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Short Notes — Multimedia Technologies

BTEUP Diploma in Computer Science & Engineering • 5th Semester • Short Notes
Session 2026-27

Short Revision Notes — prepared by KAMALDNP Academy from the official BTEUP 2026-27 syllabus. This is NOT a BTEUP board paper or publication.

These short notes cover **Multimedia Technologies**, a programme elective in the BTEUP 2026-27 fifth-semester scheme for Computer Science and Engineering — students choose either this subject or Mobile App Development as one elective. In the 2026-27 scheme the subject is a **practicum**, so most marks come from practical work, but a clear theory base is still essential for the viva and for doing the practicals correctly.

The verified syllabus has **four units**, and these notes follow exactly those four. Read a unit, revise the one-line summary at the end, and try its likely question in your own words. Always match your final preparation with the official syllabus PDF and your lab records.

Unit 1 — Introduction to Multimedia (10 Periods, 25%)

Topics: Multimedia foundation and concepts: multimedia hardware; multimedia software; multimedia operating systems; multimedia communication systems.

Multimedia foundation and concepts

Multimedia means presenting information by combining several media together — **text, graphics, images, audio, video and animation** — through a computer, usually with interactivity so the user can choose what to see next. A plain text page is not multimedia; a lesson with narration, diagrams, an animation and a quiz is.

Foundation concepts to state clearly:

- **Linear multimedia** — plays in a fixed order, like a film; the user only watches.
- **Non-linear / interactive multimedia** — the user navigates freely through menus and links, as in e-learning or a website.
- **Hypertext and hypermedia** — linked text, and linked media, that let the user jump between related items.

Applications include education and training, entertainment and games, advertising, presentations, video conferencing and information kiosks. Multimedia products are developed (authored), stored on suitable media, and delivered on computers, mobiles and the web.

Multimedia hardware and multimedia software

Multimedia hardware must capture, process, store and present large media files. Important items:

- Fast processor, large RAM and a graphics card/GPU for smooth video and animation.
- Large, fast storage (hard disk / SSD) and optical or other removable media for distribution.
- Input and capture devices: scanner, digital camera, microphone, video camera, touch screen.
- Output devices: high-resolution colour monitor, speakers or headphones, projector, colour printer.

Multimedia software falls into groups: media editing tools (image, audio and video editors), authoring tools that assemble elements into one interactive product with menus and navigation, and presentation/player software that runs the finished product. Drivers and codecs are also software essentials — without the correct codec installed, an audio or video file will simply not play correctly.

Multimedia operating systems and multimedia communication systems

A **multimedia operating system** must do more than an ordinary OS: it has to play audio and video continuously without gaps. Its special needs are:

- **Real-time scheduling** — media data must be delivered at exact times; a delayed video frame is a lost frame.
- Efficient handling of very large files and fast disk access for streaming.
- Support for many device types — sound cards, video capture, scanners — and for synchronising audio with video (lip-sync).

Multimedia communication systems carry media between people and places: video conferencing, live streaming, video on demand, internet telephony and distance learning. Their key requirements are high bandwidth, low delay, and compression, because raw video is far too large for ordinary networks. Quality falls if bandwidth drops, which is why streaming services adjust quality automatically. In viva, link the two topics: the OS manages media inside one machine; the communication system moves media between machines on time.

Likely question: Define multimedia. Describe the hardware and software components needed in a multimedia system.

Unit 2 — Basic Compression Techniques (12 Periods, 25%)

Topics: Video and audio data compression techniques — lossy and lossless; example algorithms/standards: Huffman, RLE, JPEG, MPEG, MP3, MP4, LZMA, FLAC, ALAC, ITU G. 722, H.261, H.265.

Video and audio data compression techniques — lossy and lossless

Compression reduces file size so media can be stored and transmitted easily. It works because media data contains redundancy — repeated values, predictable patterns, and details human senses barely notice.

- **Lossless compression** — no information is lost; decompression restores the exact original data. Ratio is modest (about 2:1 to 3:1). Used where every bit matters: text, software, and master audio.
- **Lossy compression** — some detail is permanently discarded, chosen where the eye or ear will not notice. Ratio is much higher, so it suits photos, music and video for delivery. Quality falls if it is compressed again and again.

For **audio**, lossless keeps the full waveform information while lossy removes sounds masked by louder sounds. For **video**, compression exploits similarity within a frame (spatial) and between successive frames (temporal) — most of a scene does not change from frame to frame. The choice is always a trade-off between file size, quality and processing time.

