Tilak Maharashtra Vidyapeeth

Bachelor of Computer Application (B.C.A)- Game Development

First Year
Semeseter- I

BCA- 171 - Programming Using C# (Pr)

1) **Introduction to computers and programming, Operators and data types in C#**
   History of Computers, Computer Hardware, Different types of Programming Languages, Introduction to C# programming, Constants and variables, Integers, Floats and Strings, statements, Identifying keywords, Examining arithmetic operators

2) **Working with Arrays and Lists, Functions/Methods in C#**
   Arrays and Lists, Parameters in functions, Returning values from functions, creating method in C#, Parameters in methods, Returning data from methods, passing named arguments, passing optional parameters

3) **Using decision statements, using compound assignment and iteration statements**
   Using if statements, using blocks to group statements, using switch statements, Writing while statements, Writing for statements, Writing do statements

4) **Managing errors and exceptions, Using Collections**
   Coping with errors, trying code and catching exceptions, writing checked statements, using "finally" block,

5) **Creating and managing structure, classes and objects, working with inheritance,**
   Defining and using a class, working with constructors, overloading constructors, understanding static classes, Understanding inheritance, declaring new methods, Declaring "virtual" methods, Declaring "override" methods. Declaring a structure, Difference between structure and class.

References

C# (Programming for Beginners in Under 8 Hours)
Learn C# in One Day and Learn It Well
Object Oriented Programming Using C#

BCA- 172- Mathematics (Th)

1) **Trigonometry**
   The Trigonometric Ratios, Inverse Trigonometric Ratios, Trigonometric Relationships, The Sine Rule, The Cosine Rule, Compound Angles, Perimeter Relationships,

2) **Vectors**
   2DVectors -Vector Notation - Graphical Representation of Vectors - Magnitude of a Vector, 3DVectors - Vector Manipulation - Multiplying a Vector by a Scalar - Vector Addition and Subtraction - Position Vectors - Unit Vectors

3) **Transformation**
   2DTransformations - 2D Translation - 2D Scaling - 2D Rotation, 3DTransformation - 3DTranslation - 3D Scaling - 3DRotations - Gimbal Lock

4) **Quaternion's**
   Adding and Subtracting Quaternion's, Multiplying Quaternion's, The Inverse Quaternion, Rotating Points around an Axis, Roll, Pitch and Yaw Quaternion's, Quaternion's in Matrix Form

5) **Matrices**
   Matrices, Basic Operations and Properties, Advanced Operations and Properties, Matrix Decomposition, Eigenvector, Diagonalization

References

Mathematics for Game Developers
Mathematics for Computer Graphics

BCA-173 -Game Design-I (Pr)

1) **Game design**
   Principles of game design,Game Design Theory,MDA,8 type of Fun in Game,Visual style, Gameplay

2) **Generate ideas for a game concept**
   Idea Development Process, Stimulus, Genre Market Research, Target platform

3) **Creating Prototype**
   Creating physical Games: Board Game, Card Game, Party Games and etc….

4) **Gimp/photoshop Basics**
   Mastering the effects of the clone and healing brush tools , working with Layers and the Adjustments Panel, basics of Masking,Transforming and maximizing Smart Objects, Employing Smart Filters to create interesting effects, Color correction, Working with text and vector shapes in Gimp, File formats, resizing, and saving, Actions and Batch Processing

References

The Art of Game Design: A Book of Lenses, Second Edition
Level Up! The Guide to Great Video Game Design
Theory of Fun for Game Design

BCA-174 - Game Development – I (Pr)

1) **Introduction to Unity Game Engine**
   Intro to Tools & navigation, Terrain system in Unity, Camera control in Unity, Scene Navigation, Project setting / Player setting, Game publishing using Unity

2) **Intro to C# programming in Unity**
   Constants and variables, Integers, Floats and Strings, Arrays and Lists, Arithmetical operators, Using if statements, Writing while statements, Writing for statements, & all Other Basic C# Concept in Unity

3) **Unity Game Engine for Developing 2D Games**
   Intro to 2D Game system in unity, Sprite Editor in Unity, Sprite Animation in Unity, 2D Physics in Unity, 2D Components, UI system in Unity, 2D Game Project

References

Getting Started with Unity 5
Unity 5 From Zero to Proficiency (Beginner)
Learning C# by Developing Games with Unity 3D Beginner's Guide

