CBCS SCHEME

BEC/BTE613A

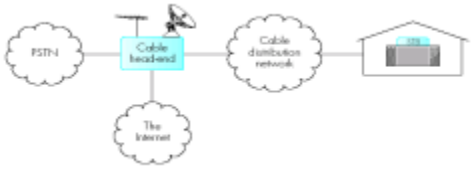
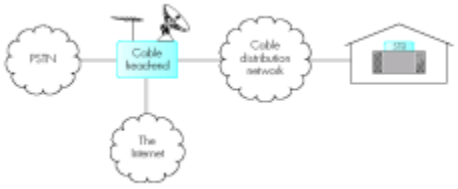
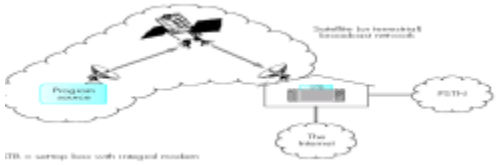
Sixth Semester B.E./B.Tech. Degree Examination, June/July 2025

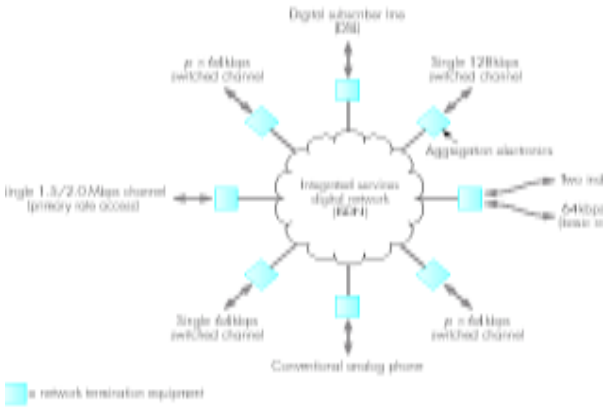
Multimedia Communication

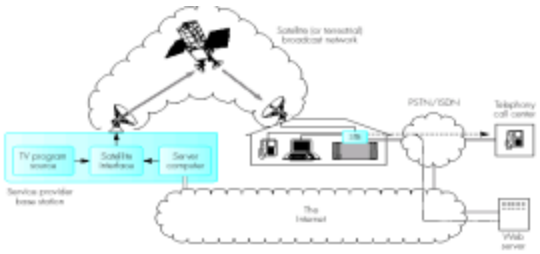
Time: 3 hrs. **Max. Marks: 100**

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.

2. M: Marks, L: Bloom's level, C: Course outcomes.

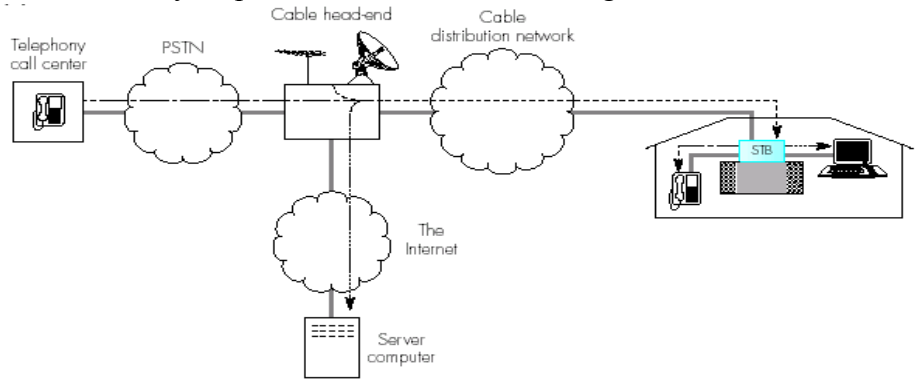
Q 1 a)	Explain broadcast television network and ISDN.  Broadcast television networks support the diffusion of analogue television programs to a wider geographical area via a cable distribution network, a satellite network .A cable modem integrated into the STB (set-top-box) provides both a low bit rate channel (connects the subscriber to the PSTN)and a high bit rate channel (connects to the Internet) from the subscriber back to the cable head-end.  A set-top box is a device that enables a television set to become a user interface to the Internet and also enables a television set to receive and decode digital television (DTV) broadcasts. DTV set-top boxes are sometimes called receivers.  In Satellite and broadcast networks by integrating an H-S modem into the STB a range of interactive services can be supported. This is the origin of the term "interactive television. Integrated Services Digital Network (ISDN) in concept is the integration of both analogue or voice data together with digital data over the same network. ISDN is a set of ITU standards for digital transmission over ordinary telephone copper wire as well as over other media. Home and business users who install an ISDN adapter (in place of a modem) can see	CO1, L2 10M

	highly-graphic Web pages arriving very quickly (up to 128 Kbps). ISDN requires adapters at both ends of the transmission so your access provider also needs an ISDN adapter. ISDN is generally available from your phone company.  DSL supports two 64 kbps channels that can be used independently or as a single combined 128kbps channel (additional box of electronics). This is known as the aggregation function. Broadband – Circuits associate with a call could have bit rates in excess of the maximum bit rate of 2Mbps – 30X64 kbps – provided by ISDN Broadband integrated services digital network (B-ISDN) – All different media types are converted in the source equipment into a digital form, integrated togeather and divided into multiple fixed-sized packets (cells) Broadband – Circuits associate with a call could have bit rates in excess of the maximum bit rate of 2Mbps – 30X64 kbps – prvided by ISDN Broadband integrated services digital network (B-ISDN) – All different media types are converted in the source equipment into a digital form, integrated togeather and divided into multiple fixed-sized packets (cells). Broadband – Circuits associate with a call could have bit rates in excess of the maximum bit rate of 2Mbps – 30X64 kbps – prvided by ISDN Broadband integrated services digital network (B-ISDN) – All different media types are converted in the source equipment into a digital form, integrated togeather and divided into multiple fixed-sized packets (cells)	
Q 1 b)	Explain Interactive television application for both cable and satellite networks. Interactive Television:Satellite Network The set-top box (STB) provides both a low bit rate connection to the PSTN and a high bit rate connection to the internet. Through the connection to the PSTN, the subscriber is able to actively respond to the information being broadcast	CO1, L2 10M

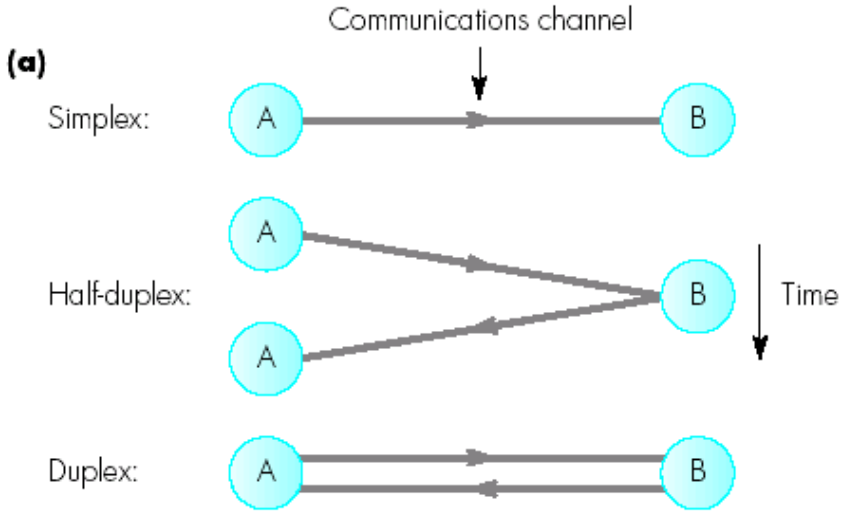


Interactive Television:Cable Network

- The set-top box (STB) provides both a low bit rate connection to the PSTN and a high bit rate connection to the internet
- Through the connection to the PSTN, the subscriber is able to actively respond to the information being broadcast

