MANIPAL INSTITUTE OF TECHNOLOGY
MANIPAL
(A constituent unit of MAHE, Manipal)

SEVENTH SEMESTER BTECH. (E & C) DEGREE END SEMESTER EXAMINATION
DECEMBER 2020/JANUARY 2021
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. A radar transmitter has a peak pulse power of 400kW, a PRF of 1500pps and a pulse width of 0.8μS. Calculate (i) the maximum unambiguous range (ii) the duty cycle (iii) the average transmitted power (iv) a suitable bandwidth.

1B. Explain integration efficiency. A ground-based air-surveillance radar has 340Hz pulse repetition rate, 1.5^0 beam width, and an antenna rotation rate of 5 rpm. Calculate the number of pulses returned from a point target per scan.

1C. A pulse Radar operating at 8 GHz has an antenna with a gain of 10 dB and a transmitting power of 1 KW. If it is defined to detect a target with a cross section of 12 square meters, and the minimum detectable signal S_{min} =-80dBm, what is the maximum range of the target?

(4+3+3)

2A. With neat diagrams explain the working of FM-CW altimeter.

2B. Calculate the maximum active tracking range of a deep space radar operating at 2.5GHz and using a peak pulse power of 0.5 MWatts with an antenna diameter of 64meters, a noise figure of 1.1dB and a 5kHz bandwidth. If the beacon antenna diameter is 1 meter, its noise figure is 13 dB and it transmits a peak pulse power of 50 Watts (Assume T=17° C and antenna efficiency =65%).

2C. With a neat block diagram explain double conversion transponder system used in communication satellites.

(4+3+3)

3A. With necessary diagrams and equations explain the butterfly effect in MTI radar and discuss the limitations of MTI radar. Also, explain the MTI radar with power amplifier transmitter.

3B. With equations and neat diagrams, explain single delay line canceler and discuss the drawbacks associated with it compared to double delay line canceler.

(6+4)

4A. Compare conventional dish antenna with phased array antenna. With neat diagrams explain active phased array radar and its applications.

4B. Explain trilateration and with neat diagrams explain the working of GPS.

(5+5)

5A. Draw the block diagram of passive SONAR and explain its operation.

5B. With neat diagrams, explain ground controlled approach system (GCA) for landing aircrafts. Compare this approach with ILS.

(5+5)