UNIVERSITY OF MINES AND TECHNOLOGY, TARKWA

FIRST SEMESTER EXAMINATIONS, NOV/DEC 2018

COURSE NO: EL 473
COURSE NAME: Advanced Communications Systems
CLASS EL IV **TIME**: 2 hours

Name**:** _____ Index Number: _____

Instruction: Attempt all questions. This paper comprises of 120 multiple-choice questions. All questions carry equal marks. Provide your answers on the answer sheets by writing the alphabet corresponding to the correct answer in each question.

Transmission Lines

1. A lossless transmission line having 50 Ω characteristic impedance and length $\lambda/4$ is short circuited at one end and connected to an ideal voltage source of 1 V at the other end. The current drawn from the voltage sources is _____.
   A. 0 B. 0.02 A
   C. ∞ D. None of the these

2. The capacitance per unit length and the characteristic impedance of a lossless transmission line are C and Z_0, respectively. The velocity of a travelling wave on the transmission line is _____.
   A. Z_0C B. $1/(Z_0C)$
   C. Z_0/C D. C/Z_0

3. A transmission line of 50 Ω characteristic impedance is terminated with a 100 Ω resistance. The minimum impedance measured on the line is equal to _____.
   A. 0 Ω B. 25 Ω
   C. 50 Ω D. 100 Ω

4. The magnitudes of the open-circuit and short-circuit input impedances of a transmission line are 100 Ω and 25 Ω, respectively. The characteristic impedance of the line is _____.
   A. 25 Ω B. 50 Ω
   C. 75 Ω D. 100 Ω

5. A transmission line is distortion less if _____.
   A. RL = 1/RC B. RL = GC
   C. RL = RC D. RL = LC

6. The Voltage Standing Wave Ratio (VSWR) can have any value between _____.
   A. 0 and 1 B. – 1 and + 1
   C. 0 and ∞ D. 1 and ∞

7. A transmission line has a characteristic impedance of 50 Ω and a resistance of 0.1 Ω/m. If the line is distortion less, the attenuation constant (in Np/m) is _____.
   A. 500 B. 5
   C. 0.014 D. 0.002

8. A transmission line of characteristic impedance 50 Ω is terminated by a 50 Ω load. When excited by a sinusoidal voltage source at 10 GHz, the phase difference between two points spaced 2 mm apart on the line is found to be $\pi/4$ radians. The phase velocity of the wave along the line is _____ m/s.
   A. 0.8×10^8 B. 1.2×10^8
   C. 1.6×10^8 D. 3×10^8

9. The return loss of a device is found to be 20 dB. The VSWR and magnitude of reflection coefficient are _____, respectively.
   A. 1.22 and 0.1 B. 0.81 and 0.1
   C. –1.22 and 0.1 D. 2.44 and 0.2

10. A transmission line of pure resistive characteristic impedance is terminated with an unknown load. The measured value of VSWR on the line is equal to 2 and a voltage minimum point is found to be at the load. The load impedance is then _____.
   A. complex B. purely capacitive
   C. purely resistive D. purely inductive

11. A two-wire transmission line of characteristic impedance Z_0 is connected to a load of impedance $Z_L (Z_L \neq Z_0)$. Impedance matching cannot be achieved with a/an _____.
   A. quarter-wavelength transformer B. half-wavelength transformer
   C. open-circuited parallel stub D. short-circuited parallel stub

12. A 50 Ω lossless transmission line has a pure reactance of $(j100)$ Ω as its load. The VSWR in the line is _____.
   A. ½ B. 2
   C. 4 D. ∞

13. A transmission line whose characteristic impedance is a pure resistance _____.
   A. must be a lossless line B. must be a distortion less line
   C. may not be a lossless line D. may not be a distortion less line

14. A short circuited stub is shunt connected to a transmission line as shown in Figure 1. If $Z_0 = 50\Omega$, the admittance Y seen at the junction of the stub and transmission line is _____.
   A. $(0.01 - j0.02)$ mho B. $(0.02 - j0.01)$ mho
   C. $(0.04 + j0.02)$ mho D. $(0.02 + j0)$ mho