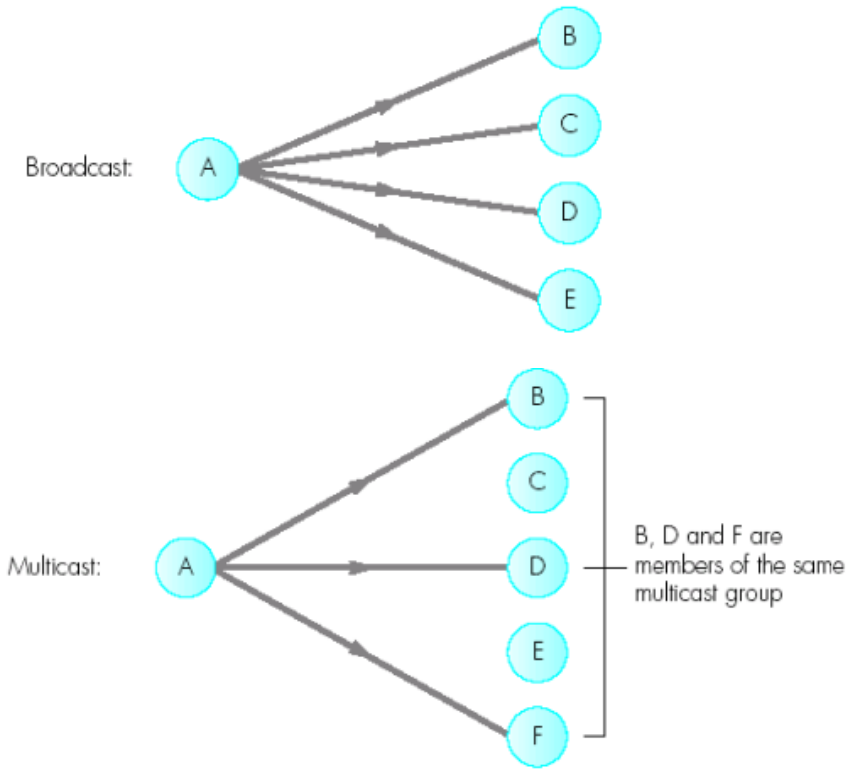


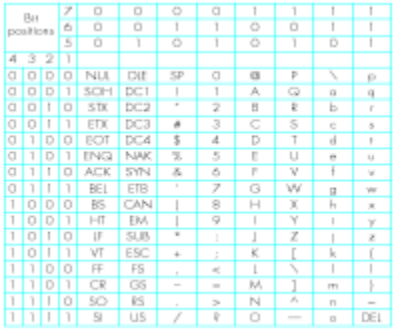
Q 2 a) With a neat diagram, explain the modes of communication. CO1, L2 10M



Simplex: The information associated with the application flows in one direction only. Half-Duplex: Information flows in both directions but alternatively (two-way alternative). Full Duplex: Information flows in both directions simultaneously (Two-way simultaneous).

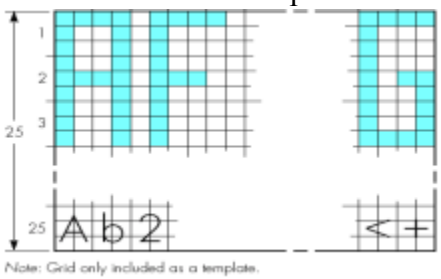
Unicast is a one-to-one communication method where data is sent from a single sender to a single receiver. This is the most common form of data transfer over networks. Examples of unicast transmission include web surfing and file transfers.
Broadcast: The information output by a single node is received by all the other nodes connected to the same network
Multicast: The information output by the source is received by only a specific subset of the nodes (Latter form known as multicast group)



Q 2 b)	Determine the propagation delay associated with the following communication channels: (i) a connection through a private telephone network of 1 km, (ii) a connection through a PSTN of 200 km, (iii) a connection over a satellite channel of 50 000 km. Assume that the velocity of propagation of a signal in the case of (i) and (ii) is 2×10^8 ms^{-1} and in the case of (iii) 3×10^8 ms^{-1}. *Answer:* Propagation delay T_p = physical separation/velocity of propagation (i) $T_P = \frac{10^3}{2\times10^8} = 5\times10^{-6}$ s (ii) $T_P = \frac{200\times10^3}{2\times10^8} = 10^{-3}$ s (iii) $T_P = \frac{5\times10^7}{3\times10^8} = 1.67\times10^{-1}$ s	CO1, L3 10M
Q 3 a)	With an example, explain different types of text representation in multimedia. Unformatted text: Known as plain text; enables pages to be created which comprise strings of fixed-sized characters from a limited character set Formatted Text: Known as richtext; enables pages to be created which comprise of strings of characters of different styles, sizes and shape with tables, graphics, and images inserted at appropriate points Hypertext: Enables an integrated set of documents (Each comprising formatted text) to be created which have defined linkages between them · Unformatted Text-Basic ASCII Character set  Control characters (Back space, escape, delete, form feed etc) Printable characters (alphabetic, numeric, and punctuation)	CO2, L2 10M

The American Standard Code for Information Interchange is one of the most widely used character sets and the table includes the binary codewords used to represent each character (7 bit binary code)
· Unformatted text supplementary set of masaic characters

The characters in columns 010/011 and 110/111 are replaced with the set of mosaic characters; and then used, together with the various uppercase characters illustrated, to create relatively simple graphical images
Unformatted Text-Examples of Videotext/Teletext



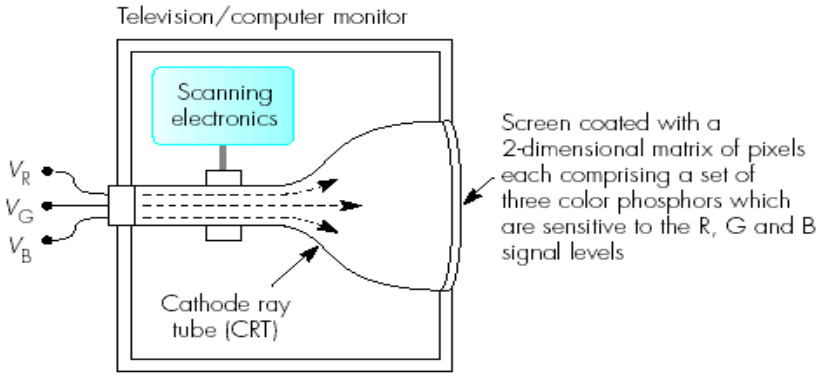
Note: Grid only included as a template.

