AJ-101

April-2015

M.Sc., Sem.-IV

PHY-510 EB : Physics

(Electronic Communication-II)

Time : 3 Hours]   **[Max. Marks : 70**

Instructions :   (1)   Symbols and terminology have their usual meanings.

                (2)   Attempt all questions.

                (3)   Scientific calculator may be permitted.

1.   (a)   Define degenerate and dominant modes in a waveguide propagation. Discuss important properties of dominant mode in a rectangular waveguide. Draw field patterns of dominant TE mode in a rectangular waveguide.   **7**

<div align="center">OR</div>

        Write down the wave equation for TM mode in a hollow rectangular waveguide. Obtain the equations for its field components.

  (b)   Obtain the field components existing in a circular waveguide under TE modes.   **7**

<div align="center">OR</div>

      (i)   An air filled circular wave guide of internal diameter 5.0 cm supports TE_{11} mode at 3 GHz. Determine :   **4**

           (i)   The cut-off frequency

           (ii)   The wavelength in the waveguide

           (iii)   Wave impedance in the waveguide.

        (Given : Root of Bessel function $p'_{11} = 1.841$)

      (ii)   Determine the cut-off wavelength for the TE_{10} mode in a rectangular waveguide of breadth 10 cm. For a 2.5 GHz signal propagated in this waveguide in the TE_{10} mode ; calculate the guide wavelength and the phase velocity.   **3**

2.   (a)   Describe the principle, structure and main features of Yagi antenna.   **7**

<div align="center">OR</div>

        Write a detailed note on effects of ground on antenna.

  (b)   Write a short note on : Types of antenna.   **7**

<div align="center">OR</div>

        Discuss the structures and main features of end fire and broad side array antennas.

3. (a) Define image frequency and its rejection ratio.

        For an AM receiver, having no RF stage, the loaded Q of antenna coupling circuit is 100. If intermediate frequency (f_i) is 455 kHz, then calculate image frequency and its rejection ratio at signal frequency (f_s) of 1000 kHz. **7**

        OR

        What is meant by superheterodyne principle. Draw the circuit of self excited mixer stage used in AM Receiver and explain its working ?

    (b) Give the block diagram of a superheterodyne A-M Receiver. Draw the circuit diagram of a typical RF stage. **7**

        OR

        (i) What are the factors on which the choice of intermediate frequency depends ? Why is intermediate frequency not chosen very low ? **5**

        (ii) Discuss the term sensitivity of a radio receiver. **2**

4. (a) Write the radar range equation and discuss various factors affecting maximum range of radar. **7**

        OR

        Write a detailed note on display methods used in radars.

    (b) Draw block diagram of MTI radar and explain its operation giving the graphical samples of its output. **7**

        OR

        Explain principle of operation of FM CW radar. If MTI radar operates on 3 GHz and pulse repetition rate is 700 then find its second lowest blind speed.

5. Answer the following questions in brief : (Each question is of one mark) **14**
    (i)   What are the types of power losses in a rectangular waveguide ?
    (ii)   Dominant modes in rectangular and circular waveguides are _____ and _____ respectively. (Fill in the blanks)
    (iii) On what factors do the cut-off frequency of a rectangular waveguide depends ?
    (iv)   What is called parasitic element of an array antenna ?
    (v)   Define Hertzian dipole.
    (vi)   Draw radiation pattern of Parabolic reflector.
    (vii) Impedance of an active element in a Yagi antenna is _____.
    (viii) What is advantage of FM CW radar over CW Doppler radar ?
    (ix)   What is blind speed ?
    (x)   Give full form of MTI RADAR.
    (xi)   Define Fidelity of a receiver.
    (xii) State the advantage of having RF stage in AM receiver.
    (xiii) Name two different detector circuits.
    (xiv) Name two local oscillator circuits.

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