PG/IIIS/EL - 2103/09

M.Sc. 3rd Semester Examination, 2009

ELECTRONICS

(*Communication Engineering*)

PAPER—EL-2103

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. Answer *all* questions : 2×5

(*a*) Why is frequency modulation more immune to noise than that in Amplitude Modulation ?

(*b*) Give two advantages of SSB–SC over double sideband full carrier amplitude modulation.

(*c*) Define a causal system ? Determine if the system described by the equation $Y(n) = X(-n)$ is causal or non–causal.

(*d*) What do you mean by Manchester code and Polar NRZ ?

(*e*) State some advantages of Optical fibre.

2. (*a*) State and prove Parseval's theorems for energy signal.

(*b*) Find the Fourier transform of a rectangular pulse signal [$x(t)$] defined by

$$x(t) = \begin{cases} 1 & |t| < a \\ 0 & |t| > a \end{cases}$$

(*c*) What happen if the duration of the pulse tends to zero ? What is the name of the function ? 3 + 4 + (2 + 1)

3. (*a*) The input to an envelope detector is a single-tone AM signal

$$x_{AM}(t) = A(1 + \mu \cos \omega_m t) \cdot \cos \omega_c t,$$

where μ is a constant, $0 < \mu < 1$, and $\omega_c >> \omega_m$. Show that if the detector output is to follow the envelope of $x_{AM}(t)$, it is required that at any time t_0

$$\frac{1}{RC} \geq \omega_m \left(\frac{\mu \sin \omega_m t_0}{1 + \mu \cos \omega_m t_0} \right).$$

(*b*) Calculate the sideband and carrier power for single tone Amplitude-Modulated Signal.

(*c*) The total power content of an AM signal is 1000 W. Determine the power being transmitted at the carrier frequency and at each of the sidebands where the percentage modulation is 100%. 4 + 3 + 3

4. (*a*) Explain in brief the basic principle of the superheterodyne receiver.

(*b*) Explain Delta Modulation in detail with a suitable diagram.

(*c*) A single tone FM is represented by the voltage equation as

$$U(t) = 12 \cos (6 \times 10^8 t + 5 \sin 1250 t)$$

Determine the following :

(*i*) Carrier frequency and modulating frequency

(*ii*) Modulating index

(*iii*) Maximum deviation. 4 + 3 + 3

(*a*) Derive the relation between output power of an AM transmitter and depth of modulation.

(*b*) The antenna current of an AM broadcast transmitter modulated to a depth of 40 % by an audio sinewave is 11 A. If increases to 12 A as a result of simultaneous modulation by another audio sinewave. What is the modulation index due to second wave ? 5 + 5

6. (*a*) What is PAM? Explain natural sampling and flat-top sampling.

(*b*) With schematic diagram, explain the generation of PAM signal. 2 + 3 + 5

[*Internal Assessment* — 10 Marks]