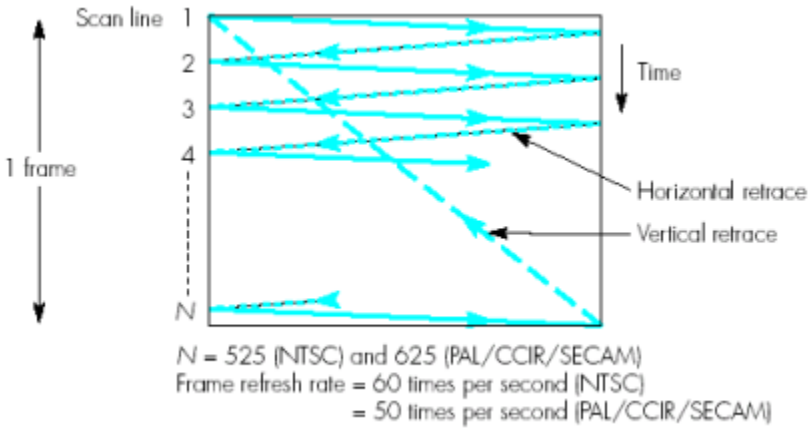
Although in practice the total page is made up of a matrix of symbols and characters which all have the same size, some simple graphical symbols and text of larger sizes can be constructed by the use of groups of the basic symbols
Formatted Text

```
<B><FONT SIZE=4><P>Formatted Text</P>
</B></FONT>
<P>This is an example of formatted text, it includes:</P>
<FONT SIZE=2>
</FONT><I><P>Italics,</I> <B>Bold</B> and <U>Underlining</P>
</U>
<FONT FACE="French Script MT"><P>Different Fonts</FONT> and <FONT
SIZE=4>Font Sizes</P>
```

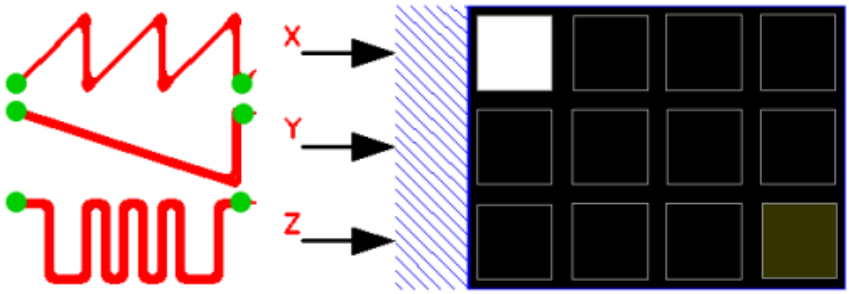
Formatted text
This is an example of formatted text, it includes:
Italics, **Bold** and Underlining
Different fonts and Font Sizes

It is produced by most word processing packages and used extensively in the publishing sector for the preparation of papers, books, magazines, journals and so on.
Documents of mixed type (characters, different styles, fonts, shape etc) possible.
Format control characters are used

	Hypertext can be used to creat  e an electronic version of documents with the index, descriptions of departments, courses on offer, library, and other facilities all written in hypertext as pages with various defined hyperlinks · Hypertext -Electronic Document in Hyper text An example of a hypertext language is HTML used to describe how the contents of a document are presented on a printer or a display; other mark-up languages are: Postscript, SGML (Standard Generalized Mark-up language) Tex, Latex.	
Q 3 b)	Explain Raster Scan Principle with neat schematic diagram for both television and Computer.  • The picture tubes used in most television sets operate using what is known as a raster-scan; this involves a finely-focussed electron beam being scanned over the complete screen	CO2, L3 10M

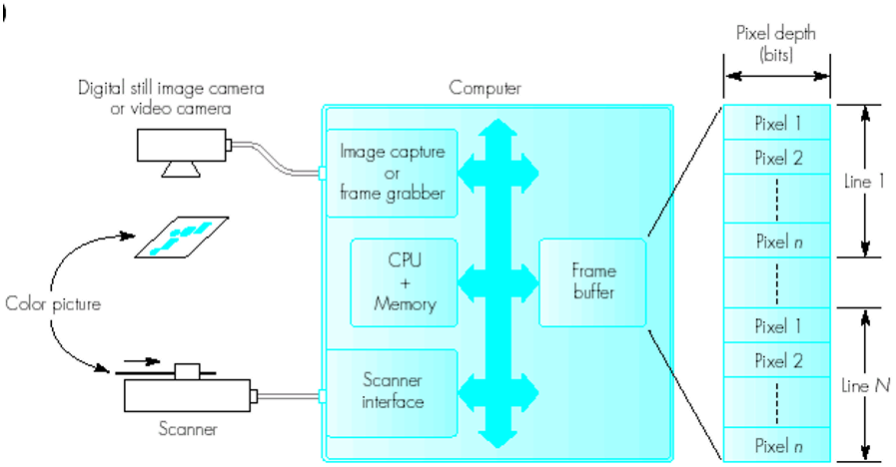


Progressive scanning is performed by repeating the scanning operation that starts at the top left corner of the screen and ends at the bottom right corner follows by the beam being deflected back again to the top left corner

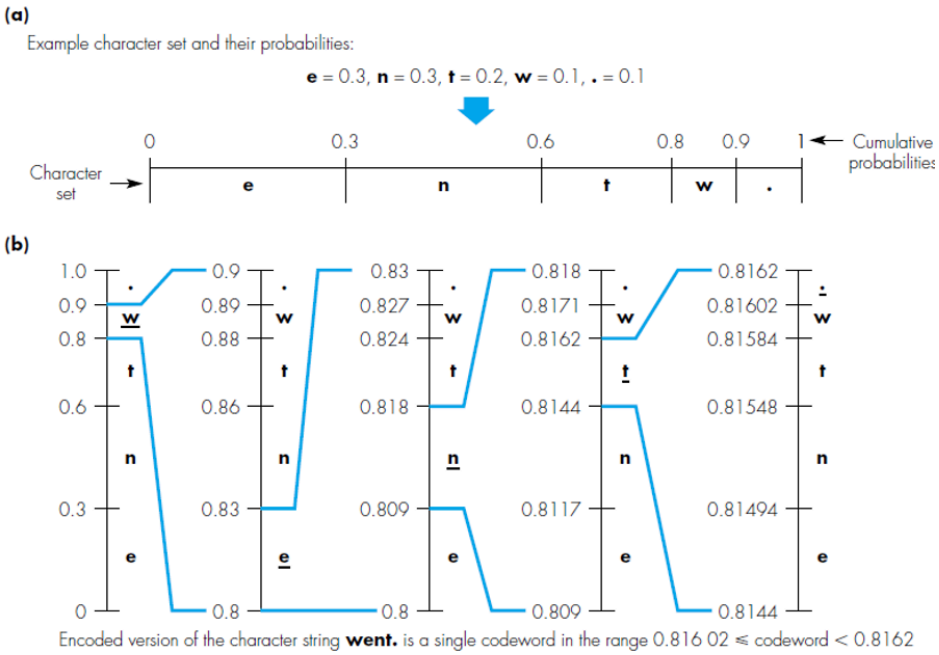


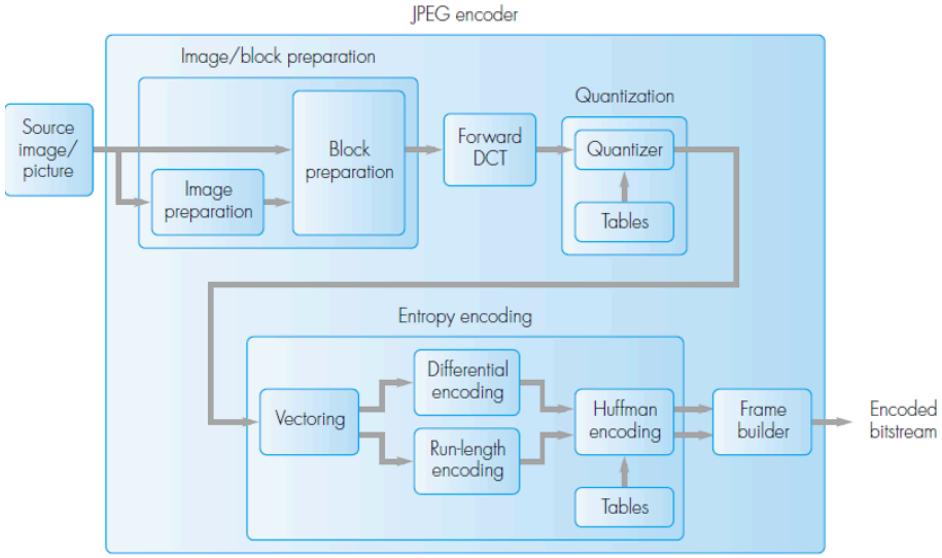
The set of three related colour-sensitive phospors associated with each pixel is called a phospor triad and the typical arrangement of the triads on each scan line is shown.

