MIZORAM PUBLIC SERVICE COMMISSION

TECHNICAL COMPETITIVE EXAMINATIONS FOR RECRUITMENT TO THE POST OF GRADE-V OF MIZORAM ENGINEERING SERVICE (AE/SDO) UNDER POWER & ELECTRICITY DEPARTMENT, GOVERNMENT OF MIZORAM JANUARY, 2012

ELECTRONICS ENGINEERING

PAPER – III

Time Allowed : 3 hours Full Marks : 150

All questions carry equal marks of 1 each.
Attempt all questions.

1. A superheterodyne receiver with an IF of 450KHz is tuned to a signal of 1200KHz. The image frequency is

(a) 750KHz (b) 1650KHz
(c) 2100KHz (d) 900KHz

2. If the carrier of a 100% modulated AM transmitter is suppressed, the percentage power saving will be

(a) 50% (b) 66.67%
(c) 78% (d) 100%

3. Required bandwidth of wideband amplifier to reproduce a pulse faithfully, depends upon ..... of the pulse

(a) width (b) rise time
(c) fall time (d) frequency

4. Noise figure of multistage amplifier

(a) increases (b) decreases
(c) remain same (d) all of the above

5. Number of side bands of an FM signal for fixed modulating voltage ..... with decrease in modulating frequency.

(a) increases (b) decreases
(c) does not change (d) none of these

6. Impedance of a half wave folded dipole antenna is

(a) 75 ohms (b) 150ohms
(c) 300ohms (d) none of these

7. The length of the directors of a yagi antenna should be ..... that of the driven element .

(a) greater than (b) less than
(c) equal to (d) independent to

8. A measure of the ability of a radio receiver to receive weak signal is

(a) fidelity (b) selectivity
(c) sensitivity (d) ductility

9. The characteristic impedance of a co-axial cable depends on diameter of

(a) inner conductor (b) outer conductor
(c) both inner & outer conductors (d) none of these

10. The ratio of voltage reflected from the load to the voltage applied to the load is called

(a) reflection loss (b) VSWR
(c) return loss (d) none of these

11. The first geostationary satellite was named

(a) Intelsat I (b) Intelsat II
(c) Intelsat III (d) Early bird

12. In VHF oscillator using butterfly capacitor

(a) only L (b) only C
(c) both L and C (d) none of these

13. The noise which assumes great importance at high frequencies is

(a) flicker noise (b) transit time noise
(c) Johnson noise (d) shot noise

14. Power spectral density of white noise ..... with frequency.

(a) is constant (b) decreases
(c) increases (d) none of above

15. In a receiver, the maximum contribution to noise is made by

(a) power supply (b) power amplifier
(c) mixer stage (d) oscillator

16. The modulation index of an AM wave is changed from 0 to 1. The transmitted power is

(a) unchanged (b) halved
(c) doubled (d) increased by 50 %

17. The output of a transmitter is 100KW with carrier unmodulated and 132KW when carrier is modulated by a sinusoidal wave. Then the depth of modulation is

(a) 32 % (b) 64%
(c) 80% (d) 100%

18. If a 240 watt carrier is simultaneously modulated by two sine waves with modulation indices of 0.3 and 0.4, its total modulation index is

(a) 0.5 (b) 0.7
(c) 0.12 (d) 0.75

145. In a microwave cable the inner conductor radius a and inner radius of outer conductor is b. For TE11 mode the cut off wavelength is about

(a) a + b (b) Π (a + b)
(c) Πa (d) Πb

146. Microwave resonators are used in

(a) microwave oscillators (b) microwave narrow band amplifiers
(c) microwave frequency meters (d) All of the above

147. Power monitor and reflectometers use the principle of

(a) directional computer (b) Klystron amplifier
(c) Gunn diode (d) TWT

148. A branched duplexer requires

(a) TR tube (b) ATR tube
(c) Both TR and ATR tubes (d) None of the above

149. A reflex klystron oscillator uses

(a) one cavity resonator (b) two cavity resonator
(c) three cavity resonator (d) none of the above

