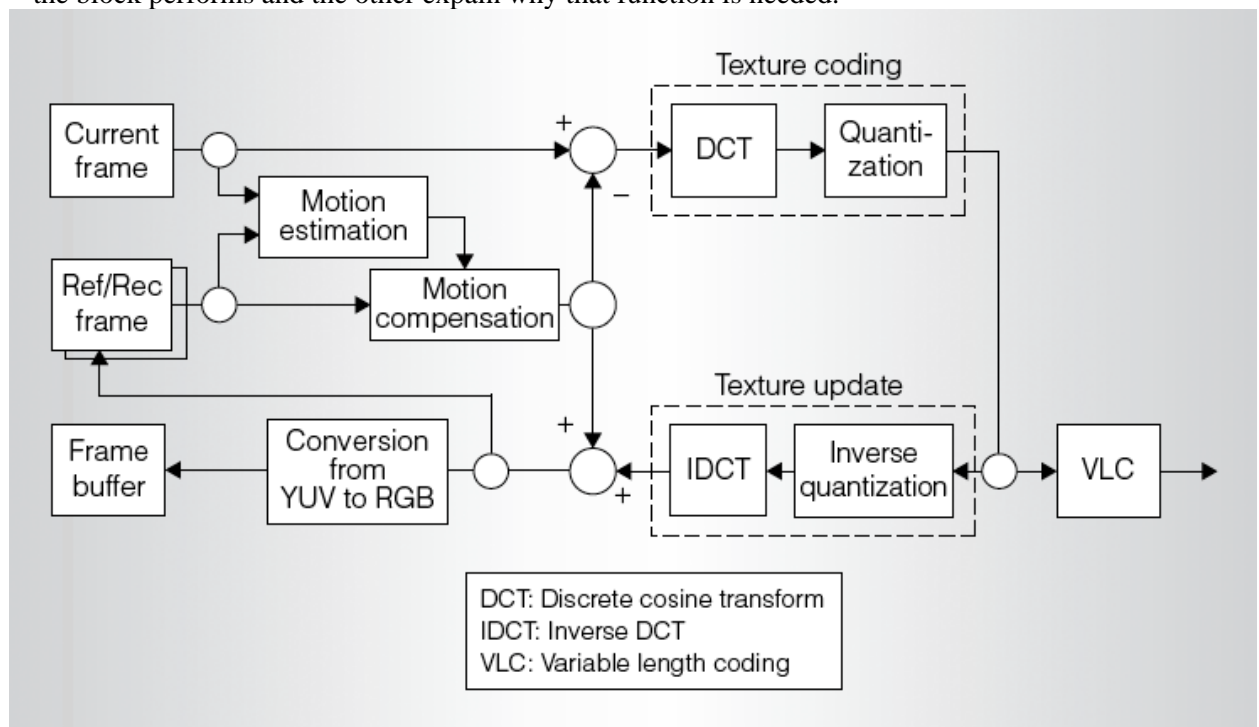


Course: <b>Broadcast Signal Transmission Systems</b>	Number: 691X/498X	Sections:
Examination: Final	Date: Dec. 22, 2015	Time: 3 Hours
Instructors: Dr. M.R. Soleymani	# of pages: 2	
Books and Materials: One (two-sided) formula sheet or class notes (not both)		
Calculators: Allowed (standard type)		
Special Instructions: Try all 7 questions. Make assumptions if necessary.		

- 1) An audio signal is assumed to have frequencies up to 15 kHz., it is sampled at 20% above the Nyquist rate. Assume the the samples are quantized such that the signal to quantization noise ratio is 73 dB. What would be the bit rate of the quantized signal? (Assume the audio signal can be approximated as a sinusoidal waveform.)
- 2) Block diagram of an MPEG encoder is shown below. Very briefly (in one or two sentences for each block) describe the system: One sentence should say what function the block performs and the other explain why that function is needed.



- 3) The uplink and downlink  $\frac{E_b}{N_0}$  of a satellite link are 30 dB and 13 dB, respectively. a) What is the overall  $\frac{E_b}{N_0}$ ? b) If one wants to have an overall  $\frac{E_b}{N_0}$  of 13 dB, what is the best combination of uplink and downlink  $\frac{E_b}{N_0}$ 's?

- 4) The transmit antenna of a TV station has a gain of 15 dBi and is installed at a height of 50 meters. The transmitter power is 50 Watts. What is the received signal power of a viewer who is 5 km. away from the TV station and whose antenna has a gain of 5 dBi and is installed at a height of 5 meters? Use two-ray propagation model.
- 5) A viewer receives TV signals with an  $\frac{E_b}{N_0}$  of 8 dB. The modulation is 8 PSK and a (192, 188) RS code is used. a) what is the packet error probability? b) What is the number of packet errors per day if the rate of the MPEG encoder is 10 Mbps?
- 6) A TV receiver has an antenna with noise temperature of  $1900^\circ$  K, an LNA with 20 dB gain and noise figure of 5 dB, a cable with 4 dB loss, an amplifier with 25 dB gain and a noise figure of 15 dB, and a receiver with a noise temperature of  $600^\circ$  K, Find the overall noise figure of the system.
- 7) The received power ( $P_r$ ) at a location is -85 dBm. The rate is 10 Mbps and the equivalent system noise temperature is  $2600^\circ$  K. a) Find the  $\frac{E_b}{N_0}$ ? What is the minimum bandwidth required if we use MPSK with roll-off factor of 0.1 and a BER of  $10^{-5}$  is required?