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

Programme: B.E(ECE) — **Year/Semester: 22231/5th**
Course Name: Analog & Digital Communication — **Course Code: EC 1351**
Maximum Marks: 30 — **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, $\|t\| \leq 1$, 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