Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

(A constituent unit of MAHE, Manipal)

I SEMESTER M.TECH. (AVIONICS)

END SEMESTER EXAMINATIONS, NOV/DEC 2019

SUBJECT: FLIGHT INSTRUMENTION AND DATA ACQUISITION [AAE 5153]

REVISED CREDIT SYSTEM
(21/11/2019)

Time: 3 Hours MAX. MARKS: 50

Instructions to Candidates:

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

1A. A test pilot on the $F-16\,XL$ test team is told by the contractor's structural engineers to fly at a constant 300 $KEAS$ (knots equivalent airspeed) to get the desired test points for the $F-16XL's$ flutter limits. The position error correction is -10 kn for the $F-16$ at 300 KIAS. **(05)**

(a) What indicated airspeed must be flown in knots to get data at $20{,}000$ ft pressure altitude? (319 KIAS) (Assume $V_c = V_e$ and iterate).
(b) What type of velocity will the ground-based radar record when the pilot is at the test point in part (a) and there is no wind? $V_t = V_g$ What if there is a wind? $V_t + V_w = V_g$.
(c) At what true velocity (in knots) must the pilot fly to conduct a test point at $30{,}000$ ft on a standard day? What about at $10{,}000$ ft?

1B. How do you differentiate between qualitative and quantitative displays? Draw the diagrammatical representations of both basic six grouping and Basic 'T' configuration of aircraft instruments. **(03)**

1C. What is Pitot static tube? Explain its working in brief with a suitable diagram. **(02)**

2A. Describe the two methods to implement an emergency landing of the military aircraft. **(05)**

2B. Explain the working principle of distance-measuring equipment (DME). **(05)**

3A. Explain with a suitable diagram the principle and working of a Fly-by-Wire actuation system as an advanced actuation implementation. **(05)**

3B. Explain the Sigma-Delta ADCs and provide a comparison with other ADCs. **(05)**

4A. Write a short note on Kinetic Heating and explain its relation with the combat aircraft flight envelope shown in figure 1 below. **(05)**

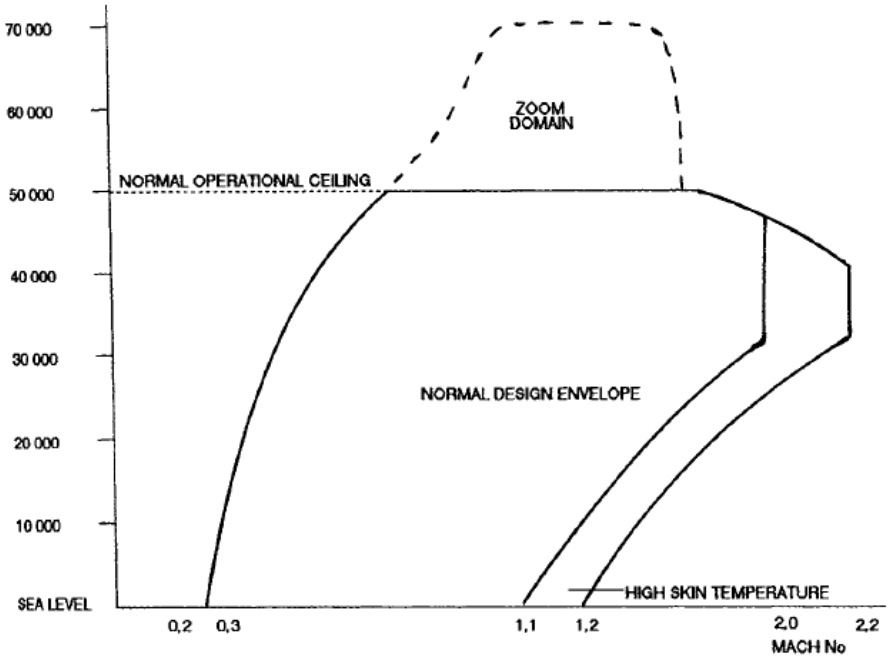

Figure 1

4B. What are Transformer Rectifier Units (TRU's)? Can TRU be used other than in isolation? **(03)**

4C. An aircraft is flying at 88 ft/s at sea level on a standard day. Find the velocity at a point on the wing where the static pressure is 2070 psf. (Pressure and density at sea level is 2116.2 psf and 0.002377 slug/ft^3). **(02)**

5A. With the help of neat and labelled diagram, explain the operation of Plastic Optical Fiber Elongation Sensor for strain measurement in aircraft structures. Also, if the refractive index of core is 1.49, operating wavelength is 650 nm and the phase difference between outputs of the two receivers is 30^0, then determine the amount of elongation of the fiber. **(05)**

5B. Explain the A429 Data Bus with the help of neat and labelled diagrams for A429 Data Bus topology, block diagram and data word format. **(05)**

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