Syllabus of B. Sc. Gaming & Mobile Application Development
(Effective for 2020-2021 Admission Session)
Choice Based Credit System
140 Credit (3-Year UG) MAKAUT Framework
w.e.f 2020-21

3rd Semester Course Structure

Subject Type	Course Name	Course Code	Credit Points	Credit Distribution			Mode of Delivery			Proposed Moocs
				Theory	Practical	Tutorial	Offline #	Online	Blended	
CC 5	Database Programming	GAM(T) 301	6	4	0	0	✓			As per MAKAUT Notification
		GAM 391		0	2	0				
CC 6	Fundamentals of Data Structure using C	GAM(T) 302	6	4	0	0	✓			
		GAM 392		0	2	0				
CC 7	Graphics Programming and Animation using OpenGL	GAM(T) 303	6	4	0	0	✓			
		GAM 393		0	2	0				
GE 3	Students will have to select from the GE Basket		6						✓	
SEC 1	Mobile database skills	GAM 354	2	0	2	0	✓			
Semester Credits			**26**							

 # Only in case offline classes are not possible due to reasons like COVID Pandemic the classes will be in synchronous online mode

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GAM 301- Database Programming

Credits- 4L+2P

Course Objective: The course is designed to introduce the concepts of Database Programming and to understand, develop and implement the queries with the database programming. In this course, you will learn to create relational databases, write SQL statements to extract information in order to satisfy the required requests, create entity relationship diagrams (ERDs) to design databases, and analyze table designs for excessive redundancy. As you develop these skills, you will use either Oracle or MySQL to execute SQL statements, a database diagramming tool to create ERDs and you should be able to understand the concepts of transaction and query optimization.

Sl. No.	Course Outcome	Mapped modules
1	Remember & understand the concepts of Database Programming which aims to implement real-world entities for creating relational databases.	M1
2	Remember & understand how to create entity relationship diagrams (ERDs) to design databases.	M1, M2
3	Analyse, evaluate, implement, and evaluate a query using the concepts of Relational Model and Normalization.	M3, M4,M5,M6
4	Understand & apply the appropriate SQL statements to extract information in order to satisfy the required requests.	M1,M2, M3, M4, M5, M6
5	Analyse the concepts of transaction in Database Programming	M4, M5
6	Analyse and create using Indexing in Database Programming	M4, M6

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Theory- GAM(T) 301

Module Number	Headline	Total Hours	%age of questions	Blooms Level	Remarks (If any)
M 1	Introduction	10	20	1,2	
M 2	E-R Model	10	20	1,2	
M 3	Relational Model and Normalization	10	20	2	
M 4	SQL	4	20	2,3	
M5	Transaction and Query Processing	10	10	4	
M6	Indexing	6	10	3,4	
		50	**100**		

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Practical- GAM 391

Module Number	Headline	Total Hours	%age of questions	Blooms Level	Remarks (If any)
M 3	Relational Model and Normalization	8	30	2	
M 4	SQL	10	50	2,3	
M 5	Transaction and Query Processing	8	20	4	
		26	**100**		

Detailed Syllabus

Paper: Database Programming (including Lab)

Module I: Introduction (10L)
Concept & Overview of DBMS, Components of Database System, Basics of Database Management System, File-based System and Database Management System, Advantages of using Database over File based system, Data Models, Database Languages, Database Administrator, Database Users, Data Abstraction, Three Schema architecture of DBMS.

Module II: E-R Model (10L)
Basic Terminology related to ER Model, Relational Model – Introduction, Advantages and Disadvantages, Identifying Entities, and Relationships, Types of Relationships, Relationship Participation, Notations in ER Model, Strong and Weak entity sets, Managing Many-to-many, Relationship, Example of E-R Model, Types of Integrity Constraints, Subclass and Superclass, Generalization, Specialization, Aggregation.

Module III: Relational Model and Normalization (10L+8P)
Concept of Relational Model, Keys, Entity integrity Rule, Closure set, Functional Dependency, Armstrong Axioms, Relational Set Operators, Relational Algebra and relational calculus, Different anomalies in designing a Database, need for Normalization, Normalization using functional dependencies, Decomposition, Boyce-Codd Normal Form, 3NF, Normalization using multivalued dependencies, 4NF,5NF.

Module IV: SQL (4L +10P)
Introduction, Features of SQL, Database Languages - Data definition and Data manipulation languages, Data Definition Commands, Data Manipulation Commands, (SELECT Statement and different Clauses, SQL Functions - Aggregate, Date and Time Functions, String Functions, Null Values, Domain Constraints, Referential Integrity Constraints, Different types of Join and Set Operators, Group by and having clauses, Sub-query, Views, Advances SQL Roll-up, Commit and Save point, Create user grant revoke.

