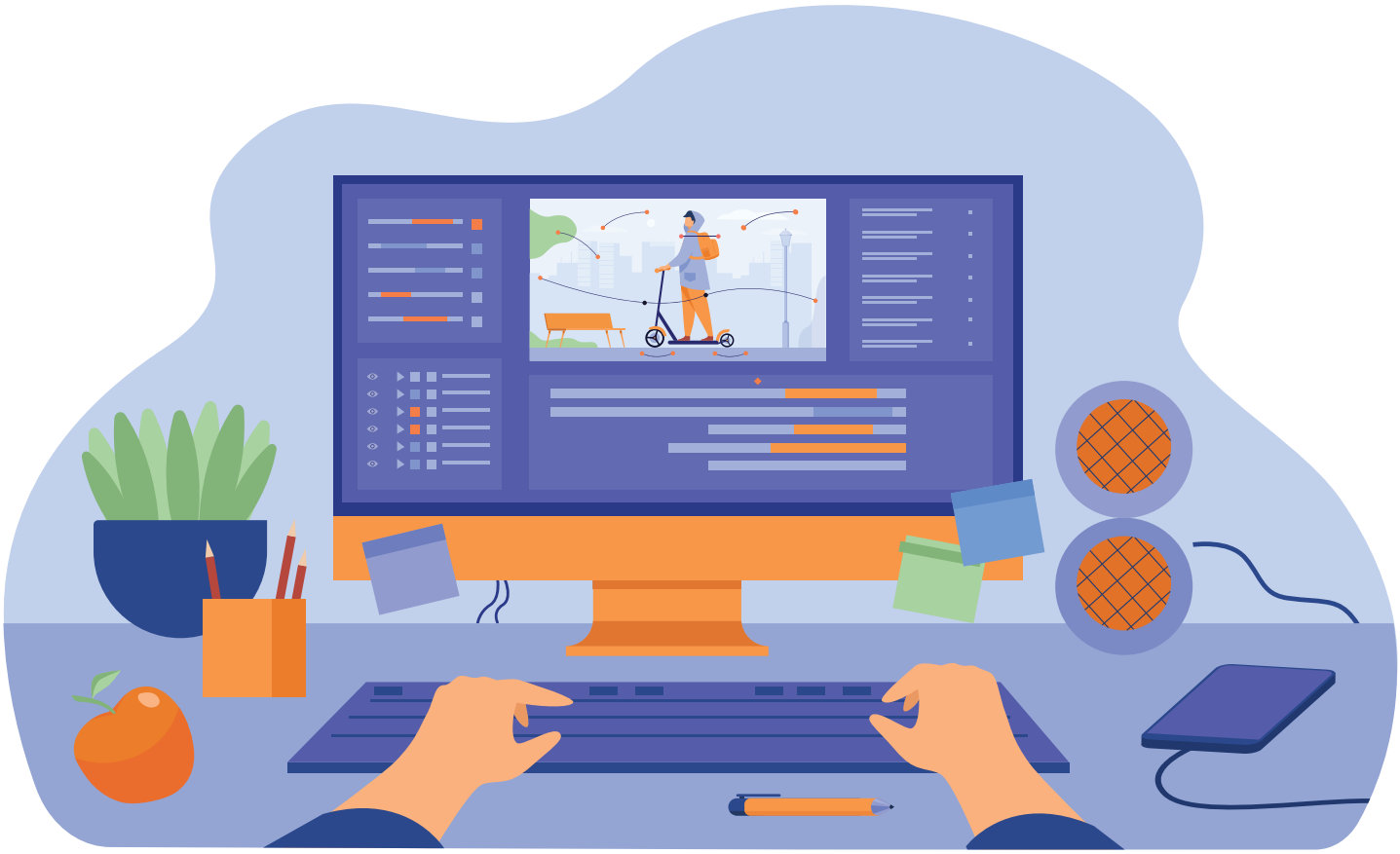
National Curriculum of Pakistan
2022-23

COMPUTER GRAPHICS AND ANIMATION

Grades 9-12



NATIONAL CURRICULUM COUNCIL SECRETARIAT
MINISTRY OF FEDERAL EDUCATION AND
PROFESSIONAL TRAINING, ISLAMABAD
GOVERNMENT OF PAKISTAN

