

**BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(END SEMESTER EXAMINATION)**

**CLASS: BE
BRANCH: IT**

**SEMESTER : VI
SESSION : SP/19**

SUBJECT: IT6021 COMMUNICATION THEORY

TIME: 3.00 Hrs.

FULL MARKS: 60

INSTRUCTIONS:

1. The question paper contains 7 questions each of 12 marks and total 84 marks.
 2. Candidates may attempt any 5 questions maximum of 60 marks.
 3. The missing data, if any, may be assumed suitably.
 4. Before attempting the question paper, be sure that you have got the correct question paper.
 5. Tables/Data hand book/Graph paper etc. to be supplied to the candidates in the examination hall.
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- Q.1(a) Write the needs of modulation. [2]
- Q.1(b) State the two convolution theorems of Fourier transform and prove that the multiplication of two signals in time domain is equivalent to convolution of their frequency transforms. [4]
- Q.1(c) Explain time shifting and frequency shifting property of Fourier transform and find the Fourier transform of damped sinusoidal waveform defined as:
 $g(t) = \exp(-t)\sin(2\pi f_c t)u(t)$ [6]
- Q.2(a) Define transmission efficiency. What is its maximum value for AM? [2]
- Q.2(b) Explain the working principle of switching modulator. [4]
- Q.2(c) Discuss the advantages of SSB-SC over AM. How signal transmission takes place for long distance if carrier is suppressed in it? Also obtain the expression for the SSB-SC modulated wave when only USB is transmitted and plot its spectrum. [6]
- Q.3(a) An unmodulated carrier frequency is given by 1MHz. After frequency modulation maximum frequency is given by 1.4 MHz. Find frequency deviation and minimum frequency. [2]
- Q.3(b) Explain the Armstrong method for generation of wideband FM. [4]
- Q.3(c) What are different methods of FM demodulation? Explain Phase Lock Loop (PLL) With the help of block diagram and equations in detail. [6]
- Q.4(a) Describe the multiplexing hierarchy for digital multiplexing. [2]
- Q.4(b) Classify digital multiplexers and explain Synchronous time division multiplexing. [4]
- Q.4(c) Discuss the advantages and disadvantages of FDM. With the help of block schematic, explain the principle of Frequency Division Multiplexing (FDM). [6]
- Q.5(a) For a superheterodyne AM receiver having no RF amplifier, the loaded Q-factor of antenna coupling circuit is 100. Now if intermediate frequency is 455 KHz, then determine the image frequency and its rejection ratio at an incoming frequency of 25 MHz. [2]
- Q.5(b) Explain the salient feature of broadcast radio receivers. [4]
- Q.5(c) Draw the block diagram of superheterodyne receivers and explain the function of each block. [6]
- Q.6(a) Define correlation and covariance and State the condition for two random variables to be orthogonal and uncorrelated. [2]
- Q.6(b) Define CDF and pdf of a random variable and write their various properties. [4]
- Q.6(c) Define ergodic random process. Consider a random process $X(t)$ given by:
 $X(t) = A \cos(\omega t + \theta)$ where, A and ω are constants and θ is random variable over $[-\pi, \pi]$. Show that $X(t)$ is ergodic in both mean and autocorrelation. [6]
- Q.7(a) Define thermal noise and shot noise. [2]
- Q.7(b) Two resistors 20 k Ω and 50 k Ω are at room temperature (290⁰ K). Determine for the bandwidth of 100 KHz, the thermal noise for two resistors in series and for two resistors in parallel. [4]
- Q.7(c) Explain noise factor and noise figure. Derive the expression for overall noise factor of amplifiers connected in cascade. [6]

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