EEL715: Digital Image Processing **Minor III, IInd Sem 2014-15**
Max Marks: 40 **Duration: 1 hour**

Ques 1. Propose a gray-level slicing transformation capable of producing an output image that contains the information carried by the 5^{th} and 6^{th} bit-planes of a 10-bit input image. (0^{th} bit is the LSB). **(5)**

Ques 2. Approximate the log transform using a piecewise linear transform (assume 4 equal linear components, and assume that the bit depth is 10 bits). **(3)**

Ques 3. Given that the reflectance along a line is given by $f(x) = A$, and the illumination along the same line is 0 for $x < T_1$, B for $T_1 < x < T_2$, and 0 for $x > T_2$. Show how one can use Homomorphic filtering to reduce the effect of illumination. Clearly illustrate the procedure using figures and mathematical calculations. **(8)**

Ques 4. Given that white noise with exponential pdf is processed using the following spatial domain filter:

$$\begin{bmatrix} 1/3 & 0 & 0 \\ 0 & 1/3 & 0 \\ 0 & 0 & 1/3 \end{bmatrix}$$

Obtain the pdf of the output. Compute its mean and variance. **(2+2)**

Ques 5. Assuming that the acquired image contains blurring due to uniform linear motion between scene and camera. Assume that the shutter stays open for a time period T (displacement along x-axis during that period is a and along y-axis is b). White Gaussian noise with PSD = $N_0/2$gets added to this image. Obtain the Weiner filter to restore this image. Assume that the PSD of the image is I_0. **(10)**

Ques 6. Show that the parallel projections converted from fan-beam projections are not sampled uniformly. Obtain this non-uniform sampling. Show that this can lead to blurring, ringing and aliasing. How can one minimize these effects? **(2+4+3+1)**