

**MIZORAM PUBLIC SERVICE COMMISSION**  
**TECHNICAL COMPETITIVE EXAMINATIONS FOR**  
**JUNIOR GRADE OF MIZORAM ENGINEERING SERVICE, P&E CADRE (ELECTRICAL WING)**  
**UNDER POWER & ELECTRICITY DEPARTMENT,**  
**GOVERNMENT OF MIZORAM, JUNE-2022**

**ELECTRONICS & COMMUNICATION ENGINEERING**  
**PAPER-III**

Time Allowed : 3 hours

FM : 200

**SECTION - A (Multiple Choice questions)**

**(100 Marks)**

*All questions carry equal mark of 2 each. Attempt all questions.*

*This Section should be answered only on the **OMR Response Sheet** provided.*

1. The baud rate when using the binary transmission is :
  - (a) Always equal to the bit rate
  - (b) Equal to twice the BW of an ideal channel
  - (c) Not equal to the signalling rate
  - (d) Equal to one half of the BW of ideal channel
2. The main advantage of DSB and SSB is :
  - (a) More carrier power
  - (b) Double the side band power
  - (c) Higher power can be put into sidebands
  - (d) Less carrier power
3. The amplitude modulator works on the principle of :
  - (a) Division
  - (b) Addition
  - (c) Subtraction
  - (d) Multiplication
4. In a delta modulation, the slope overload distortion can be reduced by :
  - (a) Decreasing the step size
  - (b) Decreasing the granular noise
  - (c) Decreasing the sampling rate
  - (d) Increasing the step size
5. Source encoding in a data communication system is done in order to :
  - (a) Enhance the information transmission rate
  - (b) Reduce the transmission errors
  - (c) Conserve the transmitted power
  - (d) Facilitate clock recovery in the receiver
6. Which one of the following modulation techniques has got maximum SNR?
  - (a) AM-SSB
  - (b) AM-DSB
  - (c) FM
  - (d) AM-SC
7. Fading in ship-to-ship communication can be reduced by using which of the following?
  - (a) Space diversity
  - (b) Directional antenna
  - (c) Broad band antenna
  - (d) Frequency diversity
8. Frequencies in UHF range propagate by means of :
  - (a) Sky waves.
  - (b) Surface waves.
  - (c) Ground waves.
  - (d) Space waves.

9. While selecting a satellite system which of the following is the first determining factor?
- (a) Antenna size (b) EIRP  
(c) Antenna gain (d) Coverage area
10. Satellite operates in which of the following frequency range?
- (a) VHF (b) MF  
(c) VHF and UHF (d) HF
11. Given an AM radio signal with a bandwidth of 10 kHz and the highest-frequency component at 705 kHz, the carrier signal frequency is :
- (a) 695 kHz (b) 700 kHz  
(c) 705 kHz (d) 710 kHz
12. An AM broadcast transmitter has a carrier power of 50 kW. With 80% modulation, total power that would be produced will be :
- (a) 40 kW (b) 50 kW  
(c) 66 kW (d) 100 kW
13. The maximum improvement in power efficiency and reduction in bandwidth of an AM signal can be achieved by :
- (a) having modulation index closer to 100%  
(b) having modulation index closer to 10%  
(c) removing the carrier signal  
(d) removing the carrier signal and its one of the Sidebands
14. Assuming that the power removed from the carrier signal could be put into the sidebands, AM signal results in a power gain for the information-carrying part of the signal of at least \_\_\_\_\_ times.
- (a) 6 (b) 4  
(c) 3 (d) 2
15. The modulation index of an AM signal is changed from 0 to 1. The transmitted power is :
- (a) unchanged (b) halved  
(c) increased by 50% (d) doubled
16. A 108 MHz carrier signal is frequency modulated by sinusoidal modulating signal. The maximum frequency deviation is 100 kHz. The approximate transmission bandwidth of the FM signal is \_\_\_\_\_ if the frequency of the modulating signal is 1 kHz.
- (a) 2 kHz (b) 100 kHz  
(c) 101 kHz (d) 200 kHz
17. In a commercial TV broadcast station, the sound portion of TV signal is frequency modulated with a maximum frequency deviation of 50 kHz and a maximum modulating-signal frequency of 15 kHz. The deviation ratio is :
- (a) 3.3 (b) 0.3  
(c) 750 (d) 100
18. A narrowband FM does not have the following feature :
- (a) it does not show any amplitude variations  
(b) it has two sidebands  
(c) both sidebands are equal in amplitude  
(d) both sidebands have identical phase difference with respect to carrier

