

MIZORAM PUBLIC SERVICE COMMISSION
COMPETITIVE EXAMINATIONS FOR JUNIOR GRADE OF M.E.S.
UNDER POWER & ELECTRICITY DEPARTMENT, AUGUST, 2018.

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. Which modulator is an indirect way of generating FM?
(a) Reactance FET (b) Varactor diode
(c) Armstrong (d) Reactance bipolar transistor
2. The image (second) channel selectivity of a super heterodyne communication receiver is determined by
(a) Antenna and pre-selector (b) The preselect or and RF amplifier
(c) The pre selector and IF amplifier (d) The RF and IF amplifier
3. In a low level amplitude modulation system, the amplifier following the modulated stage must be
(a) A class-C amplifier (b) A linear device
(c) a non-linear device (d) a harmonic device
4. The modulation index of an amplitude modulated wave is changed from 0 to 1. The transmitted power is
(a) Doubled (b) Half
(c) Increased by 50% (d) Unchanged
5. In a ratio detector
(a) The linearity is worse than in phase discriminator
(b) Stabilization against signals strength variations provided
(c) The output is twice that obtainable from a similar phase discriminator
(d) The circuit is the same as in a discriminator, except that the diodes are reversed
6. In phase modulation, the frequency deviation is
(a) Independent of the modulating signal frequency
(b) Inversely proportional to the modulating signal frequency
(c) Directly proportional to the modulating signal frequency
(d) Inversely proportional to the square root of the modulating frequency.
7. An FM signal has a carrier swing of 100 kHz and a modulating signal of 10kHz. Its modulation index is
(a) 0.1 (b) 5
(c) 10 (d) 20

8. In a radio receiver AGC is used
- (a) To improve the noise figure of the receiver
 - (b) To maintain the carrier level at the second detector input constant
 - (c) To improve selectivity of the receiver
 - (d) None of the above
9. The standard IF value for FM receivers is
- (a) 10.7 MHz
 - (b) 110.7 MHz
 - (c) 400 MHz
 - (d) 500 MHz
10. In a super heterodyne receiver, which stage produces IF signal?
- (a) Grand condenser
 - (b) RF amplifier
 - (c) Mixer
 - (d) None of these
11. In frequency modulation
- (a) the frequency of carrier varies according to the amplitude of modulating signal
 - (b) the frequency of carrier varies according to the frequency of modulating signal
 - (c) the frequency of carrier varies according to the phase of modulating signal
 - (d) the frequency of carrier varies according to the amplitude and phase of modulating signal
12. The function of a pre-emphasis circuit in a communication system is to boost the
- (a) modulated wave
 - (b) whole audio band
 - (c) higher audio frequency
 - (d) lower audio frequency
13. In radio wave propagation the ionosphere plays a significant role at _____ frequencies.
- (a) optical
 - (b) ultra high
 - (c) high
 - (d) microwave
14. Tropospheric scatter is used with the frequency in the range of
- (a) HF
 - (b) VHF
 - (c) UHF
 - (d) VLF
15. The INSAT operates in
- (a) Q band
 - (b) S band
 - (c) C band
 - (d) Ku band
16. Linear velocity of a satellite in a circular orbit is
- (a) Independent of its mass
 - (b) Directly proportional to its mass
 - (c) Directly proportional to square of its mass
 - (d) Directly proportional to square root of its mass
17. A passive satellite
- (a) Only generates signals
 - (b) Only reflects back signals
 - (c) Only absorbs signals
 - (d) Receives, modulates and reflects the signals
18. The angle of inclination of a satellite whose orbit is over the equator is
- (a) 0°
 - (b) 90°
 - (c) 100°
 - (d) 135°