بسم الله الرحمن الرحيم

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It is with great pride that we, at the National Curriculum Council Secretariat, present the first core curriculum in Pakistan's 75-year history. Consistent with the right to education guaranteed by Article 25-A of our Constitution, the National Curriculum of Pakistan (2022-23) aspires to equip every child with the necessary tools required to thrive in and adapt to an ever-evolving globalized world.

The National Curriculum is in line with international benchmarks, yet sensitive to the economic, religious, and social needs of young scholars across Pakistan. As such, the National Curriculum aims to shift classroom instruction from rote learning to concept-based learning.

Concept-based learning permeates all aspects of the National Curriculum, aligning textbooks, teaching, classroom practice, and assessments to ensure compliance with contemplated student learning outcomes. Drawing on a rich tapestry of critical thinking exercises, students will acquire the confidence to embark on a journey of lifelong learning. They will further be able to acknowledge their weaknesses and develop an eagerness to build upon their strengths.

The National Curriculum was developed through a nationwide consultative process involving a wide range of stakeholders, including curriculum experts from the public, private, and non-governmental sectors. Representatives from provincial education departments, textbook boards, assessment departments, teacher training departments, *deeni madaris*, public and private publishers, private schools, and private school associations all contributed their expertise to ensure that the National Curriculum could meet the needs of all Pakistani students.

The experiences and collective wisdom of these diverse stakeholders enrich the National Curriculum, fostering the core, nation-building values of inclusion, harmony, and peace, making the National Curriculum truly representative of our nation's educational aspirations and diversity.

I take this opportunity to thank all stakeholders, including students, teachers, and parents who contributed to developing the National Curriculum of Pakistan (2022-23)

Dr. Mariam Chughtai
Director
National Curriculum Council Secretariat
Ministry of Federal Education and Professional Training

Computer Graphics and Animation
Progression Grid
9-12

Domain A: Display technologies.

Standard 1: Analyze the traditional and modern display technologies used in graphic design.

Grade 9	Grade 10	Grade 11	Grade 12
Benchmark I: Students will be able to analyze traditional and modern display systems and the working principle of graphics processor(GPU).		**Benchmark I**: Students will be able to identify emerging display technologies & future needs.	
Student Learning Outcomes			
[SLO:CGA-09-A-01]: Define the concept of pixels and resolution from the perspective of display devices. [SLO:CGA-09-A-02]: Identify the components of CRT monitors such as electron gun, cathode, deflection yoke, phosphorus coating,	[SLO:CGA-10-A-01]: Define the concept of Graphic Processors (GPU) [SLO:CGA-10-A-02]: Explain the purpose and applications of Graphic Processors (GPU) [SLO:CGA-10-A-03]:	[SLO:CGA-11-A-01]: Define the concept of foldable display systems. [SLO:CGA-11-A-02]: Identify 5 manufacturers of foldable display systems. [SLO:CGA-11-A-03]:	[SLO:CGA-12-A-01]: Define next generation display technologies such as: Quantum-dot display LED (QD-LED) Electroluminescent quantum dots (ELQD, QDLE, EL-QLED)/AMQLED. [SLO:CGA-12-A-02]: Explain the advantages of quantum dot display technologies over all existing display systems.