BCA-176- Human-Computer Interaction (Th)

1) **Human-computer interfaces for games**
   Technology, Interfaces, Human Factors, User interface design principles

2) **Methods of control and forms of feedback in games**
   Feedback, Information Communication, User psychology, Control method design

3) **Prototype an interface for a game using HCI techniques (Photoshop/Gimp/Unity)**
   Game specification analysis, Interface decisions for each mode, User interface flow chart, Prototype interface design for Game

References

HUMAN COMPUTER INTERACTION IN GAME DESIGN
Human-Computer Interaction (3rd Edition)

Semester- II

BCA-271 - Intro to Java Programming (Pr)

1) **Introduction to Programming and Java**
   Working with variables, Types of variables, Reference types, Declaration, Initialization
2) **Decision making in Java**
   If, else and Switch statements
3) **Loops and Methods**
   Loops- While loop, break and continue , Do while loops, For loops
   Methods- Structure of a method, Modifier
   Return type, Parameters, working with method, body
4) **Controlling the flow of the program**
   Comparisons using operators and methods,
   Understanding language control
5) **Working with arrays**
   Introduction to arrays, Dynamic arrays,
   Multi-dimensional arrays
6) **OOP concepts**
   Introduction to OOP, Classes and Objects, Abstraction, Inheritance, Polymorphism,
   Encapsulation
7) **Handling Exceptions and Debugging**
   Recognizing error types, Exceptions,
   Debugging and testing your applications

References

Learning Java by Building Android Games, 1st EditionBy: John Horton
Beginning Java Programming, 1st EditionThe Object-Oriented Approach
By: Aimee Backiel, Bart Baesens, SeppevandenBroucke

BCA-272- Android App Development (Pr)

1) **Introduction to Android and Java**
   Installing JDK, Installing Android studio
2) **Getting started with Android**
   Preparing Android studio, Building the project, Android UI types, Lifecycle phases
3) **Building and Installing**
   Emulators and devices, Creating and running the emulator, Building our App, Installing a setup to a device
4) **Android and model-view-controller**
   Benefits of MVC, Updating the View layer and Controller layer, Connecting and running on a device, Configuring device for development,
   Adding resources to a project, Referencing resources in XML
5) **UI fragments and Fragment Manager**
   Introducing fragments, Fragments and the support library, Adding dependencies in Android studio,
   Hosting a UI fragment, Fragment manager and fragment lifecycle
6) **Working with Sound**
   Loading sounds, Playing sounds, Unloading sounds,
   Implement sound in the app
7) **Working with User Input**
   Android Input methods, Keyboard and Keypad
   Touch, Custom gestures, On-screen controllers
   Accelerometer, Adding user input
8) **Physics**
   Box-2D physics engine, Box-2D concepts,
   Setting up Box-2D, Building levels for physics game

References

Android Programming: The Big Nerd Ranch Guide… (Kindle Edition) by Bill Phillips, Chris Stewart
Learning Android Game Programming: A Hands-On… (Kindle Edition) by Richard A. Rogers

BCA-273- Data Structure (Pr)

1) **Working with nodes**
   The Node, Building a chain from nodes, The principle of Induction, Induction on summation
2) **Asymptotic Notation**
   Introduction, The O-Notation, Big omega notation, Theta notation
3) **Arrays**
   Types, Bounds, Bounds check, Declaring array types, Array structures
4) **List structures and Iterators**
   Syntactic sugar, Implementations, Bidirectional lists, Doubly linked list implementation, Vector implementation
5) **Stacks and Queues**
   Stacks, Application of stacks, Queues
6) **Trees & Graphs**
   Traversal, Binary search trees, Adding and deleting from binary search tree, Directed & Undirected Graphs, Weighted Graphs, Graph Traversals

References

Data Structures and Algorithms Made Easy
Data Structures Using C++

BCA-274- Software Engineering (Th)

1) **Software Engineering**
   Introduction, History and Software Engineer.

2) **Software Development Activities**
   Communication, Requirement Gathering,
   Feasibility Study, System Analysis, Software Design, Coding, Testing, Integration, Implementation
   Operation and Maintenance and Disposition

3) **Software Development Paradigm**
   Introduction, Methodologies, History, Verb approaches and Subtopics. Agile Development, Waterfall Model and V Model and etc.