19. Quantization noise is produced in
(a) Delta modulation (b) Pulse Code Modulation
(c) Pulse Amplitude Modulation (d) Pulse Width Modulation
20. Bit rate of a digital QPSK communication system is 34 Mbps. The baud rate is
(a) 68 Mbps (b) 32 Mbps
(c) 100 Mbps (d) 17 Mbps
21. A zero source generates two messages with probability 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
22. A communication channel with AWGN has a Bandwidth of 4KHz and an SNR of 15. Its channel capacity is
(a) 1.6 kbps (b) 16 kbps
(c) 32 kbps (d) 64 kbps
23. The dominant mode in rectangular waveguide is
(a) TE_{10} (b) TE_{11}
(c) TE_{12} (d) TE_{20}
24. Cut off wavelength of circular waveguide in TM mode is
(a) $\frac{2}{\sqrt{\left(\frac{m}{a}\right)^2 + \left(\frac{n}{b}\right)^2}}$ (b) $\frac{2a\pi}{(ha)_{nm}}$
(c) $\frac{2}{\sqrt{\left(\frac{m}{a}\right)^2 - \left(\frac{n}{b}\right)^2}}$ (d) $\frac{2ab}{\sqrt{(ha)_{nm}}}$
25. The waves in waveguide
(a) Travel along the border walls of the waveguide
(b) Reflected from side walls but do not travel along them
(c) Travel through the dielectric without touching the walls
(d) Travel along the four walls
26. Theoretically number of nodes that can exist in cylindrical waveguides
(a) Zero (b) One
(c) Two (d) Infinite
27. In rotary phase shifter, rotatable section plate is
(a) Half wavelength (b) Horizontal
(c) One wave length (d) Vertical
28. Twists are useful to change
(a) Direction of propagation (b) Orientation of E vector
(c) Splitting the propagation (d) Blocking the propagation
29. The basic principle of operation of klystrons is
(a) Resonance (b) Degenerative feedback
(c) Velocity modulation (d) Negative resistance

30. Due to debunching, the power output of Reflex klystron is
(a) Decreases (b) Increases
(c) No change (d) Constant
31. The paths of electrons in magnetron are
(a) Cycloid (b) Circular
(c) Elliptical (d) Parabolic
32. Maximum electronic efficiency of two cavity Klystron is
(a) 58% (b) 85%
(c) 35% (d) 100%
33. The magnet surrounding the body of a Travelling Wave Tube serves the purpose
(a) To focus into a tight beam (b) To accelerate electrons to higher velocities
(c) For dense bunching (d) For larger amplification
34. Out of the following diodes, the noisiest one is
(a) TRAPATT (b) IMPATT
(c) GUNN (d) Tunnel
35. In tunnel diode, the Fermi level is not in
(a) Conduction band (b) Valance band
(c) Forbidden energy gap (d) None of the above
36. Gunn domains start near
(a) Cathode region (b) Anode region
(c) Middle of the diode (d) Start of the diode
37. Gunn effects occurs in semiconductors only when doped with
(a) n-type (b) p-type
(c) No doping (d) None of these
38. For an ideal cavity 'Q' value is
(a) Zero (b) Infinity
(c) One (d) Two
39. The mode used in the laboratory bench is
(a) Dominant mode (b) Degenerative mode
(c) Regenerative mode (d) None of the above
40. In a microwave bench, the source is always followed by
(a) Attenuator (b) Detector
(c) Isolator (d) Wave meter
41. Impedance of the line to the right of voltage minimum is
(a) Inductive (b) Capacitive
(c) High resistance (d) Low resistance
42. If P_r and P_i are reflected and incident powers, then the reflection coefficient r is
(a) $\frac{P_r}{P_i}$ (b) $\frac{P_i}{P_r}$
(c) $\sqrt{\frac{P_r}{P_i}}$ (d) $\sqrt{\frac{P_i}{P_r}}$

43. Q factor is measured using
- (a) Reflect metre method
 - (b) Transmission line method
 - (c) Power ratio method
 - (d) Current ratio method
44. Setting contents of a microprocessor to zero can be efficiently done by
- (a) MOV Immediate instruction using zero as immediate data
 - (b) AND Immediate instruction using zero as immediate data
 - (c) XORing register with itself
 - (d) None of these
45. A microprocessor is called an n-bit microprocessor depending upon
- (a) Registers' length
 - (b) Size of internal data bus
 - (c) Size of external data bus
 - (d) None of these
46. With reference to 8085 microprocessor, ANA R/M is
- (a) An arithmetic instruction
 - (b) A logic instruction
 - (c) Data transfer instruction
 - (d) Control instruction
47. What is the size(in bits) of the stack pointer in 8085?
- (a) 8
 - (b) 24
 - (c) 32
 - (d) 16
48. In an 8085 microprocessor, the instruction CMP B has been executed while the content of the accumulator is less than of register B. As a result
- (a) Carry flag will be set but Zero flag will be reset
 - (b) Carry flag will be reset but Zero flag will be set
 - (c) Both Carry flag and Zero flag will be reset
 - (d) Both Carry flag and Zero flag will be set
49. An 8085 assembly language program is given below. Assume that the carry flag is initially unset. The content of the accumulator after the execution of the program is
- ```
MVIA, 07H
RLC
MOV B, A
RLC
RLC
ADD B
RRC
```
- (a) 8C H
  - (b) 64 H
  - (c) 15 H
  - (d) 23 H

