

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

# MO-154

March-2019

M.Sc., Sem.-IV

## 510 : Physics (Electronic Communication-II) (New Course)

Time : 2:30 Hours]

[Max. Marks : 70

- Instructions :**
- (1) Attempt **All** questions.
  - (2) **All** questions carry equal marks.
  - (3) Symbols and terminology have their usual meanings.
  - (4) Scientific calculator may be permitted.

1. (A) (i) Write down transmission line equations in frequency domain. Using these equations obtain the general equations for propagation constant, characteristic impedance and phase velocity of the T-line. 7
- (ii) Define the following term and explain their physical significance with reference to transmission line, (a) Characteristic impedance (b) VSWR (c) Reflection co-efficient 7

**OR**

- (i) What is called a lossless transmission line ? For a terminated lossless transmission line obtain the equation for reflection co-efficient at the load. Discuss special cases of termination of a lossless line.
- (ii) What is Smith chart ? Derive the equations of constant resistance and reactance circles of Smith chart. Discuss how Smith chart is obtained from these equations.
- (B) Answer in brief any **four** questions from the following : (Each question is of **one** mark). 4
- (i) What are the maximum and minimum values of reflection co-efficient ?
  - (ii) What is the mode of propagation of EM wave in co-axial line ?
  - (iii) What is quarter wave transformer ?
  - (iv) A short circuited transmission line of half wavelength length represents \_\_\_\_\_ impedance. (inductive, capacitive, resistive)
  - (v) (0,0) point on Smith chart represents \_\_\_\_\_ load. (short circuited, open circuited, matched)
  - (vi) The distance around the Smith chart once is \_\_\_\_\_. ( $\lambda/2$ ,  $\lambda$ ,  $\lambda/4$ )

2. (A) (i) Explain the principle, structure and important properties of Yagi-Uda antenna. 7
- (ii) Write a detailed note on: Parabolic reflector antenna. 7
- OR**
- (i) Discuss about the effects of ground on antenna.
- (ii) Derive radiation field equations for Hertzian dipole.

- (B) Answer in brief any **four** questions from the following : (Each question is of **one** mark). 4
- (i) What is isotropic antenna ?
  - (ii) What is called parasitic element of an array antenna ?
  - (iii) Define “directivity” of an antenna.
  - (iv) What are the types of microwave antennas ?
  - (v) What is called End fire action ?
  - (vi) What is log periodic antenna ?
3. (A) (i) For FM receiver, derive the expression for signal to noise ratio at the reference and at the output. 7
- (ii) What is AGC ? Why is it needed in receiver ? Draw the circuit of practical diode detector and discuss its working. 7
- OR**
- (i) Discuss superheterodyne FM receiver with neat and clean block diagram. Compare the differences and similarities between AM and FM superheterodyne receiver.
  - (ii) State the advantage of having RF stage in superheterodyne AM receiver. Draw the circuit diagram of a typical RF stage. What is image frequency ?
- (B) Answer in brief any **three** questions from the following : (Each question is of **one** mark). 3
- (i) Why is intermediate frequency not chosen very low ?
  - (ii) Local oscillator frequency is kept higher than the signal frequency. (TRUE or FALSE)
  - (iii) What do you mean by high selectivity ?
  - (iv) Define modulation index in AM system.
  - (v) Which block in AM superheterodyne receiver provides maximum voltage gain ?
4. (A) (i) Write in the brief, “FMCW radar”. 7
- (ii) Discuss in detail, “A-Scope Radar display”. 7
- OR**
- (i) Obtain Radar Range equation.
  - (ii) Explain in detail, “conical switching” in the tracking method of radar. Draw some necessary block diagram.
- (B) Answer in brief any **three** questions from the following: (Each question is of **one** mark). 3
- (i) Write advantages and disadvantages of monopulse tracking system.
  - (ii) What is PRF ?
  - (iii) What is maximum unambiguous range ?
  - (iv) What is the difference between scanning and tracking ?
  - (v) A marine radar operating at 10 GHz has a maximum range of 50 km with an antenna gain of 4000. If the transmitter has a power of 250 kW and minimum detectable signal of  $10^{-11}$  W. Determine the cross section of the target the radar can sight.
 

(a) 28.35 m <sup>2</sup>	(b) 38.35 m <sup>2</sup>
(c) 44.45 m <sup>2</sup>	(d) 34.45 m <sup>2</sup>

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1. (A) (i) What are the types of wave guide ? Discuss the properties of the  $TE_{10}$  mode for rectangular waveguide. 7
- (ii) Write down the electric and magnetic field wave equations in frequency domain. Find out its general solution in rectangular co-ordinates. 7

**OR**

- (i) Write down the wave equation for TE mode in a hollow rectangular waveguide. Obtain the equations for its field components.
- (ii) Write short note on : Modes in a waveguide.  
An air filled circular wave guide of internal diameter 5.0 cm supports  $TE_{11}$  mode at 3 GHz. Determine the cutoff frequency, guide wavelength and the phase constant. (Take  $X'_{11} = 1.841$ ).
- (B) Answer in brief any **four** questions from the following : (Each question is of **one** mark). 4
- (i) State main advantages of waveguides over other types of transmission line.
  - (ii) What is the mode of propagation of EM wave in co-axial line ?
  - (iii) Define the term 'cut- off frequency'.
  - (iv) As the wavelength of the signal increases what happens to the dimensions of a waveguide ?
  - (v) What are the causes of power losses in a waveguide ?
  - (vi) Dominant modes in rectangular and circular waveguides are \_\_\_\_\_ and \_\_\_\_\_ respectively. (Fill in the blanks).

2. (A) (i) Explain the principle, structure and important properties of Yagi-Uda antenna. 7
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- OR**
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  - (ii) Explain in detail, “conical switching” is the tracking method of radar. Draw some necessary block diagram.
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