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**Question Paper Code : 40447**

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2021.

Third / Fourth Semester

Electronics and Communication Engineering

EC 8491 – COMMUNICATION THEORY

(Common to Computer and Communication Engineering / Geoinformatics Engineering)

(Regulations 2017)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)



1. Write the names of AM modulators and demodulators.

2. Why VSB is preferred over SSB for video signals? Please explain briefly.

3. What is the difference between phase modulation and frequency modulation?

4. What is the difference between NBFM and WBFM?

5. What is power spectral density?

6. What is the difference between auto-correlation and cross correlation?

7. Write the names of different noise sources present in communication systems.

8. Explain briefly the difference between in-phase and quadrature component of a complex signal.

9. Explain briefly time division multiplexing.

10. What is aliasing and how it can be overcome?

PART B — (5 × 13 = 65 marks)

11. (a) What is amplitude modulation? What are the advantages of SSB over DSBSC and AM. Explain any one SSB modulator. (3+4+6)

Or

(b) What is super heterodyne receiver? Explain in detail. Also, Calculate the image frequency corresponding to the signal frequency of 1000 kHz if the intermediate frequency is 450 kHz. (8+5)

12. (a) Derive the expression for wideband frequency modulation in terms of bessel's functions.

Or

(b) Let $m(t) = cos\left[\left(4\pi * 10^3\right)t\right]$ be the message signal and $c(t) = 5cos\left[\left(2\pi * 10^6\right)t\right]$ be the carrier signal. *c(t)* and *m(t)* are used to generate an FM signal. If the peak frequency deviation of the generated FM signal is three times the transmission bandwidth of the AM signal. Then, calculate the coefficient of the term $cos\left[4\pi\left(1008 * 10^3\right)t\right]$ in the FM signal in terms of the Bessel coefficients.

13. (a) A sinusoidal function with a random phase is given by $x(t) = A\ sin(2\pi ft + \theta)$. Derive the expression and hence, calculate the maximum amplitude of autocorrelation function of this signal.



Or

(b) The power spectral density and power of a signal $x(t)$ are $S_x(\omega)$ and $P_x$ ,respectively. Then, derive and calculate the power spectral density and power of the signal $Ax(t)$. Where A is a constant. Give proper explanation.

14. (a) Define noise Figure. Calculate the average noise figure of cascaded networks.

Or

(b) Explain pre-emphasis and de-emphasis in detail.

15. (a) The amplitude of a random signal is uniformly distributed between –10V to +10V. Calculate the approximate step-size of the quantization if the signal to quantization ratio required in uniformly quantizing the signal is 43.5 dB.

Or

(b) Calculate the nyquist sampling rate for the signal given below:

$$x(t) = \frac{sin(300\pi t).sin\,c(700t)}{\pi t}$$

PART C — (1 × 15 = 15 marks)

16. (a) A 100MHz carrier is frequency modulated using a message signal $m(t) = A\sin(10^3 \pi t)$. The resultant FM signal has frequency deviation of 10 kHz. Then

(i) Calculate the modulation index of the FM wave

(ii) Derive the expression and hence calculate the capture range of a PLL used for FM demodulation of this signal. (3 + 12)

Or

(b) An analog voltage signal with maximum significant frequency of 1kHz and voltage range of 0 to 10V, is to be digitally encoded with a resolution of 0.01%. To avoid the loss of information, Calculate the following:

(i) Minimum sampling rate required

(ii) Minimum number of bits in the digital code

(iii) R.M.S value of the quantization noise

(iv) Signal to Quantization Noise Ratio (SQNR) in dB (2+4+5+4)