Huffman, RLE and LZMA

Huffman coding is a lossless method that gives short codes to symbols that occur frequently and longer codes to rare symbols, based on a frequency table and a binary tree. No code is a prefix of another, so decoding is unambiguous. It is used inside many other formats as a final coding stage.

Run-Length Encoding (RLE) is the simplest lossless idea: a run of repeated values is stored as the value plus a count. It works very well on images with large flat areas (diagrams, icons) and badly on photographs where neighbouring pixels keep changing.

LZMA (Lempel-Ziv-Markov chain Algorithm) is a powerful lossless dictionary-based method used in formats such as 7z and xz. It finds repeated sequences and refers back to them, achieving high ratios at the cost of slower compression. Remember the grouping for the exam: Huffman, RLE and LZMA are all **lossless**.

JPEG, MPEG, MP3 and MP4

JPEG is the standard lossy format for still photographs. It divides the image into 8×8 blocks, transforms them, discards fine detail the eye misses, and then codes the result. The user can choose the quality setting — higher quality means a larger file. JPEG suits photos; it is poor for sharp text and line art.

MPEG is a family of standards for moving pictures with sound, using both within-frame and between-frame compression with frame types such as I, P and B frames. **MP3** (MPEG Audio Layer III) is the famous lossy audio format that removes sounds the ear is unlikely to hear, shrinking music files to roughly one-tenth size at common bitrates.

MP4 is a multimedia **container** format (MPEG-4 Part 14) that holds video, audio, subtitles and images in one file for storage and streaming. Exam caution: MP3 is a coding format for audio, MP4 is mainly a container — do not describe them as the same kind of thing.

FLAC, ALAC, ITU G.722, H.261 and H.265

FLAC (Free Lossless Audio Codec) compresses audio with zero loss — playback is bit-identical to the original — typically saving 40–60% of the size. **ALAC** (Apple Lossless Audio Codec) does the same job in the Apple ecosystem. Both suit music archiving and professional work, unlike MP3 which trades quality for size.

ITU G.722 is a standard for wideband speech coding used in telephony and conferencing, giving clearer voice than older narrowband telephone coding at a 64 kbps rate.

H.261 was an early video coding standard designed for video conferencing over ISDN lines at multiples of 64 kbps; it established ideas — block-based coding and motion compensation — that later standards refined. **H.265**, also called HEVC, is a modern successor giving roughly the same quality at about half the bitrate of H.264, making 4K streaming practical, at the cost of heavier processing. Trend to quote: each new video standard aims at better quality at a lower bitrate.

Likely question: Differentiate between lossy and lossless compression. Write a short note on any two: Huffman coding, JPEG and MPEG.

Unit 3 — Content Development and Distribution (10 Periods, 25%)

Topics: Desktop publishing (CorelDRAW, Photoshop, PageMaker); multimedia animation and special effects (2D/3D animation, Flash).

Desktop publishing — CorelDRAW, Photoshop and PageMaker

Desktop publishing (DTP) means preparing publication-quality pages — magazines, brochures, notices, books — on a personal computer instead of a traditional press composing room. The three syllabus tools have distinct roles:

- **CorelDRAW** — a **vector** graphics editor for logos, illustrations, layouts and artwork that must scale without losing sharpness.
- **Photoshop** — the standard tool for editing **raster (bitmap)** photographs: retouching, colour correction, resizing, combining images and preparing them for print or web.
- **PageMaker** — a page-layout program for assembling text and graphics into multi-page documents with columns, master pages and styles, ready for printing.

A typical DTP flow: prepare artwork in CorelDRAW, correct photos in Photoshop, then lay out the complete pages in the layout program and check proofs before printing. In viva, remember the one-line division — draw vectors, edit photos, assemble pages.

Multimedia animation — 2D and 3D animation

Animation creates the illusion of movement by showing a series of slightly different still images (frames) rapidly one after another. The brain joins them into smooth motion; around 24 frames per second is standard for film-quality movement.

- **2D animation** works in a flat plane — characters and objects have height and width only. Made by drawing frames, or by tweening, where the software fills the in-between frames between key frames. Classic cartoons and web banners are 2D.
- **3D animation** builds objects as models with depth in a virtual scene, adds surfaces, lighting and a camera, and then renders the scene frame by frame. Used in films, games, product demos and architectural walkthroughs — more realistic, but slower and costlier to produce.

Steps common to both: story/script, storyboard, creating characters and scenes, animating, adding sound, and final rendering/output.

