



ANIMATIONS USING JAVASCRIPT

During these classes, the students will explore the drawing commands of JavaScript and write code in text based environment to create beautiful landscapes and drawings. They will then learn how to create simple animations using sprites.

SESSION	CONCEPT	SKILLS
1	Cartesian coordinate system	Exploration Explore the JavaScript platform, basic drawing commands
2	Shapes and Angles	Creativity, Decomposition Create art by superimposing shapes
3	Variables, Random numbers	Numeracy, Computation Use random numbers to get different outputs
4	Functions	Abstraction Define and use functions in the code to do specific tasks.
5	Draw Loop	Generalization, Pattern recognition Write code to create animated shapes
6	Objects, Properties	Abstraction, Creativity Manipulating sprite properties to create gif images
7	Counter Pattern	Numeracy, Decomposition Use the counter pattern to animate sprites
8	Conditionals	Logic, Decision making Use conditionals to control the sprite's state
9	Project Work	
10	Formative Assessment	Assessment of learning



GAME DESIGN USING JAVASCRIPT

During these classes the students will learn how to manipulate sprite properties and use events to create interactive games in JavaScript.

SESSION	CONCEPT	SKILLS
11	Events-I	Logic Use edge detection to restrict the sprite within the canvas
12	User Input-I	Logic, Generalization Use mouse events to create a simple clicker game
13	User input-II	Logic, Generalization Use key events to control the sprite using keyboard keys
14	Game Design	Algorithms, Decomposition Plan the interface, layout and create UI of the game
15	Game Development	Generalization, Persistence Complete the UX code for the game
16	Variables	Numeracy Add variables to store the game score
17	Debugging	Problem solving, Persistence Test and debug the game
18	Project-I	Step-wise thinking, Decomposition Plan the UI, levels, algorithm of their own game
19	Project-II	Logic, Persistence Write code for the different levels of their game
20	Course review and feedback	



INTRODUCTION TO PYTHON PROGRAMMING

During these classes, students will learn the basic concepts of python such as sequencing, loops, conditionals, functions, variables. They will write code to create graphical projects using the turtle library commands. They will also apply basic mouse and key events and write code to create simple animations and interactive games.

SESSION	CONCEPT	SKILLS
21	Introduction to the Python programming interface	Exploration, Sequencing Turtle Navigation
22	Cartesian Coordinate system	Numeracy Understanding graphical axis
23	Loops	Creativity, Pattern recognition Loops to create Geometric shapes
24	Nested Loops	Creativity, Pattern abstraction Nested Loops to create beautiful Mandala patterns
25	Conditionals	Decision making Use of conditionals in programming
26	Formative assessment	Assessment of learning
27	Functions	Abstraction Functions to build on existing Patterns
28	Keyboard Events-I	Logic Programming Keyboard events 1
29	Keyboard Events-II	Logic, Generalization Programming Keyboard events 2
30	Mouse Events-I	Logic Programming Mouse events 1
31	Mouse Events-II	Logic, Generalization Programming Mouse events 2
32	Reinforcement of concepts	Decomposition, Generalization Design the drawing application, add Notification Panel
33	Reinforcement of concepts	Logic Complete the coding of the drawing application



34	Time function	Logic, Creativity Build a Timer
35	Variables	Numeracy Add Scoring to an application
36	Project Work- I	Step-wise thinking, Creativity Start making an Interactive Game using Events
37	Project Work- II	Pattern recognition, Creativity Game Setup
38	Project Work-III	Logic, Problem solving Game Logic
39	Project Work-IV	Perseverance, Presentation Putting the Game together
40	Course review and feedback	

ADVANCED PYTHON PROGRAMMING

During these classes, students will explore advance python concepts such as data types, type casting, and basic data structures like tuples, lists and dictionaries. This course also gets them ready for the AI and machine learning module in which they will be exploring the CV2 library of python.

