

Seat No. : \_\_\_\_\_

**AP-103**

**April-2023**

**M.Sc., Sem.-IV**

**510 : Physics**

**Remote Sensing and Electronic Communication-II**

**(Old and New Course)**

**Time : 2:30 Hours]**

**[Max. Marks : 70**

**Instructions :**

- (i) Symbols have their usual meanings.
- (ii) Scientific calculators are allowed.

1. (A) With help of a figure and necessary equations describe Planck's law, Wien's displacement law and Stefan Boltzmann law. 7
- (B) Discuss how pushbroom scanning is different from whiskbroom scanning. Which scanning method is better and why ? 7

**OR**

- (A) What do you understand by spectral signature ? Plot spectral signatures of soil and vegetation and discuss how these features can be identified in an image. 7
- (B) Distinguish between : 7
- (i) spectral resolution and radiometric resolution
  - (ii) simple vegetation index and normalized difference vegetation index

2. (A) What is meant by image enhancement ? What are the different techniques used for image enhancement ? Discuss in detail about histogram equalization. 7

(B) Why geometric correction is needed on a satellite image ? How is it achieved ? 7

**OR**

(A) What do you understand by image restoration ? Discuss about radiometric and atmospheric corrections. 7

(B) What is meant by spatial frequency of an image ? Discuss the processes of convolution in the context of high pass filters. 7

3. (A) For FM receiver, derive the expression for signal to noise ratio at the reference and at the output. 7

(B) Define AGC. Why is it needed in receiver ? Draw the circuit of practical diode detector and discuss its working. 7

**OR**

(A) Discuss superheterodyne FM receiver with neat and clean block diagram. Compare the differences and similarities between AM and FM superheterodyne receiver. 7

(B) State the advantage of having RF stage in superheterodyne AM receiver. Draw the circuit diagram of a typical RF stage. What is image frequency ? 7

4. (A) Discuss in detail, "Moving Target Indicator (MTI) radar". 7

(B) Explain in detail, "FMCW radar". 7

**OR**

(A) Explain in detail, "pulsed radar system". 7

(B) With necessary block diagram explain conical switching for radar tracking. 7

5. Briefly answer any **Seven** questions from the following : (2 marks each)

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- (i) What is meant by atmospheric window ? What is its significance in remote sensing ?
  - (ii) Define emissivity. What will be emissivity of a black body and a perfect reflector ?
  - (iii) What is Modulation Transfer Function (MTF) ? If its value is one, what does it mean ?
  - (iv) What is the significance of PAN band used in satellite sensor ?
  - (v) Spatial resolution of sensor used in Cartosat is 0.65 m, what does it mean ?
  - (vi) What are the two advantages of Principal Component Analysis (PCA) ?
  - (vii) Why is intermediate frequency not selected very low ?
  - (viii) Local oscillator frequency is considered higher than the signal frequency. (TRUE or FALSE)
  - (ix) What do you mean by selectivity of a receiver ?
  - (x) Military radar operates at 7 GHz with 4.9 MW power output. If the antenna diameter is 15 m, the receiver bandwidth is 2.6 MHz and has a 17 dB noise figure, determine the maximum radar range for  $0.8 \text{ m}^2$  target.
  - (xi) What is blind speed ?
  - (xii) How does the main/interrogating radar system identify that the detected signal (radar beacon) is from friend or foe ?
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