Name:

Enrolment No:

UPES

End Semester Examination, May 2024

Course: Communication System **Semester: IV**

Program: B. Tech. (Electronics & Computer Engineering) **Time : 03 hrs.**

Course Code: ECEG 2069 **Max. Marks: 100**

Instructions: Answer all the questions.
The diagram must be neat and clean.

SECTION A

(5Qx4M=20Marks)

S. No.		Marks	CO
Q 1	**Objective questions** (a) A carrier is amplitude modulated to a depth of 40%. The increase in power is: (i) 40% (ii) 20% (iii) 16% (iv) 8% (b) The positive RF peaks of an AM voltage rise to a maximum value of 12V and drop to a minimum value of 4V. The modulation index assuming single tone modulation is (i) 3 (ii) 1/3 (iii) ¼ (iv) ½ (c) Which of the following are the main purpose of using modulation in communication (i) Practibility of antenna (ii) Multiplexing (iii) Narrow-banding (iv) All of these (d) Frequency range of amplitude modulated wave is_____	**4**	**CO1**
Q 2	**Objective questions:** (a) Which of the following gives maximum probability of error (i) ASK (ii) FSK (iii) BPSK (iv) QPSK (b) In a commercial FM broadcast system, the modulating signal frequency is limited to about (i) 3.4 kHz (ii) 5 kHz (iii) 15 kHz (iv) 20 kHz (c) The message carrying efficiency is best in (i) FM (ii) AM (iii) DSB-SC (iv) PM (d) Which of the following is the advantage of FM over AM (i) Noise immunity (ii) Fidelity (iii) Wide bandwidth (iv) Probability of noise spike generation	**4**	**CO3**
Q 3	A 4-bit input **message (1101)** is fed into a linear block coder. Find the **output** code, if the **H matrix** of linear block code is given as $H = \begin{bmatrix} 1 & 1 & 1 & 0 & 1 & 0 & 0 \\ 1 & 1 & 0 & 1 & 0 & 1 & 0 \\ 1 & 0 & 1 & 1 & 0 & 0 & 1 \end{bmatrix}$	**4**	**CO4**

Q 4	Frequency modulation is utilized for the transmission of a music signal. Provide a visual representation of the block diagram that illustrates the reception process of this signal.	**4**	**CO1**
Q 5	An FM radio link has frequency deviation of 30 kHz. The modulating frequency is 3kHz. Calculate the bandwidth needed for the link. What will be the bandwidth if the deviation is reduced to 15kHz.	**4**	**CO1**
SECTION B **(4Qx10M= 40 Marks)**			
Q 6	What do you understand by PCM system. Draw the waveform of the following line codes for the binary word 10110011. (i) UNRZ (ii) BNRZ (iii) URZ (iv) BRZ (v) Manchester Code (vi) BRZ-AMI **OR** Describe delta modulation system. What are its limitation and how can they be overcome in digital communication.	**10**	**CO2**
Q 7	What is the bandwidth of the base (unmodulated) message of a TV signal? Determine the necessary bandwidth required for this signal to be modulated under the following three conditions. (a) Doble Side Band Amplitude Modulation with a modulation index of 0.5 (b) Vestige Side Band Amplitude Modulation with a modulation index of 1. (c) Frequency Modulation with a modulation index of 5.	**10**	**CO1**
Q 8	The generator polynomial of a **cyclic code** is $G(x) = x^3 + x^2 + 1$. Determine the **code** of these input messages using both **systematic** and **nonsystematic cyclic code**. (a) 1100 (b) 1001 (c) 1011	**10**	**CO4**
Q 9	(a) Consider a message signal with the **maximum frequency** of f_m, and it undergoes **sampling** at a rate of f_s. Explore the following three scenarios using a well-defined frequency domain diagram. i. $f_s = 2 f_m$ ii. $f_s < 2 f_m$ iii. $f_s \geq 2 f_m$ (b) If 4 E1 lines are multiplexed and in between each line 10 synchronization bits are used, this multiplexed line is needed to transmit using Manchester line coding. Then find the minimum transmission rate and bandwidth required.	**10**	**CO3**

	SECTION-C **(2Qx20M=40 Marks)**		
Q 10	(a) A signal is represented as m(t) = 2 Sin $4\pi\times1000$ t +4 Cos 3140 t + 6 Cos $2\pi\times500$ t. It modulates a carrier, 5 Cos $2\pi\times10^5$ t, in amplitude. (i) Determine the resultant modulation index. (ii) State whether the DSB wave is under-modulated or over-modulated. (iii) Calculate the power of the unmodulated signal. (iv) Determine the efficiency of the wave. (v) Determine the minimum sampling frequency. (vi) Draw the spectrum of the resultant SSB. (vii) Determine the transmission rate if it is quantized with 1024 levels. (viii) Determine the bandwidth of SSB. (ix) Draw the spectrum of VSB (taken only one band in LSB) (x) Determine the bandwidth of VSB (taken only one band in LSB) (b) An amplitude modulated amplifier has power output of 50W at 100% modulation and the internal loss in the modulator is 10W. (i) Calculate the unmodulated carrier power (ii) What power output is required from the modulator (iii) If 100% modulation is reduced to 75%. How much output is needed from the modulator.	**20**	**CO1**
Q 11	(a) Design and explain quadrature phase shift keying (QPSK) transmitter and receiver section. (b) What is the significance of Matched filter in digital communication. Derive the expression of probability of error for FSK and BPSK. **OR** (a) Design and explain the synchronous detection of FSK and PSK system. **(b)** A binary receiver system receives a bit rate of 1Mbps. The waveform amplitude is 5mV and the noise power spectral density is 0.5 X 10^{-11} W/Hz. Calculate the average bit error probability if the modulation schemes are (i) ASK (ii) FSK (iii) PSK	**20**	**CO3**