Reg. No.										

Manipal Institute of Technology, Manipal

(A Constituent Institute of Manipal University)

V SEMESTER B.TECH (AERONAUTICAL ENGINEERING)

END SEMESTER EXAMINATIONS, NOV/DEC 2015

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	Mention all the variants of ramjet engine.	(02)
1B	Derive an expression for pressure loss in the Ramjet combustion chamber and also write the temperature ratio.	(03)
1C	Derive the Tsialkowski's Equation.	(05)
2A	Write the principle of electrical propulsion.	(02)
2B	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)
2C	Derive the jet velocity 'V_j' expression of gas from a high pressure chamber and also draw the conclusions.	(05)
3A	Derive the maximum thrust force (F_{max}) through 'child longmuir law'.	(02)
3B	With the help of ramjet thrust equation bring the Mach number and temperature relation.	(03)
3C	Hot gases are generated at a temperature of 2,000 K and a pressure of 15 MPa in a rocket chamber. The molecular mass of the gas is 22 kg/Mole and specific heat ratio of the gas is 1.32. The gases are expanded to the ambient pressure of 0.1 MPa in a convergent-divergent nozzle having a throat area of 0.1 m^2 . Calculate: (i) Exit jet velocity, (ii) Characteristic velocity (iii) Ideal optimum thrust coefficient (iv) Specific impulse and (v) Thrust generated.	(05)

4A	Define coulomb's law in theory of electromagnetism.	(02)
4B	Define the following: Thermal Efficiency, Specific Fuel Consumption, Specific thrust.	(03)
4C	The booster rocket of a satellite launch vehicle operates an altitude of 30 Km. The rocket has a constant chamber pressure of 7 MPa.	(05)

(i) If the nozzle is designed for optimum expansion at an altitude of 16 km determine the area ratio of the nozzle. The specific heat ratio of the gases can be assumed constant and equal to 1.20 . The throat area of the nozzle is 0.1 m^2. The variation of ambient pressure with altitude is given in the following:

Altitude (Km)	0	4	8	12	16	20	30
Pressure (N/m^2)	101325	61660	35651	19399	10353	5529	1186

(ii) What would be the thrust coefficient of the nozzle at the altitude of 30 Km? What is the percentage reduction from the value corresponding to optimum expansion at 30 Km?

(iii) Till what altitude would flow separation in the nozzle take place?

5A	What is wave combustion? Write the types of combustion instability.	(02)
5B	Explain the advantages and dis-advantages of hybrid propellant rockets.	(03)
5C	Obtain the expression for shape of the Nozzle and also draw the conclusions.	(05)

6A	What is Kepler's law?	(02)
6B	Write the any three differences between liquid propellant rockets and solid propellant rockets.	(03)
6C	A high pressure-fed liquid propellant rocket based on the gas generator cycle has a vacuum thrust of 735 KN and burn duration of 180 secs. The propellants used are N_2O_4 and UDMH. The specific impulse is 2950 N-s/kg. The Mixture ratio is 1.87. The pressure in the thrust chamber of the rocket is 6MPa and the propellant supply pressure to the chamber is 7 MPa. N_2O_4 is stored in the propellant tank at a pressure of 0.4 MPa and UDMH is stored at 0.32 MPa. The densities of N_2O_4 and UDMH are 1400 Kg/m^3 and 790 Kg/m^3 respectively, at the temp used in the rocket. Determine Power required to drive N_2O_4 and UDMH pump.	(05)