150. The most commonly used magnetron is

(a) cylindrical (b) parallel plate
(c) inclined plate (d) flat plate

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135. If the minimum range of a radar is to be doubled, the peak power has to be increased by a factor of

(a) 2 (b) 4
(c) 8 (d) 16

136. A wave guide section in a microwave circuit acts as

(a) LPF (b) BPF
(c) HPF (d) BSF

137. The main advantage of TWT over klystron is

(a) Higher bandwidth (b) Higher gain
(c) Higher frequency (d) Higher output

138. The magnitudes of OC and SC input impedances of a transmission line are 100Ω and 25Ω. The characteristic impedance is

(a) 25Ω (b) 50Ω
(c) 75Ω (d) 100Ω

139. The radiation resistance of a circular loop of one turn is 0.01 Ohm. For 5 turn loop the radiation resistance is

(a) 0.002Ω (b) 0.01Ω
(c) 0.05Ω (d) 0.25Ω

140. A line is excited by a 100V, 200 Ohm source and is terminated by 100 Ω resistance. If voltage on line reaches steady state value in 80nsec., the natural resonant frequency is

(a) 100MHz (b) 50MHz
(c) 12.5MHz (d) 6.25MHz

141. The manufacturing technique used to manufacture strip type transmission line is

(a) photo-etching technique (b) oxidation technique
(c) cladding (d) epitaxial

142. In micro strip circuits, the dielectric material most commonly used is

(a) silicon (b) rubber
(c) plastic (d) bakelite

143. In microwave resistor the wall thickness is made as small as possible to

(a) have high R (b) have low R
(c) reduce capacitor (d) reduce inductance

144. For a 50Ω resister for 3 GHz application, the stray capacitance should be less than

(a) 1μF (b) 1nF
(c) 1pF (d) 0.1pF

19. An FM signal with a modulation index m_f is passed through a frequency tripler. The wave in the output of the tripler will have a modulation index of

(a) $m_f/3$ (b) m_f
(c) $3m_f$ (d) $9m_f$

20. Increasing the height of the radiating antenna the coverage area of TV station would

(a) increase (b) decrease
(c) not change (d) none

21. Decibel is a logarithmic unit denoting

(a) noise level (b) current
(c) voltage (d) power ratio

22. Harmonic generators use which amplifier?

(a) class- A (b) class-AB
(c) class-C (d) class-B

23. In low level AM system, the amplifier following the modulator stage must be

(a) harmonic device (b) class-C amplifier
(c) linear device (d) class-A amplifier

24. Sometimes microwave signals follow the earth's curvature. This is due to

(a) ionospheric reflection (b) faraday rotation
(c) tropospheric scatter (d) ducting

25. In an oscillator crystal, the parallel resonant frequency is ..... series resonant frequency

(a) equal to (b) higher than
(c) lower than (d) none of these

26. The signal propagation time between two ground stations in a synchronous satellite link is about

(a) 50ms (b) 135ms
(c) 270ms (d) none of these

27. The uplink and downlink frequencies are made different in satellite links in order to

(a) reduce transmitter power
(b) increase the isolation between transmitter and receiver
(c) reduce antenna size
(d) increase bandwidth

28. The information capacity (bits/sec) of a channel with bandwidth W MHz and transmission time T is given by

(a) WT (b) W^2T
(c) W/T (d) T/W

29. The purpose of source coding is to

(a) increase the information transmission rate (b) decrease the information transmission rate
(c) decrease the S/N rate (d) decrease the probability error.