focusing system and deflection plates. [SLO:CGA-09-A-03]: Explain the working principle of CRT monitors such as electron gun, cathode, deflection yoke, phosphorus coating, focusing system and deflection plates. [SLO:CGA-09-A-04]: Define the basics of Flat panel display systems [SLO:CGA-09-A-05]: Identify the working principle of Flat panel display systems such as: liquid crystals displays (LCDs) , light emitting diodes (LEDs) and plasma panels. [SLO:CGA-09-A-06]: Explain the advantages of Flat panel displays over Cathode Ray-tube	Identify the components of Graphics Processors; memory interface, digital to analogue converter, cooling device, graphics connectors and PCI [SLO:CGA-10-A-04]: Identify the functionality of the given components of Graphic Processors; memory interface, digital to analogue converter, cooling device, graphics connectors and PCI Graphics Card [SLO:CGA-10-A-05]: Define the concept and usage of projection displays. [SLO:CGA-10-A-06]: Identify the components of projection displays	Explain the usage of polymer plastic (polyimide (PI)) in composition of foldable display systems. [SLO:CGA-11-A-04]: Identify and describe display technologies for gaming including: OLED (Organic Light Emitting Diode), QLED (Quantum Dot LED) and AMOLED (Active Matrix Organic Light Emitting Diode). [SLO:CGA-11-A-05]: Identify and describe display technologies for movies and streaming, such as: 4K UHD (Ultra High Definition) and HDR (High Dynamic Range). [SLO:CGA-11-A-06]: Identify and describe main display	[SLO:CGA-12-A-03]: Discuss the concept of quantum dots as artificial atoms. [SLO:CGA-12-A-04]: Explain the elemental composition of quantum dots, mainly lead sulfide, lead selenide, cadmium selenide, cadmium sulfide, cadmium telluride, indium arsenide, and indium phosphide. [SLO:CGA-12-A-05]: Compare all quantum dots with LCD, LED and OLED systems with their pros and cons. [SLO:CGA-12-A-06]: Identify and describe the display technologies used for business presentations such as: Interactive Display Systems, Wireless Presentation Solutions and 4K laser Projectors. [SLO:CGA-12-A-07]: Describe the future demands of display devices from the perspective of the user.

(CRT) based systems. [SLO:CGA-09-A-07]: Define the basics of Random Scan Display Systems [SLO:CGA-09-A-08]: Identify the working principles of Random Scan Display i.e, the construction of display through electronic beam on specific area of screen. [SLO:CGA-09-A-09]: Explain Video controller and its components [SLO:CGA-09-A-10]: Identify the difference between display processor and video controller.	such as: LCDs, arc lamps and lenses. [SLO:CGA-10-A-07]: Describe LED technologies including Organic LED (OLED) and micro LED. [SLO:CGA-10-A-08]: Explain the composition of OLEDs. [SLO:CGA-10-A-09]: Discuss the concept of Micro LED (µLED). [SLO:CGA-10-A-10]: Identify micro-LED as an emerging display system with multiple advantages including vivid colors, enhanced contrast, and wider color gamut, while also being energy-efficient.	technologies for graphics designs such as IPS (In-Plane Switching), Adobe RGB and sRGB Colour Gamuts and Calibration Capabilities that allows designers to fine-tune color accuracy to their preference. [SLO:CGA-11-A-07]: Explain the working mechanism of IPS (In-Plane Switching). [SLO:CGA-11-A-08]: Discuss the advantages and disadvantages of all above mentioned display systems.	

Domain B: Graphics

Standard 1: Apply the collected knowledge about 2D and 3D design to Design 2D and 3D images and logos.