OR		
Q 4 a)	Derive the time to transmit the following digitized image at both 64 kbps and 1.5 Mbps: i) 640 × 480 × 8 – VGA compatible image ii) 1024 × 768 × 24 – SVGA compatible image. Answer: The size of each image in bit is as follows	CO2, L2 10M

	a VGA image = 6404808 = 2.46Mbits an SVGA image = 102476824 =18.88Mbits The time to transmit each image is given as follows at 64Kbps VGA = $\frac{2.46\times10^{6}}{64\times10^{3}} = 38.4\ sec$ at 64Kbps SVGA = $\frac{18.88\times10^{6}}{64\times10^{3}} = 295\ sec$ at 1.5Mbps: VGA = $\frac{2.46\times10^{6}}{1.5\times10^{6}} = 1.64\ sec$ at 1.5Mbps: SVGA = $\frac{18.88\times10^{6}}{1.5\times10^{6}} = 1259\ sec$	
Q 4 b)	Explain the detailed block diagram of Digital Camera and Scanner. Answer:  Digital cameras and scanners: Typical arrangement that is used to capture and store a digital image produced by a scanner or a digital camera (either a still camera or a video camera) An image is captured within the camera/scanner using an image sensor A two-dimensional grid of light-sensitive cells called photosites A widely-used image sensor is a charge-coupled device (CCD):Image sensor that converts the level of light intensity on each photosite into an equivalent electrical charge. Photosites: Silicon chip which consists of a two-dimensional grid of light-sensitive cells, which stores the level of intensity of the light that falls on it For color images, the color associated with each photosite – and hence pixel position – is obtained in a number of ways. These include the three methods	CO2, L2 10M

	(i) In this method, the surface of each photosite is coated with either a red, green, or blue filter so that its charge is determined only by the level of red, green, or blue light that falls on it. The coatings are arranged in a 3 x 3 grid structure as shown in the figure. The color associated with each photosite/pixel is then determined by the output of the photosite – R, G, or B – together with each of its 8 immediate neighbors. The levels of the two other colors in each pixel are then estimated by an interpolation procedure involving all nine values. This method is used with most consumer-quality cameras. (ii) This method involves the use of three separate exposures of a single image sensor, the first through a red filter, the second a green filter, and the third a blue filter. The color associated with each pixel position is then determined by the charge obtained with each of the three filters – R, G, and B. Since three separate exposures are required for each image, this approach cannot be used with video cameras. It is used primarily with high-resolution still-image cameras in locations such as photographic studios where the camera can be attached to a tripod. (iii) This method uses three separate image sensors, one with all the photosites coated with a red filter, the second coated with a green filter, and the third coated with a blue filter. A single exposure is used with the incoming light split into three beams each of which exposes a separate image sensor. This method is used in professional-quality high-resolution still and moving image cameras since, in general, they are more costly owing to the use of three separate sensors and associated signal processing circuits.	
Module 3		
Q5 a)	How the Coding Operation takes place in arithmetic Coding? Consider the transmission of a message comprising a string of characters with probabilities. e = 0.3, n = 0.3, t = 0.2, w = 0.1, ● = 0.1 The word needed to be transmitted is Went. Solution:	CO3, L2 10M

		
Q5 b)	Explain JPEG encoding technique. Solution:The Joint Photographic Experts Group forms the basis of most video compression algorithms. Source image is made up of one or more 2-D matrices of values. 2-D matrix is required to store the required set of 8-bit grey-level values that represent the image. For the colour image if a CLUT is used then a single matrix of values is required. If the image is represented in R, G, B format then three matrices are required. If the Y, Cr, Cb format is used then the matrix size for the chrominance components is smaller than the Y matrix (Reduced representation). Once the image format is selected then the values in each matrix are compressed separately using the DCT. In order to make the transformation more efficient a second step known as block preparation is carried out before DCT. In block preparation each global matrix is divided into a set of smaller 8X8 submatrices (block) which are fed sequentially to the DCT. Once the source image format has been selected and prepared (four alternative forms of representation), the set values in each matrix are compressed separately using the DCT).	CO3, L2 10M



Using DCT there is very little loss of information during the DCT phase The losses are due to the use of fixed point arithmetic .

The main source of information loss occurs during the quantization and entropy encoding stages where the compression takes place.

The human eye responds primarily to the DC coefficient and the lower frequency coefficients (The higher frequency coefficients below a certain threshold will not be detected by the human eye).

This property is exploited by dropping the spatial frequency coefficients in the transformed matrix (dropped coefficients cannot be retrieved during decoding).

In addition to classifying the spatial frequency components the quantization process aims to reduce the size of the DC and AC coefficients so that less bandwidth is required for their transmission (by using a divisor).

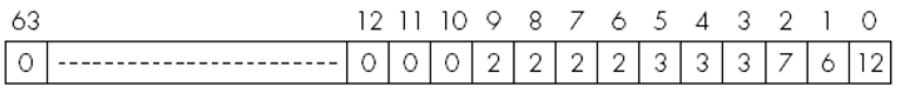
The sensitivity of the eye varies with spatial frequency and hence the amplitude threshold below which the eye will detect a particular frequency also varies.

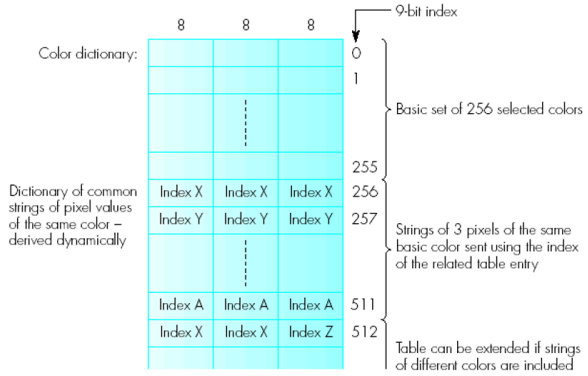
The threshold values vary for each of the 64 DCT coefficients and these are held in a 2-D matrix known as the quantization table with the threshold value to be used with a particular DCT coefficient in the corresponding position in the matrix.

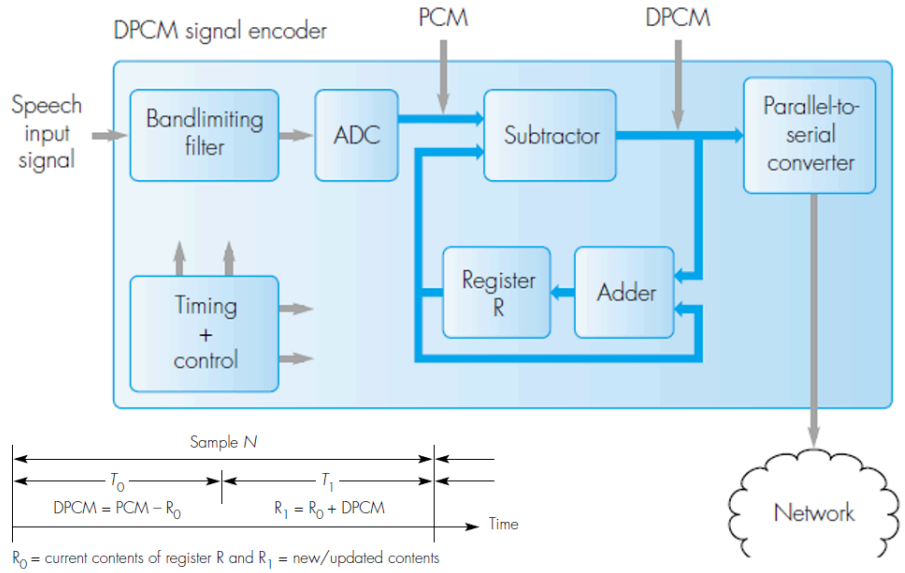
From the quantization table and the DCT and quantization coefficients number of observations can be made:

