SEMESTER-III EXAMINATION-2021
CLASS: M.Sc.
SUBJECT: PHYSICS
PAPER CODE: MPH-E304
COMMUNICATION ELECTRONICS- I

Time: 3 hour   **Max. Marks: 70**
                                                                                 Min. Pass: 40%

Note: Question Paper is divided into two sections: **A and B.** Attempt both the sections as per given instructions.

SECTION-A (SHORT ANSWER TYPE QUESTIONS)

Instructions: Answer any five questions in about 150 words each. Each question   (5 X 6 = 30 Marks) carries six marks.

Q.1. Calculate the percentage of power saving when the carrier and one of the sidebands are suppressed in an AM wave with 100% modulation. If only the carrier of this modulated AM wave is suppressed, what is the percentage power saving now?

Q.2. What is AM? A transmitter radiates 15 kW with the carrier modulated and 20 kW with the carrier sinusoidally unmodulated. Calculate the modulation index and % modulation.

Q.3. Derive the expression for power relations in the AM wave.
The tuned-circuit of the oscillator in an AM transmitter uses a 10 μH coil and 1 nF capacitor. Now, if the oscillator output is modified by audio frequencies upto 8 kHz, then find the frequency range occupied by the sidebands.

Q.4. What are different types of internal and external noise? Define SNR and explain its significance.

Q.5. For the three cascaded amplifier stages, each with noise figures 3dB and power gains of 10 dB, Determine the total noise figure.

Q.6. Find the relation between modulation index and max. & min voltage of an AM envelop.
The tuned-circuit of the oscillator in an AM transmitter uses a 10 μH coil and 1 nF capacitor. Now, if the oscillator output is modified by audio frequencies upto 8 kHz, then find the frequency range occupied by the sidebands.

Q.7. Differentiate between AM and FM receivers.

Q.8. What is pre-emphasis? Explain why de-emphasis must also be used?

Q.9. Show that phase discriminator is a FM demodulator.

Q.10. Describe FET reactance modulator circuit for FM generation.

SECTION-B (LONG ANSWER TYPE QUESTIONS)

Instructions: Answer any FOUR questions in detail. Each question   (4 X 10 = 40 Marks) carries 10 marks.

Q.11. Prove that the balanced modulator produces an output consisting of sidebands only with carrier removed. Discuss a method to generate SSB. What are the advantages of SSB over DSBSC?
The antenna current of an AM transmitter is 8 A when only the carrier is sent, but it increase to 8.93 A when the carrier is modulated by a single sine wave. Find the percentage modulation. Determine the antenna current when the percent of modulation changes to 0.4.

Q.12 (a). What is frequency modulation? Differentiate FM with AM. Find the carrier and modulating frequencies, modulation index, maximum deviation of the FM wave represented by the voltage equation: $v = 12 \sin (6 \times 10^8 t + 5 \sin 1250t)$.

(b). Differentiate between frequency and phase modulation. A 25MHz carrier is modulated by a 400 Hz audio sine wave. If the carrier voltage is 4V and the maximum deviation is 10 KHz, write the equation of this modulated wave for: a) FM and b) PM

Q.13. Discuss the types of losses that may occur with RF transmission lines.

Define and explain the meaning of the term SWR. Find the formula for SWR if the load is purely resistive.

It is required to match a 400 Ω load to a 500 Ω transmission line, to reduce the SWR along the line to 1. What must be the characteristic impedance of the quarter-wave transformer used for this purpose, if it is connected directly to the load?

Q.14. (a) Explain the terms: Critical frequency, MUF and Skip distance.

(b) Describe the strata of ionosphere and their effects on sky wave propagation. Why this propagation is generally better at night then during the day.

Q.15. (a) What happens when a carrier is modulated by a single noise frequency? Draw the vector diagram.

(b) Write short notes on stereophonic FM multiplex transmission system .

Q.16. Explain the terms: Bandwidth, Beamwidth and Polarization as applied to the radiation from antenna.

(b) What is an antenna array? With the aid of sketches, explain the operation of Yagi-Uda antenna. List its applications. Why it is called as super-gain antenna?

Q.17. (a) Explain the working of a TRF receiver with the help of block diagram.

(b) Discuss RF section and characteristics of Superhetrodyne radio receiver. What is intermediate frequency and its importance?

Q.18. (a) Explain the working of a FM receiver with the help of block diagram.

(b) For a broadcast superhetrodyne AM receiver having no RF amplifier, the loaded Quality Factor Q of the antenna coupling circuit is 100. Now if the intermediate frequency is 455 kHz, then determine the following:

(i) The image frequency and its rejection ratio at an incoming frequency of 1000 kHz.

(ii)The image frequency and its rejection ratio at an incoming frequency of 25 MHz.