Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

A Constituent Institution of Manipal University

V SEMESTER B.TECH. (AERONAUCAL ENGINEERING)

END SEMESTER EXAMINATIONS, NOV/DEC 2017

SUBJECT: ORBITAL MECHANICS [AAE 4012]

REVISED CREDIT SYSTEM
(29/12/2017)

Time: 3 Hours MAX. MARKS: 50

Instructions to Candidates:

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

1A. Explain rectilinear and curvilinear trajectories. **(02)**

1B. Prove that specific energy is constant for an orbit. **(03)**

1C. Use the two-body equations of motion to show why orbiting astronauts experience weightlessness. **(05)**

2A. State and prove Kepler's third law. **(02)**

2B. The perigee of a satellite in a parabolic geocentric trajectory is 7000 km. Find the distance d between points P_1 and P_2 on the orbit which are 8000 km and 16,000 km, respectively, from the center of the earth. **(03)**

2C. An earth satellite is in an orbit with perigee altitude Zp = 400 km and apogee altitude Za= 4000 km. Find each of the following quantities: **(05)**
(a) Eccentricity
(b) Angular momentum
(c) Perigee velocity
(d) Apogee velocity
(e) Semi major axis
(f) Period of the orbit

3A. Explain various mean, true and eccentricity anomalies using proper diagram and equations. **(02)**

3B. Suppose you have the information about state vectors of an orbiting body. How do you find orbital parameters from this data? Explain the procedure with relevant equations. **(03)**

3C. Explain various types of perturbations, types and consequences. **(05)**

4A. Explain plane change orbital maneuvers. Also explain the transfers for changing various orbital parameters. **(02)**

4B. Explain Bi elliptical Hohmann transfer using proper diagrams and equations. **(03)**

4C. A 2000 kg spacecraft is in a 480 km by 800 km earth orbit. Find **(05)**
(a) The Δ v required at perigee to place the spacecraft in a 480 km by 16,000 km transfer ellipse
(b) The Δ v (apogee kick) required at B of the transfer orbit to establish a circular orbit of 16,000 km altitude.
(c) The total required propellant if the specific impulse is 300 s.

5A. Explain the term synodic period with proper diagrams and equations. **(02)**

5B. What do you mean by Sphere Of Influence of a planet? Calculate the radius of Sphere Of Influence of earth. Given mass of earth is 5.974×10^{24} Kg , mass of sun is 1.98×10^{30} Kg, radius of earth is 149.6×10^{6} Km. **(03)**

5C. Explain patched conic method with proper diagrams. **(05)**