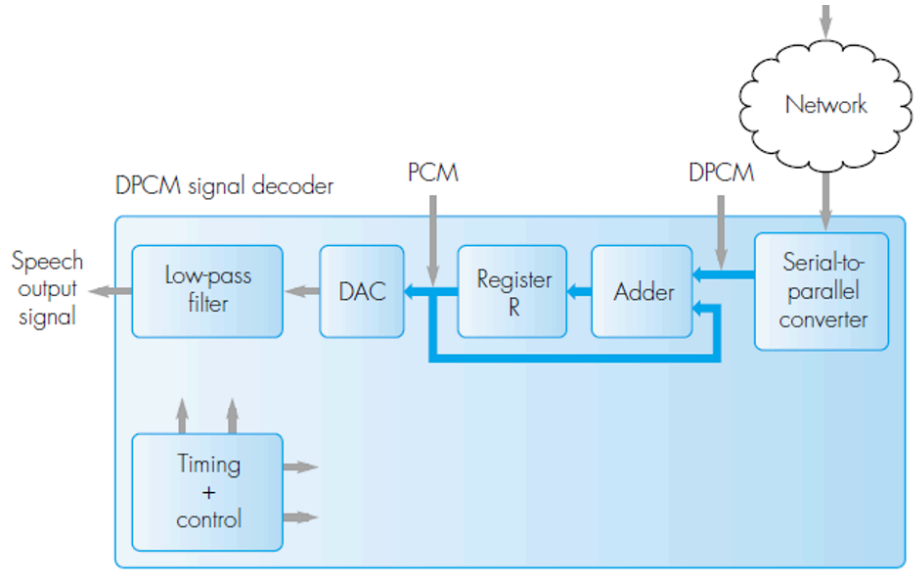
- The computation of the quantized coefficients involves rounding the quotients to the nearest integer value.
- The threshold values used increase in magnitude with increasing spatial frequency.
- The DC coefficient in the transformed matrix is largest.
- Many of the higher frequency coefficients are zero

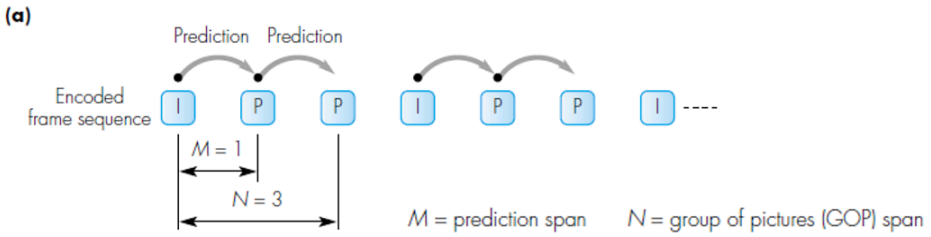
Entropy encoding consists of four stages.

	Vectoring – The entropy encoding operates on a one-dimensional string of values (vector). However the output of the quantization is a 2-D matrix and hence this has to be represented in a 1-D form. This is known as vectoring.In order to exploit the presence of the large number of zeros in the quantized matrix, a zig-zag of the matrix is used Differential Encoding:In this section only the difference in magnitude of the DC coefficient in a quantized block relative to the value in the preceding block is encoded. This will reduce the number of bits required to encode the relatively large magnitude. Run length encoding: The 63 values in the vector are the AC coefficients. Because of the large number of 0's in the AC coefficients they are encoded as string of pairs of values. Each pair is made up of (skip, value) where skip is the number of zeros in the run and value is the next non-zero coefficient. Huffman encoding:Significant levels of compression can be obtained by replacing long strings of binary digits by a string of much shorter codewords. The length of each codeword is a function of its relative frequency of occurrence. Normally, a table of codewords is used with the set of codewords precomputed using the Huffman coding algorithm. The role of the frame builder is to encapsulate all the information relating to an encoded image/picture	
Q 6 a)	Explain the concept of run-length coding and statistical coding. Answer: Run-length coding: Examples of run-length encoding are when the source information comprises long substrings of the same character or binary digit. In this the source string is transmitted as a different set of codewords which indicates only the character but also the number of bits in the substring, providing the destination knows the set of codewords being used, it simply interprets each codeword received and outputs the appropriate number of characters/bits e.g. output from a scanner in a Fax Machine 000000011111111110000011 will be represented as 0,7 1,10 0,5 1,2 If we ensure the first substring is always 0, then the string could be represented as 7,10,5,2. The values in the vector which are run length encoded are the AC coefficients and it consists of a large number of 0. Because of the large number of 0's in the AC coefficients they are encoded as a string of pairs of values. Each pair is made up of (skip, value) where skip is the number of zeros in the run and value is the next non-zero coefficient  	CO3, L2 10M

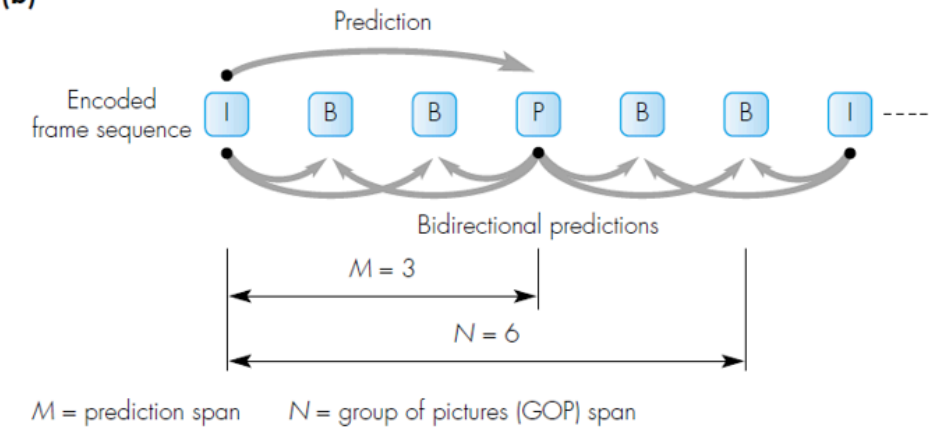
	The above will be encoded as (0,6) (0,7) (0,3)(0,3)(0,3) (0,2)(0,2)(0,2)(0,2)(0,0) Final pair indicates the end of the string for this block. statistical encoding: A set of ASCII codewords are often used for the transmission of strings of characters. However, the symbols and hence the codewords in the source information do not occur with the same frequency. E.g A may occur more frequently than P which may occur more frequently than Q The statistical coding uses this property by using a set of variable length codewords – the shortest being the one representing the most frequently appearing symbol. It is necessary to ensure that a shorter codeword in the set does not form the start of a longer code word. Otherwise, the decoder will interpret the string on the wrong codeword boundaries. A code word set that avoids this happening is said to process the prefix property e.g. Code words that have this property are Huffman encoding algorithm.	
Q 6 b)	Explain GIF and TIFF format Solution: Although colour images comprising 24-bit pixels are supported GIF reduces the number of possible colours that are present by choosing 256 entries from the original set of 224 colours that match closely to the original image Hence instead of sending as 24-bit colour values only 8-bit index to the table entry that contains the closest match to the original is sent. This results in a 3:1 compression ratio The contents of the table are sent in addition to the screen size and aspect ratio information The image can also be transferred over the network using the interlaced mode  .The LZW can be used to obtain further levels of compression	CO3, L2 10M

