INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)
Dundigal, Hyderabad -500 043

INFORMATION TECHNOLOGY

COURSE DESCRIPTOR

Course Title	**ADVANCED DATABASES**				
Course Code	**AIT505**				
Programme	B.Tech				
Semester	V				
Course Type	Elective				
Regulation	R16				
Course Structure	**Theory**			**Practical**	
	Lectures	**Tutorials**	**Credits**	**Laboratory**	**Credits**
	3	-	3	-	-
Chief Coordinator	Mr. D. Rahul, Assistant Professor				
Course Faculty	Mr. N. Bhaswanth, Assistant Professor				

I. COURSE OVERVIEW:

This course will address the advanced issues in modern database systems and applications. Databases underlie most complex computing systems. Major upcoming applications include scientific computing and enterprise integration. The present course will focus on the data-related issues in building, analyzing, and maintaining complex software systems. It will highlight the common concepts behind the different applications.

Increasingly, software systems that involve databases are heterogeneous. Traditionally, such systems are made to function in an unprincipled manner. This is because the simple approaches designed for small, centralized, homogeneous databases are ineffective and inappropriate for dealing with large, distributed, heterogeneous environments. Programmers often handcraft solutions, which distract them from their main objectives in scientific and business problem-solving and decision-support. However, the past few years have seen significant advances in techniques for operating and maintaining heterogeneous database systems.

II. COURSE PRE-REQUISITES:

Level	Course Code	Semester	Prerequisites	Credits
UG	ACS005	III	Database Management Systems	4

III. MARKS DISTRIBUTION:

Subject	SEE Examination	CIA Examination	Total Marks
Advanced Database	70 Marks	30 Marks	100

IV. DELIVERY / INSTRUCTIONAL METHODOLOGIES:

✔	Chalk & Talk	✔	Quiz	✔	Assignments	✔	MOOCs
✔	LCD / PPT	✔	Seminars	✘	Mini Project	✔	Videos
✘	Open Ended Experiments						

V. EVALUATION METHODOLOGY:

The course will be evaluated for a total of 100 marks, with 30 marks for Continuous Internal Assessment (CIA) and 70 marks for Semester End Examination (SEE). Out of 30 marks allotted for CIA during the semester, marks are awarded by taking average of two CIA examinations or the marks scored in the make-up examination.

Semester End Examination (SEE): The SEE is conducted for 70 marks of 3 hours duration. The syllabus for the theory courses is divided into five units and each unit carries equal weight age in terms of marks distribution. The question paper pattern is as follows. Two full questions with "either" or "choice" will be drawn from each unit. Each question carries 14 marks. There could be a maximum of two sub divisions in a question.

The emphasis on the questions is broadly based on the following criteria:

50 %	To test the objectiveness of the concept.
50 %	To test the analytical skill of the concept OR to test the application skill of the concept.

Continuous Internal Assessment (CIA):

CIA is conducted for a total of 30 marks (Table 1), with 25 marks for Continuous Internal Examination (CIE), 05 marks for Quiz/ Alternative Assessment Tool (AAT).

Table 1: Assessment pattern for CIA

Component	Theory		Total Marks
Type of Assessment	CIE Exam	Quiz / AAT	
CIA Marks	25	05	30

Continuous Internal Examination (CIE):

Two CIE exams shall be conducted at the end of the 8th and 16th week of the semester respectively. The CIE exam is conducted for 25 marks of 2 hours duration consisting of two parts. Part–A shall have five compulsory questions of one mark each. In part–B, four out of five questions have to

be answered where, each question carries 5 marks. Marks are awarded by taking average of marks scored in two CIE exams.

Quiz - Online Examination

Two Quiz exams shall be online examination consisting of 25 multiple choice questions and are to be answered by choosing the correct answer from a given set of choices (commonly four). Such a question paper shall be useful in testing of knowledge, skills, application, analysis, evaluation and understanding of the students. Marks shall be awarded considering the average of two quiz examinations for every course.

Alternative Assessment Tool (AAT)

This AAT enables faculty to design own assessment patterns during the CIA. The AAT converts the classroom into an effective learning centre. The AAT may include tutorial hours/classes, seminars, assignments, term paper, open ended experiments, METE (Modeling and Experimental Tools in Engineering), five minutes video, MOOCs etc.