SESSION	CONCEPT	SKILLS
41	User Input, command line functions	Sequencing, Exploration Introduction to Python and text based programming. Play with simple command line functions and create a simple chatbot that prints your bio.
42	Data types	Numeracy, Logic Use Python Dictionaries and basic datatypes and create a virtual pet
43	Type Casting, Conditionals	Abstraction, Logic, Decision making Use conditionals and create functions to create the virtual pet



44	While Loop, String basics	Pattern recognition Use loops and string functions to create a password checker
45	For Loops	Step-wise thinking Use for loops to perform word search in text
46	Advance string operations	Logic, Generalization Use string operations to create a secure password generator project
47	Lists	Decomposition, Problem solving Continue the coding of the secure password generator project.
48	Nested Conditionals	Decision making, Problem solving Complete the project, test and debug it.
49	Nested Loops	Pattern abstraction, Decomposition Create a program to generate math tables
50	Formative Assessment	Assessment of learning
51	Functions with Arguments	Abstraction Start the dice game project
52	Errors and Debugging	Logic, Problem solving Complete, test and debug the dice game project.
53	Concepts reinforcement	Practice Problems to reinforce the concepts learnt so far.
54	List to String and String to List conversion	Pattern recognition, Logic Create a playlist editor.
55	Random numbers	Step-wise thinking, Numeracy Write simple algorithms for number manipulations, generate random numbers, detect duplicates to make a number sorter
56	Flags and Toggle variables	Step-wise thinking, Logic, Decomposition Algorithm to create flags for toggle style variables. Start the palindrome project
57	Function scoping- Global vs Local variables	Logic, Abstraction Complete the palindrome project



58	Project Work-I	Step-wise thinking, Logic Start 'Decode Secret Messages' project
59	Project Work-III	Problem solving, Perseverance Complete, test and debug the project.
60	Course review and feedback	

ARTIFICIAL INTELLIGENCE

This module opens students up to the world of AI and Machine Learning. They explore different google AI experiments such as AutoDraw, Infinite drum machine, etc. to understand how machine learns. They then create on voice, image and text recognition projects using teachable machines and Scratch. They then dive deeper into how computer visualizes images and create various image and video manipulation projects using the CV2 library of python.

Module 1 : Introduction to AI and Machine Learning

SESSION	CONCEPT	PROJECTS
61	Introduction to the big ideas of Artificial Intelligence	AI Perception Understand perception and sensors, Playing with a Drawing AI and analysing the data that powers it
62	Design a rule based emotion detector, Evaluate its scalability and discuss the limitations	Build Rule Based System, AI Representation Create a simple Sentiment Analysis program
63	Design classification labels and providing training data	Build AI Classifier, Data Collection Improving the Sentiment Analyser with Machine Learning, Playing with Music AI experiments
64	Introduction to Machine Learning and understanding its basic components	Machine Learning fundamentals Investigating existing Machine Learning systems from Recommendation engines to Spam filters
65	Compare tasks computers can do better than humans and vice versa to understand the idea of intelligence.	Explore Artificial vs Human Intelligence Make a Smart Home system to control virtual devices



Module 2 : Learning from Data in Machine Learning		
SESSION	CONCEPT	PROJECTS
66	Convert the Smart Home system to a Machine Learning based model which can learn on its own from data.	ML Project Cycle Analyse results from Smart Home system to plan Iteration for revising the data improve the accuracy
67	Understand the idea of confidence in Machine Learning analysis. Add speech recognition abilities to the Smart Home system to be able to take voice commands.	ML Confidence Threshold, Data Selection Implement the enhancement for Smart Home system, adding confidence threshold to the decision making algorithm
68	Make Face Detection programs which detects faces and facial features in an image or from the webcam feed and creatively replaces them with smileys etc.	ML Pre-trained Models Make a face detection program using a machine learning model pre-trained on a dataset of 400,000 face images
69	Plan and implement an object recognition program based on the machine learning knowledge gained thus far. Discuss the anomalies and how to fix them.	ML Data Variance, Designing own Classifier Design own classifier to automatically distinguish between various Fruits
Module 3 : Image Representation - Colors & Pixels		
SESSION	CONCEPT	PROJECTS
70	Understand how images are represented on digital devices.	Image Representation Understanding an Image as an ordered collection of pixels
71	Understand the RGB color scheme, image resolution and depth of images.	Image Bit Depth Create simple images starting from black & white images to RGB color images
72	Understand how images are coded and how to read the image data like image size, depth and color values.	Understand Image Data Read image data and print specific parts of the image



