AS2520, Propulsion Lab Aug-Nov 2021
End Semester Examination
Department of Aerospace Engineering, IIT Madras
Total marks 30

1. List the set of apparatus required (listing more than required invites negative marking) for the following experiments ***15 marks***

a. Burn rate measurement in solid rocket

b. Ramjet

c. Piston engine + propeller

d. Burn rate measurement in hybrid rocket

e. Diffusion flame height

2. A hybrid rocket motor with wax as fuel and gaseous oxygen as oxidizer is to be designed. The burn rate for wax is $\dot{r} = 0.116 G_{ox}^{0.62}$ ($\dot{r}$ in mm/s and G_{ox} in kg/m^{2}s). The mass flow rate of gaseous oxygen is a constant at 0.030 kg/s. Density of the fuel is 900 kg/m^3.The length of the fuel grain is 0.134 m and the initial port diameter is 0.009 m. The web thickness is 0.022 m and throat diameter is 0.008 m. The chamber temperature T_c = 3400 K, molecular weight of burnt gases is 22 and γ = 1.2. What is the variation of thrust Vs time, chamber pressure vs time and O/F vs time for this rocket? Only a convergent nozzle has been used. Take at most 5 points on the time axis and make a table as shown below. What would have been the situation if the *'n'* of the propellant instead of 0.62 were to be 0,0.5 in two different cases? Do not calculate and enter values into the table for these two situations, but using algebraic equations argue the two situations. Which one would be preferred and why?

15 marks

Sl. No.	Time	Mass flow rate of fuel	O/F	Chamber Pressure	Thrust
1					
2					
3					
4					
5					