

DiplETE – ET (Current Scheme)

Time: 3 Hours

JUNE 2015

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. In a rectangular waveguide, the phase velocity
- (A) increases with increasing frequency
 - (B) decreases with increasing frequency
 - (C) is independent of frequency
 - (D) None of the above
- b. N messages, each band limited to ω_0 are to be transmitted over a common channel. It is possible to achieve this objective by
- (A) TDM
 - (B) FDM
 - (C) any of TDM & FDM
 - (D) None of these
- c. The required phase difference between the feeds of successive elements in an end-fire array is
- (A) 0°
 - (B) 180°
 - (C) depends upon the distance between the elements
 - (D) depends upon the number of elements
- d. For broadcast purpose, full AM is preferred to SSB because
- (A) it requires larger bandwidth
 - (B) generation of AM is simpler
 - (C) detection of full AM is simpler
 - (D) None of these
- e. For an EM wave, the electric component always meets a perfect conducting boundary at an angle
- (A) 0°
 - (B) 90°
 - (C) 45°
 - (D) None of these

- f. Rhombic aerials are preferred for reception because
- (A) they are cheaper
 - (B) their gain is higher
 - (C) they can be installed at smaller heights
 - (D) the large ground plane below them makes them immune to static noise
- g. If the power of transmitter is doubled, the field strength at a point will go up by
- (A) 2 dB
 - (B) 6 dB
 - (C) 3 dB
 - (D) None of these
- h. Inter symbol interference is a problem in
- (A) AM Transmitter
 - (B) FM Transmitter
 - (C) PCM Transmitter
 - (D) None of these
- i. In a radio receiver with simple AGC
- (A) an increase in signal strength produces more AGC
 - (B) an audio stage gain is normally controlled by AGC
 - (C) the faster the AGC time constant, the more accurate is the control
 - (D) the highest AGC voltage is produced between stations
- j. PCM channels can be energised
- (A) on wire circuits only
 - (B) on radio circuits only
 - (C) on both
 - (D) None of these

Answer any FIVE Questions out of EIGHT Questions.

Each question carries 16 marks.

- Q.2** a. Define modulation and discuss the need for modulation. (5)
- b. Define the equivalent noise temperature. Under what conditions could this be a more useful quantity than the noise figure? (5)
- c. A receiver connected to an antenna whose resistance is 50Ω has an equivalent noise resistance of 30Ω . Calculate the receiver's noise figure in decibels and its equivalent noise temperature. (6)
- Q.3** a. Define Amplitude modulation and modulation index. A certain transmitter radiates 9 KW with the carrier unmodulated, and 10.125 KW when the carrier is sinusoidally modulated. Calculate the modulation index. If another sine wave, corresponding to 40% modulation, is transmitted simultaneously, determine the total radiated power. (10)

- b. Provide a comparison between filter system and phase shift method for SSB generation. (6)
- Q.4** a. Out of the various advantages of FM over AM, identify and discuss those due to the intrinsic qualities of FM. (8)
- b. What is pre-emphasis? Why is it used? Sketch a typical pre-emphasis circuit and explain why must deemphasis also be used? (8)
- Q.5** a. Define the terms sensitivity, selectivity and image frequency. (6)
- b. In a broadcast superheterodyne receiver having no RF amplifier, the loaded Q of the antenna coupling circuit (at the input to the mixer) is 100. If the intermediate frequency is 455kHz, in order to make the image frequency rejection of the receiver as good at 25MHz as it is at 1000 kHz, calculate the loaded Q which an RF amplifier for this receiver would have to have and the new intermediate frequency that would be needed (if there is to be no RF amplifier) (10)
- Q.6** a. Define radiation resistance of an antenna. Calculate the radiation resistance of a $\lambda/16$ wire dipole in free space. (8)
- b. What are the four major functions that must be fulfilled by antenna couplers? (8)
- Q.7** a. What is fading? List its major causes. (3)
- b. Explain what is meant by isotropic source and isotropic medium. (3)
- c. A rectangular waveguide measures $3 \times 4.5\text{cm}$ internally and has a 9 GHz signal propagated in it. Calculate the cut off wavelength, guide wavelength, group and phase velocities and characteristic wave impedance for TE_{10} and TM_{11} mode. (10)
- Q.8** a. A 2 kHz channel has a SNR of 24 dB. Calculate the maximum capacity of this channel. Assuming constant transmitting power, calculate the maximum capacity when the channel bandwidth is (i) halved and (ii) reduced to a quarter of the original value. (8)
- b. Explain why PCM is more noise resistant than the other forms of pulse modulation. (6)
- c. Name any two digital modulation systems other than PCM. (2)
- Q.9** a. What are the advantages of optical fibers over coaxial cables? (8)
- b. Differentiate between echo canceller and echo suppressor. (8)