30. The rate at which information can be passed through a tele-communication channel depends on the

(a) carrier frequency (b) bandwidth
(c) transmission time (d) transmitter power

31. A zero memory source generates two messages with probabilities 0.8 and 0.2. These are coded as 1 and 0.2. The code efficiency is

(a) 0.2 (b) 0.5
(c) 0.7 (d) 1.0

32. In a single error correcting hamming code the number of message bits in a block is 26. The number of check bits in the block would be

(a) 3 (b) 4
(c) 5 (d) 7

33. Data rate R and information rate Rt are different because of

(a) channel capacity C, being high (b) equivocation
(c) entropy h(x) (d) none of these

34. Parity check bit for error detection is used in

(a) digital computer (b) voice communication
(c) digital camera (d) none of these

35. A source that emits statistically independent symbols are

(a) memory less (b) Markov source
(c) stochastic source (d) none of these

36. Information content of a message has the characteristic that

(a) it is additive (b) Increases linearly with time
(c) It increases monotonically (d) All of the above

37. By properly coding and grouping longer sequence, it is possible to

(a) increase efficiency (b) reduce delay in transmission
(c) increase delay (d) make H = C

38. A source with memory is known to be

(a) Markov source (b) stochastic source
(c) consists of long sequence of symbols (d) none of these

124. In a wave guide the dielectric region is generally

(a) air (b) magnetic material
(c) brass (d) mica

125. Which mode has the minimum cutoff frequency in rectangular wave guides?

(a) TE11 (b) TE10
(c) TE01 (d) TE20

126. Which mode has the lowest cutoff frequency in circular wave guides?

(a) TE01 (b) TE10
(c) TE11 (d) TE20

127. For a directional coupler the power is in the ratio of

(a) 40dB (b) 30dB
(c) 20dB (d) 10dB

128. Which of the following is not used as a microwave mixer or detector?

(a) PIN diode (b) crystal diode
(c) Schottky diode (d) backward diode

129. What is the numerical aperture in an optical fiber when critical angle is 30°?

(a) 0.5 (b) 0.70
(c) 0.886 (d) 0.2

130. If antenna diameter is increased four times, the maximum range is increased by a factor of

(a) $\sqrt{2}$ (b) 2
(c) 4 (d) 8

131. In an optical fiber the refractive index of cladding material should be

(a) nearly 1 (b) very low
(c) less than that of core (d) more than that of core

132. Fibers have numerical aperture (NA) in the range of 0.15 to 0.4. Fibers with higher NA value would have

(a) reduced losses (b) high bandwidth
(c) reduced losses and low bandwidth (d) more losses and low bandwidth

133. The semiconductor diode which can be used in switching circuit in microwave range is

(a) PIN code (b) varactor diode
(c) Tunnel diode (d) Gunn diode

134. The skin depth at 1000 MHz is compared to that at 500 MHz is

(a) 2 (b) $\sqrt{2}$
(c) 0.707 (d) 0.5

113. If a line with Zo = 300 < 0° Ω is open circuited at far end, then VSWR is

(a) 0 (b) 1
(c) infinity (d) 2

114. Which of the following parameter is negligible in transmission lines?

(a) R (b) L
(c) C (d) G

115. When a line short circuited at far end, the minimum voltage occurs at

(a) far end (b) Source end
(c) midway between source and load (d) None of these

116. The main advantage of using microwaves for communication is

(a) Large bandwidth (b) Small bandwidth
(c) Low power (d) High power

117. Microwave are used for

(a) Telephony (b) Radio broadcast
(c) TV systems (d) All of the above

118. As wavelength decreases, the size of the high directivity antenna

(a) decreases (b) increases
(c) not affected (d) either (b) or (c)

119. The width of a radio beam from a 1m diameter parabolic antenna at 1GHz is about

(a) 100° (b) 50°
(c) 10° (d) 2°

120. Satellite communication systems use the frequency band

(a) 10 to 20MHz (b) 50 to 70MHz
(c) 3 to 6GHz (d) 100 to 120GHz

121. In microwave detector used in laboratory measurement of relative power levels, standing wave ratio is about

(a) 0.1 (b) 1.25
(c) 5 (d) l0

122. Hollow wave guides are used as transmission lines at frequencies

(a) above 1GHz (b) above 5 GHz
(c) above 10MHz (d) above 1 MHz

123. Compared to coaxial lines, the advantages of wave guides are

(a) higher power handling capacity
(b) lower loss per unit length
(c) cheaper and simpler mechanical structure
(d) all of the above