Module V: Transaction and Query Processing (10L+8P)
Transaction Processing States, ACID Properties of Transaction, read and write operations in transaction, commit and rollback, concurrency problems and reasons for recovery, System log, Steps of Query Processing, Query Optimization.

Module VI: Indexing (6L)
Introduction, Overview, Primary Secondary Multi level, Dense and Space Index.

Suggested Readings:

1. Korth, Silberschatz, Sudarshan – Database System Concepts; Tata Mc. Graw Hill
2. Ramez Elmasri, Shamkant B Navathe - Fundamentals of Database Systems; Pearson
3. C.J. Date - An Introduction to Database Systems, 8e, Pearson Education
4. Rajiv Chopra - Database Management Systems; S CHAND

5. Atul Kahate - Introduction to Database Management Systems, Pearson
6. Walter Shields -SQL QuickStart Guide: The Simplified Beginner's Guide to Managing, Analyzing, and Manipulating Data with SQL
7. Ben Forta- SQL in 10 Minutes a Day, Sams Teach Yourself

GAM 302- Fundamentals of Data Structure using C
Credits-4L+2P

Course Objective: The course is designed to introduce fundamental concepts of data structures and learn how these data structures are implemented to solve programming challenges and apply them in various algorithms. A good algorithm usually comes together with a set of good data structures that allow the algorithm to manipulate the data efficiently. This will help to understand what is going on inside a particular built-in implementation of a data structure and what to expect from it.

Sl. No.	Course Outcome	Mapped modules
1	Understand how the choice of data structures and algorithm design methods impact the performance of programs.	M1
2	Apply various data structures such as stack, queue, hash table, binary search tree, graph to solve programming challenges.	M2,M3,M4,M5,M6
3	Understand and apply basic algorithmic techniques such as linear and binary search, sorting to solve computational problems.	M2, M3, M4, M5
4	Analyse and apply data structures that are used in industry-level applications, such as linked lists, trees, and hash tables.	M1,M2, M3, M4, M5

5	Remember and understand that data structures and design patterns are both general programming and software architecture topics that span all software, not only games.	M1,M2
6	Analyse and design using guided competitive programming laboratory work	M2, M3,M4, M5,M6

Theory- GAM(T) 302

Module Number	Headline	Total Hours	%age of questions	Blooms Level	Remarks (If any)
M 1	Concepts of Abstract data type	8	10	2	
M 2	Data Structure using Array	8	20	3	
M 3	Searching and Sorting	9	20	2,3	
M 4	Linked List	8	20	3,4	
M5	Trees	8	20	1,2	
M6	Graphs and Hashing	9	10	3,4	
		50	**100**		

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Practical- GAM 392

Module Number	Headline	Total Hours	%age of questions	Blooms Level	Remarks (If any)
M 2	Data Structure using Array	6	20	3	
M 3	Searching and Sorting	5	20	2,3	
M 4	Linked List	5	20	3,4	
M5	Trees	5	20	1,2	
M6	Graphs and Hashing	5	20	3,4	
		26	**100**		

Detailed Syllabus

Module I: Concepts of Abstract data type (8L)
Concept of abstract data types, Structure, union, enum, pointer to structure, Self-referential structure, Pointer to pointer, Dynamic Memory Allocation

Module II: Data Structure using Array (8L+6P)
Stack, queue, circular queue, priority queue, dequeue and their operations and applications

Module III: Searching and Sorting (9L+5P)

Searching: linear search, Binary search, their comparison, Sorting: insertion sort, Selection sort. Quick sort, Bubble sort, Heap sort, Comparison of sorting methods, Analysis of algorithm, complexity using big 'O' notation.

Module IV: Linked List (8L +5P)
Linear link lists, doubly linked lists, stack using linked list, queue using linked list, circular linked list and their operations and applications.

Module V: Trees (8L+5P)
Binary trees, binary search trees, representations and operations, thread representations, sequential representations, B tree, B+ tree, AVL tree.

Module VI: Graphs and Hashing (9L+5P)
Introduction to graphs, Definition, Terminology, Directed, Undirected & Weighted graph, Representation of graphs, Graph Traversal: Depth first search and Breadth first search. Spanning Trees, minimum spanning Tree, Shortest path algorithm.
Definition, Hashing functions, Load factor and collision, open addressing (linear probing).