73	Introduction to Python's OpenCV image processing library.	Python's Image Processing Library Use Python's image processing library to apply the above learnt principles
74	Understand how to create own image data and use it to manipulate existing images.	Image Manipulation Make simple modifications to existing images like creating overlays and cropping images
Module 4 : Image Processing		
SESSION	CONCEPT	PROJECTS
75	Combining two images in different ways to create new images.	Image Overlay Adding logos & watermarks to images programmatically
76	Understand how to use OpenCV's event handlers to interact with an image.	Event Based Programming Read image data and modify it in an interactive application
77	Understand how to modify image brightness, sharpness, color scheme etc. to create interesting effects and filters.	Image Filters Create Instagram style filters by modifying image pixel values
78	Understand how to search for a feature in an image and apply filter to the identified image segments.	Image Segmentation Change colors of specific objects in an image
79	Understand how the 'green screen' is used in movies like Avengers to create special effects.	Green Screen Replicate special effects scenes from movies like Avengers, Superman
80	Understand how video processing works by going through a video frame by frame.	Video Processing Create a Harry Potter style invisibility cloak
Module 5 : Teachable Machine		
SESSION	CONCEPT	PROJECTS



81	Use above principles to design own Image Classifier project end to end.	Create own Image Classifier project
82	Use above principles to design own Audio Classifier project end to end.	Create own Audio Classifier project
Module 6 : Machine Learning Algorithms		
SESSION	CONCEPT	PROJECTS
83	Understand what goes behind the scenes in the Machine Learning applications created so far.	Machine Learning Algorithms Create own simple Machine Learning algorithms
84	Understand one of the ML algorithms, Decision Trees in depth to see how machines learn on their own.	Decision Trees Create a sorting ML application and see the Decision Tree at the heart of it
85	Understand how internet search engines like Google, Bing work to power the web.	Searching Algorithms Create own simple Searching algorithm
86	Understand how real world dynamic systems learn from data on the fly.	Mapping State Space Understand how self-driving cars work
87	Explore the question of Ethics & Bias in AI applications via case studies of face detection algorithms, platforms like YouTube etc.	Ethics & Bias in AI
88	Introduction to Neural Networks and Deep Learning responsible for the AI & ML revolution over the last decade.	Introduction to Neural Networks
89	Revise the concepts covered thus far and prepare for the upcoming Review	
90	Take Review for the AI course, Reflect on the course learnings and discuss the future of AI	



ANDROID APP DEVELOPMENT

This course introduces students to the basics of App development using Thunkable platform. They learn how to use API's and create android and IOS compatible apps which can be published on the playstore.

SESSION	CONCEPT	SKILLS
91	Introduction to the interface of the App Designing platform to be used	Exploration, Creativity, Logic Add components and set their properties, do the screen layout work in terms of organizing components in rows and columns App: Speech to Text converter
92	Introduction to Event driven programming	Generalization Program the components to react when clicked. Build in speech to text conversion from previous project into a language translator
93	Lists and List viewer	Pattern recognition, Generalization Add a list of source languages and of target languages, and ability for user to choose a language from them Add Text to Speech ability, to hear the Translation from the language translator
94	Basic UI components	Creativity Embed Animations on screen, create various screen navigation options to make an interactive app to change the screen color, based on understanding of the RGB color scheme
95	Audio and Video component	Decomposition, Logic Use various media types like audio, video, images and learn how to embed them in an App
96	Wireframe design	Creativity, Step-wise thinking Make Wireframe sketches to plan out the screens of the Quiz app.
97	Project Work-I	Logic Finish App screens design and start coding them
98	Project Work- II	Numeracy Plan and use the database for the quiz app



99	Project Work -III	Problem solving Create a bugs and features list for the quiz App made earlier Test thoroughly and populating the Bugs & Features list and debug the code
100	Course review and feedback	

WEBSITE DESIGN AND DEVELOPMENT

During this course students will get hands-on experience of planning, implementing and testing a series of web pages with HTML, CSS and JavaScript. They will start planning and developing their very own website, starting from the very first session. Towards the end of the course, they will be able to create a fully functional website, which we will be proud to host on the PurpleTutor domain.

