

Time: 3 Hours

DECEMBER 2013

Max. Marks: 100

PLEASE WRITE YOUR ROLL NO. AT THE SPACE PROVIDED ON EACH PAGE IMMEDIATELY AFTER RECEIVING THE QUESTION PAPER.

NOTE: There are 9 Questions in all.

- Question 1 is compulsory and carries 20 marks. Answer to Q.1 must be written in the space provided for it in the answer book supplied and nowhere else.
- The answer sheet for the Q.1 will be collected by the invigilator after 45 minutes of the commencement of the examination.
- Out of the remaining EIGHT Questions answer any FIVE Questions. Each question carries 16 marks.
- Any required data not explicitly given, may be suitably assumed and stated.

Q.1 Choose the correct or the best alternative in the following: (2×10)

a. A carrier is simultaneously modulated by two sine waves with modulation indices of 0.3 and 0.4, then the effective modulation index is

- (A) 0.64 (B) 0.5
(C) 0.7 (D) 1

b. An FM signal with a modulation index m_f is passed through a frequency tripler. The wave in the output of the tripler will have a modulation index of

- (A) $m_f/3$ (B) m_f
(C) $9m_f$ (D) $3m_f$

c. In case of FM if the message frequency is 15 kHz and the frequency deviation is 75 kHz, then the bandwidth required for transmission is

- (A) 180 kHz (B) 90 kHz
(C) 150 kHz (D) 75 kHz

d. A superheterodyne receiver with an IF of 455 kHz is tuned to a signal at 1000 kHz. Then the image frequency is

- (A) 2190 kHz (B) 1910 kHz
(C) 1650 kHz (D) 2000 kHz

e. To provide two or more voice circuits with the same carrier, it is necessary to use

- (A) ISB (B) Carrier reinsertion
(C) SSB with pilot carrier (D) Lincompex

f. A receiver has poor IF selectivity. It will therefore also have poor

- (A) Double-spotting (B) Diversity reception
(C) Blocking (D) Double conversion

Code: AE65

Subject: ANALOG COMMUNICATIONS

- g. Impedance inversion may be obtained with
- (A) A short-circuited stub (B) An open-circuited stub
(C) A half-wave line (D) A quarter-wave line
- h. When electromagnetic waves are propagating in a waveguide
- (A) They travel along the broader walls of the guide
(B) They travel through the dielectric without touching the walls
(C) They are reflected from the walls but do not travel along them
(D) They travel along the four walls of the guide
- i. Which of the following antennas is best excited from a waveguide?
- (A) Helical (B) Horn
(C) Biconical (D) Discone
- j. In order to separate channels in a TDM receiver, it is necessary to use
- (A) Band pass filters (B) Differentiator
(C) Integrator (D) AND gate

**Answer any FIVE Questions out of EIGHT Questions.
Each question carries 16 marks.**

- Q.2** a. With neat block diagram explain communication system model. (6)
- b. What is noise? What are internal and external noise and briefly discuss them? (6)
- c. Calculate the noise voltage at the input of a Television RF amplifier, using a device that has a 200-ohm equivalent noise resistance and a 300 ohm input resistor. The bandwidth of the amplifier is 6 MHz and temperature is 17° C. (4)
- Q.3** a. Define amplitude modulation and modulation index in AM system also derive an expression for AM wave and find its required Bandwidth. (7)
- b. With suitable block diagram explain filter method of SSB generation. (5)
- c. In an AM wave if the carrier and one of the sideband of is suppressed, calculate the percentage power saving for a depth of:
- (i) 100 percent modulation (ii) 80 percent modulation and
(iii) 50 percent modulation (4)
- Q.4** a. With neat circuit diagram explain the working of Phase discriminator type FM demodulation. (6)
- b. In which system pre-emphasis and de-emphasis are used? Also explain its operation. (5)

- c. An FM wave is represented by $v(t) = 10 \sin(6\pi 10^6 t + 6 \sin 1250\pi t)$. Find
 (i) The carrier and modulating frequencies.
 (ii) The modulation index.
 (iii) Is it narrow band or wideband FM?
 (iv) Maximum deviation of FM wave.
 (v) What power this FM will dissipate in a 10 ohm resistor? (5)
- Q.5** a. With neat diagram explain the working of super- heterodyne receiver. (8)
- b. What is stub? What are the limitation of single stub matching and also explain the working of double stub matching network. (8)
- Q.6** a. Draw the general equivalent circuit of a transmission line and simplified circuit for a radio frequency line. What permit this specification? (10)
- b. Representing general unmodulated wave $x = A \sin(\omega t + \phi)$ draw the basic modulation wave forms. (6)
- Q.7** a. For a wave propagating in a parallel-plane wave guide define cut-off wavelength, group and phase velocity and also derive the relation between them. (8)
- b. A wave is propagating in a parallel-plane waveguide. The frequency is 6 GHz and the plane separation is 3 cm, calculate:
 (i) The cut-off wavelength for the dominant mode
 (ii) The wavelength in a waveguide and also for dominant mode
 (iii) The corresponding phase and group velocities (8)
- Q.8** a. Explain the working of PCM system and also mention the selection of number of bits in PCM system. (7)
- b. Compare PAM, PWM and PPM. (6)
- c. Calculate the capacity of a standard 4 kHz telephone channel with signal to noise ratio of 32 dB. (3)
- Q.9** a. With neat diagram explain the channel translating equipment showing the formation of a basic 12-channel group B. (8)
- b. Describe the method of laying a submarine cable. What are the respective function of lightweight armored cable. (8)