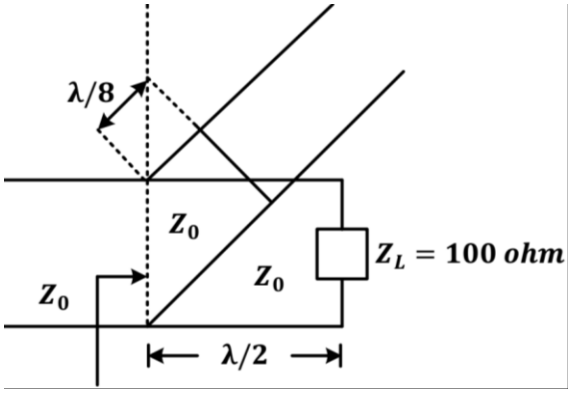

Figure 1

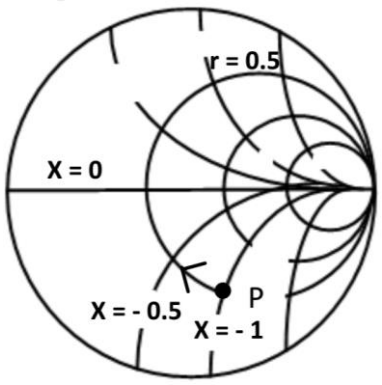

Figure 2

15. Consider an impedance Z = R + *j*X marked with point P in an impedance smith chart as shown in Figure 2. The movement from point P along a constant resistance circle in the clockwise direction by an angle 45° is equivalent to _____.
    A. adding an inductance in series with Z
    B. Adding a capacitance in series with Z
    C. adding an inductance in shunt across Z
    D. adding a capacitance in shunt across Z

Multiplexing and Multiple-Access Techniques

16. TDMA stands for _____.
    A. Time Domain Multiple Access
    B. Time-Division Multiple Access
    C. Tone Division Multiple Access
    D. none of the above

17. CDMA stands for _____.
    A. Code-Division Multiple Access
    B. Carrier Division Multiple Access
    C. Compact Digital Multiplex Arrangement
    D. none of the above

18. TDMA is used instead of TDM when _____.
    A. all the signals come from the same source
    B. the signals come from different sources
    C. TDM is used in RF communications
    D. they mean the same thing

19. When calculating the maximum number of users, a limiting factor in FDM is _____.
    A. the type of media used
    B. the length of the channel
    C. the bandwidth of each signal
    D. all of the above

20. A DS-1 signal contains _____.
    A. 12 channels
    B. 24 channels
    C. 32 channels
    D. 64 channels

21. The bit-rate of a DS-1 signal over a T-1 line is _____.
    A. 64 kbps
    B. 256 kbps
    C. 1.536 Mbps
    D. 1.544 Mbps

22. Besides data bits, a DS-1 frame contains a _____.
    A. timing bit
    B. T-bit
    C. signalling bit
    D. framing bit

23. In DS-1, a bit is “stolen” out of each channel _____.
    A. every frame
    B. every other frame
    C. every sixth frame
    D. every twelfth frame

24. Moving signals from one line to another is called _____.
    A. time switching
    B. space switching
    C. line switching
    D. cross-point switching

25. Moving PCM samples from one time-slot to another is called _____.
    A. time switching
    B. space switching
    C. signal switching
    D. cross point switching

26. A digital space switch is a _____.
    A. multiplexer
    B. TDM switch
    C. computerised Strowger switch
    D. cross point switch

27. Spread-spectrum can be done by using _____.
    A. computer-controlled frequency reuse
    B. frequency-hopping
    C. direct-sequence method
    D. all of the above

28. The term "chip rate" is used in describing _____.
    A. computer-controlled frequency reuse
    B. frequency-hopping
    C. direct-sequence method
    D. all of the above

29. For a given data rate, direct-sequence systems, compared to standard RF systems, use _____.
    A. about the same bandwidth
    B. much more bandwidth
    C. much less bandwidth
    D. approximately double the bandwidth