39. Significance of channel coding theorem due to Shannon lies in the fact that

(a) rs > C bpsec
(b) r = C
(c) rs = C
(d) exchange of code rate r and error probability Pe

40. For an electromagnetic wave traveling in free space, the power carried by the wave changes with 'd' in proportion to

(a) d (b) 1/d
(c) $1/d^2$ (d) d^2

41. Coulomb's law is a

(a) vector equation (b) scalar equation
(c) may be vector or scalar equation (d) phasor equation

42. The unit of electric field intensity is

(a) NC^{-1} (b) Fm^{-1}
(c) Nm^{-1} (d) FC^{-1}

43. A long wire has a charge density $1*10^{-9}$ Cm^{-1}. The electric field at a point at radial distance 2m will be

(a) $6Vm^{-1}$ (b) $60Vm^{-1}$
(c) $600Vm^{-1}$ (d) $0.6Vm^{-1}$

44. The force between two charges in 120N. If the distance between the charges is doubled, the force will be

(a) 120N (b) 60N
(c) 30N (d) 15N

45. A field line and equipotential surface are

(a) always parallel (b) always at 90°
(c) inclined at θ° (d) any of above

46. The charge on an isolated conductor resides

(a) at the surface of the conductor
(b) inside the conductor
(c) partly at surface and partly inside the conductor
(d) with uniform distribution over the volume of the conductor.

47. An electron falls through a potential difference of 1V. If velocity is zero, the final velocity of electron is about

(a) 1m/sec (b) 1Km/sec
(c) 100Km/sec (d) 600Km/sec

48. Two spherical drops of water each having a charge Q and surface potential V are combined to form a bigger drop. The surface potential of the bigger drop will be

(a) V (b) 2V
(c) < V but > 2V (d) none of these

49. A parallel plate capacitor is charged so that the electric field in the dielectric is E. If the permittivity of dielectric is ε, the energy density i.e. energy per unit volume is

(a) $0.5\ \varepsilon E$ (b) $0.5\ \varepsilon E^2$
(c) $0.5\ \varepsilon^2 E$ (d) $0.5\ E^2/\varepsilon$

50. Taking the earth's radius as 6370Km and electrosphere height as 25Km, the capacitance of earth electrosphere combination is about

(a) 1 F (b) 0.2F
(c) 0.01F (d) 1μF

51. Divergence of D is a

(a) scalar point function (b) vector point function
(c) phasor (d) may be scalar or vector point function

52. One capacitor has dielectric of Єr =6 and electric field intensity is 50V/m. Another capacitor has Єr=100 and E=10V/m. Then the ratio of energies stored in two capacitors is

(a) 1 (b) 1.5
(c) 2 (d) 2.5

53. A particle having charge e is released in an electric field E. If there are no collisions than the velocity of the particle will be

(a) constant (b) increasing
(c) decreasing (d) none of these

54. A lightning stroke has a current of 100KA and a duration of 200m/sec. If potential is 100KV the energy involved is

(a) 2000 MJ (b) 200 MJ
(c) 20 MJ (d) 0.2 MJ

55. Conductance is analogous to

(a) flux (b) current
(c) reluctance (d) permeance

56. An air gap is usually inserted in magnetic circuits to

(a) increase flux (b) decrease flux
(c) increase mmf (d) prevent saturation

57. The relative permeability of ferromagnetic material is

(a) 1 (b) less than 1
(c) 100 (d) more than 1000

101. The orbital period of a geostationary satellite is

(a) 12hrs (b) 24hrs
(c) 36hrs (d) 48hrs

102. BPSK stands for

(a) binary pulse shifting key (b) broad pulse shifting key
(c) binary phase shifting key (d) bit phase shifting key

