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 $T_0 = 290°K$ and Boltzmann's constant 1.38×10^{-23} J/°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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Roll No .....

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. 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 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

   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.