

5. a) Explain the significance of the term 'Noise temperature' as applied to a receiver.
- b) Calculate the system noise of a receiver that has three stages of a receiver having overall gain of 40dB and bandwidth of 30 kHz. The noise figure is 7dB. Assume  $T_0 = 290^\circ\text{K}$  and Boltzmann's constant  $1.38 \times 10^{-23} \text{ J/}^\circ\text{K}$ .
- c) Calculate the minimum receivable signal in radar receiver which has an IF bandwidth of 1.5 MHz and a 9-dB noise figure.
- d) The first stage of a two stage amplifier has a voltage gain of 10, 600 ohms input resistance, 1600 ohms equivalent noise resistance and 27K ohms resistance. For the second stage these values are 25, 81 K ohms and 1 M Ohms respectively. Calculate the equivalent input noise resistance of two stage amplifier.

OR

Calculate the noise voltage at the input of television RF amplifier using a device that has a 200 ohms equivalent noise resistance and 300 ohms input resistance. The band width of amplifier is 6 MHz and temperature is 17 degree C.

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**EC - 405****B.E. IV Semester**

Examination, December 2015

**Analog Communication***Time : Three Hours**Maximum Marks : 70*

- Note:** i) Answer five questions. In each question part A, B, C is compulsory and D part has internal choice.
- ii) All parts of each question are to be attempted at one place.
- iii) All questions carry equal marks, out of which part A and B (Max. 50 words) carry 2 marks, part C (Max. 100 words) carry 3 marks, part D (Max. 400 words) carry 7 marks.
- iv) Except numericals, Derivation, Design and Drawing etc.

1. a) What is Causal system?
- b) Find the Fourier transform of impulse function.
- c) What are the merits and limitations of Fourier Transform?
- d) Find the Fourier series of the function  
 $x(t) = \cos(5t) + \cos(15t)$   
 in exponential form.

OR

Find the Fourier transform of the function

$$x(t) = 5t^2 - 15t$$

How will be the Fourier transform be changed if this function has a period of 10 sec.?

[2]

2. a) The antenna current of AM transmitter is 10 amperes for only the carrier component and 11 amperes when carrier is modulated. Find the depth of modulation.
- b) What is meant by vestigial side band transmission?
- c) How modulation index in AM can be determined with the help of an oscilloscope?
- d) Suppose nonlinear devices are available for which the output current  $i_0$  and input voltage  $v_i$  are related by
- $$i_0 = av_i + b v_i^3$$
- where  $a$  and  $b$  are constant. Explain how these devices may be used to produce the product modulation.

OR

Show that any scheme that can demodulate DSB-SC can also demodulate AM. Is the converse also true?

3. a) Illustrate the relationship between FM and PM with the help of block diagram.
- b) A carrier is frequency modulated by two sinusoidal signals of frequency  $f_1$  and  $f_2$ . Make out an expression the FM signal defining the modulating signal clearly.
- c) A 400 Hz modulating signal of voltage 2.4 volts is modulated under FM to have a modulation index of 60. Calculate the maximum deviation and required bandwidth.
- d) Justify the statement 'FM has infinite bands'. Calculate the bandwidth of an FM signal generated to have a deviation of 75 kHz by a message signal of 9 kHz. What is the modulation index of the FM wave?

OR

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[3]

An angle modulated signal with carrier frequency  $\omega_c = 2\pi \times 10^6$

$$s(t) = 10 \cos (\omega_c + 0.1 \sin 2000 \pi t)$$

- i) Find the power of the modulated signal
- ii) Find the frequency deviation
- iii) Find the phase deviation

4. a) List the advantages of Superheterodyne receiver over TRF receiver.
- b) List the factors influencing the choice of IF for a radio receiver.
- c) In a superheterodyne receiver the input AM signal has a center frequency of 1425 kHz and bandwidth 10 kHz. The input is down converted to 455 kHz (single stage down conversion). What is the image frequency?
- d) Draw the block diagram of high level AM transmitter and explain the function of each block.

OR

In a broadcast super-heterodyne receiver having no RF amplifier, the loaded Q of the antenna coupling circuit (at the input to the mixer) is 100. If the intermediate frequency is 455 kHz, calculate :

- i) The image frequency and rejection ratio at 1000 kHz.
- ii) The image frequency and its rejection ratio at 25 mHz.