| Reg. No | | | | | | | | | | | | | | | | |
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# B.Tech DEGREE EXAMINATION, JUNE 2024

Fifth Semester

## 18ECC205J - ANALOG AND DIGITAL COMMUNICATION

*(For the candidates admitted during the academic year 2018-2019 to 2021-2022)*

**Note:**

i. **Part - A** should be answered in OMR sheet within first 40 minutes and OMR sheet should be handed over to hall invigilator at the end of 40<sup>th</sup> minute.

ii. **Part - B** and **Part - C** should be answered in answer booklet.

**Time: 3 Hours**                                                                 **Max. Marks: 100**

### PART - A (20 × 1 = 20 Marks)
Answer **all** Questions

<div align="right">Marks BL CO</div>

1. Which of the following analog modulation scheme requires minimum transmitted power and minimum channel bandwidth?    1    1    1
   (A) VSB                            (B) DSB-SC
   (C) SSB-SC                         (D) DSB-FC

2. The positive RF peaks of an AM voltage rise to a maximum value of 10 V and drop to a minimum of 6 V. The modulation index is ----------------------    1    3    1
   (A) 3                             (B) 1/3
   (C) 1/4                           (D) 1/6

3. A 100 MHz carrier is frequency modulated by 10 KHz modulating wave. For a frequency deviation of 75 KHz, calculate the modulation index of the FM signal.    1    3    1
   (A) 100                           (B) 5
   (C) 7.5                           (D) 75

4. FM signal can be generated using phase modulator by _____ the modulating signal    1    1    1
   (A) differentiating              (B) integrating
   (C) amplifying                   (D) summing

5. The abrupt change in the master oscillator Frequency due to abrupt changes in the load is known as ------------------    1    1    2
   (A) Frequency drift              (B) Frequency Scintillation
   (C) Frequency deviation          (D) Frequency modulation

6. The noise-quieting effect of carrier in FM detector is a phenomenon in which the output noise power varies ----------------------    1    1    2
   (A) inversely with square of carrier power   (B) directly with square of carrier power
   (C) directly with carrier power              (D) inversely with carrier power

7. The Intermediate Frequency is 455 KHz. If the radio receiver is tuned to 855 KHz, then the local oscillator frequency is _____    1    3    2
   (A) 1410 KHz                     (B) 1610 KHz
   (C) 1310 KHz                     (D) 1710 KHz

8. The bandwidth of a baseband signal with resonant frequency 650 KHz is 10 KHz. The Q factor of the tuned circuit is --------------------    1    3    2
   (A) 25                           (B) 55
   (C) 65                           (D) 75

9. Calculate the Nyquist rate for sampling when a continuous time signal is given by $x(t)=5 \cos 100\pi t+10 \cos 200\pi t-15 \cos 300\pi t$    1    3    3
   (A) 100 Hz                       (B) 150 Hz
   (C) 300 Hz                       (D) 600 Hz

10. The processing gain of the DPCM signal is directly proportional to ____     1    1    3
    (A) variance of the quantization error        (B) variance of the input sample
    (C) variance of the prediction error          (D) quantized signal

11. The peak pulse Signal to Noise Ratio of a matched filter depends only on the ratio of     1    2    3
    the signal energy to the --------------- of the white noise at the filter input.
    (A) Probability density function              (B) Power spectral density
    (C) Cumulative density function               (D) Conditional probability

12. The width of the eye opening defines ---------------.     1    1    3
    (A) The sensitivity of the system to          (B) Time interval over which the
        timing errors                                 received signal can be sampled
                                                      without error from ISI

    (C) Noise margin of the system                (D) Time interval over which the
                                                      received signal can be sampled with
                                                      error from ISI

13. The data rate of QPSK is _____ of BPSK.     1    2    4
    (A) Thrice                                    (B) Four times
    (C) Twice                                     (D) same

14. Quadrature amplitude modulation (QAM) is a combination of _____.     1    1    4
    (A) PSK and FSK                               (B) ASK and FSK
    (C) ASK and PSK                               (D) ASK and MFSK

15. QPSK is a modulation scheme where each symbol consists of --------------------     1    1    4
    (A) 2 bits                                    (B) 1 bit
    (C) 4 bits                                    (D) 8 bits