Grade 9	Grade 10	Grade 11	Grade 12
Benchmark I: Students will be able to design and manipulate 2D and 3D graphics		**Benchmark I**: Students will be able to design a 3D image and professional logo	
Student Learning Outcomes			
[SLO:CGA-09-B-01]: Define the concept of Raster Graphics and Vector Graphics. [SLO:CGA-09-B-02]: Explain the basic design principles of both graphics categories. [SLO:CGA-09-B-03]: Describe the concept of	[SLO:CGA-10-B-01]: Define the concept of powerpoint design and its importance. [SLO:CGA-10-B-02]: Add 3D graphics on their slides about their favorite sports. [SLO:CGA-10-B-03]: Explain the importance of color	[SLO:CGA-11-B-01]: Define the concept of 2D arrays (grid) in digital graphics as a collection of rows and columns. [SLO:CGA-11-B-02]: Design an algorithm for creating 2D and 3D graphics.	[SLO:CGA-12-B-01]: Define image operations: Image Dimension, Image aspect ratio, Image color space, Image type and Image Crop of 3D images. [SLO:CGA-12-B-02]: Define linear and non-linear operations on image. [SLO:CGA-12-B-03]: Discuss mathematical formation and representation of image in the form of matrix.

Pixel and Path in graphics. [SLO:CGA-09-B-04]: Explain Primary (Red, Blue and Green), Secondary Colors, and tertiary colors (Mainly CMYK) [SLO:CGA-09-B-05]: Identify minimum 20 possible color combinations available for digital graphics. [SLO:CGA-09-B-06]: Analyze different graphic extensions such as : JPG, JPEG, GIF and TIFF. [SLO:CGA-09-B-07]: Explain 5 major elements of computer graphics: Line, shape, form, texture, space, imagery, typography and color.	scaling for visualization of data. [SLO:CGA-10-B-04]: Identify major color palettes and their details for implementing. [SLO:CGA-10-B-05]: Design 2D images and apply rotation, scaling and enhancement using any free software. [SLO:CGA-10-B-06]: Apply image compression on their 2D images ‘without degrading image data. [SLO:CGA-10-B-07]: Create 3D graphics on any free application software. [SLO:CGA-10-B-08]:	[SLO:CGA-11-B-03]: Design a 2D image and apply graphics processing including frame disposal, auto crop and maintain quality of image while resizing it. [SLO:CGA-11-B-04]: Apply image enhancement techniques including noise reduction, adjust sharpness and brightness using any application software. [SLO:CGA-11-B-05]: Apply remove background and change background operations on image using web applications. [SLO:CGA-11-B-06]: Compare raw image	[SLO:CGA-12-B-04]: Apply gaussian filter manually on 2D image with complete dry-run. [SLO:CGA-12-B-05]: Apply image slicing and layering to get knowledge of each layer. [SLO:CGA-12-B-06]: Contrast 2 different images and merge them using free application software. [SLO:CGA-12-B-07]: Design image on a software named blender and convert that image into 3D. [SLO:CGA-12-B-08]: Identify requirements of a professional logo based on academic organizations. [SLO:CGA-12-B-09]: Design a professional 3D logo of their school as a project on Adobe Illustrator..

[SLO:CGA-09-B-08]: Create simple vector images on Inkscape and LibreOffice Draw. [SLO:CGA-09-B-09]: Define 2D graphics and 3D graphics [SLO:CGA-09-B-10]: Identify x, y and z axis plotting for 2D and 3D graphics. [SLO:CGA-09-B-11]: Design 2D image on Canva application. [SLO:CGA-09-B-012]: Design a 3D model on SketchUp Free as a class project. Note: Suggested free softwares for practicals:	Identify 3 main dimensions, height, width and depth for designing 3D graphics. [SLO:CGA-10-B-09]: Identify 2 main components of 3D graphics i.e, wireframe (skeleton) and texture (surface). [SLO:CGA-10-B-09]: Design a 3D wireframe on a grid that supports extensions like VTK & HDF. [SLO:CGA-10-B-10]: Design a 3D logo on the application named 3D Coat as a project. [SLO:CGA-10-B-11]: Describe the concept of Holograms.	and enhanced image, write 5 differences. [SLO:CGA-11-B-07]: Explain 3D modeling and 3D rendering. [SLO:CGA-11-B-08]: Design 3D image and adjust image lighting, shading and rotation for artistic effects. [SLO:CGA-11-B-09]: Discuss the effects of shading by varying the level of darkness. [SLO:CGA-11-B-010]: Design 3D artistic image of their favorite cartoon character as a project.	

