Department of Computer Science and Engineering, S V N I T, Surat
Mid Semester Examination, October 2021
M.Tech.-I Computer Engineering (First Semester)
Course: (CO611) Computer Vision and Image Processing

Date: 22 Oct 2021 Time: 10:30 am to 12:00 pm Marks: 30

Instructions:
1. Write your MTech Admission No/Roll No and other details clearly on the answer books.
2. Assume any necessary data but give proper justifications.
3. Be precise and clear in answering the questions.

Q.1

(a) Show that the Laplacian operation is isotropic (invariant to rotation). The following are the equations relating coordinates after axis rotation by an angle θ: [6]

$$x = x' \cos\theta - y' \sin\theta$$
$$y = x' \sin\theta - y' \cos\theta$$

where (x, y) are the unrotated and (x', y') are the rotated coordinators.

(b) Introduce the following terms: Scene irradiance, Scene radiance, Image irradiance and Solid angle. [4]

Q.2 Derive an equation for the mapping of object patch to image patch with necessary diagram and equations. Also show that image irradiance E is proportional to scene radiance L. [8]

Q.3

(a) Explain the processes of histogram equalization and histogram specification with necessary equations in detail. [4]

(b) Why does histogram equalization usually not produce images with flat histograms? [2]

Q.4 The histogram of an image can be approximated by probability distribution function $p_r(r) = Ae^{-r}$. A is normalizing factor and intensity r varies 0 to l. Calculate transformation function $s = T(r)$ such that $p_s(s) = Bse^{-s^2}$. B is normalizing factor and intensity s takes value between 0 to l. (Hint: $p_s(s)ds = p_r(r)dr$) [6]