Special effects and Flash

Special effects are visual (and audio) tricks added to animation and video to show things that are difficult, dangerous or impossible to film directly — explosions, magical transformations, weather, impossible camera moves. In multimedia they are produced digitally by morphing (one shape smoothly changing into another), warping, particle effects for fire, smoke and rain, and compositing (combining separately created layers into one scene).

Flash is the classic tool named in the syllabus for web animation: it created vector-based animations and interactive content that stayed small in file size and played in the browser through a plug-in, widely used for animated websites, banners, cartoons and simple games. Its key ideas — vector graphics, timeline animation, tweening and interactivity through scripting — remain the model for understanding web animation generally.

Good effects support the story or message; effects added only for show distract the viewer and increase file size and production time.

Likely question: Write short notes on the use of CorelDRAW, Photoshop and PageMaker in desktop publishing.

Unit 4 — Introduction to Digital Imaging (10 Periods, 25%)

Topics: Basics of graphic design and use of digital technology; definition of digital images; digital imaging in multimedia.

Basics of graphic design and use of digital technology

Graphic design is the art of communicating a message visually — arranging text, pictures, colour and space so the result is attractive and easy to understand. Its basic elements are line, shape, colour, texture and space; its working principles include balance, contrast, alignment, repetition and proximity (related items placed together).

Digital technology changed this work completely:

- Designs are created and edited on computer with graphics software; mistakes can be undone and versions saved.
- Images can be reused, resized, recoloured and combined in minutes.
- The same design can be output for print, web, mobile and display screens.
- Colour must be handled correctly — RGB for screens, CMYK for print is the standard practical distinction.

For a diploma student, the exam point is simple: design rules decide whether a multimedia screen looks professional, and digital tools make applying and revising those rules fast and repeatable.

Definition of digital images

A **digital image** is a picture represented in the binary form a computer can store and process. There are two fundamental types:

- **Bitmap (raster) image** — made of a grid of tiny dots called **pixels**, each pixel storing a colour value. Photographs are bitmaps. Enlarging a bitmap beyond its pixel count makes it look blocky (pixelated). Examples: JPEG, PNG, BMP.
- **Vector image** — made of mathematical lines, curves and shapes. It can be enlarged to any size without losing sharpness, and files are usually small. Logos and illustrations are vectors. Examples: files from CorelDRAW; SVG on the web.

Important terms: **resolution** (number of pixels, e.g. 1920×1080; density in ppi/dpi), **colour depth** (bits per pixel — 24-bit gives about 16.7 million colours) and **file size**, which grows

with resolution and colour depth. Choosing the right type — bitmap for photos, vector for logos — is a basic viva test.

Digital imaging in multimedia

Digital imaging is the complete process of capturing, creating, editing, storing and displaying digital images. Images enter a multimedia product by scanning prints, capturing with a digital camera, downloading from libraries, or creating original artwork in graphics software. They are then edited — cropped, resized, colour-corrected and compressed — before being placed in the product.

Its role in multimedia:

- Images explain faster than text — diagrams, screenshots and photos carry the main teaching load in e-learning and presentations.
- Scanned and captured images connect the real world (documents, objects, places) to the computer product.
- Correct format and compression keep quality acceptable while file size stays small enough for smooth delivery — linking this unit back to Unit 2.

A digital imaging workflow is incomplete without checking resolution for the target medium: screen display needs far fewer pixels than print, and sending print-sized images to a web page only slows it down.

Likely question: What is a digital image? Differentiate between bitmap and vector images, and explain the role of digital imaging in multimedia.

Quick Revision — One Line Each

- Multimedia = text + graphics + audio + video + animation delivered interactively through a computer.
- Hardware for authoring: fast CPU, large RAM/storage, scanner, camera, microphone, speakers, graphics card.
- Authoring software assembles media elements into one interactive product; players only present it.
- Lossless compression restores the exact original; lossy discards detail permanently for much smaller files.
- Huffman assigns short codes to frequent symbols; RLE stores runs as value + count.
- JPEG = lossy still images; MPEG = video standards family; MP3 = audio; MP4 = multimedia container.
- FLAC and ALAC are lossless audio; LZMA is high-ratio lossless general compression.
- H.261 was an early video-conference codec; H.265 (HEVC) gives similar quality at about half the H.264 bitrate.
- DTP trio: CorelDRAW (vector design), Photoshop (photo editing), PageMaker (page layout).

- 2D animation moves flat drawings; 3D animation models objects in three dimensions with lighting and rendering.
- A digital image is pixels (bitmap) or mathematical shapes (vector); resolution is measured in pixels / ppi.

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