Reg. No.										

Manipal Institute of Technology, Manipal

(A Constituent Institute of Manipal University)

V SEMESTER B.TECH (AERONAUTICAL ENGINEERING)

END SEMESTER EXAMINATIONS, DEC 2015- AN 2016

SUBJECT: AIRCRAFT PROPULSION - II [AAE 307]

REVISED CREDIT SYSTEM

Time: 3 Hours MAX. MARKS: 50

Instructions to Candidates:

- Answer **ANY FIVE FULL** the questions.
- Missing data may be suitable assumed.

1A With the help neat diagram write the working principle of scramjet engine. (02)

1B Derive the burning rate of energy balance equation for composite propellant by representing each term clearly. (03)

1C Explain the Nuclear Thermal Rockets (NTR) working principle with neat diagram. Also write the advantages and dis-advantages of NTR. (05)

2A What is sputtering? How to overcome the sputtering phenomena in electrical propulsion? (02)

2B Derive the expression for equilibrium pressure (P_{equ}) through choice of index 'n' for stable operation of solid propellant rocket. (03)

2C An end-burning rocket uses a cylindrical double base propellant grain with a diameter of 200mm and generates a thrust of 350 N over a period of 300 sec. The thrust coefficient is 1.15. The characteristics of the propellant are; Density of propellant grain =1500 kg/m^3, a_{70}=4 mm/sec, n=0.5, C*=1500 m/sec. (05)

Determine the thrust developed by the solid propellant rocket given in the above example, when the rocket is operated during day time in a hot desert, wherein the ambient temperature is 50^{0}C and the propellant grain is soaked to the above temperature. The design of the grain can be assumed to be for a nominal initial propellant temperature of 25^{0}c. The values of C* and C_F can be assumed not to change with the initial temperature of the grain. The temperature sensitivity coefficient is 0.0035$^0C^{-1}$.

3A Derive the residence time (t_{res}) equation for a given rocket. (02)

3B What are the advantages and dis advantages of splash plate injectors. (03)

3C Derive the equation for bulk mode of combustion instability in Liquid Propellant Rocket (LPR). Write also the conclusions. (05)

4A Determine the minimum beam diameter of an ion rocket, generating a thrust of 0.5 N, using xenon as the propellant. The potential difference between the extractor grid and the accelerator grid of the ion thruster is 3 KV and the gap between them is 1 mm. The permittivity of free space is 8.85×10^{-12} C^2/Nm^2. (02)

4B What is Tri-propellant rocket? What are the elements of Tri-propellants and also write importance of Tri-propellant rockets. (03)

4C What is standing wave? What is the role of standing wave in the combustion chamber and also show the mathematical representation of standing waves for a given combustion chamber. (05)

5A What is 'chu' theory? Also write the applications of this theory. (02)

5B Write the applications of plasma propulsion. (03)

5C Write the short notes on the following with neat diagram: (05)

(i) Electromagnetic thruster

(ii) Hall effect thruster

6A Write the principle of pulse detonation rocket. (02)

6B The altitude and orbit of a satellite are maintained using a number of small rockets housed in the satellite. The altitude and orbit corrections required during the lifetime of satellite are estimated to be 950 m/sec. if the jet velocity of rocket is 2500 m/sec and dry mass of satellite (Dry mass without the propellant being loaded in the satellite) is 800 Kg, determine the mas of propellant required for the altitude and orbit corrections. (03)

6C Define the following: (05)

(i) Coulomb's Law

(ii) Permeability

(iii) Popping

(iv) Impinging jet injectors

(v) Specific impulse