VI. HOW PROGRAM OUTCOMES ARE ASSESSED:

Program Outcomes (POs)		Strength	Proficiency assessed by
PO1	**Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	3	Seminars & Assignments
PO2	**Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	2	Assignments
PO3	**Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.	3	Seminars
PO4	**Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.	1	Seminars & Assignments
PO5	**Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.	2	Seminars

3 = High; 2 = Medium; 1 = Low

VII. HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

Program Specific Outcomes (PSOs)		Strength	Proficiency assessed by
PSO1	**Professional Skills:** The ability to research, understand and implement computer programs in the areas related to algorithms, system software, multimedia, web design, big data analytics, and networking for efficient analysis and	2	Lectures

Program Specific Outcomes (PSOs)		Strength	Proficiency assessed by
	design of computer-based systems of varying complexity.		
PSO2	**Software Engineering Practices:** The ability to apply standard practices and strategies in software service management using open-ended programming environments with agility to deliver a quality service for business success	2	Seminars & Assignments
PSO3	**Successful Career and Entrepreneurship:** The ability to employ modern computer languages, environments, and platforms in creating innovative career paths to be an entrepreneur, and a zest for higher studies.	-	-

3 = High; 2 = Medium; 1 = Low

VIII. COURSE OBJECTIVES (COs):

The course should enable the students to:	
I	Define entity relationship model and transaction processing system.
II	Understand various storage structures for database.
III	Describe the distributed and parallel database processing.
IV	Describe object oriented database concepts and models.
V	Understand various advancements in database technology

IX. COURSE OUTCOMES (COs):

COs	Course Outcome	CLOs	Course Learning Outcome
CO 1	Understand the concept of Active Databases in Starburst, Oracle, and DB2.	CLO 1	Understand and explain the key ideas underlying database systems and the database approach to information storage and manipulation.
		CLO 2	Design and implement database applications.
		CLO 3	Understand the types of tasks involved in database administration and the facilities provided in a typical database system to support these tasks.
CO 2	Analyze the concepts of Temporial and Object Databases-SQL.	CLO 4	Design adequate backup, recovery and security measures for a database installation, and understand the facilities provided by typical database systems to support these tasks.
		CLO 5	Define and use important temporal concepts, such as time point, time interval, and time-interval operators such as before, after and overlaps.
		CLO 6	Understand the temporial data model at the conceptual level.
CO 3	Understand the Concepts of Relational calculi, relational algebra and recursion.	CLO 7	Describe some of the extensions to conventional query languages that have been proposed to support temporal query processing.
		CLO 8	Critically assess the strengths and weaknesses of Object databases with respect to Relational systems.

COs	Course Outcome	CLOs	Course Learning Outcome
		CLO 9	Describe why Object databases appear to be such a good fit for a number of major growth areas in computing, such as Web-based and multimedia information systems.
CO 4	Explore the concept of Spatial, Text and Multimedia Databases.	CLO 10	Describe the strategy being adopted by major database supplier Oracle to address the apparent threat of Object database systems, and critically compare this approach with a pure Object technology approach
		CLO 11	Formulate, using relational calculus solutions to a broad range of query problems
		CLO 12	Identify a range of concepts, techniques and tools for creating and editing the interactive multimedia database
CO 5	Understand the concept of Uncertainty in Databases.	CLO 13	Identify the current and future issues related to multimedia technology to store information
		CLO 14	Impart an overview of emerging data models like temporal, mobile and spatial databases
		CLO 15	Understand the commercial relational database system (Oracle) by writing SQL using the system.

X. COURSE LEARNING OUTCOMES (CLOs):

CLO Code	CLO's	At the end of the course, the student will have the ability to:	PO's Mapped	Strength of Mapping
AIT505.01	CLO 1	Understand and explain the key ideas underlying database systems and the database approach to information storage and manipulation.	PO1, PO3, PO5	2
AIT505.02	CLO 2	Design and implement database applications.	PO2, PO3	2
AIT505.03	CLO 3	Understand the types of tasks involved in database administration and the facilities provided in a typical database system to support these tasks.	PO1, PO2	3
AIT505.04	CLO 4	Design adequate backup, recovery and security measures for a database installation, and understand the facilities provided by typical database systems to support these tasks.	PO1	3
AIT505.05	CLO 5	Define and use important temporal concepts, such as time point, time interval, and time-interval operators such as before, after and overlaps.	PO2, PO5	2
AIT505.06	CLO 6	Understand the temporal data model at the conceptual level.	PO3, PO5	2
AIT505.07	CLO 7	Describe some of the extensions to conventional query languages that have been proposed to support temporal query processing.	PO1, PO4	2
AIT505.08	CLO 8	Critically assess the strengths and weaknesses of Object databases with respect to Relational systems.	PO2, PO4	1
AIT505.09	CLO 9	Describe why Object databases appear to be such a good fit for a number of major growth areas in computing, such as Web-based and multimedia	PO3	3