30. "Processing gain" is another term for _____.
    A. RF gain
    B. computer speed
    C. spreading gain
    D. improved signal-to-noise ratio

31. To calculate processing gain, divide the transmitted RF bandwidth by _____.
    A. the digital data bit rate
    B. bandwidth of original baseband
    C. the S/N ratio
    D. the chip size

32. A receiver for frequency-hopping spread-spectrum would be a _____.
    A. narrowband receiver
    B. wideband receiver
    C. direct-conversion receiver
    C. CDMA receiver

33. A receiver for direct-sequence spread-spectrum would be a _____.
    A. narrowband receiver
    B. wideband receiver
    C. direct-conversion receiver
    D. "chip-rate" receiver

34. CDMA _____.
    A. cannot be used with frequency-hopping spread-spectrum
    B. cannot be used with direct-sequence spread-spectrum
    C. cannot be used on an RF channel
    D. allows many transmitters to use a band simultaneously

35. For optimal performance, CDMA requires the use of _____.
    A. orthogonal PN sequences
    B. non-orthogonal PN sequences
    C. true-random PN sequences
    D. none of the above

Satellite Communications

36. Most satellites operate in the frequency range of _____.
    A. 300 MHz to 3 GHz
    B. 30 MHz to 300 MHz
    C. Above 300 GHz
    D. 3 GHz to 30 GHz

37. The frequency band used by most satellite is _____.
A. UHF B. VHF
C. SHF D. EHF

38. The bandwidth of a typical satellite is _____.
A. 500 MHz B. 900 MHz
C. 200 MHz D. None of these

39. For satellite communication, the frequency should be _____.
A. Less than the critical frequency of ionosphere
B. Equal to the critical frequency of ionosphere
C. More than the critical frequency of ionosphere
D. None of these

40. Geostationary satellites follow _____.
A. circular path B. elliptical path
C. inclined path D. cycloidal path

41. A synchronous satellite orbits the earth once in _____.
A. 24 hours B. 12 hours
C. 6 hours D. 1 hour

42. The distance of a geostationary satellite from the surface of the earth is nearly _____.
A. 360 km B. 3600 km
C. 36,000 km D. 3,60,000 km

43. Satellite sends back signals to earth by means of _____.
A. Yagi antenna B. chicken-mesh antenna
C. horn antenna D. dipole antenna

44. In satellite communication, _____.
A. Amplitude modulation is used B. Frequency modulation is used
C. Pulse width modulation is used D. Pulse Amplitude modulation is used

45. Antenna elevation angle at the ground station for satellite communication is always kept above 5° to _____.
A. minimise the sky noise temperature
B. reduce the effect of oxygen and water vapour absorption on the antenna noise temperature
C. minimise the slant range
D. increase the visibility of the satellite

46. For global communication, the minimum number of satellite needed is _____.
A. one B. three
C. seven D. eleven

47. FM is preferred for satellite communication because _____.
    A. satellite channel has large bandwidth and less noise
    B. It gives high modulation index
    C. low bandwidth is essentially required
    D. Other methods of modulation will result in fading and distortion

48. In a satellite system, _____.
    A. upward link frequency is half of downward link frequency
    B. upward link frequency is greater than that of downward link frequency
    C. upward link frequency is lesser than that of downward link frequency
    D. upward link frequency is equal to downward link frequency

49. A geostationary satellite _____.
    A. remains stationary in space
    B. remains at a height of 1000 km above the surface of earth
    C. orbits the earth with 24-hour period
    D. remains always in a direction opposite to that of sun, with respect to earth

50. Satellite communication links are preferred over sub-marine cables because _____.
    A. they are faster
    B. they involve lesser cost
    C. of their multiple access ability
    D. none of these

51. The satellite orbit almost invariably used with remote sensing satellite is _____.
    A. geostationary orbit
    B. geosynchronous orbit
    C. sun synchronous orbit
    D. Molniya orbit

52. The beam width required for a satellite antenna for full global coverage is approximately _____.
    A. 1
    B. 5
    C. 18
    D. 4

