

INDIAN INSTITUTE OF TECHNOLOGY, KHARAGPUR

Date of Examination 20.4.2001 FN/AN

Time : 2/3 Hrs.
Full Marks

Autumn/Spring Semester 19.00-01

Subject No. 114002

4th Yr. B. Tech. (Hons)/B.Arch./M.Sc.
Subject Name Introduction to Avionics

No. of Students 22 of the Department of Aerospace Engineering

Instructions ; ANSWER ALL QUESTIONS

1. Explain with sketches, how oscillation is produced in
 - a) a simple L - C circuit
 - b) a phase-shift oscillator
2. a) Explain how side-band frequencies are produced in transmission of amplitude-modulated (AM) wave.
b) Explain, with a block diagram, operation as well as advantage of a superheterodyne receiver.
3. Draw the circuit diagram (only) of
 - a) a Wien-bridge oscillator without op-amp
 - b) a Wien-bridge oscillator using op-amp
4. Write short notes on
 - a) characteristics of LF/MF signals in comparison to VHF signals
 - b) loop antenna
 - c) bearing indicator of an ADF equipment
5. Explain briefly (with block/circuit diagrams)
 - a) how a simple radio receiver works
 - b) how a carbon microphone works
 - c) how the 180° ambiguity is removed in ADF receiver
6. Draw the block diagram of a VOR airborne receiver and explain its operation.
7. Explain the operation of ground and airborne components of localiser and marker beacons in ILS.
8. Calculate
 - a) VHF reception range of an aircraft at an altitude of 3600 ft.

- b) minimum feedback factor k necessary for an amplifier of gain 500 to become an oscillator
- c) frequency of an RC phase-shift oscillator having $R = 220 \text{ K } \Omega$ and $C = 500 \text{ pF}$.
- d) frequency of a Colpitts oscillator having $L = 30 \text{ Henry}$, $C_1 = 20 \text{ pF}$ and $C_2 = 40 \text{ pF}$.
- e) the length of half-wave antenna required for transmission of a signal of frequency $2 \times 10^6 \text{ Hz}$.
- f) the frequency range occupied by the side bands if the 600 KHz signal is modulated by audio frequencies upto 15 KHz .
- g) the frequencies generated by a superheterodyne receiver when a carrier signal of frequency 120 MHz is fed.