



SEVENTH SEMESTER B. TECH. (E & C) DEGREE END SEMESTER EXAMINATION

NOVEMBER 2018

SUBJECT: RADAR AND NAVIGATION SYSTEMS (ECE - 4032)

TIME: 3 HOURS

MAX. MARKS: 50

Instructions to candidates

- Answer **ALL** questions.
- Missing data may be suitably assumed.

- 1A. With neat diagrams, explain the operation of wideband duplexer for transmit and receive condition.
- 1B. An L-band radar operating at 1.25GHz uses a peak pulse power of 3MW and must have a range of 185.2 km for objects whose radar cross section is 1 m^2 . If the minimum receivable power of the receiver is $2 \times 10^{-13} \text{ W}$, what is the smallest diameter the antenna reflector could have, assuming it to be a full paraboloid with $\eta=0.65$.
- 1C. Explain predictable losses in radar range equation. (3+3+4)
- 2A. Determine the range and Doppler velocity for an FM CW radar operating at 9.25GHz if the target is approaching the radar. Given the beat frequency $f_b(\text{up})=15\text{KHz}$ and $f_b(\text{down})=25\text{KHz}$ for the triangular modulation, the modulating frequency is 1MHz and Δf is 1KHz.
- 2B. With relevant equations, explain the working principle of multiple frequency CW Radar.
- 2C. With a neat block diagram explain T/R module and compare active phased array radar with passive phased array radar (3+3+4)
- 3A. With a neat block diagram, relevant equations and sketches, explain the working of FM-CW altimeter.
- 3B. With a neat diagram, explain three segments of GPS system. (6+4)
- 4A. With a neat block diagram, explain the working of SONAR. Also discuss their applications.
- 4B. A pulse Radar operating at 8GHz has an antenna with a gain of 10dB and a transmitting power of 1KW. If it is defined to detect a target with a cross section of 12 square meters and the minimum detectable signal $S_{\min} = -80\text{dBm}$. What is the maximum range of the target?
- 4C. With neat diagrams explain, A-Scope and PPI display used in Radar systems. (3+3+4)
- 5A. With neat diagram, explain Instrument Landing System (ILS).
- 5B. With relevant equations and diagrams, explain the butterfly effect in MTI Radar (5+5)

