education

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B.Tech. Scheme of Examination & Syllabus 2025-26
COMPUTER SCIENCE AND BUSINESS STUDIES

THIRD SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation			
						MSE	CA	ESE	Total
25CB305T	Fundamentals of Management and Business Strategy	3	-	-	3	20	20	60	100

Course Objectives	Course Outcomes
<ol style="list-style-type: none"> To sensitize students about the concepts of strategic management To make aware the interdependence of all the departments in an organization. To make the students aware about the business tactics and implementation of strategies. 	<p>At the end of the course students will be able to:</p> <ol style="list-style-type: none"> To learn the fundamental concepts of strategic management to analyze business situations and apply these concepts to solve business problems. To understand the fundamental principles of and interrelationships among business functions such as: R&D, production, marketing, finance, HR and information technology To understand the inter-relationships of business to individuals, other organizations, government and society. To analyze complex, unstructured qualitative and quantitative problems, using appropriate tools.

Unit I Introduction to Strategic Management and Internal Environment of Firm- Recognizing a Firm's Intellectual Assets [9 Hrs]

Importance of Strategic Management; Vision and Objectives; Schools of thought in Strategic Management; Strategy Content, Process, and Practice; Fit Concept and Configuration Perspective in Strategic Management, Core Competence as the Root of Competitive Advantage; Sources of Sustained Competitive Advantage; Business Processes and Capabilities-based Approach to Strategy; The 7S Framework; Strategic Control and Corporate Governance

Unit II External Environments of Firm- Competitive Strategy [9 Hrs]

Five Forces of Industry Attractiveness that Shape Strategy; The concept of Strategic Groups, and Industry Life Cycle; Generic Strategies; Generic Strategies and the Value Chain.

Corporate Strategy, and Growth Strategies: The Motive for Diversification; Related and Unrelated Diversification; Business Portfolio Analysis; Expansion, Integration and Diversification; Strategic Alliances, Joint Ventures, and Mergers & Acquisitions

Unit III: Functions of Management & Organization Behavior [9 Hrs]

Planning, Organizing, Staffing, Directing, Controlling

Organization Behavior Introduction, Personality, Perception, Learning and Reinforcement, Motivation, Group Dynamics, Power & Influence, Work Stress and Stress Management, Decision Making, Problems in Decision Making, Decision Making, Organizational Culture, Managing Cultural Diversity

Leadership: Concept, Nature, Importance, Attributes of a leader, developing leaders across the organization, Leadership Grid

Unit IV: Organizational Design [9 Hrs]

Classical, Neoclassical and Contingency approaches to organizational design; Organizational theory and design, Organizational structure (Simple Structure, Functional Structure, Divisional Structure, Matrix Structure)**Managerial Ethics & Leadership:** Ethics and Business, Ethics of Marketing & advertising, Ethics of Finance & Accounting, Decision— making frameworks, Business and Social Responsibility, International Standards, Corporate Governance, Corporate Citizenship, Corporate Social Responsibility

Unit V: Management Theories [9Hrs]

Concept and Foundations of Management, Evolution of Management Thoughts [Pre-Scientific Management Era (before 1880), Classical management Era (1880-1930), Neo-classical Management Era (1930-1950), Modern Management era (1950-on word). Contribution of Management Thinkers: Taylor, Fayol, Elton Mayo etc.

Text Books

S.N	Title	Authors	Edition	Publisher
1.	Contemporary Strategic Management	Robert M. Grant	7TH	Blackwell

Reference Books

S.N	Title	Authors	Edition	Publisher
1.	Competitive Strategy	M.E. Porter		M.E. Porter
2.	Competitive Advantage	Richard Rumelt		

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