CLO Code	CLO's	At the end of the course, the student will have the ability to:	PO's Mapped	Strength of Mapping
		information systems.		
AIT505.10	CLO 10	Describe the strategy being adopted by major database supplier Oracle to address the apparent threat of Object database systems, and critically compare this approach with a pure Object technology approach	PO2	2
AIT505.11	CLO 11	Formulate, using relational calculus solutions to a broad range of query problems	PO1, PO4	2
AIT505.12	CLO 12	Identify a range of concepts, techniques and tools for creating and editing the interactive multimedia database	PO3, PO4	3
AIT505.13	CLO 13	Identify the current and future issues related to multimedia technology to store information	PO2	2
AIT505.14	CLO 14	Impart an overview of emerging data models like temporal, mobile and spatial databases	PO2	2
AIT505.15	CLO 15	Understand the commercial relational database system (Oracle) by writing SQL using the system.	PO1, PO3	3

3 = High; 2 = Medium; 1 = Low

XI. MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES

Course Outcomes (COs)	Program Outcomes (POs)						
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2
CO1	3	3	3		1	3	2
CO2	3	3	2		2	3	
CO3	3	2	3	2		2	2
CO4	3	2	3	2		2	3
CO5	3	2	3				

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XII. MAPPING COURSE LEARNING OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

(CLOs)	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CLO 1	3		3		1								2		
CLO 2		2	3										3		
CLO 3	3	3												2	

(CLOs)	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CLO 4	3												3		
CLO 5		3			2								2		
CLO 6			2		1								2		
CLO 7	3			2										2	
CLO 8		2		1									2		
CLO 9			3												
CLO 10		2												3	
CLO 11	3			1											
CLO 12			3	2									2		
CLO 13		2													
CLO 14		1													
CLO 15	3		3												

3 = High; 2 = Medium; 1 = Low

XIII. ASSESSMENT METHODOLOGIES – DIRECT

CIE Exams	PO1, PO2, PO3, PO4, PO5, PSO1, PSO2	SEE Exams	PO1, PO2, PO3, PO4, PO5, POS1, POS2	Assignments	PO1, PO2, PO4	Seminars	PO1, PO3, PO4, PO5
Laboratory Practices	-	Student Viva	-	Mini Project	-	Certification	-
Term Paper	-						

XIV. ASSESSMENT METHODOLOGIES - INDIRECT

✔	Early Semester Feedback	✔	End Semester OBE Feedback
✘	Assessment of Mini Projects by Experts		

XV. SYLLABUS

Unit-I	ACTIVE DATABASES
Syntax and Semantics (Starburst, Oracle, DB2): Taxonomy, applications, integrity management, workflow management, business rules, design principles, properties, rule modularization, rule debugging, IDEA methodology, open problems.	
Unit-II	**TEMPORIAL AND OBJECT DATABASES**
Overview: Time domain, data types, associating facts with time, temporal query language; Transact-	

SQL (T-SQL): Time ontology, data model, language constructs; Implementation: System architecture, temporal support, support for TSQL2.	
Unit-III	**COMPLEX QUERIES AND REASONING**
Logic of Query Languages: Relational calculi, relational algebra, recursive rules, syntax and semantics of data log, fix point semantics. Implementation Rules and Recursion: Rule rewriting methods, compilation and optimization, recursive queries in SQL, open issues.	
Unit-IV	**SPATIAL, TEXT AND MULTIMEDIA DATABASES**
Traditional Indexing Methods: Secondary keys, spatial access methods, text retrieval; Multimedia indexing: 1D time series, 2D color images, sub pattern matching..	
Unit-V	**UNCERTAINITY IN DATABASES AND KNOWLEDGE BASES**
Introduction: Uncertainty in image database, uncertainty in temporal database, uncertainty in null value; Models of uncertainty; Uncertainty in relational databases: Lattice based relational databases, probabilistic relational databases	
Text Books:	
1. Carlo Zaniolo, Stefano Ceri, ―Advanced Database Systems‖, Morgan Kauffmann Publishers, VLDB Journal, 1st Edition, 1997.	
Reference Books:	
1. Raghu Ramakrishnan, ―Database Management System‖, McGraw-Hill Publications, 3rd Edition, 2000 2. Abraham Silberschatz, Henry F. Korth and S.Sudharshan, ―Database System Concepts‖, Tata McGraw-Hill, 6thEdition, 2010	

XVI. COURSE PLAN:

The course plan is meant as a guideline. Probably there may be changes.