53. A satellite earth station antenna having a maximum gain of 60 dB at the operational frequency is fed from a power amplifier generating 10 kW. If the feed system has a loss of 2 dB, determine earth station EIRP (Effective Isotropic Radiated Power).
    A. 98 dBW
    B. 100 dBW
    C. 89 dB
    D. 98 dB

54. A radio communication link is to be established via the ionosphere. The virtual height at the midpoint of the path is 300 km and the critical frequency is 9 MHz. The maximum usable frequency for the link between the stations of distance 800 km assuming flat earth is _____.
    A. 11.25 MHz
    B. 12 MHz
    C. 15 MHz
    D. 25.5 MHz

55. If a satellite is launched at an orbital radius of twice that of a geostationary satellite, how much time will the launched satellite take to travel around the earth _____.
    A. 48 hrs
    B. 12 hrs
    C. 96 hrs
    D. 6 hrs

56. Which of the following techniques not suitable for automatic satellite tracking?
    A. Monopulse
    B. Step-track
    C. Conical Scanning
    D. Lobe switching

57. Which of the following statements is not correct?
    A. A geo-synchronous satellite remains practically stationary relative to earth antennas.
    B. A geo-synchronous satellite means the same thing as geo-stationary satellite.
    C. There is a trade-off between the cost of a communication satellite and cost of its earth stations.
    D. Three geo-synchronous satellites cannot give 100% global coverage.

58. Which ionosphere layer is responsible for return of a radiation at frequency 30 MHz?
    A. D
    B. E
    C. F
    D. All the above

59. Communication satellites are allotted bandwidth of 500 MHz. This can be increased by using __.
    A. Frequency and Polarisation re-use
    B. Time Division Multiplexing
    C. Frequency Division Multiplexing
    D. Triple modular redundancy

60. What does a link budget for satellite communication include _____.
    A. total cost of satellite
    B. cost of satellite plus launch vehicle
    C. signal and noise levels in dB
    D. margins of error permitted

61. The output stage of a transponder on-board a satellite has a maximum power output of 10 watts. However, it is not operated at the maximum power output in order to _____.
    A. conserve the available limited battery power
    B. reduce noise due to device
    C. avoid inter-modulation distortion
    D. avoid heating up of the satellite beyond a preset value

Antenna and Wave Propagation

62. What is the wavelength of Super high frequency (SHF) especially used in Radar & satellite communication?
    A. 1 m – 10 m
    B. 1 cm – 10 cm
    C. 10 cm – 1 m
    D. 0.1 cm – 1 cm

63. Which among the following is an application of high frequency?
    A. SONAR
    B. Subsurface communication
    C. Radio navigation
    D. Facsimile

64. Wavefront is basically a locus of points acquiring similar _____.
    A. Phase
    B. Frequency
    C. Amplitude
    D. Wave equation

65. In which kind of waveform is the phase velocity defined?
    A. Sinusoidal
    B. Rectangular
    C. Square
    D. Triangular

66. Which among the following is/are not present in free space?
    A. Solid bodies
    B. Ionised particles
    C. Interference of normal radiation and radio wave propagation
    D. All of the above

67. Power density is basically termed as _____ power per unit area.
    A. Reflected
    B. Refracted
    C. Radiated
    D. Diffracted

68. If the path difference of two waves with single source traveling by different paths to arrive at the same point, is λ/2, what would be the phase difference between them?
    A. $\beta \times (\lambda/2)$
    B. $\beta / (\lambda/2)$
    C. $\beta + (\lambda/2)$
    D. $\beta - (\lambda/2)$

69. Which ionisation layer exists during day time & usually vanishes at night due to highest recombination rate?
    A. D-region
    B. Normal E-region
    C. Sporadic E-region
    D. Appleton region

70. What is the possible range of height for the occurrence of sporadic E-region with respect to normal E-region?
    A. 20 km – 50 km
    B. 45 km – 85 km
    C. 90 km – 130 km
    D. 140 km – 200 km

71. F2 layer of appleton region acts as a significant reflecting medium for _____ frequency radio waves.
    A. Low
    B. Moderate
    C. High
    D. All of the above