• Inkscape • LibreOffice Draw • Canva • SketchUp Free			

Domain C: Audio and Video

Standard 1: Apply the concepts of audio and video to create podcasts and interactive videos,

Grade 9	Grade 10	Grade 11	Grade 12
Benchmark I: Students will be able to identify different types of audio and video editing tools.		**Benchmark I**: Students will be able to design an interactive video.	
Student Learning Outcomes			
[SLO:CGA-09-C-01]: Define the concept of sound and audio along with its types.	[SLO:CGA-10-C-01]: Explain sound waves, frequency, volume, amplitude. [SLO:CGA-10-C-02]:	[SLO:CGA-11-C-01]: Describe the concept and usage of interactive videos.	[SLO:CGA-12-C-01]: Design an interactive video based quiz of their favorite subject and share it with their friends.

[SLO:CGA-09-C-02]: Identify the components of analogue audio such as signal levels, sound wave, continuous stream. [SLO:CGA-09-C-03]: Identify the components of digital audio such as digital stream and bits. [SLO:CGA-09-C-04]: Explain types of different audios such as: MP3, WAV, AAC and WMA. [SLO:CGA-09-C-05]: Record a Podcast on StreamYard and share it with their friends as a Project. [SLO:CGA-09-C-06]: Define Video as a set of moving visual media including sounds.	Define human hearing mechanism. [SLO:CGA-10-C-03]: Define the concept of recording digital sound. [SLO:CGA-10-C-04]: Identify devices involved in recording such as microphone, analog to digital converters and speakers. [SLO:CGA-10-C-05]: Define sample rate, generated audio files, bit depth and audio pathways. [SLO:CGA-10-C-06]: Create screen recording of 5 minutes using Movavi Screen Recorder. [SLO:CGA-10-C-07]: Apply notes at the	[SLO:CGA-11-C-02]: Identify and describe the elements of interactive videos such as clickable hotspots, branching, quizzes, operational buttons and 360 degree view. [SLO:CGA-11-C-03]: Explain different types of videos such as: interactive videos, explainable videos, product videos, live streams and documentaries. [SLO:CGA-11-C-04]: Design an interactive video of computer graphics and animation course using an application named CapCut. [SLO:CGA-11-C-05]:	[SLO:CGA-12-C-02]: Explain the audience engagement in interactive videos. [SLO:CGA-12-C-03]: Add user-driven navigation and polls in their created video as a project.

[SLO:CGA-09-C-07]: Identify the components of Video recorders such as: Lens, Imager, recorder and converter. [SLO:CGA-09-C-08]: Explain the process of recording a video and decomposing it for editing; mainly frame based editing. [SLO:CGA-09-C-09]: Explain the types of Videos: MP4, MOV, AVI and WebM. [SLO:CGA-09-C-010]: Create a video by Screen Recording via an application SLO:CGA-09-C-11: Add different video clips to the video they created earlier.	beginning and ending of the video. [SLO:CGA-10-C-08]: Insert captions and filters on record video. [SLO:CGA-10-C-09]: Apply rough-cut to ensure the consistency of frame rates and refine it. [SLO:CGA-10-C-010]: Apply relevant transitions on your video. [SLO:CGA-10-C-11]: Discuss the usage of video in education and entertainment industries. [SLO:CGA-10-C-12]: Define video editing techniques including cutting segments (trimming), re-sequencing clips, and	Apply transitions suitable to the video content.	

SLO:CGA-09-C-12: Implement transitions, trim unwanted frames, insert filters and captions. Suggested free applications: **Active Presenter.**	adding transitions and other special effects. [SLO:CGA-10-C-13]: Differentiate between video and animation.		

Domain D: Animation and Virtual Reality

Standard 1: Apply computer animations and virtual reality concepts to design virtual tours and films.