	GIF also allows an image to be stored and subsequently transferred over the network in an interlaced mode; useful over either low bit rate channels or the Internet which provides a variable transmission rate The compression image data is organized so that the decompressed image is built up in a progressive way as the data arrives TIFF is a flexible and highly detailed image format developed by Aldus Corporation (now owned by Adobe). Unlike GIF, TIFF supports very high image quality with color depths of up to 24 bits or more, making it ideal for storing photographs, scanned documents, and high-resolution graphics. TIFF can use lossless compression methods like LZW or ZIP, or it can be stored uncompressed, depending on the application's requirements. This format supports multiple layers and pages, and is commonly used in desktop publishing, printing, medical imaging, and professional photography due to its ability to preserve fine details. TIFF files tend to be large in size, reflecting their high-quality nature. They are not well-suited for web use due to their size and lack of browser support, but are excellent for archiving and printing purposes.	
Q 7 a)	Explain the working principle of DPCM. Answer: DPCM is a derivative of standard PCM For most audio signals, the range of the differences in amplitude between successive samples of the audio waveform is less than the range of the actual sample amplitudes.  The previous digitized sample value is held in reg R(temp storage reg.) Subtractor- Difference signal is computed by subtracting (Ro) from the digitized sample of ADC	CO4, L2 10M

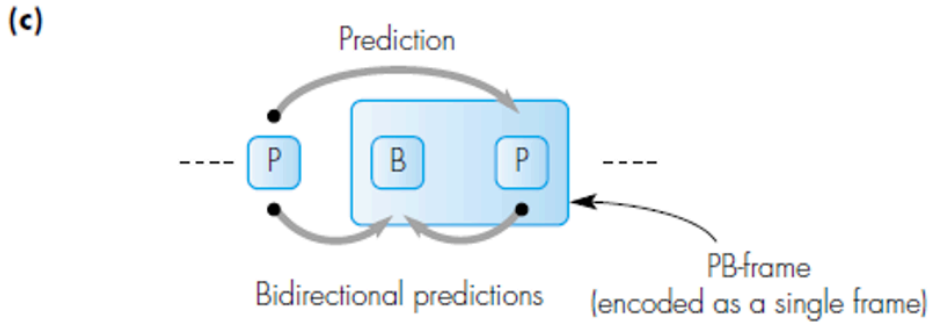
	Adder -helps in updating the new register value by adding the computed difference with the prev. actual to calculate the current actual amplitude Reg R is updated with the difference signal The decoder adds the DPCM with previously computed signal in the reg The o/p of ADC is also known as residual signal. There are schemes to predict the more accurate previous signal The proportions used are determined by predictor coefficients Decoding: Typical savings of DPCM are limited to just 1 bit for a PCM voice signal which reduces the bit rate requirement from 64 kbps to 56kbps.  As the output of ADC is directly used, the accuracy of each computed diff (residual signal) is determined by the accuracy of the prev signal/value held in the register Therefore, previous value held in the register is only an approximation. Hence a technique developed for estimating a more accurate version of the previous value. (Predictive DPCM).	
Q7 b)	With example frame sequences. Explain the meaning of the following type compressed frame and the reasons for their use: i) I – frame are Intracoded.I-frames are encoded without reference to any other frames. The number of frames between successive I-frames are called as group of pictures.Error in I-frame would affect a complete loss of scene. So I-frames are inserted frequently i) I – frame ii) P – frame iii) B – frame	CO4, L2 10M



ii) P – frame: Predictive frame (unidirectional). Encoding of a P-frame is relative to the contents of either a preceding I-frame or a preceding P-frame bidirectional (B-frames) are used in fast moving objects in the frames.The number of P-frames between I-frame is limited since any errors present in the first P-frame will be propagated to the next. The no. of frames between P-frame and I-frame is predictive span.Combination of I-frame and P-frame works well for small movements in scenes.

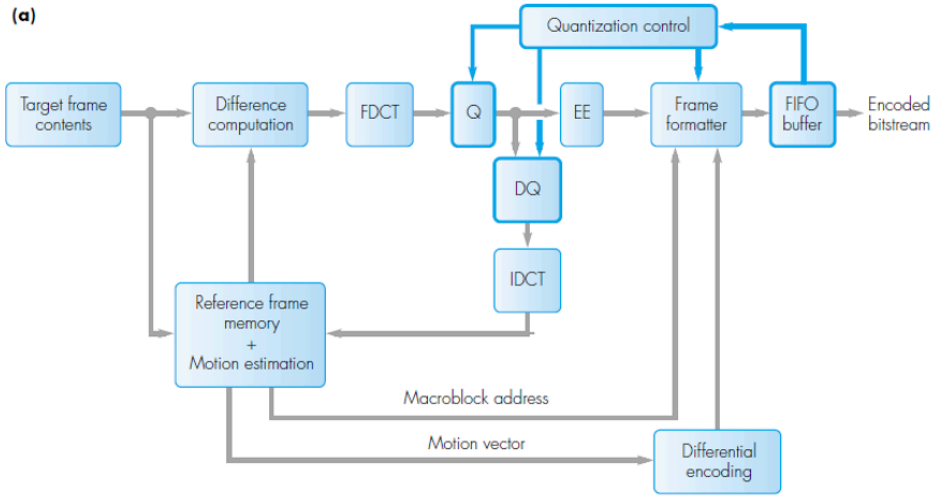


iii) B – frame: Predictive frames (Bidirectional): their contents are predicted using search regions in both past and future frames. For fast movement of objects in scenes a second predictive frame B-frame is inserted.Two neighboring P- and B-frames are encoded as if they were a single frame, PB-Frame.

