

GUJARAT TECHNOLOGICAL UNIVERSITY**BE SEM-VIII Examination May 2012****Subject code: 181103****Subject Name: RADAR & NAVIGATIONAL AIDS (D.E.-II)****Date: 08/05/2012****Time: 10.30 am – 01.00 pm****Total Marks: 70****Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

- Q.1 (a)** From first principles, derive the fundamental form of radar range equation. State the various parameters that influence the radar range performance. Considering noise as the chief factor limiting the receiver sensitivity, obtain the modified form of radar equation taking the effect of thermal noise. **07**
- (b)** In a pulse radar, **04**
- (i) Transmitter power = 500 KW
 - (ii) Radar Range = 200 miles
 - (iii) Wavelength = 10.7 cm
 - (iv) Effective area = 15 sq m.
 - (v) Directivity of antenna = 0.5
 - (vi) Radar cross section = 1 sq m.
- Find the value of minimum weak signal that can be detected by radar unambiguously.
- (c)** What is the peak power of a radar pulse if the pulse width is 1 μ sec, the PRF is 1500Hz and the average power is 500Watts? What is the duty cycle? Calculate the unambiguous range in nautical miles. **03**
- Q.2 (a)** (i) Define the following : **03**
- (a) Radar cross section (b) Multiple time around echoes
 - (c) Land clutter (d) Electronic navigation (e) Duplexer
 - (f) surveillance radar
- (ii) What is the use of delay line cancellor? Obtain the frequency response of a single delay line cancellor **04**
- (b)** (i) Loop input circuits minimize the antenna effect in loop direction finder. Justify **07**
- (ii) Compare Adcock and loop antenna for direction finding. How the former eliminates the polarization errors? Sketch different forms of Adcock antenna.
- OR**
- (b)** (i) Draw the block diagram of pulse radar and explain its operation describing the function of all modules. **07**
- (ii) How multiple frequency CW radar can be used to measure the range of a moving target?
- Q.3 (a)** What is Doppler effect. Explain in detail the block diagram of a CW radar and show how the Doppler frequency is measured. Where is this radar used? With a CW transmit frequency of 3GHz, calculate the Doppler frequency seen by a stationary radar when the target radial velocity is 90km/hr. **07**

- (b) Explain the working of a VHF automatic direction finder. How remote indication of the bearing can be obtained? **07**
- OR**
- Q.3 (a)** How FMCW radar overcomes the shortcomings of Doppler CW radar? Draw the block diagram of FMCW radar and derive the expression for the radial velocity and the range of the moving target when the transmitted signal is modulated by the triangular waveform. If the beat frequency measured is 600 Hz, determine the range of the target. The frequency is modulated at the rate of 30KHz over a range of 1.5 KHz **07**
- (b) What is an MTI radar? How can moving objects be recognized on an A Scope? Draw the block diagram of an MTI radar with Power Amplifier transmitter and explain its operation? What is the need for Coho and Stalo? **07**
- Q.4 (a)** Explain the principle of working of LORAN A. Discuss the sequence of transmission and reception of pulses. How absolute delay τ is measured? **07**
- (b) Draw the block diagram of a radio compass receiver and explain the function of each element with necessary equations and waveforms. **07**
- OR**
- Q.4 (a)** Derive an expression for the emf induced in a loop antenna by an electromagnetic wave incident at an angle Θ with the plane of the loop antenna. Explain how the arrangement is used for determining the bearing of the transmitting station. How sense finding is done? **07**
- (b) What is V.O.R? Explain its principle with necessary waveforms and operation of the VOR ground equipment. **07**
- Q.5 (a)** For a Decca Navigation system explain the following: **07**
- (i) The basic principle of operation
 - (ii) Frequencies of master and Slave Stations
 - (iii) Lane and Zone
 - (iv) Normal and Lane identification Transmission.
- (b) What is DME? Explain AIR borne DME interrogator with modes of operation. **07**
- OR**
- Q.5 (a)** What is the need for ILS at the airport? Explain the localizer and glide slope systems of ILS with radiation pattern of antennas in each case. **07**
- (b) What is meant by blind speed with reference to the MTI radar? Obtain an expression for the blind speed in terms of PRF. How is staggered PRF used to extend the first blind speed? An MTI radar is operating at 6 GHz with a pulse period of 0.5 msec. Find its unambiguous range and fifth blind speed. **07**
