

**JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT**  
**TEST -2 EXAMINATION- October 2017**

**B.Tech (CSE/IT) V<sup>th</sup> Semester**

COURSE CODE: 10B11EC514

MAX. MARKS: 25

COURSE NAME: COMMUNICATION SYSTEMS

COURSE CREDITS: 4

MAX. TIME: 1.5 Hrs

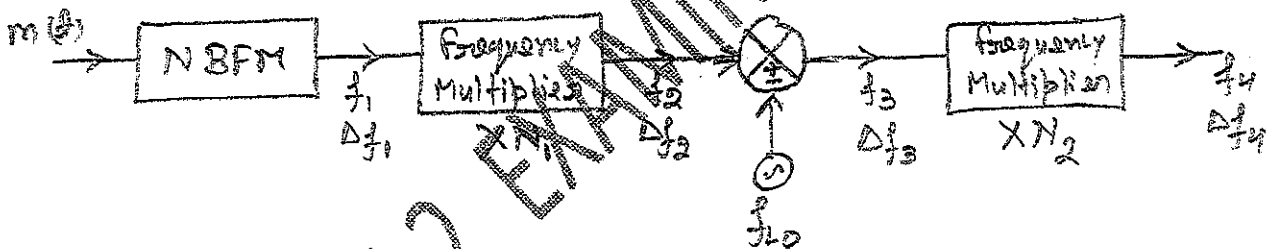
*Note: All questions are compulsory. Carrying of mobile phone during examinations will be treated as case of unfair means.*

**Q1. (a)** Prove that the FM signal has theoretically infinite bandwidth. (2.5)

(b) FM is better than AM in some aspects and AM is better than FM in others. Justify this by comparing these two techniques. (2.5)

**Q2. (a)** Discuss the concept of Phase Locked Loop (PLL) in the detection of FM with the block diagram. (2.0)

(b) A block diagram of an indirect FM generator is shown below. Calculate the maximum frequency deviation ( $\Delta f_4$ ) of the output of FM transmitter and the carrier frequency ( $f_4$ ) if  $f_1 = 300\text{kHz}$ ,  $\Delta f_1 = 30\text{Hz}$ ,  $f_{LO} = 10.5\text{MHz}$ ,  $N_1 = 64$  and  $N_2 = 48$ . (3.0)



**Q3. (a)** Discuss various approaches in detail to access a common communication channel by multiple message signals. (3.0)

(b) Discuss the threshold improvement in FM with the help of Pre-emphasis and De-emphasis. (2.0)

**Q4. (a)** An angle modulated signal with carrier frequency  $\omega_c = 4\pi \times 10^6$  is described by the equation  $\phi_{EM}(t) = 8 \cos[\omega_c t + 4 \sin(1500t) + 6 \sin(3000\pi t)]$ . Find:

- i. The power of modulated signal
- ii. The frequency deviation  $\Delta f$
- iii. The modulation index  $\beta$
- iv. The phase deviation  $\Delta \phi$
- v. Estimate the bandwidth

(0.5+1+0.5+0.5+1=3.5)

(b) For a modulating signal of  $15\text{kHz}$ , find the number of channels available in MF band ( $300\text{kHz} - 3\text{MHz}$ ) when (i) AM is used (ii) FM with frequency deviation  $\Delta f = 75\text{kHz}$  is used. (1.0)

(c) For AM broadcast Super-heterodyne receiver the standard value of intermediate frequency ( $f_{IF}$ ) is used. Calculate the image frequency at an incoming signal of frequency  $900\text{kHz}$ . (0.5)

Q5. (a) Draw the block diagram and discuss the concept of Super-heterodyne receiver. Compare its merits and demerits with TRF (Heterodyne) receiver. (2.5)

(b) A periodic square wave  $m(t)$  frequency-modulates a carrier of frequency  $f_c = 10\text{kHz}$  with  $\Delta f = 1\text{kHz}$ . The carrier amplitude is  $A$ . The resulting FM signal is demodulated as shown below. Sketch the waveforms at points (b), (c), (d) and (e). (2.5)