4) **Project Development**
   Planning, Architecture & Design, Implementation, Testing, Software Quality and Deployment & Maintenance.

5) **Re-Engineering**
   Introduction, Reverse Engineering and Round-trip Engineering.

References

https://en.wikibooks.org/wiki/Introduction_to_Software_Engineering
http://faculty.mu.edu.sa/public/uploads/1429431793.203Software%20Engineering%20by%20Somerville.pdf

BCA-276- Artificial intelligence (AI) (Th)

1) **Intro to Game AI**
   Introduction to AI, Intelligent Agent , Game AI Model and Interactive Agent, Analysis of Games - AI agent and its features

2) **Mathematics and Computer Science**
   Probability, Statistics, Bayes Theorem, Data Structures - Queue, Stack, Trees, Analysis of Algorithm, Sorting, Design and development of a game using Dice (Using Random class and Conditional probability), Design and development of a Digital Board Game

3) **FSM(Finite States Machine)**
   FSM, Animation cycles, Mixamo Animation, Development of Game AI using FSM e.g. Crossroad with Traffic signal and vehicles, pedestrians

4) **Flocking**
   Flocking - Concept, Research papers, programming and Demonstration, Documentation for Game AI system (with ERD Entity Relationship Diagram, FSMs)

5) **Problem Solving**
   Solving problems by searching, Informed Search, Path Finding , A* Path finding, Navigation Mesh

References

Artificial Intelligence: A Modern Approach (Third Edition)
Artificial Intelligence for Games Second Edition
Unity AI Programming Essentials

SECOND YEAR

Semester - III

BCA-371- Programming using C ++ (Pr)

1) **Introduction to C++ programming, Working with Conditions and Loops**
   Declaring variables, Integer constants, Expressions, Character expressions, The if statement, Nesting if statement, Conditional expressions, Creating while Loop, Creating For Loop, Breaking and Continuing

2) **Working with Functions, Working with Arrays**
   Writing and using a Function, Returning values from function, Passing arguments to function, Function with multiple arguments, Introduction to Arrays, Declaring an Array, Adding and getting values from Array

3) **Working with Strings and Boolean, Working with Classes**
   Getting a part of a string, Changing a part of a string, Adding onto a string, Adding two string, Working with Boolean values, Understanding Objects and Classes, Describing member functions and Data, Accessing members, Introduction to pointers, Passing objects to functions, Using the this pointer

4) **Working with Constructors and Destructors**
   Starting with constructors, Ending with destructors, Sampling constructors and Destructors, Adding parameters to constructors

5) **Planning and building Objects**
   Recognizing objects, Finding other objects, Encapsulating objects, Building hierarchies, Establishing hierarchies, Protecting members when inheriting, overriding member functions

6) **Working with arrays, pointers**
   Declaring arrays, Arrays and pointers, Using multidimensional arrays, Allocating an array on the heap, Storing arrays of pointers and arrays of arrays

7) **Pointing with pointers and working with references**
   Pointers to functions, Pointing a variable to a member function, Pointing to static member functions, Reference variables, Returning a reference from a function

References

C++ for Beginners
Programming: Principles and Practice Using C++
Object Oriented Programming with C++

BCA-372- Virtual & Augmented Reality (Pr)

1) **Fundamentals of AR and VR**
   What is Augmented Reality, What is Virtual Reality, What is Mixed Reality, How Human Vision Works, Computer Vision, Stereo vision, Understanding Depth, Perspective and 3D, Sensors, Input options - Magnetic Triggers, Gyroscopes, Gaze, Gesture, Voice, Spatial Sounds, Spatial Mapping, Tools and Technologies.

