Code No: 09A82107 **R09**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B. Tech IV Year II Semester Examinations, May - 2013
Launch Vehicle and Missile Technology
(Aeronautical Engineering)

Time: 3 Hours **Ma**

Answer any Five Questions
All Questions Carry Equal Marks

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1.a) Describe a rocket and its functioning in detail.
b) Describe the Space Shuttle of USA. [10+5]

2.a) Describe the contoured nozzle of a solid rocket motor, with the help of a sketch showing all the details.
b) Describe the different types of grains of a solid propellant. [8+7]

3.a) Describe the different types of pressurization in a liquid stage.
b) What air tank volume is required to pressurize the propellant tank of a 5000 N thrust rocket using a liquid monopropellant at a chamber pressure of 1.62 MPa for 36 seconds in conjunction with a solid catalyst? The air tank pressure is 12.5 MPa and the propellant tank pressure is 2.75 MPa. [9+6]

4.a) Describe the aerodynamic forces and moments acting on a rocket during flight.
b) Calculate the skin friction coefficient of the fin of chord 1m of a rocket flying at 200 m/s speed. The density of air is 0.9 kg/m^3, and coefficient of viscosity is 0.00002 kg/(m) (s). Assume fully turbulent flow over the fin. [9+6]

5.a) Set up the equations of motion for the gravity turn of a single stage rocket and explain how the trajectory of the rocket can be obtained. Explain all the assumptions clearly.
b) The masses of a rocket at the beginning and end of the motor burning are 10000 kg and 5000 kg respectively. If the specific impulse of the fuel is 1961 N s/ kg, what is its ideal burn-out velocity? [10+5]

6. Explain the different types of separation systems, where they are required and how they function. [15]

7. What are the parameters observed in ground testing and flight testing of rockets? Identify those that are common and those that are specific to each. [15]

8. Identify the materials that can be used for a cryogenic stage and explain their suitability. [15]

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