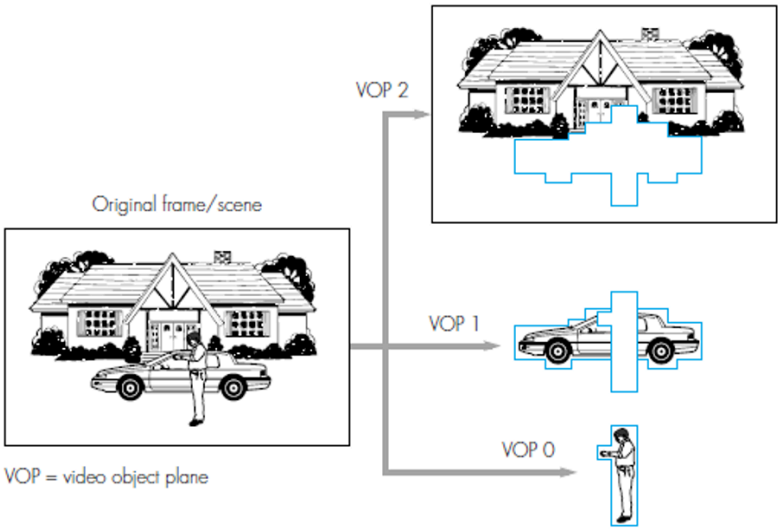


Q8 a)	With a neat diagram, explain H.261 video encoder principle.	CO4, L2

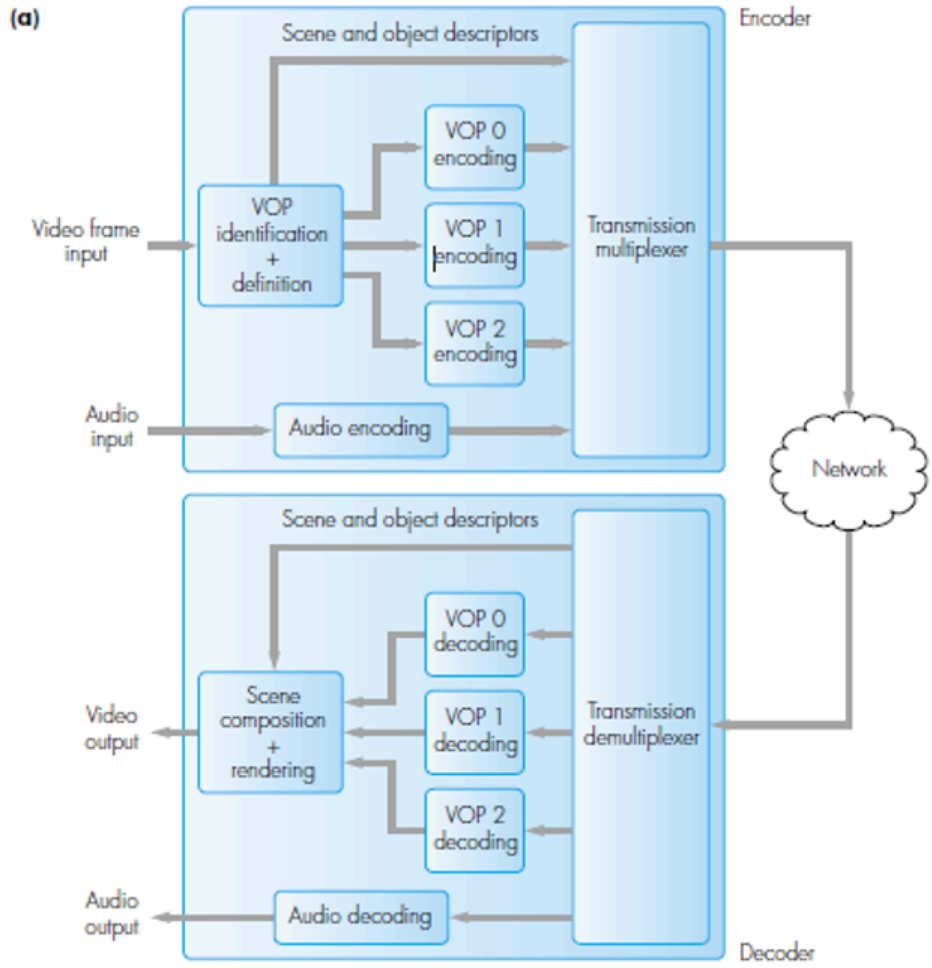
	Answer: Defined for the provision of video telephony and videoconferencing services over an ISDN Transmission channels are multiples of 64kbps Digitization format used is either the common intermediate format(CIF) or the quarter CIF(QCIF) CIF: Y=352X288, Cb=Cr=176X144 QCIF:Y=176X144, Cb=Cr= 88X72 Progressive scanning used with frame refresh rate of 30 fps for CIF and 15 or 7.5 fps for QCIF **Input Video Frame** Raw frames are fed into the encoder one by one. **Motion Estimation and Compensation (Inter-frame coding)** Compares current frame with previous one to find motion vectors (how objects move). Only **difference information** (residuals) is encoded, reducing redundancy. **Discrete Cosine Transform (DCT)** Each frame is divided into 8×8 blocks. DCT converts spatial data into frequency domain (high/low frequencies). **Quantization** DCT coefficients are **quantized** to reduce precision and size (lossy step). Higher quantization → lower quality but better compression. **Zig-Zag Scanning and Run-Length Encoding** Coefficients are reordered (zig-zag) to group zeros together. Run-length encoding compresses repeated values. **Variable Length Coding (VLC)** Huffman coding is used for further compression. **Bitstream Multiplexer** Combines motion vectors, quantized DCT coefficients, and control data into a final compressed bitstream. **FIFO Buffer & Rate Control** Data is stored temporarily in a **First-In-First-Out (FIFO)** buffer. Maintains **constant output bitrate** by adjusting quantization levels dynamically. Ensures compatibility with **fixed bandwidth** channels like 64 kbps	10M

	ISDN.  For bandwidth optimization variable bit rate of encoder is converted into const bit rate By passing through FIFO buffer Feedback is provided to quantizer o/p of the buffer is defined by the transmission bit rate, two threshold values are defined low and high If contents of buffer is below the low threshold ,quantization threshold is reduced and the o/p rate is increased, if it is above high threshold then the threshold is increased and the o/p rate is reduced Control procedure is implemented for GOB and not for MB. Two threshold Low → Quantization threshold↓ → Output bit rate ↑ High → Quantization threshold ↑ → Output bit rate ↓ Hence, since the same compression technique is used for macroblocks in video encoders, it is possible to obtain a constant output bit rate from the encoder by dynamically varying the quantization threshold used. This is the role of the FIFO buffer	
Q 8 b)	Explain the coding principles of MPEG – 4. Answer:MPEG-4 has: Content-based functionalities-each scene is defined in the form of background and one or more foreground objects -Audio-visual object(AVOs) Each AVO- is defined as one or more audio and video objects Object descriptor- each audio and video object origin description is required for manipulation Binary format for scenes (BIFS)- language used for modifying objects(example for video objects changing shape, color, appearance and for audio objects changing volume etc..) Scene descriptor- contains composition of a scene.	CO4, L2 10M

Defines how the various AVOs are related to each other in the context of the complete scene
Figure below- A frame/scene is defined in the form of a number of AVOs
Each video frame is segmented into a number of Video object planes(VOPs), each of which corresponds to an AVO of interest



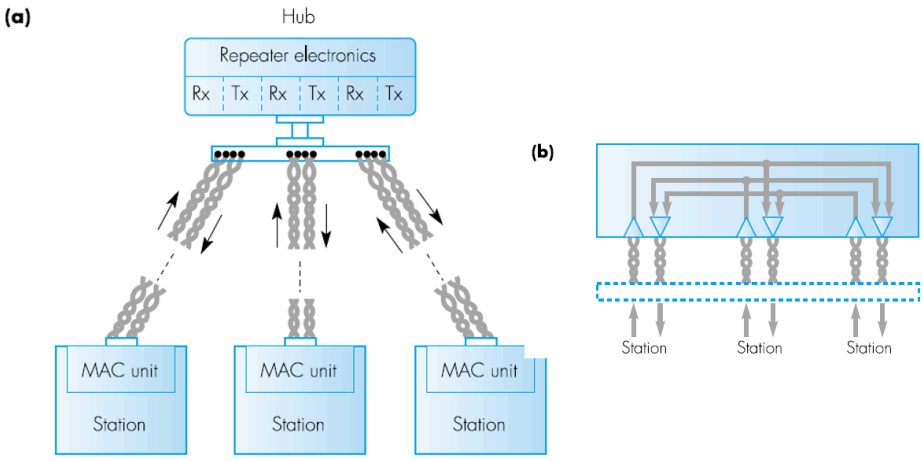
In the example frame is shown as consisting of three VOPs:
VOP 0 – To represent the person approaching the car
VOP 1 – the remainder of the car parked outside the house
VOP 2 – the remainder of the background
Each VOP is encoded separately based on its shape, motion and texture
Each VOP is encapsulated within a rectangle. It is chosen so that it completely covers the related AVO using the minimum number of macroblocks
EACH VOP in the rectangle which refers to the related AVO WITH min MB.
The motion and texture of each VOP is also encoded and the bitstream is multiplexed together with related object and screen descriptor Information .
At the receiver the bitstream is demultiplexed and individual stream decoded.
Decompressed information , screen descriptor and object information together creates the video frame
AUDIO AND VIDEO COMPRESSION
Audio associated with an AVO is compressed using one of the audio compression algorithms and it depends on the available bandwidth/ bit rate of the transmission channel and the sound quality required.
Different algorithms like G.723.1, DOLBY AC3, MPEG LAYER 2 USED for different applications

