Marks scored:

KATHMANDU UNIVERSITY
End Semester Examination [C]
July, 2017

Level : B. E.
Year : IV

Course : ETEG 408
Semester : I

Exam Roll No. :

Time: 30 mins.

F. M. : 20

Registration No.:

Date JUL 10 2017

SECTION "A"
[20 Q. × 1 = 20 marks]

1. In a microwave communication system noise is most likely to affect the signal_____.
   a) at the transmitter
   b) in the channel
   c) in the information source
   d) at the destination

2. A klystron operates on the principle of_____.
   a. amplitude modulation
   b. frequency modulation
   c. phase modulation
   d. velocity modulation

3. One of the following types of noise becomes of great importance at the high frequencies. It is the_____.
   a) shot noise b) random noise c) impulse noise d) transit time noise

4. When microwave signals follow the curvature of the earth, this is known as _____.
   a. ducting
   b. the faraday effect
   c. tropospheric scatter
   d. ionosphere reflection

5. A receiver connected to an antenna whose resistance is 50 Ω has an equivalent noise resistance of 30 Ω. Then the receiver's noise figure is_____.
   a) 1.3 dB b) 0 dB c) 2 dB d) 2.04 Db

6. Radar silence is_____.
   a. area in which radar waves can't penetrate
   b. a region shielded from radar illumination
   c. a period of time during which radar transmission is stopped
   d. a period of time when radar searching for target

7. A helical antenna is used for satellite tracking because of it's_____.
   a) nature of polarization
   b) maneuverability
   c) broad bandwidth
   d) good front to back ratio

8. If the PRF is 1200 pps and the pulse width is 1.5 μs, the duty cycle will be_____.
   a) 12.5 % b) 8 % c) 0.18 d) 0.12

9. If v_g is group velocity, v_p is phase velocity and v_c is velocity of light then indicate the true statement.
   a) $v_g v_p = 2v_c$ b) $v_g = v_p v_c$ c) $v_g v_p = v_c^2$ d.) $v_c = v_g v_p$

10. A radar transmitter has a peak pulse power of 400 kW, a PRF of 1500 pps and a pulse width of 0.8 μs. The maximum unambiguous range is_____.

a) 10 km b) 50 km c) 100 km d) 250 km

11. A magnetron whose oscillating frequency is electronically adjustable over a wide range is called a_____.

a) coaxial magnetron
b) dither tuned magnetron
b) frequency agile magnetron
d) voltage tunable magnetron

12. The radar cross-section area least depends on _____.

a) frequency
b) polarization of the incident wave
c) degree of surface roughness
d) direction of the target

13. Indicate false statement. Klystron amplifiers may use intermediate cavities to_____.

a) prevent the oscillations that occur in two cavity klystrons
b) increase the bandwidth of the device
c) improve the power gain
d) increase the efficiency of the klystron

14. In the Radar, if the pulse echo is received in 100 μs, the distance of the target could be_____.

a) 1500 km b) 150 km c) 15 km d) 1.5 km

15. The multifamily klystron_____.

a) is not a good low power amplifier because of noise
b) has a high repeller voltage to ensure a rapid transit time
c) is not suitable for pulsed operation
d) needs a long transit time through the buncher cavity to ensure current modulation

16. VOR gives_____.

a) range of target
b) height of target
c) position of target
d) velocity of target

17. The wavelength of a wave in a waveguide _____.

a) is greater than in free space
b) depends only on the waveguide dimensions and the free space wavelength
c) is inversely proportional to phase velocity
d) is directly proportional to group velocity

18. In a microwave communications system free space path loss calculation formula uses is _____.

a) $94.2 + 20 \log f + 20 \log d$
b) $92.4 + 20 \log f + 20 \log d$
c) $94.2 + 10 \log f + 20 \log d$
d) $92.3 + 10 \log f + 20 \log d$

19. At what frequency does oxygen cause excessive attenuation?

a) 60 GHz b) 50 GHz c) 40 GHz d) 30 GHz

20. Dominant mode of circular waveguide is_____

a) TE_{11} b) TE_{10} c) TE_{01} d) TM_{00}

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SECTION "B"

Attempt *ANY FIVE* questions. Missing data may be suitably assumed. Each symbol carries their usual meaning.

1. a. Explain Gunn Effect. With a suitable sketch explain the working principle of a Gunn diode. [3]
   b. How can we improve the detection capability of the radar? [3]
   c. Why multiple frequency CW radar is employed? Explain its principle of operation. [3]
   d. An aircraft is flying at a speed of 350 km/h. Compute the Doppler frequency for radar operating at a wavelength of 15 cm. [2]

2. a. Explain the properties and advantage of geostationary orbit. The range between a ground station and a satellite is 42000 km. Calculate the free space loss at operating frequency of 6 GHz. [7]
   b. State Kepler's laws as applied to satellite communications. Briefly describe the effect of G/T parameters. [4]

3. a. A rectangular waveguide with dimensions 2.42 cm x 1.12 cm supporting TE_{10} mode at 6 GHz is filled with a dielectric of relative permittivity ε_r. What are the limits on ε_r if only the dominant mode propagates? [6]
   b. How microwave link repeater system works? what is its significance? explain with suitable diagram. [5]

4. a. Mention applications of Cavity resonator. [2]
   b. With the help of diagram explain the operating principles of Travelling Wave Tube. [4]
   c. What is tunneling effect? Explain the construction and working of the device, which uses this effect. Also discuss its V-I characteristics. [5]

5. a. Explain the properties and advantage of microwave frequency for telecommunications. [3]
   b. Differentiate between VOR and DVOR. [3]
   c. Two rectangular waveguides are joined end to end and have the same dimension a x b. If the first guide is air filled and the second is filled with dielectric of relative permittivity of ε_r , then find the limit of ε_r such that a single dominant mode operation is possible in both the guides. [5]

6. a. A 35 GHz pulse radar having following parameters,

$P_t = 2000$ KW	T = 290 K	G = 66 dB	B = 250 MHz
Lsys = 10 dB	F = 5 dB	n = 10	$(S_0/N_0)_{min} = 10$ dB

   is used to detect and track the target. Assume the radar cross section of 4.45×10^{-5} m^2.
   i. Find the maximum range of radar?
   ii. If the maximum range of radar is reduced by 10 km, what will be the degradation in receiver sensitivity in dB? [2+4]
   b. Explain how to calculate the width of stripline for given characteristic impedance. [5]