Reg. No.									

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

(A constituent unit of MAHE, Manipal)

SECOND SEMESTER M.TECH. (DEFENCE TECHNOLOGY)

END SEMESTER EXAMINATIONS, MAY 2024

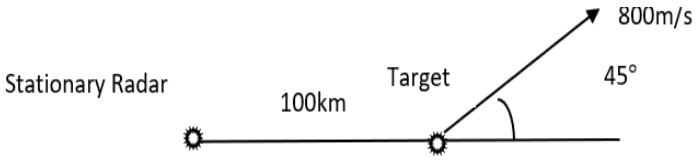
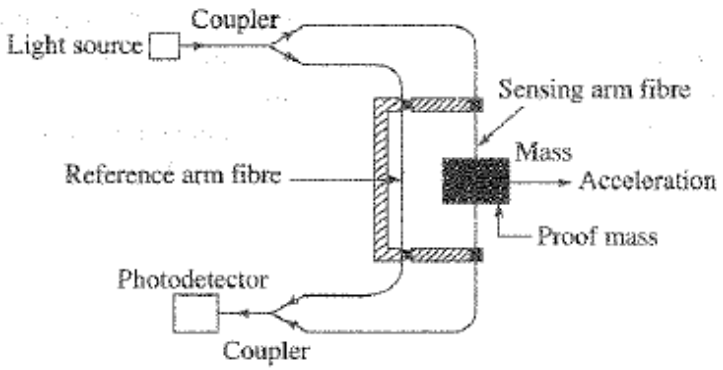
GUIDANCE & CONTROL [AAE 5276]

REVISED CREDIT SYSTEM

Time: 3 Hours **Date: 3rd May 2024** **Max. Marks: 50**

Instructions to Candidates:

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

Q.NO	Questions	Marks	CO	BTL
1A.	In an FM-CW Radar, transmitting at an average frequency of 300 MHz, the rate of the frequency is 10 Hz, and the peak-to-peak frequency variation is 80 kHz. Calculate the beat (difference) frequencies during the increasing and decreasing portions of the FM Cycle. The radar target configuration is shown in Fig. 1.  Fig. 1. RADAR target configuration	(05)	1	3
1B.	Consider a RADAR with pulse repetition frequency 1000Hz. A) Find the time duration between 2 pulses. B) Suppose an echo from a distance aircraft is received 20 microseconds after a pulse is transmitted, what is the distance of the aircraft from the RADAR. Is there a "Second Time Around Echo Effect" from this aircraft?	(03)	1	3
1C.	Interpret the type of accelerometer given in Fig. 2. and discuss the working of the same.  Fig. 2. Accelerometer	(2)	2	3

2A.	Find the power density at a target situated at 50Km from RADAR radiating a power of 100MW, from a lossless isotropic antenna. If this RADAR now employs a lossless isotropic antenna with a gain of 5000 and the target has a radar cross-section of $1.2m^2$, then what is the power density of echo signal at receiver?	***(5)***	***1***	***3***
2B.	Illustrate the working of a spring-mass accelerometer with the help of necessary equations and schematic.	***(03)***	***2***	***2***
2C.	Illustrate the GNSS receiver front-end architecture and discuss.	***(02)***	***1***	***2***
3A.	An aircraft is approaching the runway and there is zero visibility. Design a glide slope coupler and automatic flare control for safe landing of the aircraft.	***(05)***	***3***	***6***
3B.	Describe the two modes of operation of a complete longitudinal flight control system.	***(03)***	***3***	***2***
3C.	What is a Dutch Roll? How it can be eliminated?	***(02)***	***3***	***3***
4A.	Illustrate with the help of control loop, how β–βdot method of obtaining coordination is much better than just the β method.	***(05)***	***4***	***4***
4B.	Sketch the functional diagram of pitch orientational control system with stick steering.	***(03)***	***3***	***3***
4C.	Give the state space model representation of longitudinal and lateral dynamics of an aircraft.	***(02)***	***3***	***2***
5A.	An aircraft pilot intends to obtain heading changes by commanding a yaw rate. Which autopilot control system will achieve this task and how?	***(05)***	***4***	***4***
5B.	Describe the missile launching and guidance system with the help of a neat diagram.	***(03)***	***3***	***3***
5C.	Sketch control system block diagram to obtain coordination using computed yaw rate.	***(02)***	***4***	***3***