2) **VR Overview**
   Unity VR Introduction, Enabling VR in Unity Project, previewing VR in Unity, Hardware, Software, VR Sample Project, Creating your first VR Project, Frame rate in Editor, Camera Movement & Node, Image Effect for VR, Render Scale,

3) **Interaction in VR**
   VREyeRaycaster, VRInput, VRInteractiveItem, interaction in menu scene, Interaction in Maze scene, Interaction in Flyer scene, Gaze, The Reticle, Rotation & Position of the Head in VR, TouchPad&KeyBoard interaction during VR GamePlay

4) **VR Game Movements**
, Fade blink transitions in VR, Flyer VR movement, Maze –Table top style game movement, Shooter Movement,

5) **Optimization for VR in Unity & Project**
VR Optimization fundamentals, The Profiler, Geometry, Overdraw, Level of Details, Draw call Batching, Light Mapping, Light probes, Reflection probes, Occlusion culling, Anti-Aliasing, Texture, Shader, Quality Settings

6) **Augmented Reality using Vuforia and Unity**
Introduction to AR with Vuforia, Managing License, Target Manager, Creating Targets, Image Targets, Cylinder Targets, Installing Vuforia for Unity Extention, User-Defined Targets,Multi-Targets, Device Databases, Cloud Databases, Working with VuMarks, Deploying the app.

7) **Other kinds of AR experiences**
Big space AR -
What are they, How does it work, Input options - object detection, gestures, motion tracking, floor detection. Applications.
Projection mapping based AR -
What are they, Input options - Motion tracking, 3D mapped layouts. Applications.

References

Unity Virtual Reality Projects

BCA-373- Data Communication & Networks(Th)

1) **Data Communication Concepts**
   Networks and open system standards: the OSI reference model, Network topologies and the physical layer - Bus/Tree topology, ringtopology, star topology, The future of data communications

2) **Transmission Media and Transmission Technologies**
   The electrical interface, Metallic media, Optical fiber media, Wireless media (line-of-sight media),
   Baseband and broadband transmission, Transmission bandwidth (link capacity)

3) **Data Transmission**
   Simplex, half-duplex, full-duplex communications,
   Serial and parallel transmission, Synchronous transmission, Asynchronous transmission

4) **Data Security and Integrity**
   Error detection and correction,

5) **Local Area Networks**
   LAN standards (IEEE standards 802 for LANs), Interconnecting LANs, LAN Hardware (server platforms, backup devices, LAN adapters, printers, etc.), LAN system software, LAN application software, LAN selection criteria

6) **Metropolitan Area Networks (MANs) and Wide Area Networks (WANs)**
   Network routing, Public data networks, Circuit -switched data network, Packet-switched data network, Internet protocol, ISDN, Electronic mail

7) **Network Interconnections (Internetworking)**
   LAN-to-LAN connections and LAN-to-Host connections, Repeaters, Bridges, Routers, and Gateways, Interconnection utilities

References

Data Communications and Networking, Fourth Edition , by: Behrouz A. Forouzan

BCA-374- Game Development – II (Pr)

1) **Lighting & Shading in unity**
   Material & texturing in Unity, Physics Lighting and Rendering in Unity

2) **Audio in unity**
   Working with Audio Source , Working with Audio Listener

3) **Particle system & Sky box in Unity**
   Working with Particle system, Working with Sky box , Working with different effects in Unity

4) **Developing 3D Game using Unity Engine**
   Exporting Assets from 3D Software , Different Types of camera in Unity , Character Navigation, 3rd Person Camera movement, Creating Enemy characters runtime, Animation control in Unity , Graphic User Interface in Unity , Assigning Properties & Methods for player, Build Simple Artificial Intelligence for enemy character

References

Learning C# by Developing Games with Unity 3D Beginner's Guide
Mastering Unity 2D Game Development - Building Exceptional 2D Games with Unity

BCA-376- Database Management System (Pr)

1) **Database Management Overview**
   Introduction to Database Management
   Data processing, Characteristics of database
   Data models, Overview of conventional data models and Types of database systems

2) **Data modeling using Entity-Relationship approach**
   Data Modelling introduction, Entity-Relationship model, Steps in building data model and Developing the basic schema

3) **SQL**
   Introduction and history, SQL commands
   Data manipulation language, Queries
   Constraints in SQL.