103. Armstrong transmitter uses

(a) LC oscillator (b) Crystal oscillator
(c) RC oscillator (d) either (a) or (c)

104. In radio receiver the output from local oscillator is fed to

(a) RF amplifier (b) Mixer
(c) IF amplifier (d) Detector

105. The simplest method of suppression of unwanted side band in AM is

(a) Filter method (b) Phase shift method
(c) Third method (d) Both (a) or (b)

106. Which of the following antennas is not wide band?

(a) Marconi (b) Helical
(c) Folded dipole (d) Discone

107. Top loading in an antenna increases

(a) effective height (b) beam width
(c) input capacitance (d) bandwidth

108. Shannon Hartley law

(a) refers to noise (b) defines bandwidth
(c) describes signaling rate (d) refers to distortion

109. For an ideal 3000Hz channel, nyquist rate is

(a) 3000bps (b) 6000bps
(c) 9000bps (d) 12000bps

110. As frequency is increased, the skin effect

(a) increases (b) decreases
(c) remains same (d) changes abruptly

111. Which of the following is used in integrated circuits?

(a) microstrip line (b) coaxial line
(c) twin wire line (d) shielded cable

112. The primary constants of a transmission line are

(a) R and L (b) R,L and C
(c) R and C (d) R,L,G and C

90. For attenuation of high frequencies we should use

(a) shunt capacitance (b) series capacitance
(c) shunt inductance (d) series inductance

91. An SSB-AM signal can not be demodulated by

(a) BJI balanced modulator (b) Complete phase shift generator
(c) Diode balanced modulator (d) Product detector

92. For AM receivers the standard IF frequency is

(a) 106KHz (b) 455KHz
(c) 1.07MHz (d) 10.7MHz

93. Losses in optical fibers can be caused by

(a) impurities (b) microbending
(c) attenuation in the glass (d) all of these

94. A balun transformer gives an impedance transformation of

(a) 4:1 (b) 2:1
(c) 1:4 (d) 1:2

95. Interlacing is used in television to

(a) produce the illusion of motion
(b) ensure that all the lines on the screen are scanned, not merely the alternate ones
(c) simplify vertical pulse train
(d) avoid flicker

96. Satellites used for international communication are called

(a) comsat (b) domsat
(c) marisat (d) intelsat

97. FSK is used mostly in

(a) telegraphy (b) telephony
(c) satellite (d) radio

98. In PCM, the biggest disadvantage as compared to AM is

(a) larger bandwidth (b) larger noise
(c) inability to handle analog signals (d) incompatibility with TDM systems

99. To couple a co-axial line to a parallel line wire it is best to use

(a) slotted line (b) balun
(c) directional coupler (d) $\lambda/4$ transformer

100. Each kilometer of travel of electromagnetic wave means a time delay of

(a) 330µsec (b) 33µsec
(c) 3.3µsec (d) 0.33µsec

58. If the area of hysteresis loop of a material is large, the hysteresis loss in the material will be

(a) zero (b) low
(c) high (d) none of these

59. Silicon steel is used in electric machines because it has

(a) low hysteresis loss (b) low retentivity
(c) low coercivity (d) all the above

60. Hard steel is suitable for making permanent magnets because it

(a) has good retentivity (b) is mechanically strong
(c) has big hysteresis loop (d) all of the above

61. The aim of shielding an instrument is

(a) to prevent damage due to moisture
(b) to provide mechanical protection
(c) to reduce the effect of stray magnetic field
(d) to increase the range of instrument

62. In a stationary conductor, an emf can be induced by

(a) changing magnetic field (b) electrons
(c) steady magnetic field (d) all of the above

63. A collapsing magnetic field around a coil

(a) tends to oppose the decay of current in the coil
(b) helps decay of current in the coil
(c) has no effect on current decay
(d) any of the above

64. Voltage is a form of

(a) potential energy (b) kinetic energy
(c) either kinetic or potential energy (d) none of the above

