Name of the Department: **Department of Physics**

Name of the Course: **B.Sc. Hons. Physics-CBCS_DSE**

Name of the Paper: **Communication Systems**

Semester: **VI**

Unique Paper Code: **32227613**

Question paper Set number: **Set B**

Duration: **3 Hours**

Maximum Marks: **75**

Attempt any four questions. All questions carry equal marks.

Q1 a) Explain the concept of cell sectoring and cell splitting.

b) What are the advantages of geostationary satellites in communication? Derive the expressions for the limits of visibility of as satellite.

c) What are the benefits of modulating a signal before transmission? Explain the difference between Analog and Digital modulation with examples of both. (6+6+6.75)

Q2 a) With proper circuit diagram explain the emitter modulation technique for the generation of Amplitude Modulation.

b) With suitable mathematical expressions draw and explain the frequency domain representation of an AM wave for a sinusoidal modulating signal.

c) Explain what happens when complex signals of random shape modulate a carrier.

d) List the advantages of SSB modulation over DSBFC. (5+6+3.75+4)

Q3 a) What is the connection between PM wave and an FM wave?

b) Explain how we can generate PM wave from FM wave and vice versa.

c) Prove that the average power of FM wave is equal to the unmodulated carrier power.

d) Explain the method of generation of FM wave using voltage-controlled oscillator.

(3.75+5+5+5)

Q4 a) Describe in detail the process of:

(i) Pulse Width Modulation.

(ii) Pulse Position Demodulation.

b) Write in detail about the GPS Navigation System and its applications. (12+6.75)

Q5 a) With the help of suitable expressions and waveforms explain the concept of Binary Amplitude Shift Keying (BASK), Binary Frequency Shift Keying (BFSK) and Binary Phase Shift Keying (BPSK).

b) A carrier wave of amplitude 10 Volts and frequency 10 MHz is modulated by a sinusoidal voltage of amplitude 2V and frequency 10 KHz. The frequency sensitivity constant is 5KHz/Volt. With proper supporting calculations and reasoning, draw the frequency spectrum of FM and AM wave. Given that; $J_0(1) = 0.77$; $J_1(1) = 0.44$; $J_2(1) = 0.11$; $J_3(1) = 0.02$ (8.75+10)

Q6 a) An SSB signal is generated by modulating a 5-MHz carrier with a 400-Hz sine tone. At the receiver, the carrier is reinserted during demodulation, but its frequency is 5.00015 MHz rather than exactly 5 MHz. How does this affect the recovered signal?

b) How is a satellite launched and is kept in orbit? Explain the balancing forces.

c) What is multiple access and explain the basic principles of CDMA. (6+6+6.75)