Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

A Constituent Institution of Manipal University

FIRST SEMESTER M.TECH (AEROSPACE ENGINEERING)

END SEMESTER EXAMINATIONS, NOV - 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 suitable assumed.

1A. Write about inertial navigation system. What are the various navigational measurements calculated in INS? List the advantages of inertial navigation system. **5**

1B. Briefly explain NGC loop. What are the applications of NGC? **3**

1C. With diagram, briefly explain NED frame and Body Frame. **2**

2A. An aircraft is flying from airport A located at $N11^{0}2'$ $E77^{0}2'$ to airport B. The actual course of flight is 278^{0}. Aircraft is flying at an altitude of 9500 ft. Wind is from 291^{0} with a speed of 24 knots. Indicated airspeed is 105 knots. Magnetic variation is $2^{0}W$. With the above given details answer the following questions: (a) Identify the fixes and mark with 'X' (b) Obtain the true course of flight and true heading (d) Wind correction angle (e) Ground Speed (f) Time of flight between A and B. **5**

2B. With neat diagram, explain gimbal platform INU and list the advantages and disadvantages of this type of INU. **3**

2C. What is gimbal lock and how the issue of gimbal lock can be solved? **2**

3A. With diagram, explain the operation of Quartz Flexure accelerometer. What are the advantages of Quartz Flexure accelerometer over pendulous accelerometer? **5**

3B. Briefly explain the working of a ring laser gyroscope. **3**

3C. Obtain the expression for scale factor of a single degree of rate gyro. **2**

4A. The position vector (1, 2, 3) of an aircraft in co-ordinate frame A need to be transformed to co-ordinate frame B. Transformation need to be performed by **5**

rotating an angle 30^0 about an axis in the y-z plane that is inclined at an angle of 45^0 to the positive y-axis of co-ordinate frame A. Obtain the position vector in co-ordinate frame B using quaternion.

4B. With block diagram explain missile autopilot configuration for lateral and longitudinal motion. **5**

5A. Explain different phases of flight for a multi-mode guided missile. List the major functions of GNC system in a missile. **4**

5B. With engagement geometry diagram, explain proportional navigation guidance. **3**

5C. Briefly write about different types of external guidance used in missiles? **3**

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