M.Sc. 3rd Semester Examination, 2019

ELECTRONICS

(Communication System and Networking)

PAPER —ELC-302

Full Marks : 50

Time : 2 hours

Answer **all** questions

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. Answer any *four* questions : 2 × 4

   (*a*) Describe the operating principle of a monophonic FM receiver. 2

   (*b*) Find the inverse Fourier transform of $\delta(2\pi t)$. 2

   (*c*) Explain the principle of operation of a frequency converter. 2

(*d*) Explain how PLL can be used in FM demodulation. 2

(*e*) A signal $m(t)$ of BW 4 kHz is transmitted using a binary compounded PCM with $\mu = 100$. Determine transmission bandwidth and output SNR if quantization level $L = 256$. 2

(*f*) Discuss how can you demodulate a PPM signal. 2

(*g*) Write down the conditions of distortionless transmission for a LTI system. 2

(*h*) Determine power efficiency η and hence find out the percentage of the total power carried by the sidebands of the AM wave for tone modulation when $\mu = 0.5$ and 0.3. 2

2. Answer any *four* questions : 4×4

(*a*) The antenna current of an AM transmitter is 8A when only the carrier is sent, but it increases to 8.93 A when the carrier is modulated by a single sine wave. Find the percentage modulation. Also determine the

antenna current when the percent of modulation changes to 0.8. 4

(*b*) With a neat sketch explain the principle of operation of the phase-shift method used for SSB generation. 4

(*c*) Discuss, how can you demodulate an AM signal using diode detector. 4

(*d*) In case of VSB modulation prove that

$$Ho(f) = \frac{1}{Hi(f+h) + Hi(f-h)}$$

where $Hi(f)$ is the transfer function of VSB shaping filter and $Ho(f)$ is the transfer function of equilizer 1000 pass filter. 4

(*e*) Write down the function of bandpass limitter in connection with Narrow Band FM(NBFM) generation. 4

(*f*) Prove with proper mathematical calculation, that FM wave is more immune to non-linear distortion in comparison with AM wave. 4

(*g*) State and prove the Nyquist sampling theorem. 4

(*h*) Explain, the modulation and demodulation process of a QAM. 2 + 2

3. Answer any *two* questions : 8 × 2

(*a*) (*i*) Write down the differences between differential PCM and delta-modulation. Prove that quantization noise

$$N_q = \frac{mp^2}{3L^2},$$

where the symbols have their usual meaning.

(*ii*) What do you mean by compounding ?

(*iii*) Calculate the channel capacity of a 4 kHz telephone channel having 32 dB signal to noise ratio. (2 + 2) + 2 + 2

(*b*) (*i*) With a neat sketch explain the Armstrong method of wideband FM generation.

(*ii*) Design an Armstrong indirect FM modulator to generate an FM signal with carrier frequency 97.3 MHz and $\Delta f = 10.24$ kHz. A NBFM generator of $f_1 = 20$ kHz and $\Delta f = 5$Hz is available. Only frequency doublers can be used as multipliers. Additionally a local oscillator (LO) with adjustable frequency between 400 and 500 kHz is readily available for frequency mixing. 4 + 4

(*c*) (*i*) Write down the principle of operation of ASK, FSK and PSK systems with suitable sketch and diagrams.

(*ii*) Discuss the TDM methods used in telephone system. (2 + 2 + 2) + 2

(*d*) (*i*) Write down the differences between NRZ and RZ signal formats.

(*ii*) What do you mean by circuit-switching and packet switching ?

(*iii*)Briefly discuss TCP/IP protocols. 2 + 2 + 4

[*Internal Assessment* : 10 Marks]