

Seat No.: _____

Enrolment No. _____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER-VIII • EXAMINATION – SUMMER 2014

Subject Code: 181103

Date: 27-05-2014

Subject Name: Radar and Navigational Aids

Time: 10:30 am TO 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)** Define the following: **07**
(i) Maximum Unambiguous range (ii) Pulse repetition frequency (iii) Minimum detectable signal. (iv) Average transmitter Power (v) Direction Finding (vi) Marker Beacons
- (b)** An L band radar operating at 1.5GHz uses a peak pulse power of 2 mw and must have a range of 100KM for objects whose radar cross section is 1Sq_m. If the minimum receivable power of the receiver is 2×10^{-3} , what is the smallest diameter the antenna reflector could have been, assuming it to be full paraboloid with $k=0.65$? What is the duty cycle of radar with PW of 3μsec and a PRT is 6ms **05**
- (c)** Determine the minimum receivable signal in a radar receiver with an IF band width of 1.5MHz and a noise figure of 9dB. **02**
- Q.2 (a)** Explain Doppler effect in CW radar and give its importance. Obtain the relation for doppler frequency shift in terms of radial velocity of moving vehicle with respect to radar. Discuss the advantages of CW radar. An 8 GHz police radar measures a Doppler freq. of 2000 Hz, from a car approaching the stationary police vehicle, in a 80km/hr speed limit zone. What should the police officer do? **08**
- (b)** Justify the following statements: **06**
(i) The wide use of CW doppler radar is to measure the speed of automobile traffic by highway police.
(ii) For improving the probability of detection integration of pulses is done in the radar receiver.
(iii) In Loran system error may be introduced by the sky wave propagation.
- OR**
- (b)** (i) Explain the principle of threshold detection in the radar receiver to overcome the probability of false alarm **06**
(ii) What is a sense finder in direction finding? Illustrate the radiation pattern of the antenna for different ratios of vertical antenna output to the maximum loop antenna.
- Q.3 (a)** Explain the principle of RADAR with the help of block diagram. Derive the fundamental form of radar range equation. Give other forms of the equation. Discuss the factors affecting the predicted maximum radar range. **07**
- (b)** Explain (i) Applications of Radar (ii) Airborne radars **07**
- OR**
- Q.3 (a)** (i) Explain four Course Radio Range. How is the course bending achieved in the system? **07**
(ii) Explain the working of goniometer.
- (b)** Why Loran system is called a hyperbolic system of navigation. Explain the principle of working of LORAN A. **07**

- Q.4 (a)** Explain the principles of the following navigation system with necessary mathematical derivations. **07**
- (i) Emf induced in a loop antenna used for direction finding.
 - (ii) V.O.R and the production of variable phase signal with waveforms
- (b)** A loop aerial to use at 500 KHz is of height 0.5meter, width 0.5 meter and 25 turns, when directed to receive a maximum signal the emf induced in the loop is 150 microvolt. What is the field strength of the signal picked up? **07**

OR

- Q.4 (a)** What is MTI radar? Explain its operation with the help of necessary equations and block diagram. What is the need for Coho and Stalo? How moving objects are recognized on an A Scope? **07**
- (b)** Explain the basic principle of operation of the Decca navigation system highlighting the frequencies of master and the slave stations, and lane identification sequences. **07**
- Q.5 (a)** Explain the following with respect to MTI Radar.: **07**
- i. Blind Speed
 - ii. Staggered PRF
 - iii. Single and double delay line canceller
 - iv. The plots of the frequency response of 2 pulse and 3pulse delay line cancellers.
- (b)** Write note on (i) Digital MTI Signal Processor (ii) Doppler beam configuration.. **07**

OR

- Q.5 (a)** Explain the localizer and glideslope systems of ILS **07**
- (b)** Describe the working of (i) AIR borne DME interrogator (ii) Aural Null Detector **07**
