Punjab Engineering College (Deemed to be university)
Mid-Term Examination (14.10.2022)

Programme: B.E(ECE)
Course Name: Analog & Digital Communication
Maximum Marks: 30

Year/Semester: 22231/5th
Course Code: EC 1351
Time Allowed: 90 min

Notes:

- **All questions are compulsory.**
- **The candidates, before starting to write the solutions, should please check the question paper for any discrepancy and also ensure that they have been delivered the question paper of right course code.**

Sr. No.	Questions	Marks
1	Define modulation. Analyze the need for modulation.	1+2
2	What is the relationship between instantaneous frequency and phase? Also design an FM modulator using PM modulator.	1+1
3	Over an interval, $\lvert t \rvert \leq 1$, an angle-modulated signal is given by: $S(t) = 10\cos(13{,}000\pi t)$ It is known that the carrier frequency, $w_c = 10{,}000\pi$. (a) Determine m(t) over the given interval if this were a PM signal with $K_p = 1000$, (b) Determine m(t) over the specified interval if this were an FM signal with $K_f = 1000$.	2+2
4	A modulating signal m(t) is given by: $m(t) = \cos(100\pi t)$ (a) Show the spectrum of m(t) (b) Examine the spectrum of the DSB-SC signal: $2m(t)\cos(1000\pi t)$ (c) From the above spectrum, suppress the LSB spectrum to obtain the USB spectrum (d) List the time domain expression for the USB signal (e) Determine the bandwidth for the DSB-SC and SSB-SC signals.	5
5	Derive the expression of Wideband FM in terms of Bessel function.	5
6	Discuss the role of an envelope detector in detecting an amplitude-modulated signal.	3
7	Design the block diagram for Super-Heterodyne receiver for AM detection tuned to 570 KHz. Solve for image rejection ratio when the receiver is tuned to 1 MHz station and the intermediate frequency is 455 KHz with Q = 100.	3+2
8	Define Sampling Theorem. Determine the frequency components present at the output of the low pass filter with cut-off frequency 15 KHz, if the sampling interval, T_s = 50 microseconds and the band-limited input message signal is: $x(t) = 10\cos(24\pi \times 10^3 t)$	1+2

Punjab Engineering College (Deemed to be university)
End-Term Examination

Programme: B.E(ECE)
Course Name: Analog & Digital Communication
Maximum Marks: 50

Year/Semester:22231
Course Code: EC 1351
Time Allowed: 3 hrs

Note:

- **All questions are compulsory.**
- **The candidates, before starting to write the solutions, should please check the question paper for any discrepancy and also ensure that they have been delivered the question paper of right course code.**

Sr. No.	Questions	Marks	Bloom's Level	Mapped CO
1	(a) Define mutual information of two random variables, X and Y. (b) Let us consider a binary source with source alphabet, S={S1,S2} with probabilities {7/16,9/16}, calculate the entropy for this source.	1+2	L1 & L4	CO-4
2	(a) Describe the block diagram of a digital communication system. (b) Illustrate the difference between digital baseband and pass-band communication.	3+1	L2 & L3	CO-3
3	Explain Phase locked loop for FM demodulation in detail. Also discuss lock range and capture range.	5	L3	CO-1
4	Describe the process of sampling and quantization for a continuous time band limited signal with a maximum frequency of f_m.	5	L2	CO-2
5	Discriminate AM and DSB-SC modulation. Give the percentage power saving in DSB-SC modulation as compared to AM.	5	L5	CO-1
6	Explain Delta modulation. Comment on slope overload noise and granular noise.	5	L3	CO-2
7	Explain Quadrature phase shift keying along with its constellation diagram. Determine its bandwidth requirement and energy per symbol.	5	L4	CO-3

8	Consider the random variable: $$X = \begin{pmatrix} x_1 & x_2 & x_3 & x_4 & x_5 & x_6 & x_7 \\ 0.50 & 0.26 & 0.11 & 0.04 & 0.04 & 0.03 & 0.02 \end{pmatrix}$$ (a) Develop a binary Huffman code for X. (b) Evaluate the code efficiency.	3+2	L5 & L6	CO-4
9	Examine the use of Minimum shift keying in eliminating phase discontinuities.	5	L1	CO-3
10	Consider a (7,4) linear block code defined by the generator matrix: $$\vec{G} = \begin{bmatrix} 1 & 0 & 0 & 0 & 1 & 1 & 0 \\ 0 & 1 & 0 & 0 & 0 & 1 & 1 \\ 0 & 0 & 1 & 0 & 1 & 1 & 1 \\ 0 & 0 & 0 & 1 & 1 & 0 & 1 \end{bmatrix}$$ (a) Find all the possible codewords. (b) Determine whether the given code is a hamming code or not. (c) Estimate the minimum hamming distance for this code. Determine the error detecting and correcting capability of the code. (d) Find the parity check matrix, H of the code. (e) If the received codeword is r = [1 1 0 1 0 1 1], compute the syndrome and correct the error if any.	2+1+3+1+1	L3 & L5	CO-4