Suggested Readings:

1. Data Structures with C by S. Lipschutz.
2. Data Structure Using C & C++, Tannenbaum, PHI
3. Data Structures in C, Ajay Agarwal, Cyber Tech
4. Data Structures Using C, Radhakrishnan & Shrinivasan, ISTE/EXCEL BOOKS
5. C and Data Structure,Radhaganesan,Scitech
6. Data Structures by R.S. Salaria, Khanna Publishing House, 20

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GAM 303- Graphics Programming and Animation using OpenGL

Credits-4L+2P

Course Objective: This is an introductory course on principles of computer graphics. We will consider both 2D and 3D graphics. We will look at raster scan graphics including line and circle drawing, polygon filling, anti-aliasing algorithms, clipping, hidden-line and hidden surface algorithms including ray tracing and rendering - the art of making photo realistic pictures with local and global illumination models. Lab course of two hours per week will supplement the theory. Implementation of basic and advanced algorithms will be done in OpenGL and C++. Basic knowledge of C/C++ programming is mandatory. The course will involve four hours of contact including lectures, tutorials and lab classes.

Sl No	Course Outcome	Mapped modules
1	Remember and Understand what computer Graphics is. It's areas of Computer Graphics Design and Drawing Animation Multimedia applications	M1, M2
2	Remember and Understand the design of the various Graphics devices, tools and components of computer as a graphics display and plot some primitive objects using C programs	M2 , M3
3	Construct the elements of graphics transformation techniques, how to clip a display viewing area in an application	M3,M4
4	Build the graphics display techniques in 3-D mode	M3,M4
5	Apply the Input & Output and OOPs programing using C++	M4,M5
6	Analyse and design using guided graphics programming laboratory work in OpenGL and C++	M4,M5 ,M6

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Theory- GAM(T) 303

Module Number	Headline	Total Hours	%age of questions	Blooms Level	Remarks (If any)
M 1	Basics of Computer graphics	8	15	1,2	
M 2	Graphics devices and Primitive Object drawing	8	15	1,2	
M 3	2-D Graphics Transformation and Clipping	8	15	2	
M 4	3-D Graphics display, Transformation, Projection and Hidden Surface removal	10	25	2,3	
M5	Concepts of OOP & Basics of C++	8	15	2,3	
M6	Programing using OpenGL API in C++	8	15	2,4	
		50	**100**		

Practical- GAM 393

Module Number	Headline	Total Hours	%age of questions	Blooms Level	Remarks (If any)
M2	Primitive Object drawing using	3	10	1,2,3	
M3	2-D Graphics Transformation and Clipping using	5	10	2,3	
M4	3-D Graphics display, Transformation, Projection and Hidden Surface removal	6	20	2,3	
M5	Concepts of OOP & Basics of C++	6	30	2,3,4	
M6	Programing using OpenGL API in C++	6	30	4,5,6	
		26	**100**		

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Paper: Graphics Programming and Animation using OpenGL (including Lab)

Module I: Basics of Computer graphics (8L)
BASICS OF COMPUTER GRAPHICS Introduction. What is computer Graphics? Area of Computer Graphics Design and Drawing Animation Multimedia application. Simulation How are pictures actually stored and displayed Difficulties for displaying pictures Block Summary Review Question and Answers.

Module II: Graphics devices and Primitive Object drawing (8L+3P)
GRAPHIC DEVICES Introduction Cathode Ray Tube Quality of Phosphors CRTs for Color Display Beam Penetration CRT The Shadow - Mask CRT Direct View Storage Tube Tablets the Light Pen Three Dimensional Devices

SIMPLE LINE DRAWING METHODS Introduction Point Plotting Techniques Qualities of good line drawing algorithms The Digital Differential Analyzer (DDA) Bresenham's Algorithm Generation of Circles

Module III: 2-D Graphics Transformation and Clipping (8L+5P)
TWO DIMENSIONAL TRANSFORMATIONS Introduction What is transformation? Matrix representation of points Basic transformation Translation Rotation Scaling

CLIPPING AND WINDOWING Introduction Need for Clipping and Windowing Line Clipping Algorithms The midpoint subdivision Method Other Clipping Methods Sutherland – Hodgeman Algorithm Viewing Transformations

GRAPHICAL INPUT TECHNIQUES Introduction Graphical Input Techniques Positioning Techniques Positional Constraints Rubber band Techniques

Module IV: 3-D Graphics display, Transformation, Projection and Hidden Surface removal (10L+6P)
THREE DIMENSIONAL GRAPHICS INTRODUCTION Need for 3-Dimensional Imaging Techniques for 3-Dimesional displaying Parallel Projections Perspective Projection Intensity Cues Stereoscope effect kinetic depth effect Shading

SOLID AREA SCAN CONVERSION Introduction Solid Area Scan Conversion Scan Conversion of Polygons Algorithm Singularity