4) **Relational database design and normalization**
   Introduction, Functional dependencies
   Multivalued dependencies, Relational database, Normal forms, Decompositions

References

http://archive.mu.ac.in/myweb_test/MCA%20study%20material/M.C.A.%20(Sem%20-%20III)%20Paper%20-%20II%20-%20Database%20Management%20System.pdf
http://www.ddegjust.ac.in/studymaterial/mca-3/ms-11.pdf

Semester- IV

BCA-471- Intro to Objective C (Pr)

1) **Understanding Objective-C**
   properties and declarations, working with numbers and strings, Working with arrays, Understanding functions, Using control statements and loops

2) **Object oriented programming**
   Properties, Methods, Classes and objects,
   Methods, Inheritance, Abstraction
   Polymorphism, Encapsulation

3) **Collection classes in Objective-C**
   Introducing collection classes, Arrays, dictionaries and sets, Mutable and immutable collections,
   Creating an NSArray and NSdictionary

4) **Handling exceptions**
   Causing an error, Using Try/Catch paradigm,
   Throwing an exception

5) **Managing Memory**
   Introduction to memory management,
   Manual-Retain release, Automatic reference counting

References

Learning Objective-C Programming, By Jesse Feiler
Learning Cocoa with Objective-C, 4th Edition,Developing for the Mac and iOS App Stores
By: Tim Nugent, Jonathon Manning, ParisButtfield-Addison

BCA-472- iOS App Development using Xcode (Pr)

1) **Introduction to Xcode**
   Requirements and installing Xcode, Features of Xcode, Live design and responsive UI,
   startingXcode, Creating a new project

2) **Interface Builder**
   toolbar area, navigator area, editor area, creating a basic interface, Elements on the view, Adding scenes, Navigating between view controllers

3) **Constraints**
   Understanding auto layout, Building an authentication view, Manually adding constraints,
   Automatically adding constraints, Previewing layout

4) **Table and Collection views**
   Table view composition, Table view styles,
   The accounts and social framework, Adding a collection view controller, Configuring a collection view

5) **Frameworks and libraries**
   Understanding frameworks, Creating the project,
   Static Libraries, Adding static library to a project

6) **Debugging and Analysis**
   Setting and using break points, The Debug navigator, The breakpoint navigator, Compile-time and Runtime errors

References

Xcode 6 Essentials (Kindle Edition) by Jayant Varma
Beginning Xcode (Kindle Edition) by Matthew Knott
Xcode 7 Essentials, 2nd Edition By: Jayant Varma, Brett Ohland

BCA-473- Software Analysis and Design (Th)

1) **Introduction**
   Introduction, analyzing the software, find the Requirements and finding the modules and parameters. Data Flow Diagram, Structure Charts, HIPO Diagram, Pseudo-Code, Decision Tables, Entity-Relationship Model and Data Dictionary.

2) **UML**
   The Use Case Model, Sequence Diagrams, Implementation Diagram, the Dynamic Model, Activity Diagrams, the Component Diagram, Use Case Diagram, Activity Diagram and State Machine Diagram

References

http://www.lubancollege.com/phocadownload/system-analysis-and-design.pdf
http://www.uoitc.edu.iq/images/documents/informatics-institute/Competitive_exam/Systemanalysisanddesign.pdf

BCA-474 - Game Development – III (Pr)

1) **Introduction to Unreal Engine**
   Intro to User Interface, viewport toolbar, Navigating the Viewport, Creating BSP, Importing Assets , Terrain in Unreal , Camera Control in Unreal

2) **Lighting & Rendering in Unreal**
   Understanding the Working of Materials, Cascade – a World Made of Particles, Pre-computed Lights, Dynamic Lights Versus Performance, Post Processing Effects

3) **Intro to Blueprint**
   Intro to Blueprint Interface **,**Post Processing Effects**,** Blueprint Editor & Graphs

4) **Introduction to C++ in Unreal Engine**
   Coding with C++, Variables and Memory, If, Else, and Switch, Functions and Macros, Looping, Creating small 3D Game using Unreal Engine

References

Game Development and Simulation with Unreal Technology
Unreal Engine Game Development Blueprints
Learning C++ by Creating Games with UE4

BCA-476- Game Design-II (Pr)

1) **Prepare game design documentation**
   Purpose of design documents
   Document layout
   Level Desing Document
   Technical Desing Document
   ProductionDocument

2) **Present a game concept to stakeholders**

3) **Sound Design basics**
   ADR, sound effects, foley, Ambience recording, sampling, synthesis,

4) **Audacity software**
   Recording & editing sounds, creating a flawless loop, laying sounds on time line, mixing sounds together, inventing new sounds using sampling, inventing new sounds using synthesis

References

Game Sound
Games As A Service: How Free to Play Design Can Make Better Games

THIRD YEAR

Semester- V

BCA-571- Multiplayer Programming(Pr)

