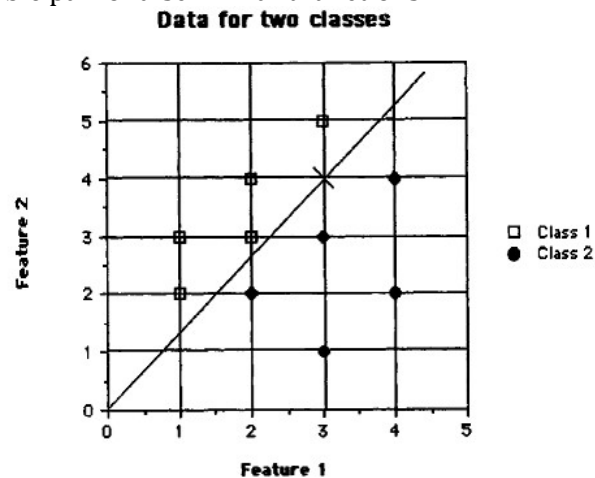


- (b) Use a diagram of the RGB colour cube to explain the mathematical definition and physical meaning of intensity, hue and saturation.

(3 + 6) + 3 = 12

Group - E

8. (a) State the key steps in the selection and evaluation of training data.
 (b) Describe the tree structure of a decision tree using hybrid method for multispectral and hyperspectral data analysis.
 (c) Calculate the likelihood of the brightness value "45" as a member of "Forest" ("F" class) or "Cropland" ("C" class) from the following:
 P(45|F) ("the probability of encountering digital value 45, given that we have category Forest") is 0.75 and P(45|C) ("the probability of encountering digital value 45, given that we have category Cropland") is 0.25, P[F] = 0.50 and P[C] = 0.50.
9. (a) Describe the general steps of supervised classification.
 (b) The figure below contains training data for two classes. Assume a linear decision boundary on the graph for classifying these data with 100% accuracy for a line that passes through the origin and the point $x_1 = 3$ and $x_2 = 4$. Write the equation for the decision boundary and a suitable pair of discriminant functions.



- (c) Describe the method of linear discriminant analysis (LDA).

4 + (2 + 2) + 4 = 12

**REMOTE SENSING
(AEIE 6143)**

Time Allotted : 3 hrs

Full Marks : 70

Figures out of the right margin indicate full marks.

Candidates are required to answer Group A and any 5 (five) from Group B to E, taking at least one from each group.

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

**Group - A
(Multiple Choice Type Questions)**

1. Choose the correct alternative for the following: **10 × 1 = 10**
- (i) Coherence of two electromagnetic waves takes place if their phase difference is
 (a) constant in time (b) constant in space
 (c) constant in time and space (d) none of these.
- (ii) A perfectly black body
 (a) is a diffuse emitter (b) absorbs all the radiations of every lengths
 (c) emits power of every wave length (d) all the above.
- (iii) Which one of the following factors does not affect the scale of the aerial photograph?
 (a) Focal length (b) Flying height
 (c) Ground elevation (d) None of these.
- (iv) Radar resolution has the unit of
 (a) seconds (b) degrees (c) meter (d) meter/sec.
- (v) Support vector machine is a
 (a) supervised learning (b) unsupervised learning
 (c) semi-supervised learning (d) reinforcement learning.
- (vi) The instruments which provide electromagnetic radiation of specified wave length or a band of wave lengths to illuminate the earth surface, are called
 (a) passive sensors (b) active sensors
 (c) sensors (d) none of these.

- (vii) Pick up the important characteristic of a target which facilitates its identification from the following:
 (a) spatial variation (b) spectral variation
 (c) temporal variation (d) all of these.
- (viii) LIDAR means
 (a) Linear Detection and Ranging (b) Linear Detection Radar
 (c) Light Detection and Ranging (d) Light Detection Radar.
- (ix) The dominant wavelength for a 800 K red hot object is
 (a) 2.36 μm (b) 3.62 μm
 (c) 6.32 μm (d) none of the above.
- (x) The part radiation due to scattered/diffused radiation entering the field of view of a remote sensor other than that from the required target,
 (a) increases the contrast of the image but reduces the sharpness
 (b) reduces the contrast of the image and also its sharpness
 (c) increases both the contrast and sharpness
 (d) reduces the contrast but increases the sharpness.

Group - B

2. (a) What are passive and active remote sensing systems?
 (b) Define the four sensor resolutions associated with a remote sensing system.
 (c) What are advantages and limitations of remote sensing?
4 + 4 + 4 = 12
3. (a) Discuss different types of atmospheric scattering in brief.
 (b) What is atmospheric absorption and atmospheric windows?
 (c) If temperature of a blackbody is 3000 K, calculate the radiance of that material for the wavelength 5 μm .
4 + 4 + 4 = 12

Group - C

4. (a) What is the basis of thermal infrared remote sensing?
 (b) What ranges of thermal infrared detectors will be appropriate to recognize 800 K forest fire and Earth surface at 300 K?

- (c) What is Ground Swath Width (GSW) correction of across track thermal infrared remote sensing? 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.
4 + 4 + 4 = 12
5. (a) Define depression angle, incident angle and polarization of electromagnetic wave associated with a RADAR system.
 (b) What is the principle of synthetic aperture radar (SAR)?
 (c) A SLAR system has a 3 millirad antenna beam width. Calculate the azimuth resolution of the system at a range of 10 and 20 km. If the system sends pulses at an interval of 0.2 μsec then what will be the slant range and ground resolution at a dispersion angle of 60°.
3 + 4 + 5 = 12

Group - D

6. (a) Why is an image algebraic operation also known as a multi-image point operation? Write down the mathematical definition of the multi-image point operation.
 (b) Why image addition improves image SNR? If nine photographs of the same scene are taken, using a stationary camera under identical illumination conditions, and then summed to generate an average image, by how many times is the SNR improved in comparison with any individual picture?
 (c) Describe image difference (subtraction) and ratio (division) operations and then compare the two techniques in terms of change detection, selective enhancement and processing efficiency.
3 + 3 + 6 = 12
7. (a) Describe the k nearest mean filter, median filter and adaptive median filter and find out the filtering results of these three filters considering a 3×3 mask for the marked pixel with a circle on the sample image shown below.

173	140	124	113	100
167	145	136	18	83
138	252	122	96	117
144	134	83	87	116
137	115	95	119	142