**53 (IE 603) CMEN**

**2015**

# COMMUNICATION ENGG.

Paper : IE 603

*Full Marks : 100*

Time : Three hours

***The figures in the margin indicate full marks for the questions.***

*Answer **any five** questions.*

1. *(a)* Define Carrier, Baseband Signal, Bandwidth and Noise for a Communication System. 4

   *(b)* With the help of a block diagram, describe the fundamental elements of a Communication System. 6

   *(c)* What do you mean by Modulation ? Explain the need for modulation. 4

(d) Show the waveforms of Amplitude Modulation and Frequency Modulation for a given Baseband Signal and a Carrier Signal. 4

(e) Define Shot Noise and Avalanche Noise. 2

2. (a) Derive the expression to find the average power for an Amplitude Modulated Wave. Also, express the modulation index in terms of total power and power in the carrier wave. 5

(b) An audio frequency signal $sin\,2\pi \times 1000t$ is used to amplitude modulate a carrier of $10\,sin\,2\pi \times 10^6 t$. Calculate — 5

(i) Modulation index

(ii) Bandwidth required

(iii) Transmission efficiency

(iv) Power delivered to a load of $300\Omega$.

(v) Power in the sidebands.

(c) The *r.m.s* antenna current of an AM transmitter increases by 20% over its unmodulated value when modulated by a $2kHz$ signal. Find the modulation index. 4

(d) Compare between Low Level and High Level Modulation Techniques. 2

(e) Explain the working of a Low Level Modulator using FET and OP-Amp. 4

3. (a) What do you mean by Frequency Modulation and Phase Modulation ? For a single sinusoidal signal, express both the FM and PM waves mathematically. 4

(b) Determine the peak frequency deviation and modulation index for an FM modulator with a deviation sensitivity $K_f = 4kHz/V$ and a modulating signal $2\cos(4000\pi t)$. For the same signal, find the peak phase deviation for a PM modulator with a deviation sensitivity $K_p = 2{\cdot}5 rad/V$. 5

(c) For an FM modulator with a peak frequency deviation $\Delta f = 10kHz$, modulating frequency $fm = 10kHz$, determine —

(i) modulation index

(ii) minimum Bandwidth required according to Bessel's function table

(iii) Approximate Bandwidth required using Carson's Rule. 5

(d) How can you get a PM modulator using FM modulator ? Explain the working of Varactor Diode FM Modulator. 6

4. (a) Define Bit rate, Band Rate and SNR for an information channel. 3

(b) State Shannon-Hartley theorem for a noisy channel. Calculate the channel capacity of a standard 4 *kHz* channel with a $20dB$ *SNR*. 5

(c) Find the Nyquist rate and interval for the signal $f(t) = cos2000\pi t \times cos1500\pi t$. 4

(d) What is Pulse Modulation ? Name the different types of Pulse Modulation Techniques. 2

(e) Compute PAM, PWM and PPM with the help of suitable waveforms. 6

5. (a) What is PCM ? Explain the principle of operation and generation of PCM. 10

(b) Name some advantages and disadvantages of PCM. 4

(c) What are ASK, FSK and PSK methods ? Give suitable waveforms. 6

6. (a) What do you mean by multiplexing ? Compare between FDD and TDM techniques with one application of each. 4

(b) What is a satellite ? Name some applications of satellite. 3

(c) Define Geostationary Satellite, Angle of elevation, angle of inclination for a Satellite Communication System. 3

(d) Explain the working of a B and W TV transmitter with the help of a block diagram. 10

7. *(a)* Explain the basic elements of Optical Fiber Communication with the help of a Block diagram. 6

*(b)* Define Total Internal Reflection, Dispersion, Diffraction and Scattering of light. 4

*(c)* Explain the propagation of light in an Optical Fiber Cable. 4

*(d)* An optical fiber core has refractive index of 1·45 and cladding refractive index as 1·40. Calculate — 6

*(i)* Critical angle

*(ii)* Acceptance angle

*(iii)* Numerical Aperture.

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