65. The magnitude of emf induced in a wire does not depend upon

(a) length of wire (b) diameter of wire
(c) speed of wire (d) flux density of field

66. If m is magnetic moment and B is flux density, the torque T on a loop of side L is

(a) m X B (b) m.b
(c) (m X B).L (d) (m X B)/L

67. A long wire is carrying current I. The value of H at a radius of 1m from the wire is 1A/m. Then I is

(a) 4Π Amp (b) Π Amp
(c) 2Π Amp (d) Π/2 Amp

68. Vacuum is an example of ..... medium.

(a) Diamagnetic (b) Ferromagnetic
(c) Non magnetic (d) Paramagnetic

69. The electrical conductivity of the ferrite is

(a) high (b) low
(c) infinite (d) zero

70. The unit for reluctance is

(a) H (b) H^{-1}
(c) A (d) A^{-1}

71. Propagation constant is expressed as

(a) ZY (b) $\sqrt{ZY}$
(c) $(ZY)^{1.5}$ (d) none of these

where Z and Y are impedance and admittance respectively.

72. Intrinsic impedance of medium Zo can be expressed as

(a) $\sqrt{(\mu\varepsilon)}$ (b) $\sqrt{(\mu/\varepsilon)}$
(c) $\sqrt{(\varepsilon/\mu)}$ (d) $\mu\varepsilon$

73. Intrinsic independent of free space is about

(a) 377Ω (b) 37.7Ω
(c) 3.77Ω (d) 0.377Ω

74. A λ/4 transformer is used for

(a) light loads (b) high frequency loads
(c) impedance matching (d) all of the above

75. The transmission loss for a 3GHz microwave system is 130dB over a certain distance. If frequency is doubled the transmission loss will be

(a) 136dB (b) 133dB
(c) 127dB (d) 124dB

76. The dominant mode in a wave guide is characterized by

(a) longest cut of wave length (b) shortest cut of wave length
(c) infinite attenuation (d) zero attenuation

77. The input impedance of a short circuited line of length less than quarter wave length is purely

(a) resistive (b) inductive
(c) capacitive (d) complex

78. The open circuit and short circuit impedance of a line are 20Ω and 5Ω respectively. Then Zo of the line is

(a) 100Ω (b) 50Ω
(c) 25Ω (d) 10Ω

79. In an ideal transmission line with matched load, the VSWR and reflection co-efficient are respectively

(a) 1 and 1 (b) 0 and 1
(c) infinity (d) 1 and 0

80. Which of the following antennas are not frequency independent?

(a) folded dipole (b) half wave dipole
(c) parabolic reflector (d) helical antenna

81. An ideal quarter wave line has characteristic impedance of 50Ω and load impedance of 100Ω, the input impedance is

(a) 25Ω (b) 50Ω
(c) 75Ω (d) 100Ω

82. The electric field around a positive charge is

(a) inward (b) outward
(c) depend upon the test charge (d) none of these

83. The curl of the gradient of a scalar function is equal to

(a) 1 (b) 0
(c) 2Π (d) infinity

84. An air filled co-axial line has the outer radius equal to twice the inner radius. Its characteristic impedance is about

(a) 0.4Ω (b) 4Ω
(c) 40Ω (d) 400Ω

85. If the frequency of a wave is 20 Hz, the time period is

(a) 20sec (b) 2sec
(c) 0.2sec (d) 0.05sec

86. The audio frequency range is

(a) 5Hz--1KHz (b) 50Hz--20KHz
(c) 16Hz--20KHz (d) 0Hz--20KHz

87. UHF range is

(a) 30MHz---300MHz (b) 300MHz---3000MHz
(c) 3000MHz---30,000MHz (d) above 30,000MHz

88. The positive peak of an AM wave is 16V and the minimum value is 4V.Assuming single tone Modulation, the modulation index is

(a) 0.6 (b) 0.25
(c) 0.36 (d) 4

89. Homodyne detection means

(a) coherent detection (b) non-coherent detection
(c) asynchronous detection (d) none of the above