CENTRAL INSTITUTE OF TECHNOLOGY, KOKRAJHAR
(Centrally Funded Institute under MoE, Govt. of India)
KOKRAJHAR :: B.T.C. :: ASSAM :: 783370

END – SEMESTER EXAMINATION (DEGREE)

Semester: **4th** Time: **3 Hrs** Full Marks: **100**
Course Code: **UECE401** Course Title: **Analog Communication**

Answer **any five** questions

1) a) Show that the autocorrelation function $R_{xx}(\tau)$ of a periodic signal is also periodic.

b) Deduce the relation between the output '$E_{YY}(f)$' and input '$E_{XX}(f)$' energy spectral density (ESD) for an LTI system.

c) Why it is not possible to get amplitude modulated signals by adding a low frequency and a high frequency signal?

d) Show that the transmitter power (P_{xC}) in a DSB-SC modulator is given by $P_{xC} = \frac{A_C^2}{2} \times P_x$; where $P_x = \langle x^2(t) \rangle = \frac{1}{T_C} \int_0^{T_C} x^2(t)\, dt$. (**6+4+5+5**)

2) a) Discuss the operation of a ring modulator in connection with the generation of DSB-SC signal. Explain why the circuit has balanced operation. Explain the absence of the baseband spectrum at the output.

b) Discuss the operation of a collector modulated Class-C amplifier for the generation of a DSB-FC signal. Hence show that the total average transmitter power $\left(P_T\big|_{av}\right)$ is given by $P_T\big|_{av} = P_B\left(1 + \frac{m^2}{2}\right)$; where '$P_B$' is the power supplied by the source 'V_{CC}'. (**7+3+7+3**)

3) a) Discuss the synchronous demodulation of an AM signal. Hence show that a frequency error of $\left(\Delta\omega = \pm\frac{\pi}{2}\right)$ in the angular frequency of the locally generated carrier will result in absence of output signal.

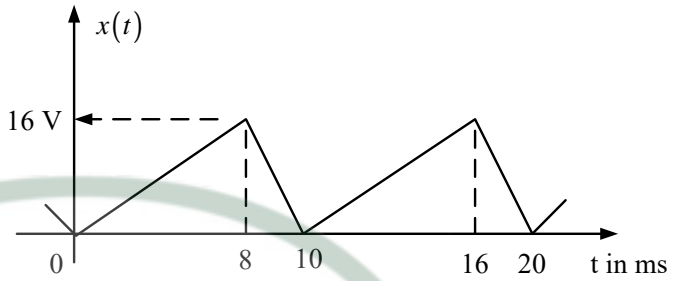
b) Show that the relation between system bandwidth (B) and rise time (T_r) is given by $T_r = \frac{\ln(9)}{6.28 \times B}$.

(**5+5+10**)

4) a) What are analytic signals? Find the time-domain representation of a lower single-sideband suppressed carrier (LSSB-SC) modulated signal.

b) Give a mathematical analysis of the demodulation of a VSB-SC signal. Hence find the realization condition for the VSB-SC filter in the above process. (**2+8+4+6**)

5) a) The message signal shown below phase modulates a carrier signal '$A_C \cos(\omega_C t)$' where $f_C = 1MHz$. If a maximum frequency deviation of 80 kHz is needed, determine the phase modulation constant (k_p) to be used by the modulator. With this obtained value of 'k_p', what will be the range of variation of the carrier frequency?



b) Discuss narrow-band phase modulated and frequency modulated signals. (**4+4+6+6**)

6) a) Discuss Carson's rule of angle modulated signals.

b) Discuss the direct method (reactance modulator) of generation of a wideband FM signal. (**8+6+6**)

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