1) **Intro to Networking**
   Protocol stack, TCP/IP, UDP, Latency

2) **Saving Data between scene in unity**
   Carry forward data to one scene to another, Using Singleton method to save the data

3) **Saving Data in local server**
   saving Game data to local server while exiting **,** how to retrieve data from local server

4) **Creating Multiplayer Game in unity**
   Implement server creation & joining an existing host, How to find active host , how objects can be created on the network, Network communication, Remote Procedure Calls, Creating multiplayer Game using Unity

References

Unity Multiplayer Games

BCA-572- Distribution & Marketing (Th)

1) **Introduction to Game Marketing**
   Finding the audience, Addressing your market, Go to market plan-, Choosing a development platform-Unity, When to begin marketing, Finding a publisher

2) **Pre-release Marketing**
   Development blog, Beta release/sales, Game Website, Game Trailer-You Tube

3) **Post-release Marketing**
   Competition's, PR, Player Reviews, Paid promotions, Networking-Industry professionals, Game news sites, Game events

4) **Social Media Marketing**
   Podcasts, Development updates-Screenshots/Images, Facebook Updates & Facebook ad page, Twitter updates

5) **Digital Distribution**
   Steam, Kongregate, multiple store Submission-Digital Stores

6) **Mobile App stores**
   Google Play, Apple Store

7) **Specialty Distributors**
   Sytherine, Facebook

8) **Marketing Plan**
   Preparing a Marketing plan, Devising a distribution strategy

BCA-573- Game Development – IV (Pr)

1) **Introduction to Cocos2D-X**

2) **Adding Scenes**
   Creating new scenes, Manipulating scenes

3) **Scene workflow in Cocos2d**
   Splash Scene , Game Scene , Game Over Scene

4) **Using Sprite sheet in Cocos2D**

5) **Developing Game using C++ in Cocos2D**
   Navigation of characters, Collision detection, Physics in Cocos2D (Box2D), Scene Navigation , Understanding Retina / non-retina image creation, Adding Sound effect , Loading & Playing Background Music, Setting up the accelerometer, create custom Cocos2d actions, Publishing Game for Mobile platforms

References

Cocos2D Game Development Essentials
Cocos2d Game Development Blueprints

BCA-574 - Career Development (Th)

1) **Job Role in Game Industry**
   Developer roles
   - game design
   - lead designer
   - UI Designer
   - 3D Artist
   - 2D Artist

   Publisher roles
   - external producer
   - marketing director
   - production scheduler
   - project coordinator

   Game tester roles
   - game tester
   - senior tester
   - quality assurance manager

2) **Terms and conditions of employment**
   Working patterns - full-time - part-time – freelance – Casual - working from home, Recruitment methods - industry-specific recruiters – advertising – networking - word of mouth

3) **Creating Portfolio**

References

Game Development Essentials: Game Industry Career Guide by Jeannie Novak

BCA-576 - Project Management (Th)

1) **Project Management Overview**
   The PMO's Mission, What Is A Project, What Is Project Management, What Is A Project Management Life Cycle, Elements of Successful Project Management, Deliverables Typically Produced for Each PMBOK Knowledge Areas.

2) **The Role of the Project Manager**
   Your Responsibilities as Project Manager, Common Challenges You Can Expect to Face, Skill Requirements of the Project Manager, Functional Competencies of the Project Manager, The Project Manager's "Unofficial" Job Duties, The Value of Introspection and Self-Awareness to "The Soft Side".
3) **Building and Maintaining an Effective Team**
   The Mechanics of Building a Team, Team Leadership Starts on Day One!, Fostering Teamwork and Synergism, Getting the Most from Individual Team Members.

4) **Preparing a Detailed Project Plan: Step by Step**
   Identifying What Needs to Be Done, (Scope Management), Identifying How Long It Will Take to Do Everything (Time Management), Identifying How Much It Costs to Get Things Done, (Cost Management), What About Project Management Software?.

References

http://www.free-management-ebooks.com/dldebk-pdf/fme-project-principles.pdf
http://group27.narod.ru/ucheba/files/McGraw_Hill-Project_Management.pdf

Semester- V

BCA-671 - Internship + Viva
BCA-672 - Elective - I - Final Project / Viva (Game Development)
BCA-673 - Elective - II - Final Project / Viva (Mobile App Development)