Grade 9	Grade 10	Grade 11	Grade 12
Benchmark I: Students will be able to design and manipulate animated objects and understand the concept of virtual reality.		**Benchmark I**: Students will be able to design an animated film and a virtual tour.	
Student Learning Outcomes			
[SLO:CGA-09-D-01]: Define Animation as a technique of converting still images into moving images.	[SLO:CGA-10-D-01]: Explain the concept of transforming objects from one shape to	[SLO:CGA-11-D-01]: Create an animation of 5 different objects on Cinema 4D software application.	[SLO:CGA-12-D-01]: Define virtual tour as a sequence of videos, still images or 360-degree images with other multimedia elements.

[SLO:CGA-09-D-02]: Discuss the concept of arc as a mandatory design principle for animations to get curved and smooth objects. [SLO:CGA-09-D-03]: Define traditional animation and concept of frame in early 20s. [SLO:CGA-09-D-04]: Identify the difference between 2D and 3D animation. [SLO:CGA-09-D-05]: Describe different animation operations including: Timing, spacing, squash and stretch. [SLO:CGA-09-D-06]: Design a Simple	another known as Morphing. [SLO:CGA-10-D-02]: Discuss the concept of tweening, panning and zooming (in & out). [SLO:CGA-10-D-03]: Identify the usage and need of fractals function. [SLO:CGA-10-D-04]: Apply tweening, panning and fractals (iteration) on any object using MS powerpoint. [SLO:CGA-10-D-05]: Define computer simulations such as virtual reality and augmented reality. [SLO:CGA-10-D-06]: Identify any 5 devices	[SLO:CGA-11-D-02]: Design an animated film from those objects. [SLO:CGA-11-D-03]: Apply any 2 available artistic effects on film. [SLO:CGA-11-D-04]: Define dynamic motion graphics and rigid body simulations. [SLO:CGA-11-D-05]: Explain the position and orientation of rigid body real-time simulations. [SLO:CGA-11-D-06]: Define the process of skinning. [SLO:CGA-11-D-07]: Discuss two main methods of character	[SLO:CGA-12-D-02]: Discuss the concept of virtual tourism and its benefits. [SLO:CGA-12-D-03]: Design a virtual tour on software named concept 3D as a project. [SLO:CGA-12-D-04]: Differentiate between virtual reality and augmented reality. [SLO:CGA-12-D-05]: Identify 5 mobile applications having the features of augmented reality. [SLO:CGA-12-D-06]: Define all three types of augmented reality including: Augmented reality for images (image tracking) Location-based augmented reality (AR with GPS) Augmented reality on surfaces (World tracking). [SLO:CGA-12-D-07]: Discuss the technological impact of VR and AR on current generations. [SLO:CGA-12-D-08]:

animation of a house on **Animaker** software. [SLO:CGA-09-D-07]: Define the basics of Virtual Reality.	used in the creation of VR environments. [SLO:CGA-10-D-07]: Define the composition of VR headsets. [SLO:CGA-10-D-08]: Identify stereoscopic display separately for each eye in VR headset, stereo sound and sensors. [SLO:CGA-10-D-09]: Describe the functions of rotation sensors and translation tracking such as gyroscope, accelerometer and compass for tracking movements. [SLO:CGA-10-D-10]: Identify Inside-Out tracking by cameras in VR headset to map out the space around you– walls, tabletops, floor–	skinning i.e, weight painting and blend shapes. [SLO:CGA-11-D-08]: Describe the working principles of skinning and rigging. [SLO:CGA-11-D-09]: Define characterization and its 5 major techniques, i.e, physical description, action, inner thoughts, reactions, and speech. [SLO:CGA-11-D-10]: Explain the concept and usage of 3D virtual tours.	Describe the future demands in the field of virtualization and simulation.

	so you can move around the virtual world. [SLO:CGA-10-D-11]: Describe Outside-In tracking by external cameras in VR headsets.		

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