NATIONAL INSTITUTE OF TECHNOLOGY, KURUKSHETRA
THEORY EXAMINATION
Question Paper

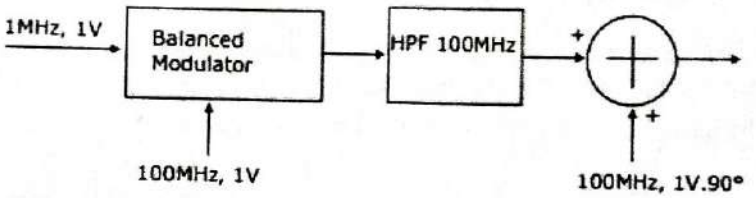
Month and year of the Examination: **Dec 2022**
Programme: **B.Tech**
Subject: **Communication Engineering**
Time allowed: **3:00 Hrs**

Semester: **3rd**
Maximum Marks: **50**
Course No.: **ECPC-35**
Roll number.....

Unless stated otherwise, the Symbols have their usual meanings in context with the Subject. Assume suitably and state, additional data required, if any.

Q 1 A) Describe in detail the square law modulation and demodulation for Amplitude modulation generation. [4]

B) A 100 MHz carrier of 1V amplitude and a 1MHz modulating signal of 1V amplitude are fed to a balanced modulator. The output of the modulator is passed through an ideal high-pass filter with cut-off frequency of 100 MHz. The output of the filter is added with 100 MHz signal of 1 V amplitude and 90^0 phase shift as shown in the figure. Find the envelope of the resulting signal? [6]



Q. 2 A) Describe the modulation efficiency of the frequency modulation. Provide the condition where modulation efficiency in the wide band frequency modulation will be maximum. [4]

B) A carrier signal is frequency modulated by a message signal of having frequency f_m and amplitude A_m. Conducting an experiment with $f_m = 1KHz$ and increasing A_m from 0V it is observed that the strength of the carrier frequency component in the spectrum becomes zero for the first time with $A_m = 2V$. Given that $J_0(\beta) = 2.4, 5.5, 8.6, \ldots$ [6]

I. Find K_a

II. Find message signal amplitude for which strength of the carrier frequency component becomes zero for the second time.

Q3 A) Describe the concept of Intermediate Frequency (IF) in the Super heterodyne receiver (SHD) and its effect. Also, describe the method how the effect of IF can be minimized. [4]

B) A receiver is tuned to 700KHz corresponding Image frequency is 1700KHz [6]

I. Find f_l and IF

II. Find Image Rejection Ratio (IRR) if two tuned amplifiers having Quality Factors 60 and 80, respectively are connected in cascaded.

Q4 A) Describe the Differential Pulse Code Modulation (DPCM) working at Transmitter and at receiver. Also, describe the advantage of DPCM over PCM. [5]

B) 10 sinusoidal message signals each having frequency of 20KHz are multiplexed using TDM sampling rate is 2.5 times to Nyquist rate. Maximum quantization error should be at most of 1% of the peak amplitude of message signal. Number of control bits are given by 5. Find bit rate of transmitter. [5]

Q5 A) Describe the Figure of Merit (FOM) in the receiver and derive FOM for Amplitude Modulation (AM). [5]

B) A video signal bandlimited to 100 MHz having power of 1mw through a channel. The power loss in the channel is given by 40 dB white noise power spectrum density is 10^{-20}watt/Hz. Find SNR at the input of receiver. [5]

OR

Q5 A) Describe the concept of thermal noise. Derive the FOM for DSBSC and SSD systems. [4]

B) A message signal bandlimited to 15KHz is transmitted through channel after modulation. Power loss in channel is given by 50dB. Double sided noise PSD is 10^{-1} Watt/Hz. Find the transmitter required to get $\left(\frac{S}{N}\right)_0$ is 40 dB, if the modulation schemes used is: [6]

I. DSB
II. AM (μ=1)