Roll No. | | | | | | | | | | |

**ANNA UNIVERSITY (UNIVERSITY DEPARTMENTS)**

**B.E. (Full Time) - END SEMESTER EXAMINATIONS, April/May 2025**

**GEO-INFORMATICS**

II Semester

**PH23C02 & Principles and Applications of Electromagnetic Radiation in Remote Sensing**

(Regulation 2023)

Time: 3hrs Max. Marks: 100

| | |
|---|---|
| CO1 | Comprehend the basic properties of electromagnetic radiation. |
| CO2 | Understand the phenomena involved during the EMR interaction with the earth's atmosphere and surface. |
| CO3 | Grasp the physics principles behind remote sensing. |
| CO4 | Identify the external parameters and concepts needed for error-free navigation. |
| CO5 | Appreciate various physics concepts involved in obtaining precise images. |

**BL – Bloom's Taxonomy Levels**

(L1-Remembering, L2-Understanding, L3-Applying, L4-Analysing, L5-Evaluating, L6-Creating)

**PART- A(10x2 = 20Marks)**

(Answer all Questions)

| Q.No | Questions | Marks | CO | BL |
|---|---|---|---|---|
| 1 | Mention some sources of EMR. | 2 | CO1 | L2 |
| 2 | Define Kirchhoff's law. | 2 | CO1 | L1 |
| 3 | Explain light polarization. | 2 | CO2 | L2 |
| 4 | Explain the principle behind Raman scattering | 2 | CO2 | L2 |
| 5 | What are active and passive sensing? | 2 | CO3 | L1 |
| 6 | Differentiate between GPR and seismic detection. | 2 | CO3 | L2 |
| 7 | Define gravitational field and provide its mathematical form? | 2 | CO4 | L1 |
| 8 | Define Earth's escape velocity and write its formula? | 2 | CO4 | L1 |
| 9 | What is the photoelectric effect? | 2 | CO5 | L1 |
| 10 | What are amplifiers? | 2 | CO5 | L1 |

**PART- B(5x 13 = 65 Marks)**

(Restrict to a maximum of 2 subdivisions)

| Q.No | Questions | Marks | CO | BL |
|---|---|---|---|---|
| 11 (a) | Briefly explain HH polarization, radiant intensity, and spectral radiance.<br>A laser emits sinusoidal electro-magnetic wave that travels in vacuum in the negative direction. The wavelength is 10 μm and E fields is parallel to y-axis, with Emax =1.2 M v/m. Then vector equations for E and B as a function of time and position are? | 5+8 | CO1 | L1,L5 |
| OR | | | | |
| 11 (b) | State and represent the Stefan-Boltzmann Law, Wein's displacement law, and the Inverse Square Law.<br>Calculate the spectral radiance emitted by a land surface at 300 K at a wavelength of 20 μm using Planck's law. | 5+8 | CO1 | L1,L5 |
| 12 (a) | Draw and explain the interaction of EMR interaction with the atmosphere, focusing on Absorption, Scattering, and Reflection. | 13 | CO2 | L3 |
| OR | | | | |

| | | | | |
|---|---|---|---|---|
| 12 (b) | How can we use spectral reflectance to map and identify different types of ground cover: vegetation, soil, and water? | **13** | CO2 | L3 |
| 13 (a) | Discuss seismic reflection: from principles to mathematic representation. | **13** | CO3 | L3 |
| **OR** | | | | |
| 13 (b) | Draw and explain the working principle of RADAR and LIDAR. | **13** | CO3 | L3 |
| 14 (a) (i) | Derive Earth's 'g' as a function of height. | **5** | CO4 | L5 |
| (ii) | Let's consider an International Space Station designed to operate at an altitude of 1000 km. When completed, it will have a weight (measured at the Earth's surface) of 4.22 $x10^6$ N. What is 'g' at this height? Also, calculate its weight when in orbit? | **8** | | |
| **OR** | | | | |
| 14 (b) (i) | State and derive Kepler's second law. | **5** | CO4 | L5 |
| (ii) | Assume a satellite with a mass = 470 Kg is orbiting in a geosynchronus orbit. Calculate its distance from earth? Mass of earth is $5.98x10^{24}$ kg. Orbital period is equal to Earth's rotational period. | **8** | | |
| 15 (a) | Explain the basic principles, operational mechanism, and processing involved in CCDs. | **13** | CO5 | L3 |
| **OR** | | | | |
| 15 (b) | Describe the working principles of radio signal devices in detail. | **13** | CO5 | L3 |

## PART- C(1x 15 = 15 Marks)

(Q.No.16 is compulsory)

| Q.No | Questions | Marks | CO | BL |
|---|---|---|---|---|
| 16. (i) | Explain the structure and composition of Earth's atmosphere. | **10** | CO2 | L2 |
| (ii) | Discuss how the dielectric constant and refractive index are useful in remote sensing. | **5** | CO2 | L3 |