Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

A Constituent Institution of Manipal University

V SEMESTER B.TECH. (AERONAUTICAL ENGINEERING)

END SEMESTER EXAMINATIONS, DECEMBER 2016

SUBJECT: AERODYNAMICS OF ROCKETS & MISSILES [AAE 4001]

REVISED CREDIT SYSTEM
(31/12/2016)

Time: 3 Hours MAX. MARKS: 50

Instructions to Candidates:

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

1A. Write down the conceptual design process of a missile and also draw the schematic diagram of a missiles with its features. **(03)**

1B. Explain the following with their definitions, advantages and disadvantages of their designs. **(05)**

a) boattail
b) hinge moment prediction
c) aerodynamic center prediction
d) nose flap control
e) flare stabilizer

1C. Consider a rocket baseline (reference diameter=0.3m) with 16% nose tip bluntness, rocket nose bluntness ratio 2.9 at Mach 2.6. If then calculate the zero lift drag for wave with blunt nose. **(02)**

2A. Explain the different design features of missiles nose. Also, write down how these design features influencing the drag of missiles (write down the empirical relations of different drags) **(05)**

2B. Write down the two main approaches which we use for the prediction of normal force on the surface of missiles. **(03)**

2C. Explain briefly about how angle of attack affecting the aerodynamic efficiency with different bluntness ratio (or fineness ratio). **(02)**

3A. Give the causes for missile- aircraft collision in air- launched missiles. **(04)**

3B. What is ballistic coefficient? How is it significant in designing a ballistic missile? **(03)**

3C. Classify missile warheads and give their characteristics. **(03)**

4A. Write a brief note on self-contained guidance system with classification. **(04)**

4B. What is free-flight dispersion? How is overall dispersion calculated for a ballistic missile? **(03)**

4C. Give the reasons for free- flight dispersion in ballistic missiles during power-off flight. **(03)**

5A. Give reason for the following: **(03)**

i. Guidance is switched to passive mode during electronic jamming.
ii. Launcher setting angle for maximum range is up to 65 degree for long range missiles.
iii. Fragmentation warheads are effective even with greater miss-distance.

5B. What are Blast warheads? How are they effective for under- water operations? **(04)**

5C. Write a note on propulsion systems used in missiles. **(03)**