SESSION	CONCEPT	SKILLS
101	The Internet and World Wide Web	Exploration Information on how does the internet work, the server-client model that powers the web to serve the vast network of websites and much more
102	What is HTML, CSS	Structuring Introduction to basic HTML tags, Introduction to CSS
103	CSS Selectors, Hyperlinks	Classification and Targeting Explanation and use of basic CSS selectors: element, id and class, Introduction to hyperlinks
104	CSS font properties	Formatting Description of the font-families and font properties
105	Grouping Elements	Grouping Description of the two grouping elements - HTML tags, span and div, and their uses
106	Div and the CSS - Box Model	Layouting Sizing a div explained, the Box Model properties of margins, borders and padding explained, how to make circular/oval images
107	Floating Elements	Aligning Placing elements next to each other



108	Positioning Elements	Planning and Visualization Demonstration of another way to lay out elements on a page, by positioning them, discussion of the different positions elements can take
109	Lists in HTML	Sequencing Introduction to lists, using different kinds of lists
110	Lists and Hyperlinks	Ordering Continuation of lists, using images as bullets, Creation of lists of hyperlinks for navigating through the website, Making a horizontal list
111	Tables	Nested Layouting Introduction to tables, Creation of a table, Styling of tables using borders and colors.
112	Assessment	Short Review Assessment of learning
113	Website Design	Basics of Designing Discussion about good web designing techniques, Remodelling the home page
114	CSS: Transformations	Creativity Learning the different ways of transforming elements on the page
115	CSS:3DTransformations and Transitions	3D Visualization Learning 3D transform methods and how to apply transitions to elements, over a time duration
116	CSS: Transition with Transform	Creative Problem Solving Combining transitions with transforms for added effect
117	CSS: Animation (Part One)	Spatial Visualization How to animate elements using the various animation properties
118	CSS: Animation (Part Two)	Spatial Visualization Continuation of animation properties
119	CSS: Text Animation	Spatial Visualization Animating text in different ways
120	Buttons	Aesthetics and Styling Adding buttons, style and animate them



121	Assessment	Short Review Assessment of learning
122	The Flexbox Layout Module	Advanced Layouting Exploring flexbox container properties
123	The Flexbox Layout Module	Advanced Layouting Exploring flex items properties
124	Website layout using flexbox	Advanced Layouting Applying flexbox properties to website
125	Responsive web design - RWD	Responsive Designing Basic Principles of designing fluid content for different devices. Making responsive images
126	RWD : Media Queries (Part One)	Responsive Designing Using the Media Queries for achieving RWD, adding breakpoints, changing orientation depending upon browser orientation
127	RWD: Media Queries (Part Two)	Responsive Designing Using the Media Queries for hiding elements, changing the font size, Making images responsive
128	CSS Grid (Part One)	Wire framing, Design Planning Exploring CSS-Grid container and item properties
129	CSS Grid (Part Two)	Wire framing, Design Planning Applying grid properties to website
130	Assessment	Short Review Assessment of learning
131	JavaScript review and Introduction to DOM	Exploration of Object Oriented Paradigm Recap of JavaScript as a coding language. Intro to JavaScript as used with HTML/CSS, The DOM-Document Object Model
132	DOM access: Using JavaScript functions	Exploration of Object Oriented Paradigm Changing elements with JavaScript functions after finding them by Id, by tag name, by class selectors
133	DOM Modification	Manipulating Objects Changing elements with JavaScript functions



134	DOM Modification	Event Based Programming Changing the attributes, styles using functions
135	DOM Modification	Creating classes for changing the styles, using inner HTML and text Content, and the difference between them
136	DOM Events	Event Based Programming How to generate and register events
137	HTML Forms and applying events to forms	Event Based Programming Form creation and identifying events to be created
138	Using events in forms	Event Based Programming Applying events for form submission
139	Student Project	Problem Solving, Application Project website work completion
140	Student Project	Problem Solving, Application Project website work review and submission

3D ANIMATION AND GAME DESIGN

During these classes, the students will learn the basics of 3D designing in the Roblox studio. They will learn to create 3D objects and scenes. They will also learn the basic commands of LUA programming script to create different animations and a maze game.

