

[239]

Sc

No. of printed pages: 02

SARDAR PATEL UNIVERSITY
M.Sc. (Physics) (IIIrd Semester) Examination
Day & Date : Friday, 26/10/2018
Time: 02:00 p.m. to 05:00 p.m.

Subject: MICROWAVE COMMUNICATION: ELECTRONICS AND TECHNOLOGY

Paper No. : PS03EPHY23

Instruction:

Figure to the right indicate marks.

Total Marks : 70

- Q.1 Multiple Choice Questions. [8]**
- (i) The transit time in the repeller space of a Reflex Klystron must be $n + \frac{3}{4}$ cycles to ensure that _____.
(a) electrons are accelerated by the gap voltage on their return
(b) returning electrons to give energy to the gap oscillations
(c) it is equal to the period of the cavity oscillations
(d) the repeller is not damaged by the striking electrons
- (ii) _____ among the following microwave devices is used as a microwave switch
(a) Gunn diode, (b) PIN diode, (c) Varactor diode, (d) Schottky diode
- (iii) _____ layer always remains present in ionosphere.
(a) F (b) E (c) D, E, F (d) D, E
- (iv) In _____ communication systems, the frequency of signals is highest.
(a) Ground wave, (b) space wave, (c) satellite, (d) ionospheric
- (v) Input signal is an electromagnetic wave in _____ antenna.
(a) Dipole, (b) loop, (c) horn, (d) ferrite rod
- (vi) Number of lobes is 4 for _____ wavelength length of dipole antenna.
(a) half, (b) full, (c) two, (d) three
- (vii) The waveguides exhibit the frequency response similar to a _____ pass filter.
(a) Low, (b) high (c) band (d) none
- (viii) The _____ mode of EM waves is dominant in rectangular wave guide.
(a) $TE_{1,0}$ (b) $TE_{1,1}$ (c) $TM_{1,1}$ (d) $TM_{0,1}$
- Q.2 Attempt any Seven of the followings: [14]**
- (i) Discuss important characteristic features of varactor diode that enable its operation at microwave frequencies.
- (ii) Sketch the Gunn diode characteristics and show why it is not possible to observe Gunn effect with similar structure constructed using silicon.
- (iii) What is radio horizon? Why it is important in space wave communication?
- (iv) Calculate the length of transmitting antenna if the distance of radio horizon is 64 kms.
- (v) Give difference between resonant and non-resonant antenna
- (vi) Explain the function of ferrite rod in ferrite rod antenna.
- (vii) Mention the primary line constants of a transmission line. Why they are known as primary line constants?
- (viii) What is phase velocity of a signal travelling on a transmission line? Why it is always less than the free space velocity?
- (ix) "The tropospheric propagation used in electronic communication system is

(1)

(PTO)

mainly because of the neutral atoms and molecules." Explain this statement.

Q.3(a) Explain how velocity modulation is exploited to excite cavity oscillations at microwave frequencies in case of a Reflex Klystron. Also mention its merits and limitations. [6]

Q.3(b) Sketch the structural diagram of a cavity magnetron and discuss its operation. What is the importance of cross-field in this device? [6]

OR

Q.3(b) With the help of neat diagram discuss the operation of a TWT at microwave frequencies. How pitch to circumference ratio of a helix in this device is adjusted to promote electron bunching to gain energy and lift frequency of an RF input signal? [6]

Q.4(a) Why the vertical polarization of EM waves is used in ground wave propagation? Describe the propagation mechanism involved in ground wave communication systems. Mention the frequency range of signals used here. [6]

Q.4(b) Using necessary figure explain the multiple hop transmission in communication systems. Why the range of distance of communication increases due to this phenomenon? [6]

OR

Q.4(b) Mention the frequency range of electronic signals used in satellite communication. Which kind of satellite is used in it? What is the average height of geostationary satellite from the earth surface? Describe the process involved in satellite communication. [6]

Q.5(a) Why the dipole antenna is also known as a resonant antenna? Draw the radiation patterns in the form of lobes in dipole antenna having length of half wave length. Explain the working of dipole antenna. [6]

Q.5(b) Draw the structure of driven array antenna. Describe the construction and operation of this antenna. [6]

OR

Q.5(b) Using necessary schematic diagram discuss in detail the construction, working, limitations and advantages of loop antenna. [6]

Q.6(a) "The dimensions of circular waveguide required for transmission of 10 GHz signal are always more than the rectangular wave guides for dominant mode propagation." Prove this statement. [6]

Q.6(b) Write down the equations for reflection coefficient and voltage standing wave ratio and mention their range. Derive the relationship between these two parameters. [6]

OR

Q.6(b) Write down the equations for characteristic impedance of transmission lines at low and high frequencies. Calculate the value of characteristics impedance of a transmission line having the primary line constant values C equal to 0.1pF and inductance equal to $0.01\ \mu\text{H}$. [6]

— X —
(2)