REMOTE SENSING
(AEIE 6134)

Time Allotted : 2½ hrs **Full Marks : 60**

Figures out of the right margin indicate full marks.

Candidates are required to answer Group A and any 4 (four) from Group B to E, taking one from each group.

Candidates are required to give answer in their own words as far as practicable.

Group – A

1. Answer any twelve: **12 × 1 = 12**

Choose the correct alternative for the following

(i) Remote sensing uses which of the following waves in its procedure?
(a) Electric field (b) Gamma rays
(c) Sonar waves (d) Electro-magnetic waves.

(ii) Duplexer is
(a) an oscillator (b) a microwave switch
(c) an amplifier (d) an active device.

(iii) The spectral region of the electromagnetic radiation which passes through the atmosphere without much attenuation is known as
(a) Ozone hole (b) Atmospheric window
(c) Ozone window (d) Black hole.

(iv) The infrared portion of EMR lies between:
(a) 0.4 – 0.7 μm (b) 0.5 – 1.0 μm
(c) 0.7 – 1.3 μm (d) 0.7 – 14 μm

(v) How much inclination must be provided at least in a tilted photograph?
(a) 13˚ (b) 20˚ (c) 3˚ (d) 34˚.

(vi) The point vertically below the observer on the earth surface is called
(a) nadir (b) zenith (c) principal point (d) celestial point

(vii) The shape of a pixel of an image can only be
(a) Rectangular (b) Circular
(c) Square (d) Triangle

(viii) Which characteristics are taken together in chromaticity?
(a) Hue and Saturation (b) Hue and Brightness
(c) Saturation, Hue and Brightness (d) Saturation and Brightness.

(ix) In which type of learning the labelled training data is used?
(a) Unsupervised learning (b) Supervised learning
(c) Semi-unsupervised learning (d) Reinforcement learning.

(x) Which of the following statements is not true about Kernel methods?
(a) It can be used for pattern analysis or pattern recognition
(b) It maps the data into higher dimensional space
(c) The data can be easily separated in the higher dimensional space
(d) It only leads to finite dimensional space.

Fill in the blanks with the correct word

(xi) The instruments which provide electromagnetic radiation of specified wave length or a band of wave lengths to illuminate the earth surface are called _____ sensors.

(xii) RADAR is the acronym of _____.

(xiii) The sun approximates a _____ K blackbody.

(xiv) LIDAR is the acronym of _____.

(xv) An 8-bit image can have _____ number of different pixel values.

Group - B

2. (a) What is remote sensing? State some important applications of remote sensing. *[(CO1)(Remember/LOCQ)]*
(b) What is the fundamental basis of remote sensing system? State the basic components of an ideal remote sensing system. *[(CO1)(Remember/LOCQ)]*
(c) What are advantages and limitations of remote sensing? *[(CO1)(Remember /LOCQ)]*
4 + 6 + 2 = 12

3. (a) Discuss different types of atmospheric scattering in brief. *[(CO1)(Remember/LOCQ)]*
(b) What is atmospheric absorption and atmospheric windows? *[(CO1)(Understand/LOCQ)]*
(c) Calculate the frequency and amount of radiant energy for the wavelength of 1 mm. Consider the speed of light as 3 × 10^8 m/s, and Plank 's constant as 6.626 × 10^(-34) J. *[(CO1)(Apply/IOCQ)]*
4 + 4 + 4 = 12

Group - C

4. (a) What is emissivity of an object? Discuss the factors that influence emissivity of an object. *[(CO2)(Understand/LOCQ)]*
(b) For the measurement of height of a tower let the relief displacement for the tower is 3.05 mm and the radial distance from the centre of the photo to the top of the tower is 65.58 mm. If the flying height is 1200 m above the base of the tower, find the height of the tower. *[(CO3)(Evaluate/HOCQ)]*
(c) What is Ground Swath Width (GSW) of across track thermal infrared scanning system? *[(CO2)(Remember/LOCQ)]*

(d) If a sensor system has total angular field of view of 100° and an altitude above ground level of 8000 m, find the GSW of this system. *[(CO2)(Analyze/IOCQ)]*

4 + 4 + 2 + 2 = 12

5. (a) What are the important measurements that can be performed with vertical aerial photography? Describe the process of area measurement of irregular shape. *[(CO3)(Remember/LOCQ)]*

(b) Explain Wein's displacement law. Considering Sun as blackbody of 6000 K, calculate the dominant wavelength emitted from it. *[(CO2)(Analyze/IOCQ)]*

(c) Justify the need of synthetic aperture radar to overcome the drawback of real aperture radar and explain its working principle. *[(CO2)(Ealuate/HOCQ)]*

(2 + 2) + 4 + 4 = 12

Group - D

6. (a) How important are the weights in image subtraction? Suggest a suitable pre-processing technique for image differencing. *[(CO4)(Understand/LOCQ)]*

(b) Describe image multiplication and its main application. *[(CO4)(Remember/LOCQ)]*

(c) Using a diagram, explain the principle of PCA. Discuss the data characteristics of PC images and their applications. *[(CO5)(Analyze/IOCQ)]*

3 + 4 + 5 = 12

7. (a) Describe the k nearest mean filter, median filter and adaptive median filter. *[(CO4)(Understand/LOCQ)]*

(b) Apply the above three filters and find out the filtering results considering a 3×3 mask for the marked pixel with a circle on the sample image shown in Fig. below. Articulate merits of the filters based on the filtering results.

138	113	140	173	100
144	18	145	18	97
167	96	122	152	146
173	87	134	83	126
167	119	98	112	123

[(CO4)(Apply/IOCQ)]

(c) List the points under what circumstances geometric corrections of remotely sensed image are required. *[(CO5)(Remember/LOCQ)]*

4 + 6 + 2 = 12

Group - E

8. (a) What are supervised and unsupervised classification? Describe the general steps of supervised classification. *[(CO6)(Understand/LOCQ)]*

(b) What is KNN classifier? Explain with examples. *[(CO6)(Understand/LOCQ)]*

(c) State the advantages and disadvantages of KNN classifier. *[(CO6)(Remember/LOCQ)]*

(2 + 2) + 4 + 4 = 12

9. (a) Build a flow diagram of data (e.g., test, training, imagery), decisions, and iterations associated with a typical back-propagation multi-layer perceptron (MLP) neural network used for imagery and other geospatial data classification.

[(CO6)(Analyse/IOCQ)]

(b) Highlight the limitations of artificial neural network. *[(CO6)(Understand/LOCQ)]*

(c) A neuron j receives inputs from four other neurons whose activity levels are 10, -20, 4 and -2. The respective synaptic weights of neuron j are 0.8, 0.2, -1.0, and 0.9. Estimate the output of neuron j considering a (i) linear activation function and (ii) sigmoid activation function. Assume that the bias applied to the neuron is zero.

[(CO6)(Evaluate/HOCQ)]

5 + 2 + 5 = 12

Cognition Level	LOCQ	IOCQ	HOCQ
Percentage distribution	59.37	22.92	17.71