M.Sc. 3rd Semester Examination, 2012

ELECTRONICS

(Communication Engineering)

[Theory]

PAPER—ELC-303

Full Marks : 50

Time : 2 hours

Answer **Q. No. 1** and any **three** questions from the rest

The figures in the right-hand margin indicate marks

Candidates are required to give their answers in their own words as far as practicable

Illustrate the answers wherever necessary

1. (*a*) State and prove the time convolution theorem.

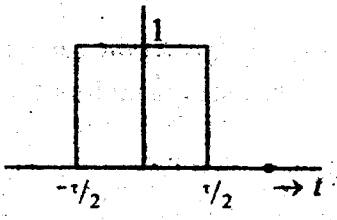
(*b*) Define a linear time invariant system. Write down the conditions of distortionless transmission of a LTI system.

(*c*) Discuss how an AM signal can be demodulated using a rectifier detector.

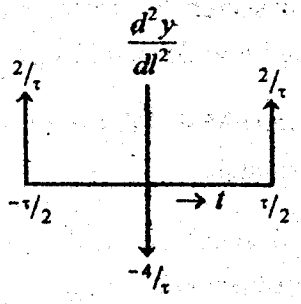
(*d*) What is the function of band-pass limitter in NBFM generation circuit ?

(*e*) Write down the interpolation formula for the signal reconstruction from uniform samples. 2 × 5

2. (*a*) Find the Fourier transform of the following gate pulse. 4



(*b*) Use the time differentiation property to find the Fourier transform of the triangular pulse $\Delta(t/\tau)$ start with the following signal.



$$\frac{d^2g}{dl^2} = \frac{2}{\tau}\left[\delta(t+\tau/2) - 2\delta(t) + \delta(t-\tau/2)\right] \quad 4$$

(*c*) If $g(t) \leftrightarrow G(f)$, prove that

$$g(at) \leftrightarrow \frac{-1}{a} G(f/a).$$ 2

3. (*a*) Discuss the function of a ring modulator in connection with DSBSC signal generation. 3

(*b*) How can you convert the carrier frequency of a DSBSC signal using a multiplier circuit ? 2

(*c*) With a neat sketch discuss the operation of a superhetero dyne AM receiver. How the signals coming from the image station are suppreme here ? 3 + 2

4. (*a*) With a neat sketch discuss the indirect method of Armstrong for wideband FM generation. 4

(*b*) How does an FM signal demodulated using slope detection method ? 2

(*c*) Why an FM signal is needed to be preemphasised before transmission ? 2

(*d*) What is a monophonic FM receiver ? 2

5. (*a*) State and prove the sampling theorem. 3

(*b*) Find an signal $g(t)$ using interpolation formula that is band limitted to BHz, and whose samples are $g(0) = 1$ and $g(1T_s) = g(2T_s) = g(3T_s) = \cdots = 0$. Where the sampling interval T_s is the Nyquist interval for $g(t)$. 3

(*c*) What is quantization noise in a PCM system? Prove that the signal to noise ratio of a PCM system

$$\frac{S}{N} = 3L^2 \frac{\widetilde{m^2(t)}}{m_{p^2}},$$

where m_p is the peak amplitude value that a quantizer can accept, L is the level of the quantizer and $\widetilde{m^2 t}$ is the power of the message signal $m(t)$. 1 + 3

6. (*a*) Calculate the capacity of a standard telephone channel with a 32 dB signal to noise ratio. Telephone channel occupy the frequency range of 300 to 3400 Hz. 2

(*b*) How can you generate a PPM signal from a PWM signal? 2

(*c*) Write down the function of PLL as a FM demodule for. 3

(*d*) Differentiate between delta modulation and differential pulse code modulation. 3

[*Internal Assessment* = 10 Marks]