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Manipal Institute of Technology, Manipal

(A Constituent Institute of Manipal University)



VI SEMESTER B.TECH (AERONAUTICAL ENGINEERING) END SEMESTER EXAMINATIONS, JULY 2016

SUBJECT: ROCKETS AND MISSILES [AAE 320]

REVISED CREDIT SYSTEM

Time: 3 Hours

MAX. MARKS: 50

Instructions to Candidates:

- ✤ Answer any FIVE FULL questions.
- Missing data may be suitable assumed.
- 1A. With neat sketches explain about the three typical squibs with neat sketches. (05)
- **1B.** Explain the effect of space environment on reentry vehicle surface materials **(03)** and list out the materials that can withstand this effect.
- 1C. Which system (pressure or turbo feed) do you recommend for a large booster (02) of a rocket and why?
- 2A. Sketch and explain the turbo-pump feed system of liquid propellant rockets (05) with construction details and flow lines of propellants.
- **2B.** List out the factors that are dependent on the satisfactory attainment of **(03)** equilibrium chamber pressure of solid propellant rocket motor with full gas flow.
- 2C. List down the Special Requirements of materials under Adverse Conditions? (02)
- **3A.** Briefly explain the different types of jet controls, with sketches and plots. **(05)**
- 3B. Explain with neat sketches attitude control of solid and liquid propellant rockets. (03)What are the problems encountered in each of them?
- **3C.** What are the design requirements of Ejection/Jettisoning system? (02)

- 4A. Obtain expressions for burnout altitude and culmination altitude attained by a sounding rocket with the assumption that thrust developed by the rocket is constant, Aerodynamic effects may be neglected and the rocket motion is in a homogenous gravitational filed.
- **4B.** What are your observations from aerodynamic characteristics of complete **(03)** missile body?
- **4C.** What is coasting phase? What is its significance in the design phase of multi- **(02)** staging rocket?
- 5A. Explain multi-staging rocket vehicle and its nomenclature and also Determine (05) the culmination altitude of two-stage rocket in its vertical ascent in a homogenous gravitational phase & in vacuum and prove that its gives best performance.
- 5B. Explain qualitatively vertical flight, constant pitch angle flight and gravity turn (03) flight of rockets. Among these three, which is the more practical flight and why?
- 5C. A rocket engine produces a thrust of 1,000 kN at sea level with a propellant (02) flow rate of 400 kg/s. Calculate the specific impulse.
- 6A. A rocket flight requires thrust variation during its flight, but the variation of thrust (05) with time is known before the design. Should a liquid engine be used or a solid motor can serve the purpose? Explain clearly with sketches.
- **6B.** A rocket has the following data:

(03)

(02)

Propellant flow rate	= 5 kg/s
Nozzle exit diameter	= 20 cm
Nozzle exit pressure	= 1.02 bar
Ambient pressure	= 1.013 bar
Thrust	= 8 kN
Determine the offective	o iot volocitv

Determine the effective jet velocity, actual exhaust jet velocity and specific impulse

6C. Write a short notes on pneumatic thrusters.