19. The number of bits per sample is increased from 8 to 16 in a PCM system. The bandwidth of the system will increase :
- (a) 1/2 times (b) 2 times  
(c) 8 times (d)  $2^8$  times
20. How many different symbols are possible at the output of a 16-QAM modulator?
- (a) 8 (b) 16  
(c) 64 (d) 256
21. The maximum height of an elliptical orbit is called the :
- (a) Apex (b) Zenith  
(c) Perigee (d) Apogee
22. Rectangular coaxial line can support :
- (a) Only TEM mode of propagation (b) Both TEM, and TE modes of propagation  
(c) Either TE or TM mode of propagation (d) TEM, TE and TM mode of propagation
23. In parallel-plate waveguide, what is the principal wave?
- (a) TEM wave  
(b) TE wave  
(c) TM wave  
(d) Combination of TE and TM waves having axial components of both electric and magnetic fields
24. Which of the following modes can exist in a rectangular waveguide?
- (a)  $TM_{10}$  (b)  $TE_{10}$   
(c)  $TM_{00}$  (d)  $TM_{01}$
25. In a waveguide, attenuation near the cut-off frequency is :
- (a) Low (b) High  
(c) Very high (d) Zero
26. The phase velocity for the  $TE_{10}$  mode in an air-filled rectangular waveguide is :
- (a) Less than the velocity of plane waves in free space  
(b) Equal to velocity of plane waves in free space  
(c) Greater than velocity of plane waves in free space  
(d) None of these
27. If the height of the waveguide is halved, its cut-off wavelength will :
- (a) Halved (b) Doubled  
(c) Remain unchanged (d) One fourth of the previous value
28. Klystron operation is based on the principle of :
- (a) Velocity modulation (b) Amplitude modulation  
(c) Frequency modulation (d) Phase modulation
29. To prevent oscillations in the TWT which one of the following is resorted to :
- (a) Bunching defocusing mechanism is used (b) Attenuator is used  
(c) External magnetic field is provided (d) Helix is used
30. Which of the following devices has the 'negative resistance' characteristic?
- (a) Reflex klystron (b) Gunn diode  
(c) P-N-P transistor (d) Magnetron

31. What is the upper limit for the data rate using an 8-PSK modulator over a conventional telephone line having bandwidth specified as 300 Hz – 3000 Hz?
- (a) 2,700 bps (b) 5,400 bps  
(c) 8,100 bps (d) 21,600 bps
32. During ground wave propagation earth behaves like a :
- (a) Leaky capacitor (b) Leaky Inductor  
(c) Series combination of capacitor and inductor (d) Parallel combination of capacitor and inductor
33. In which of the following mode of propagation the waves are guided along the surface of the earth?
- (a) Ground wave (b) Sky wave  
(c) LOS (d) Space wave
34. In which of the following layers the electron density is high?
- (a) E layer (b) F1 layer  
(c) F2 layer (d) D layer
35. What is the reason for shifting from c band to ku band in satellite communication?
- (a) Lesser attenuation (b) Less power requirements  
(c) More bandwidth (d) Overcrowding
36. For a dipole antenna :
- (a) The radiation intensity is maximum along the normal to the dipole axis  
(b) The current distribution along its length is uniform irrespective of the length  
(c) The effective length equals its physical length  
(d) The input impedance is independent of the location of the feed – point
37. 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
38. A parabolic dish antenna has a conical beam  $2^\circ$  wide. The directivity of the antenna is approximately:
- (a) 20 dB (b) 30 dB  
(c) 40 dB (d) 50 dB
39. Decimal number 9 in Gray code is :
- (a) 1100 (b) 1101  
(c) 110 (d) 1111
40. The memory devices which are similar to EEPROM but differ in the cost effectiveness is :
- (a) CMOS (b) Memory sticks  
(c) Blue-ray devices (d) Flash memory
41. Decimal 54 in hexadecimal and BCD number system is respectively :
- (a) 63, 10000111 (b) 36, 01010100  
(c) 66, 01010100 (d) 36, 00110110
42. The range of signed decimal numbers that can be represented by 7-bit 1's complement representation is :
- (a) -64 to +63 (b) -63 to 63  
(c) -127 to +128 (d) -128 to +127