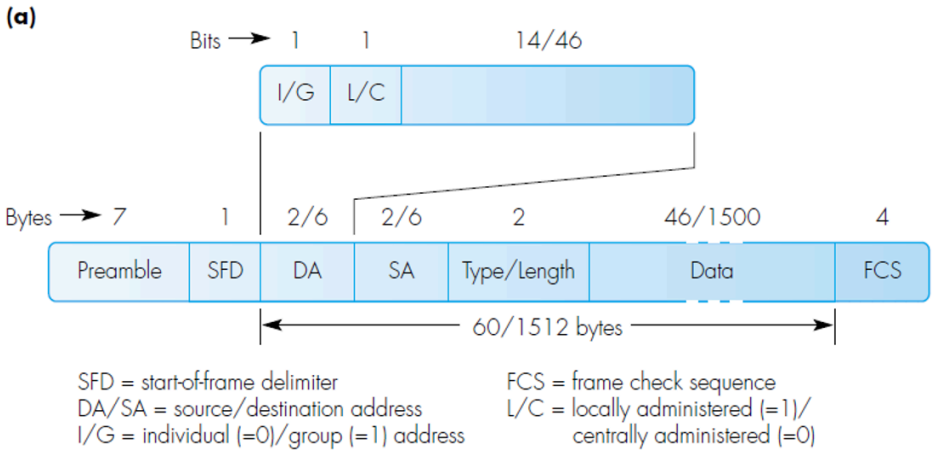
	 EACH VOP is identified, defined and encoded separately EACH object in the VOP is based on the similar properties of texture, color and brightness and such video objects bounded by rectangle containing min MB is encoded based on shape, motion and texture Any VOP which has no motion associated with it will produce a minimum of compressed information VOPs which move often occupy only a small portion of the scene/frame The bitrate of the multiplexed video stream is much lower than that obtained with the other standards.	
Q 9 a)	Explain the principles of Hub Configuration. The unshielded twisted pair (UTP) cable used for telephony to reach each desktop from the wiring closet was less than 100 m. Hence unshielded twisted-pair (UTP) cable – as used for telephony – has rapidly become the standard for use with Ethernet. The configuration used for each segment is shown in Figure(a).	CO5, L2 10M

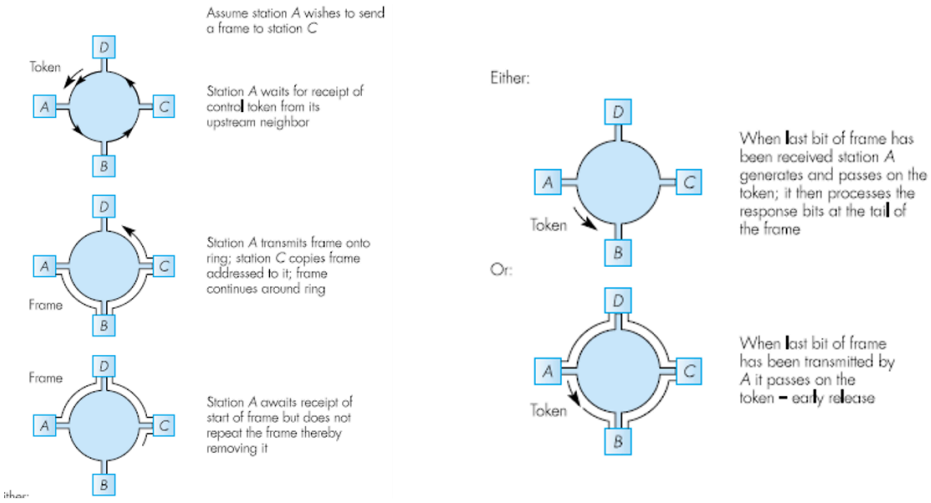
Since the cable forms a physical bus, both thick and thin wire coaxial cable installations involve the cable passing near to each attached station. As we can see in the figure, however, with twisted-pair cable a star configuration is used with the hub located in the wiring closet and each station connected to it by means of twisted-pair drop cables. Normally, category three (CAT3) UTP cable is used for telephony. Each cable contains four separate twisted pairs. In the case of Ethernet, just two pairs are used: one pair for transmissions from the station to the hub and the second pair for transmissions in the reverse direction.

To emulate the broadcast mode of working associated with CSMA/CD as shown in Figure (b), the repeater electronics within the hub repeats and broadcasts out the signal received from each of the input pairs onto all of the other output pairs. Hence the signal output by any of the stations is received by all the other stations and, as a result, the carrier sense function still involves the MAC unit within each station determining whether a signal is currently being received on its input pair. Similarly, the collision detect function involves the station determining if a signal arrives on its input while it is transmitting a frame on the output pair.

Because of their mode of operation, this type of hub is called a repeater hub and typical numbers of attached stations – and hence sockets – are from 8 through to 16. Above this number multiple hubs are stacked together and connected by repeaters or, as we shall explain in Section 8.5, bridges. As with coaxial cable, the maximum length of cable between any two stations – including the 100 m drop cables – must not exceed 1.5 km. To achieve this, in the emulated broadcast mode, normally it is necessary to use a central hub.



Q 9 b)	Explain the frame format and operation parameters of Ethernet/IEEE 802.3. Answer:Ethernet/IEEE802.3 characteristics: (a) frame format;  Preamble field- sent at the head of all frames, for synchronization of bits Start of frame delimiter after preamble, single byte and informs the valid frame start. Destination and source address – MAC address as used by MAC layer First bit in the destination address specifies the address is individual or group address Type of grouping is specified in second bit and can be locally or centrally administered Group address is used for multicasting Two byte type field indicates network layer protocol Length field indicates number of bytes in the data field Maximum size of data field – MTU (Maximum Transmission Unit) FCS – Frame Check Sequence used for error detection Ethernet/IEEE802.3 characteristics: operational parameters. Bit rate: 10 Mbps (Manchester encoded) Slot time: 512-bit times Interframe gap: 9.6 microseconds Attempt limit: 16 Back off limit: 10 Jam size: 32 bits Maximum frame size (including FCS): 1518 bytes Minimum frame size (including FCS): 512 bits	CO5, L2 10M
Q 10 a)	Explain token Ring principle.	CO5, L2

	Answer: **IEEE 802.5 TOKEN RING** Proposed in 1969 and initially referred to as a Newhall ring. **Token ring ::** a number of stations connected by transmission links in a ring topology. Information flows in one direction along the ring from source to destination and back to source. Can both be implemented using star as well as ring topologies but basically it uses ring topology logically and star topology physically. **Medium access control ::** is provided by a small frame, **the token**, that circulates around the ring when all stations are idle. Only the station possessing the token is allowed to transmit at any given time. **Physical Layer Topology: *Ring*** Stations connected in a loop.There is a point to point link between stations that form a ring. All the stations are connected together by a set of unidirectional links in the form of a ring and all frame transmissions between any of the stations take place over it by circulating the frame around the ring. Signals go in only one direction, station-to-station.Only one frame transfer can be in progress over the ring at a time. In a token ring a special bit format called a token circulated around all the stations. When a station wishes to transmit, it must wait for the token to pass by and seize the token. The data frame circles the ring and is removed by the transmitting station. Each station interrogates the passing frame. If destined for a station, it copies the frame into local buffer.  	10M
Q 10 b)	Write a short note on FDDI network components. Answer: FDDI uses two rings- primary and secondary, secondary for additional transmission path / back up	CO5, L2 10M

Two stations- dual attach station(DAS), single attach station(SAS)
DAS-attached to both rings
SAS- attached to primary ring
User stations attached through wiring concentrators
For LAN used as backbone attached stations are bridges
Failure and reconfiguration of LAN as single ring is by beaconing procedure
Beacon MAC frame is used to indicate ring failure and the token passing protocol is suspended. Until the affected failure domain has been located and repaired.