SARDAR PATEL UNIVERSITY
T.Y.B.Sc. Examination, FIFTH Semester
Wednesday, 20TH November 2019
Time : 10.00 am To 1.00 pm
Applied Physics Course Code : US05CAPH05
Course Title : Thermal Physics and Remote Sensing

Total Marks : 70

Q-1 Write answers to the following multiple choice questions in your answer book by selecting the proper option. **[10]**

   (1) The phenomenon of heat conduction is prominent in
     (a) non-metals (b) alloys (c) metals (d) wood

   (2) Solids with weekly bonded electrons are ___ conductors of heat.
     (a) good (b) poor (c) moderate (d) not

   (3) What happens when a material is heated?
     (a) It contracts (b) It melts (c) It expands (d) It bursts

   (4) Heat radiations are ___ in nature.
     (a) electric (b) magnetic (c) inductive (d) electro-magnetic

   (5) In ___ mode of heat transport the material medium is not required.
     (a) conduction (b) convetion (c) radiation (d) compression

   (6) According to Stefan's law, the emissivity of a perfectly black body is directly proportional to ___ power of its absolute temperature.
     (a) third (b) fourth (c) fifth (d) zeroth

   (7) Sensors which produce their own electromagnetic radiation are called ___ sensors.
     (a) passive (b) active (c) emitters (d) absorbers

   (8) The ability of a satellite sensor to observe a scene at regular interval of time is known as ___ resolution
     (a) spatial (b) spectral (c) radiometric (d) temporal

   (9) The wavelength range of thermal infrared range is ___
     (a) 0.1 to 0.3 μm (b) 8 to 14 μm (c) 0.4 to 3 μm (d) 1 to 30 μm

  (10) The characteristic feature of a surface which enables it to be recognized is called its ___
     (a) signature (b) texture (c) colour (d) smoothness

Q-2 Answer the following questions in brief. (Answer any Ten Questions) **[20]**

   (1) Define co-efficient of thermal conductivity.

   (2) Give a brief introduction to phenomenon of conduction of heat through a substance.

   (3) Obtain the dimensional formula for thermal conductivity.

   (4) Give a brief introduction to radiation of heat by a surface.

   (5) State Kirchoff's law of heat transfer.

   (6) Enlist the various mechanisms by which heat transfer takes place.

   (7) Enlist the major regions of electromagnetic spectrum which are widely used for remote sensing.

(8) Enlist the major types of earth features observed from the satellite.
(9) Give a brief classification of remote sensors.
(10) Write a short note on scene noise.
(11) What is the difference between resolving power and resolution?
(12) Define temporal resolution.

Q-3   In case of rectilinear flow of heat along a metal bar, obtain the Fourier Differential   [10]
       Equation of heat flow. Also discuss its special cases.
                                        OR
Q-3   (a)   Describe the method for determination of thermal conductivity of a glass tube.   [5]
       (b)   Describe Lee's method for determination of thermal conductivity of liquid.   [5]

Q-4   (a)   State Kirchoff's law of heat radiation and derive formula for the emissivity E_λ for a   [5]
              perfectly black body.
       (b)   Derive the expression for the Newton's law of cooling using Stefan's law.   [5]
                                        OR
Q-4   (a)   State and explain Stefan's law and give its thermodynamic proof.   [5]
       (b)   Draw Lummer-Pringsheim curves and hence explain Wien's displacement law.   [5]

Q-5   (a)   Explain Spectral Resolution with the help of necessary diagrams.   [5]
       (b)   What is spatial resolution? Describe the theoretical limit of resolution with the   [5]
              help of Airy pattern and explain Contrast Ratio.
                                        OR
Q-5   (a)   Write a note on Line-Pair resolution related to spatial resolution.   [5]
       (b)   Write a note on location of spectral bands.   [5]

Q-6   (a)   Discuss the leaf structure and explain importance of vegetation signature in   [5]
              reflective OIR region.
       (b)   Discuss about the Map Scale and IFOV with respect to remote sensing.   [5]
                                        OR
Q-6   (a)   Write a note on selection of sensor parameters.   [5]
       (b)   Explain the different features of snow cover and hence discuss about the   [5]
              spectral albedo from snow cover.

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