50. An 8085 assembly language program is given below.

Line 1: MVIA, B5H

Line 2: MVI B, 0EH

Line 3: XRI 69H

Line 4: ADD B

Line 5: ANI 9BH

Line 6: CPI 9FH

Line 7: STA 30101 H

Line 8: HLT

After execution of line 7 of the programme, the status of the CY and Z flags will be

(a) CY = 0, Z = 0

(b) CY = 1, Z = 0

(c) CY = 0, Z = 1

(d) CY = 1, Z = 1

**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. A two cavity klystron amplifier has the parameters of  $V_0=1.5$  kV,  $V_1=100$ V, cavity gap  $d=1$ mm,  $f=8$ KHz. Find the gap transit angle and optimum length of the drift region.
2. Find the power gain in dB of a Travelling Wave Tube (TWT) having  $V_0=10$ kV,  $I_0=500$ mA,  $f=10$ GHz,  $Z_0=25\Omega$  and interaction length of 20 cm.
3. Explain with diagram the necessary arrangements for launching  $TE_{10}$ ,  $TE_{20}$ ,  $TM_{11}$  and  $TM_{21}$  modes in a rectangular waveguide.
4. A pyramidal horn antenna has HPBW in the E and H planes respectively as 200 and 300. Determine the directivity and the physical dimensions of the aperture of the antenna if the operating frequency is 10 GHz. What will be the effective aperture of the antenna if the antenna aperture efficiency is 0.7?
5. A microwave terrestrial link of 30km long is operating at 10GHz with radiated power of 10W through a parabolic dish having maximum gain of 25dB. The receiver uses similar antenna. Find the 'free space loss' and the 'received power'.
6. Briefly explain the Spontaneous Emission and Stimulated Emission related with MASER.
7. Briefly explain the 'Three level LASER system'.
8. What is system noise temperature? How does it effects the C/N and G/T ratio?
9. Define fiber acceptance angle and numerical aperture of a fiber. How ther are related to each other?
10. A discrete source emits one of five symbols once every milisecond with probabilities 1/2, 1/4, 1/8, 1/16 and 1/16 respectively. Determine the source entropy and information rate.
11. Prove that the efficiency for a single tone AM is 33% for perfect modulation. What will be the efficiency if the value of modulation index is 0.5?

12. Show that the channel capacity of an ideal AWGN channel with infinite bandwidth is given by  $C_{\infty} \cong 1.44 \frac{S}{\eta} b/s$  where S is the average signal power and  $\frac{\eta}{2}$  is the power spectral density of AWGN channel.
13. Explain with neat circuit diagram the operation of sample and hold circuit.
14. A TV signal with bandwidth of 4.2 MHz has to be transmitted using binary PCM. The numbers of quantization levels are 512. Calculate
- (a) Sampling frequency
  - (b) Code word length
  - (c) Final bit rate
  - (d) (SNR)<sub>q</sub>
  - (e) Transmission bandwidth.
15. Explain briefly the limitations of Delta Modulation.
16. Explain the operation of Frequency Division Multiplexing(FDM) system.
17. When the modulating frequency in an FM system is 500 Hz, the modulating voltage is 2.4 volt,  $\beta = 50$ , calculate the frequency deviation. What will be the modulation index when modulating frequency is reduced to 250 Hz & modulating voltage is raised to 4 volt?
18. Differentiate between peripheral mapped I/O and memory mapped I/O.
19. Discuss the function of the following signals of 8085:  
HOLD, READY, SID, SOD,  $\overline{\text{INTA}}$
20. Briefly explain the functionality of associative memory.

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