72. The knowledge of which parameter is sufficient for deriving the time varying electromagnetic field?
    A. Electric field intensity
    B. Magnetic field intensity
    C. Current density
    D. Power density

73. According to Webster's dictionary, what is an antenna?
    A. Impedance matching device
    B. Sensor of electromagnetic waves
    C. Transducer between guided wave & free space wave
    D. Metallic device for radiating or receiving radio waves

74. Under which conditions of charge does the radiation occur through wire antenna?
    A. For a charge with no motion
    B. For a charge moving with uniform velocity with straight & infinite wire
    C. For a charge oscillating in time motion
    D. All of the above

75. In a non-isotropic directional antenna, which radiating lobe axis makes an angle of 180° w.r.t. major beam of an antenna?
    A. Minor lobe
    B. Side lobe
    C. Back lobe
    D. None of the above

76. At which angles does the front to back ratio specify an antenna gain?
    A. 0° & 180°
    B. 90° & 180°
    C. 180° & 270°
    D. 180° & 360°

77. If an observation point is closely located to the source, then the field is termed as _____.
    A. Induced
    B. Radiated
    C. Reflected
    D. Far-field

78. Which waveform plays a crucial role in determining the radiation pattern of the dipole/wire antennas?
    A. Current
    B. Voltage
    C. Frequency
    D. Phase

79. In which kind of array configuration, the element locations must deviate or adjust to some nonplaner surface like an aircraft or missile?
    A. Linear
    B. Planer
    C. Conformal
    D. All of the above

80. What is the nature of radiation pattern of an isotropic antenna?
    A. Spherical
    B. Dough-nut
    C. Elliptical
    D. Hyperbolic

81. In broadside array, all the elements in the array should have similar _____ excitation along with similar amplitude excitation for maximum radiation.
    A. Phase
    B. Frequency
    C. Current
    D. Voltage

82. Which mode of propagation is adopted in HF antennas?
    A. Ionospheric
    B. Ground wave
    C. Tropospheric
    D. All of the above

83. For which band/s is the space wave propagation suitable over 30 MHz?
    A. VHF
    B. SHF
    C. UHF
    D. All of the above

84. If the tower antenna is not grounded, which method of excitation is/are applicable for it?
    A. Series
    B. Shunt
    C. Both A and B
    D. None of the above

85. In ungrounded antennas, if an excitation is applied directly across the base insulator, then on which factor/s would the voltage across the insulator depend?
    A. Power delivered to antenna
    B. Power factor of impedance
    C. Both A and B
    D. None of the above

86. Which among the following exhibits perpendicular nature in TEM wave?
A. Electric field
B. Magnetic field
C. Direction of propagation
D. All of the above

87. Which equations are regarded as wave equations in frequency domain for lossless media?
A. Maxwell's
B. Lorentz
C. Helmholtz
D. Poisson's

88. In an electrical circuit, which nature of impedance causes the current & voltages in phase?
A. Reactive
B. Resistive
C. Capacitive
D. Inductive

89. Which type of ground wave travels over the earth surface by acquiring direct path through air from transmitting to receiving antennas?
A. Surface wave
B. Space wave
C. Both A and B
D. None of the above

90. After which phenomenon/phenomena do the waves arrive at the receiving antenna in ionospheric propagation?
A. Reflection or Scattering
B. Refraction
C. Defraction
D. All of the above

91. By which name/s is an ionospheric propagation, also known as?
A. Sea wave propagation
B. Ground wave propagation
C. Sky wave propagation
D. All of the above

Wireless Communications

92. Which of the following is/are the main part(s) of basic cellular system.
A. A mobile Unit
B. A cell Site
C. A mobile Telephone Switching Office
D. All of the above

93. Fading of the received radio signals in a mobile communication environment occurs because of:
A. Direct propagation
B. Multipath Propagation
C. Bi-path Propagation
D. None of the above

94. State whether True of False.
i. The cells or subdivisions of a geographical area are always hexagonal.
ii. A land to Mobile call originates through the Telephone exchange.
A. True, False
B. False, True
C. False, False
D. True, True

