Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

A Constituent Institution of Manipal University

FIRST SEMESTER M.TECH. (CONTROL SYSTEMS)

END SEMESTER EXAMINATIONS, DEC 2016/JAN 2017

SUBJECT: NAVIGATION GUIDANCE AND CONTROL [ICE 5124]

Time: 3 Hours MAX. MARKS: 50

Instructions to Candidates:

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

1A. Describe flight dynamics with the help of a neat diagram. **3**

1B. List the different types of flight control systems. **2**

1C. The aerodynamic data for an A/C is given as: **5**

$Y\beta/v$ = -0.746, Yp/v = 0.006, Yr/v = 0.001, g/v = 0.0369, Y_A/v = 0.0012, Y_R/v = 0.0092, L_β = -12.9, L_p= -0.746 , L_r = 0.387, L_A = 6.05, L_R = 0.952, N_β = 4.31, N_P = 0.024, N_Y = -0.174, N_A = -0.416, N_R = -1.76.

Using the state vector $(\beta,P,r,\varphi)^T$, write A and B matrices and also find the Dutch roll mode, Roll subsidence and spiral mode.

2A. Design an automatic glide slope coupler. **5**

2B. Which are the two modes of operation of a complete longitudinal flight control system? Explain both. **5**

3A. How a coordinate turn can be obtained using lateral acceleration as feedback? **4**

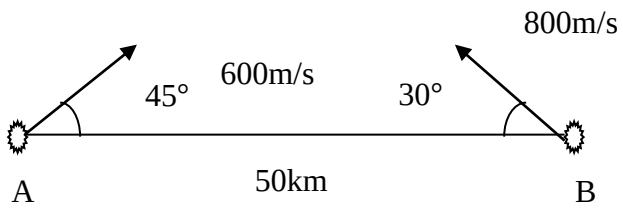
3B. Draw the block diagram of Yaw Orientational Control System. **3**

3C. Explain roll angle autopilot with neat diagram. **3**

4A. Explain missile launching and guidance system with diagram. **3**

4B. Derive the expression for the maximum unambiguous range of the RADAR. **3**

4C. The position and velocity of two A/C 'A' and 'B' are as shown in figure below:- **4**



'A' carries CW radar transmitting at 300 MHz frequency and tracking 'B'.

Then:-

1) What is the Doppler freq. shift recorded by the radar in ‘A’?
2) Is this shift +ve or –ve?
3) What should be the flight deviation of ‘B’ for the Doppler freq. shift to be Zero?

5A. Explain terrestrial navigation system. **4**

5B. What is GPS? Give the specifications of GPS. **3**

5C. Describe air traffic control. **3**

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