

KATHMANDU UNIVERSITY  
End Semester Examination  
February/March, 2019

Marks Scored:

Level : B.E.

Course : ETEG 408

Year : IV

Semester: I

Exam Roll No.:

Time : 30 mins.

F.M. : 20

Registration No:

Date FEB 18 2019

SECTION "A"

[20 Q. × 1 = 20 marks]

*Choose the most appropriate answer.*

- Pulse radar operating at 10GHz frequency has an antenna with a gain of 28 dB and a transmitted power of 2 kW. If it is desired to detect a target of cross section  $12 \text{ m}^2$ , and the minimum detectable signal is  $-90 \text{ dBm}$ , the maximum range of the radar is \_\_\_\_\_.  
a) 8114 m                      b) 2348 m                      c) 1256 m                      d) 4563 m
- The term radar cross section defines the \_\_\_\_\_.  
a) scattering ability of the target  
b) power radiating ability of the radar  
c) amount of energy scattered by unwanted objects  
d) cross section of radar area through which energy is emitted
- If the peak transmitted power in a radar system is increased by a factor of 16, the maximum range will be increased by a factor \_\_\_\_\_.  
a) 2                              b) 4                              c) 8                              d) 16
- If a return echo arrives after the allocated pulse interval \_\_\_\_\_.  
a) it will interfere with the operation of the transmitter  
b) the receiver might be overloaded  
c) it will not be received  
d) the target will appear closer than it really is
- High frequency waves follow \_\_\_\_\_.  
a) the ground wave propagation                      b) guided wave propagation  
c) the ionospheric propagation                      d) surface wave propagation
- In electromagnetic waves, polarisation is \_\_\_\_\_.  
a) due to transverse nature of waves                      b) always vertical in isotropic medium  
c) due to longitudinal nature of waves                      d) caused by reflection of waves
- Electromagnetic wave in which the electric field is entirely transverse to the direction of propagation is known as \_\_\_\_\_.  
a) TE wave                      b) TEM wave                      c) TM wave                      d)  $\text{TE}_{10}$  wave
- For a rectangular wave guide with  $a = 2 \text{ cm}$  and  $b = 1 \text{ cm}$ , the cut-off wavelength for  $\text{TE}_{10}$  mode will be \_\_\_\_\_.  
a) 2 cm                              b) 1 cm                              c) 4 cm                              d) 8 cm

9. \_\_\_\_\_ is tracking radar.
- a) Monostatic radar  
b) Bistatic radar  
c) Monopulse radar  
d) Secondary surveillance radar
10. Which of the following position services provided by the GPS require crypto keys?
- a) Precise position service  
b) Standard position service  
c) Ultimate position service  
d) Doppler position service
11. The intentional degradation of GPS signal in specific areas is called \_\_\_\_\_
- a) selective degradation  
b) selective availability  
c) distributed GPD  
d) signal jamming
12. What type of antenna is used in GPS systems?
- a) Yagi antenna  
b) Helical array antenna  
c) Loop antenna  
d) Parabolic antenna
13. Rainfall is an important factor for fading of radio waves at frequencies above \_\_\_\_\_.
- a) 10 GHz  
b) 100 GHz  
c) 1 GHz  
d) 100 MHz
14. The cavity resonator \_\_\_\_\_.
- a) is equivalent to an LC resonant circuit  
b) in a klystron has its output taken from the reflector plate  
c) produces a frequency which is independent of the cavity size  
d) has a low Q factor for narrow operation.
15. A traveling wave tube (TWT) amplifies signal by virtue of \_\_\_\_\_.
- a) the absorption of energy by the signal from an electron stream  
b) the effect of an external magnetic field  
c) the energy contained in the cavity resonators  
d) the energy liberated from the collector
16. The frequency of the oscillation generated by a magnetron is mainly determined by \_\_\_\_\_.
- a) the flux density of the external magnet  
b) the ratio of the dc cathode voltage to the magnetic flux density  
c) the number of the cavity resonators  
d) the dimension of each cavity resonator
17. For an elliptical orbit? Eccentricity  $e$  is \_\_\_\_\_.
- a)  $0 < e < 1$   
b)  $e = 0$   
c)  $e = 1$   
d)  $e < 0$
18. The velocity of a geostationary satellite is nearly \_\_\_\_\_.
- a) 1255 km/hr  
b) 6757 km/hr  
c) 11052 km/hr  
d) 12644 km/hr
19. What is the approximate path loss from satellite to earth station? \_\_\_\_\_
- a) 100 dB  
b) 50 dB  
c) 75 dB  
d) 200 dB
20. A satellite cross link means \_\_\_\_\_.
- a) earth station to satellite link  
b) satellite to earth station link  
c) satellite to satellite link  
d) satellite to terrestrial network link

KATHMANDU UNIVERSITY  
End Semester Examination  
February/March, 2019

FEB 18 2019

Level : B.E.  
Year : IV  
Time : 2 hrs. 30 mins.

Course : ETEG 408  
Semester: I  
F.M. : 55

SECTION "B"

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

1.
  - a. Write the applications of microwave system? Explain in detail about microwave radio relay system and its applications. [1+3]
  - b. What is GNSS? Why we need GNSS? Explain about GLONASS and differential GPS? [3]
  - c. Explain the working principle of VOR. [4]
2.
  - a. A 30 GHz pulse radar having following parameters,  
 $P_t = 2000\text{KW}$                        $T = 290\text{ K}$                        $G = 60\text{ dB}$                        $B = 200\text{ MHz}$   
 $L_{sys} = 10\text{ dB}$                        $F = 5\text{ dB}$                        $n = 10$                        $(S_0/N_0)_{min} = 10\text{ dB}$   
is used to detect and track the target. Assume the radar cross section of  $4.45 \times 10^{-5}\text{ m}^2$ . Find the degraded maximum range of radar, if the sensitivity of the radar receiver is deteriorates by 3 dB. [7]
  - b. Explain the working mechanism and application of Gunn diode. [4]
3.
  - a. A rectangular waveguide with dimensions 2.42 cm x 1.12 cm supporting  $TE_{10}$  mode at 5 GHz is filled with a dielectric of relative permittivity  $\epsilon_r$ . What are the limits on  $\epsilon_r$  if only the dominant mode propagates? [6]
  - b. How can we find the range and velocity by using FMCW radar? Explain with suitable diagram using the moving target case. [5]
4.
  - 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 4 GHz. [6]
  - b. Derive the expression for link budget calculation of Satellite system. What is the significance of G/T parameter? Explain with example. [5]
5.
  - 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 the significance of micro-strip and strip-line in microwave engineering? Explain the width calculation mechanism of strip-line with suitable example. [5]
6.
  - a. Explain the properties and advantage of SAW devices. [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  $\epsilon_r$ , then find the limit of  $\epsilon_r$  such that a single dominant mode operation is possible in both the guides. [5]

