Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

A Constituent Institution of Manipal University

FIRST SEMESTER M.TECH (AEROSPACE ENGINEERING)

END SEMESTER EXAMINATIONS, DEC - 2017

SUBJECT: NAVIGATION AND GUIDANCE OF AEROSPACE VEHICLES [ICE 5104]

Duration: 3 Hours MAX. MARKS: 50

Instructions to Candidates:

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

1A. Define the following terminologies: **5**

a) Flight path planning
b) Guidance
c) Navigation
d) Indicated air speed
e) True air speed

1B. Explain the principle of operation of inertial navigation systems. What are the components of inertial navigation system used in aircraft? **3**

1C. Calculate the true air speed of an aircraft flying with an indicated air speed of 100 knots at 3000ft altitude. **2**

2A. Obtain the Euler angle based transformation matrix for transforming a vector from earth axis to body axis system. **5**

2B. With schematic diagram, briefly explain GPS system. **3**

2C. What are the advantages of stable platform INU. What is gimbal lock and how to solve the problem of gimbal lock? **2**

3A. Derive the expression for relative position ($\mathbf{r}_{rel}$), relative velocity ($\mathbf{v}_{rel}$), and relative acceleration ($\mathbf{a}_{rel}$) of an aircraft w.r.t a moving frame. The absolute position of aircraft and moving frame are $\mathbf{r}$ and $\mathbf{r}_o$ respectively, w.r.t an inertial frame. **5**

3B. Briefly explain the difference between rate gyro and rate integrating gyro. **3**

3C. What is scale factor and show that scale factor of SDFG is inversely related to torsion bar stiffness. **2**

4A.	With diagram, explain the working of pendulous accelerometer. Obtain the expression for measured acceleration.	**5**
4B.	With block diagram, explain pitch orientational control system and basic lateral autopilot.	**5**
5A.	Write about different intercept rules used in guidance system.	**5**
5B.	Explain different types of commanded guidance.	**3**
5C.	What are the functions of a missile GNC system?	**2**

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