(b) In a village road, buses cross a particular place at a Poisson rate of 4 per hour. If a boy starts counting at 9.00 am.

    (i)   What is the probability that his count is 1 by 9.30 a.m?

    (ii)   What is the probability that his count is 3 by 11.00 a.m?

    (iii) What is the probability that his count is more than 5 by noon?

15. (a) Find the power spectral density of the random process $\{x(t)\}$ if $E\{x(t)\} = 1$ and $R_{xx}(\tau) = 1 + e^{-\alpha|\tau|}$.

<div align="center">Or</div>

(b) If $\{x(t)\}$ is a *wss* process with auto correlation function $R_{xx}(\tau)$ and if $y(t) = x(t+a) - x(t-a)$ prove that $syy(w) = 4\,sm^2(aw)\,s_{xx}(w)$.

Question Paper Code : P 1257

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2009.

Fifth Semester

(Regulation 2004)

Electronics and Communication Engineering

EC 1301 — COMMUNICATION THEORY

(Common to B.E. (Part-Time) Fourth Semester Regulation 2005)

Time : Three hours   Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. "For television signal transmission vestigial sideband modulation is selected" Justify your answer.

2. A message signal given by $m(t) = 2\cos(100\Pi t) + 3\sin(240\Pi t)$ modulates a carrier of frequency 12 MHz. Give the time domain expression of the DSBSC wave and plot the spectrum of the same.

3. A carrier wave of frequency 100 MHz is frequency modulated by a sinusoidal wave of amplitude 2 volts and frequency 100 KHz. The frequency sensitivity of the modulator is 2.5 KHz/volt. Determine the Bandwidth of FM signal.

4. List the non-linear effects in FM system.

5. Mention the characteristics of whit noise.

6. Define thermal noise. Give the expression for the thermal noise voltage across a resistor.

7. Define FM threshold effect.

8. Define noise figure of AM receiver.

9. State source coding theorem.

10. Calculate the entropy of the source with symbol probabilities $\frac{1}{2}, \frac{1}{4}$ and $\frac{1}{4}$.

PART B — (5 × 16 = 80 marks)

11. (a) (i) Draw the block diagram of a super heterodyne receiver and explain the function in detail. (10)

    (ii) Compare the performance of amplitude modulation systems by using different attributes. (6)

Or

    (b) (i) The efficiency η of ordinary AM is defined as the percentage of the total power carried by the sidebands. (8)

        (1) Find η for $\mu = 0.5$ (50 percent modulation);

        (2) Show that for a single tone AM η_{max} is 33.3 percent at $\mu = 1$.

    (ii) The input to an envelope detector is a single tone AM signal $X_{AM}(t) = A(1 + \mu \cos \omega_m t) \cos \omega_c t$ where μ is constant, $0 < \mu < 1$, and $\omega_c \gg \omega_m$.

        Show that if the detector output is to follow the envelope of $X_{AM}(t)$ it is required that at any time t_0.

        $1/RC \geq \omega_m (\mu \sin \omega_m t_0 / 1 + \mu \cos \omega_m t_0)$. (8)

12. (a) (i) Derive an expression for the spectrum of FM signal assuming single tone modulation. (12)

    (ii) State the relationship between FM and PM. (4)

Or

    (b) (i) Explain in detail about non-linear model and linear model of PLL. (10)

    (ii) Write a note on FM stereo receivers. (6)

13. (a) (i) Calculate the noise equivalent bandwidth of LPF with the bandwidth of 2 MHz. (6)

    (ii) What is narrow band noise? Discuss the properties of the quadrature components of a narrow-band noise. (10)

Or

    (b) (i) Derive the expression for output signal to noise ratio for a DSB-SC receiver using coherent detection. (10)

    (ii) Write short notes on noise in SSB receivers. (6)

14. (a) (i) Explain the process of preemphasis and deemphasis by stating the need for preemphasis. (10)

(ii) Compare the performance of AM and FM in the presence of noise. (6)

Or

(b) (i) Explain the noise in AM receiver using its noisy model block diagram. (10)

(ii) Describe the capture effect in FM receivers. (6)

15. (a) (i) A high-resolution black-and-white TV picture consists of about 2×10^6 picture elements and 16 different brightness levels pictures are repeated at the rate of 32 per second. All picture elements are assumed to be independent, and all level have equal likelihood of occurrence. Calculate the average rate of information conveyed by this TV picture source. (6)

(ii) Define mutual information. Find the relation between the mutual information and the joint entropy of the channel input and channel output. (10)

Or

(b) (i) A binary symmetric channel is shown in Fig. 1. Find the rate of information transmission over this channel when P = 0.9, 0.8 and 0.6. Assume that the symbol (or) bit rate is 1000 per sec. (12)
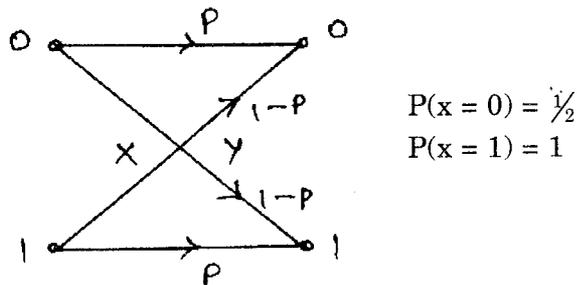

$P(x = 0) = \frac{1}{2}$
$P(x = 1) = 1$

Fig. 1

(ii) Calculate the entropy of an unbiased dice. (4)