95. In _____, Frequency Spectrum is divided into smaller spectra and is allocated to each user.
A. TDMA
B. CDMA
C. FDMA
D. FGMA

96. In _____, multiple access is achieved by allocating different time slots for the different users.
A. TDMA B. CDMA
C. FDMA D. FGMA

97. State whether True of False.
i. In GSM, only TDMA is used.
ii. There is zero inter-channel interference in CDMA.
A. True, False B. False, True
C. False, False D. True, True

98. The basic GSM is based on _____ traffic channels.
A. connection oriented B. connection less
C. packet switching D. circuit switching

99. _____ are typically characterised by very small cells, especially in densely populated areas.
A. 2G system B. 3G system
C. 2.5G system D. 3.5G system

100. A antenna which attempts to direct all its energy in a particular direction is called as a _____.
A. Directional Antenna B. One to One Antenna
C. Propagation Antenna D. Single Direction Antenna

101. Which mode is used for installing networks in wireless communication device characteristics?
A. Fixed and wired B. Mobile and wired
C. Fixed and wired D. Mobile and wireless

102. Wireless LANs implement security measures in the _____.
A. System Layers B. Data Link Layers
C. Sub Layers D. Multi Layers

103. Specifications for a wireless LAN are called _____.
A. Standard 802.3z B. Standard 802.3u
C. Project 802.3 D. IEEE 802.11

104. In wireless LAN, there are many hidden stations so we cannot detect the
A. Frames B. Collision
C. Signal D. Data

105. Term that is used for stationary or mobile wireless station and also have optional central base station is called _____.
A. Point to point B. Multi point
C. Network point D. Access point

106. Wireless communication is started in _____.
A. 1869 B. 1895
C. 1879 D. 1885

107. Wireless LANs implement security measures in the _____.
A. Session Layers
B. Data Link Layers
C. Sub Layers
D. Application Layers

108. In forward transmission of Interim Standard 95 (IS-95), for control and synchronisation there are _____.
A. 5 Channels
B. Channels
C. 9 channels
D. 11 channels

109. Station on a wireless ALOHA network is maximum of _____.
A. 400 km
B. 500 km
C. 600 km
D. 700 km

110. A collision in a wireless network may add additional energy from 5 to _____.
A. 25%
B. 20%
C. 15%
D. 10%

Data Communication and Computer Networks

111. What is the minimum number of wires needed to send data over it serial communication link layer?
A. 1
B. 2
C. 3
D. 4

112. Which data communication method is used to send data over a serial communication link?
A. simplex
B. half duplex
C. full duplex
D all of these

113. Which of the following statements is incorrect?
A. teleprocessing combing telecommunication and DP techniques in online activities.
B. Multiplexers are designed to accept data from several I/O devices and transmit a unified stream of data on one communication line.
C. a half-duplex line is a communication line in which data can move in two directions, but not the same time.
D. batch processing is the preferred processing mode for telecommunication operations.

114. The interactive transmission of data within a time sharing system may be best suited to _____.
A. simplex line
B. half duplex lines
C. full duplex line
D. bi-flex lines

115. Teleprinters _____.
A. are used for printing at remote locations, not for input.
B. offer both high-speed operation and a variety of formatting controls.
C. have a printer for output and a keyboard for input
D. are same as teletypes.

116. Which of the following is an example of a bounded medium?
    A. coaxial cable
    B. wave guide
    C. fibre optic cable
    D. all of these

117. Coaxial cable has conductors with _____.
    A. a common axis
    B. equal resistance
    C. the same diameter
    D. none of these

118. The area of coverage of a satellite radio beam is called its _____.
    A. beam width
    B. circular polarisation
    C. footprint
    D. identity

119. The amount of uncertainty in a system of the symbol is called.
    A. bandwidth
    B. entropy
    C. loss
    D. quantum

120. Buffering is _____.
    A. the process of temporarily storing the data to allow for small variation in device speeds.
    B. a method to reduce cross-talks
    C. storage of data within the transmitting medium until the receiver is ready to receive
    D. a method to reduce the routing overhead