Lecture No.	Topics to be covered	Course Learning Outcomes (CLOs)	Reference
1	Understand the Syntax and Semantics Starburst	CLO 1	T2: 1.1
2	Understand the Syntax and Semantics Oracle	CLO 2	T2: 1.3
3	Understand the Syntax and Semantics DB2	CLO 2	T2: 1.4
4	Define Taxonomy	CLO 4	T2: 1.5 R2: 3.3
5	Describe the Applications ,integrity management	CLO 4	T2: 1.8.1 R2: 3.3
6	Define the Workflow management	CLO 7	T2: 1.8 R2: 3.3
7	Understand the Business rules	CLO 6	T2: 1.10
8-10	Design principles, properties	CLO 5	T1: 2.1
10-13	Describe Rule modularization, rule debugging	CLO 4	T1: 2.2
14	Demonstrate IDEA methodology	CLO 6	T1: 2.4
15	Explain the Open problems	CLO 2	T1: 2.5
16-17	Define the temporal and object databases	CLO 3	T1: 3.2
18-19	Understand the Time domain, data types	CLO 4	T1: 3.5
20-22	Demonstrate the Associating facts with time, temporal query language	CLO 1	T1: 3.7

Lecture No.	Topics to be covered	Course Learning Outcomes (CLOs)	Reference
23	Understand the Transact-SQL (T-SQL)	CLO 1	T1: 4.1
24-26	Define the Time ontology, data model, language constructs	CLO 4	T1: 4.2.2 - 4.2.5
27-29	Explain the System architecture, temporal support, support for TSQL2	CLO 4	T1:4.3, 4.4
30	Demonstrate Logic of Query Languages	CLO 3	T1: 19.1 R1: 4.3
31	Solve Relational calculi, relational algebra, recursive rules,	CLO 8	T1:19.1.3 R1: 4.3
32-35	Explain the Syntax and semantics of data log, fix point semantics	CLO 9	T1: 19.4
36-38	Implementation Rules and Recursion	CLO 10	T1:19.4, 19.5
39	Define Rule rewriting methods	CLO 8	T1: 19.5 R1: 4.3
40-42	Explain the Compilation and optimization, recursive queries in SQL	CLO 9	T1: 19.7, 19.8.1
43	Demonstrate the Open issues	CLO 13	T1: 19.8.2
44	Understand the Traditional Indexing Methods	CLO 10	T2: 15.1, 15.2
45	Define Secondary keys, spatial access methods	CLO 14	T2: 15.3
46	Understand the Text retrieval	CLO 13	T2: 15.4 - 15.6
47	Define Multimedia indexing	CLO 12	T2: 16.1, 16.2
48	Explain the 1D time series, 2D color images, sub pattern matching.	CLO 9	T2: 16.3, 16.4
49	Understand the Uncertainty in image database, uncertainty in temporal database	CLO 10	T2: 17.1, 17.2
50	Define Uncertainty in null value	CLO 11	T2: 17.3, 17.4
51	Explain the Models of uncertainty	CLO 15	T2: 17.6
52	Explain the Uncertainty in relational databases	CLO 10	T2: 17.7, 17.8
53	Demonstrate Lattice based relational databases	CLO 12	T1: 8.1
54	Demonstrate Probabilistic relational databases	CLO 14	T1: 8.3.1

XVII. GAPS IN THE SYLLABUS - TO MEET INDUSTRY / PROFESSION REQUIREMENTS:

S NO	Description	Proposed actions	Relevance with POs	Relevance with PSOs
1	Active Databases: Syntax and Semantics of Starburst, Oracle and DB2	Work Shops/ Guest Lectures	PO1, PO3	PSO1
2	Object Databases and Complex Queries	Work Shops/ Laboratory Practices	PO3	PSO2

Prepared by:
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