43. In order to design a memory system of size 16 k bytes using chips with 11 address lines and 4 data lines each, how many chips are required?
- (a) 8 (b) 2  
(c) 16 (d) 4
44. The content of accumulator after the execution of instructions
- ```
MVI A A7H
ORA A
RLC
```
- (a) CFH (b) 4FH  
(c) 4EH (d) CEH
45. Data path are used to study :
- (a) Control circuits only (b) Data circuits only  
(c) Combination of control and data circuits (d) None of the above
46. In the 8085 microprocessor, the RST6 instruction transfers the program execution to the following location :
- (a) 30 H (b) 24 H  
(c) 48 H (d) 60 H
47. An 8085 microprocessor based system uses a  $4K \times 8$ -bit RAM whose starting address is AA00H. The address of the last byte in this RAM is :
- (a) AFFFH (b) B9FFH  
(c) BFFFH (d) A9FFH
48. The method used for resolving data dependency conflict by the compiler itself is :
- (a) Delayed load (b) Operand forwarding  
(c) Prefetch target instructions (d) Loop buffer
49. The number of out pins of a 8085 microprocessor are :
- (a) 40 (b) 27  
(c) 21 (d) 19
50. Which of the following 8085 assembly language instruction does not affects the contents of the accumulator?
- (a) CMA (b) CMPB  
(c) DAA (d) ADDB

**SECTION - B (Short answer type question)**  
**(100 Marks)**

*All questions carry equal marks of 5 each.*

*This Section should be answered only on the Answer Sheet provided.*

1. The probabilities of five possible outcomes of an experiment are  $(1/2)$ ,  $(1/4)$ ,  $(1/8)$ ,  $(1/16)$ , and  $(1/16)$ . Determine the entropy and information rate if there are 16 outcomes per second.
2. What is the need of low pass filter and sample-and-hold circuit in PCM generator? Explain slope over load error and granular noise associated with Delta Modulation (DM).
3. Define critical angle and numerical aperture associated with optical fiber communication. For a silica optical fiber, the refractive index of core layer and cladding layer is 1.56 and 1.35 respectively. Calculate critical angle and numerical aperture.
4. Define dispersion in optical fiber communication. Briefly explain intermodal dispersion, chromatic dispersion, and waveguide dispersion.
5. Explain the principle of operation of a two-hole directional coupler. What is the limitation of this structure?
6. Derive the radar range equation.
7. Draw the timing diagram for IN instruction of Intel 8085 microprocessor.
8. Define AM & FM. Explain the principle in short and its uses.
9. What are the main functions performed by BIU and EU unit of 8086 microprocessor?
10. Prove that the percent power saving with SSBSC transmission is as high as 83.34% for modulation index of 1.0, as compared to conventional AM with full carrier.
11. Discuss the principle of "MASER" and its applications.
12. A waveguide operating in TE<sub>10</sub> mode has dimensions  $a=2.26$  cm and  $b=1$  cm. The measured guide wavelength is 4 cm. Find
  - (a) The cutoff frequency of the propagating mode
  - (b) The frequency of operation
  - (c) Maximum frequency of propagation in this guide
13. Explain why a dielectric filled waveguide cannot support TEM waves.
14. Explain the use of Magic Tee for a four port circulator.
15. A typical step-index profile optical fiber has a fiber core having radius = 4  $\mu$ m and refractive index = 1.46. The relative refractive index difference is specified as 0.3%. Determine the normalized frequency parameter V at the following operating wavelength
  - (a) 1300 nm
  - (b) 1550 nm
16. With the help of an example explain the operation of the following instructions in 8085.
  - (a) LHLD addr
  - (b) RST 4
  - (c) CP 2000
  - (d) IN 20H
  - (e) DAD B
17. Explain the various steps involved while executing CALL instruction with an example.
18. Write an assembly language program for carrying out multiplication of two 8 bit numbers.
19. Draw the timing diagram for instruction MVIA, 30H which is stored at address 2000H.
20. Design a memory system for 8085 microprocessor such that it should contain 8 Kbyte of EPROM and 8 Kbyte of RAM.