SESSION	CONCEPT	SKILLS
141	Digital Citizenship	Exploration Cyber security, Software Set-up
142	Introduction to Roblox Studio	Exploration, Visualization Getting familiar to the 3D Game designing platform
143	Working with 3D Parts	Creativity, Spatial Visualization Putting 3D parts together to build an obstacle course
144		

Learning Path For EARLY ACHIEVERS



145	Creating game levels	Creativity, Logic Creating multiple check points that serve as the milestones for the player
146	LUA Coding fundamentals	Computational Thinking Learning how to code using Lua programming language : Loops, Functions, Variables
147		
148	Developing the Game theme	Creativity, Imagination Adding an ambience to the game
149		
150	Deadly Lava	Creativity, Logic Making the game adventurous by introducing Lava lands and touch events
151	Getting Started with building a Maze	Step wise Thinking Planning of a 3D Maze game
152	Create a score system	Numeracy, Critical thinking Adding collectable items, enemies and score board to the game
153		
154	Build the Maze	Persistence, Problem Solving Completing the construction of the Maze as per the plan
155		
156	Finish Line	Persistence, Generalization Building the destination for the Maze
157		
158	Blocked Door	Logic, Computation Making the game more adventurous by adding an obstacle door to reach the destination. Making use of coding a closed door which opens only if the player satisfies certain conditions.
159	Introduction to World Building	Exploration Getting familiar with the components of 3D scene building
160		
161	Plan and Get started	Imagination, Step-wise Thinking Plan an adventure game and the scenes that are involved

Learning Path For EARLY ACHIEVERS



162	Visual Effects	Creativity, Exploration Working with shadows and lights , Learning to blur / deepen / sharpen the visual effects
163	Building a fireplace	Visualization, Generalization Use of 3D game designing techniques to build a fireplace
164		
165	Beautification	Creativity, Decomposition Learning about Decals and Textures : Adding details to the game ambience like Trees , Chairs, Tables, Lamps, Wallpapers
166		
167	Completion	Persistence Working with sound effects
168		
169	Basics of Roblox Animation	Exploration What is animation? Introduction to the basics of 3D Animations in Roblox
170		
171	Creating animations	Creativity, Step-wise Thinking Plan and build your first animation in Roblox. Ex: A human performing an action of swimming/dancing/walking etc.
172		
173	Export and play	Generalization, Problem-solving Learn how to export your animation to the game. Modify your game theme, Export and play
174		
175	Scripting Game Mechanics	Computational thinking, Logic Application of Lua Coding to achieve game outcomes
176		
177	Connecting the dots	Generalization, Logic, Critical Thinking Weaving together the game parts to finish the game
178		
179	Game assessment and feedback	Problem-solving, Persistence Game feedback and modification
180	Publish the game	Publish and Play



DATA SCIENCE FUNDAMENTALS

These classes make the students ready to learn the data science concepts and methods using Python programming language. Students will explore the different python modules, file handling and the basic statistical methods that will be used to analyse data in the next course.

181	Introduction to Python modules	Exploration What are python packages. Introduction to introduction, _main_ packages.
182	Introduction to python packages	Generalization Programming using packages
183	Introduction to python packages	Numeracy What are modules. Use of statistics module functions
184	Introduction to the math module	Exploration, Numeracy Introduction to the math module functions
185	Math module functions	Computational Thinking Programming using math module functions
186	Introduction to the random module	Exploration, Numeracy Introduction to Random module functions
187	Random module functions	Computational Thinking Programming using Random module functions
188	Error handling	Problem solving, Persistence What are errors. Types of errors and how to debug them
189	Assessment	Assessment of Learning
190	Introduction to files	Exploration Basic introduction of files, types of files, file modes, errors in files.
191	Working with text files-II	Generalization, Step wise Thinking What are text files, how open and close files, reading and writing text files
192	Working with binary files-I	Generalization, Step wise Thinking What are binary files, how open and close files, reading and writing binary files



193	Working with binary files-II	Logic, Computational Thinking Use of pickle module, file access modes.
194	Assessment	Assessment of Learning
195	Data and its purpose, importance of data, types of data - structured, unstructured, structured data types - quantitative and qualitative data	Grouping, Abstraction Data and its purpose, importance of data, types of data - structured, unstructured, structured data types - quantitative and qualitative data
196	Data processing cycle	Logic, Step wise Thinking Understanding the stages of data processing cycle
197	Basic statistical methods for understanding data - Mean, Median, Mode, Standard Deviation and Variance	Computational Thinking, Numeracy Programming using Mean, Median, Mode, Standard Deviation and Variance
198	Basic statistical methods for understanding data - Mean, Median, Mode, Standard Deviation and Variance	Computational Thinking, Numeracy Programming using Mean, Median, Mode, Standard Deviation and Variance
199	Assessment	Assessment of learning
200	Course Review and Feedback	