3-D Dimensional Transformations Introduction Three-Dimensional Transformation Translations Scaling Rotation Viewing Transformation The Perspective Algorithms Three Dimensional Clipping Perspective view of Cube

HIDDEN SURFACE REMOVAL Introduction Need for hidden surface removal The Depth – Buffer Algorithm Properties that help in reducing efforts Scan Line coherence algorithm Span – Coherence algorithm Area-Coherence Algorithms Warnock's Algorithm Priority Algorithms

Module V: Concepts of OOP & Basics of C++ (8L+6P)

Introduction to OOP, Procedural vs OOP, Program structure, namespace, identifiers, variable, constants, enum, operators, typecasting, control structure. Simple functions, call and return by reference, inline function, overloading of functions, friend function, Objects and Classes - Basic of objects and classes in C++, Private and public, static data and function member, constructor and their types, destructor, Inheritance, Polymorphism

Module VI: Programing using OpenGL API in C++ (8L+6P)

An introduction to the fundamentals of computer graphics through the use of OpenGL. Topics include use of OpenGL and GLUT API, input handling, coordinate systems and transformations, viewing and projection, illumination and shading, curve and surface representation, and object hierarchies.

Text Books:

1. Introduction to Computer Graphics, A. Mukherjee, VIKAS
2. Computer Graphics, Multimedia and Animation -2010 by Pakhira Malay K.
3. Multimedia & Animation - 2018, by V.K. Jain, Khanna Publishing House
4. Procedural & Mathematical Elements in Computer Graphics, Rogers, TMH
5. Donald Hearn and M. Pauline Baker. "Computer Graphics with OPENGL" 3rd Edition Pearson Publishers, 2011.
6. Angel, Interactive Computer Graphics: A Top-Down Approach Using OpenGL, 5th edition, Addison-Wesley, 2009.
7. Shreiner, et al, OpenGL Programming Guide: The Official Guide to Learning OpenGL Version 2.1, 6th edition, Addison-Wesley, 2008.

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GAM 354- Mobile Database Skills
Credits-2P

Course Objective: This is an introductory course on mobile databases used in different mobile devices or platforms. This course is a practical approach to explore the various mobiles databases popularly used in the various mobile app development environments across various mobile or embedded platforms. The course requires instructor's guidance of 2 hours/week including lectures, tutorials and lab classes.

Sl No	Course Outcome	Mapped modules
1	Understand and Design what mobile database and their area of applications	M1, M2
2	Understand and design of the various mobile databases	M2 , M3
3	Understand and apply data storage operations on popular mobile databases	M3,M4
4	Understand and apply data storage operations on cloud based mobile databases	M4

Module Number	Headline	Total Hours	%age of questions	Blooms Level	Remarks (If any)
M 1	Basics of Mobile databases	4	10	1,2	
M 2	Different Mobile Databases	6	30	1,2	
M 3	Use of Mobile Databases	8	30	2,3	
M 4	Use of Cloud based Databases for Mobile apps	8	30	2,3	
		26	**100**		

Paper: Mobile Database Skills

Module I: Basics of Mobile Database (4P)

Introduction - what is a mobile database, what's the use of a mobile database, features of mobile databases, Footprint of mobile databases, native database support by different mobile platforms like Android, iOS, Online mobile database for mobile apps, limitations, components of mobile database environment.

Module II: Different Mobile Databases (6P)

Use of SQLite database, advantages and disadvantages of SQLite, SQLite alternatives - Couchbase Lite, Realm DB, Oracle Barkeley DB, ORMLite, Object Box, SnappyDB, Sparksee Mobile, SQL Anywhere, SQL Server Compact and UnQLite. Use of NoSQL on mobile platforms.

Module III: Use of Mobile Databases (8P)

Data storage, insertion, update operations in mobile databases like SQLite, Couchbase Lite, Realm MongoDB, Oracle Barkeley DB. General criteria to select right databases for Mobile Apps **–** structure of data, size of data, speed and scale, data modeling , data security, support for multiple mobile app platforms, data synchronization between local database and backend server, low network issue.

Module IV: Use of Cloud based Databases for Mobile apps (8P)

Use of cloud based databases for mobile app, Firebase database – Key features, setup and configuration, data organization, read, write, update , delete operation. Other alternative online databases - Cloud Firestore, Couchbase Server. Network and Security issues.

Study and lab Resources:

1. SQLite - https://www.sqlite.org/index.html
2. Couchbase - https://www.couchbase.com/
3. Realm MongoDB - https://realm.io/
4. Oracle Berkeley DB - https://www.oracle.com/database/berkeley-db/
5. Firebase - https://firebase.google.com/