16. FSK system is represented by _____ carriers     1    1    4
    (A) 4                                         (B) 2
    (C) 16                                        (D) 8

17. A PN sequence is generated using a feedback shift register of length 3. What is the     1    3    5
    length of PN sequence?
    (A) 3                                         (B) 6
    (C) 5                                         (D) 7

18. Which of the following is used to reject the narrow-band interference?     1    1    5
    (A) TDMA                                      (B) CDMA
    (C) FDMA                                      (D) OFDMA

19. An event has six possible outcomes with the probabilities P = {1/2, 1/4, 1/8, 1/16,     1    3    5
    1/32, 1/32}. The entropy of the system is _____.
    (A) 7/16 bits/message                         (B) 61/16 bits/message
    (C) 31/16 bits/message                        (D) 73/16 bits/message

20. A generator polynomial is used to generate _____.     1    1    5
    (A) Shannon Fano codes                        (B) Hamming codes
    (C) Cyclic codes                              (D) Gray codes

## PART - B (5 × 4 = 20 Marks)                    Marks BL    CO
### Answer **any 5** Questions

21. A 400 W carrier is modulated on a depth of 75%. Calculate the total power in the     4    3    1
    amplitude modulated wave.

22. The maximum deviation allowed in an FM broadcast system is 75 KHz. If the     4    3    1
    modulating signal is a single tone sinusoid of 20 KHz, find the bandwidth of the FM
    signal. What will be the change in the bandwidth, if modulating frequency is
    doubled? Determine the bandwidth when the modulating signal amplitude is also
    doubled.

| | | Marks | BL | CO |
|---|---|---|---|---|
| 23. | Explain direct FM Transmitter with neat Block diagram. | 4 | 1 | 2 |
| 24. | Represent the data 10100111 by using the following line coding techniques<br>1.Unipolar NRZ  (2 Marks)<br>2. Bipolar RZ   (2 Marks) | 4 | 3 | 3 |
| 25. | How an eye pattern diagram is used to analyze the Inter-symbol interference? | 4 | 2 | 3 |
| 26. | List out the important features of $\pi/4$ QPSK. | 4 | 1 | 4 |
| 27. | A continuous signal is band limited to 5KHz.The signal is quantized in 8 levels of a PCM system with the probabilities 0.25, 0.2, 0.2, 0.1, 0.1, 0.05, 0.05 and 0.05.Calculate the rate of information. | 4 | 3 | 5 |

### PART - C (5 × 12 = 60 Marks)
Answer all Questions

| | | Marks | BL | CO |
|---|---|---|---|---|
| 28. | (a) Illustrate the working of linear diode detector and derive the expression for choice of time constant. | 12 | 2 | 1 |
| | **(OR)** | | | |
| | (b)  Explain the method of demodulation of FM signal using Foster Seeley discriminator with neat circuit diagram and required phasor diagram, | | | |
| 29. | (a) Describe in detail about constituent stages of AM Super-heterodyne Receiver with neat diagram. | 12 | 3 | 2 |
| | **(OR)** | | | |
| | (b) Derive an expression for Figure of Merit of a  Frequency modulated System. | | | |
| 30. | (a) Elaborate the working of Pulse Code Modulation (PCM) transmitter and Receiver with neat block diagram. Also derive an expression of Signal to Quantization Noise Ratio of a PCM System. | 12 | 3 | 3 |
| | **(OR)** | | | |
| | (b) Derive an expression of the probability of error of the Matched Filter. | | | |
| 31. | (a) Explain in detail about the generation and detection of Frequency Shift Keying (FSK) with a neat diagram. Also, derive its probability of error. | 12 | 2 | 4 |
| | **(OR)** | | | |
| | (b) Explain the Quadrature Phase Shift Keying (QPSK) transmitter, receiver, and signal space diagram using appropriate illustrations, and also obtain an expression for the error probability of QPSK. | | | |
| 32. | (a) Explain the working of the FHSS transmitter and receiver with neat diagram. | 12 | 3 | 5 |
| | **(OR)** | | | |
| | (b) In a communication system, the source transmits five different messages say $S_1$, $S_2$, $S_3$, $S_4$, $S_5$ with the probabilities of 0.4, 0.19, 0.16, 0.15 and 0.15 respectively. Find the code word for each message and the coding efficiency using Shannon Fano coding. | | | |

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