Register Number:……..

KUMARAGURU
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B.E DEGREE EXAMINATIONS: MAY/JUNE 2023

(Regulation 2018)

Sixth Semester

AERONAUTICAL ENGINEERING

U18AET6104**:** Rocket Propulsion

COURSE OUTCOMES

CO1:	**Illustrate the Basic principles and parameters of rockets.**
CO2:	**Differentiate and interpret the ignition systems of rocket**
CO3:	**Analyze the performance of solid-core nuclear thermal rockets, arc jets, and ion thrusters.**
CO4:	**Analyze the performance of Liquid Propellant Rockets**
CO5:	**Interpret the advanced propulsion techniques of a rocket**

Time: Three Hours **Maximum Marks: 100**

Answer all the Questions:-

PART A (10 x 2 = 20 Marks)
(Answer not more than 40 words)

1.	Differentiate between duct jet and rocket propulsion.	CO1	[K_1]
2.	Define mass ratio and propellant mass fraction.	CO1	[K_2]
3.	Name any two different types of igniters used in solid rockets.	CO2	[K_1]
4.	Differentiate between deflagration and detonation.	CO2	[K_2]
5.	What are the factors influencing the burning rate in solid rocket motor ?	CO3	[K_2]
6.	What is the root cause of erosive burning and how to overcome this problem?	CO3	[K_2]
7.	Classify various types of liquid propellants .	CO4	[K_1]
8.	State the purpose of ablative material in liquid propulsion system.	CO4	[K_2]
9.	What is solar sail?	CO5	[K_2]
10.	Differentiate between Cryogenic rockets and Electric rockets.	CO5	[K1]

Answer any FIVE Questions:-
PART B (5 x 16 = 80 Marks)
(Answer not more than 400 words)

11.		Define the following performance parameter. i) Specific and Total impulse ii) Effective exhaust velocity and characteristic velocity iii)Impulse to weight and thrust to weight ratio iv)Internal efficiency and propulsive efficiency	16	CO1	[K_2]

12.	a)	Write a short notes on ignition process .	08	CO2	[K_3]
	b)	Briefly discuss about pyrogen and pyrotechnic igniter.	08	CO2	[K2]
13.	a)	Durin the testing of new propellant in a stand burner the regression rate at two chamber pressure of 7 and 17 Mpa are found to be 25 and 45 mm/s respectively .if the regression rate happens to the follow the Saint Roberts law,determie the chamber pressure when it regressions at 35 mm/s.	08	CO3	[K_4]
	b)	A two-stage rocket has the following masses:1st stage propellant mass 120,000 kg,1st stage dry mass 9000 kg, 2nd stage propellant mass 30000, 2nd stage dry mass 3000 kg, and payload mass 3000kg.The specific impulse of the 1st and 2nd stages are 260s and 320s.Calculate the rocket total incremental velocity ΔV.	08	CO3	[K_4]
14.	a)	With neat sketch explain the workimg principle of gas pressure and turbopump pressure feed system in liquid rocket engine.	08	CO4	[K_2]
	b)	With neat sketch briefly discuss about thrust vector control in liquid rocket engine .	08	CO4	[K_2]
15.	a)	Describe briefly electric rocket propulsion.	08	CO5	[K_2]
	b)	Write a short notes on Ion propulsion techniques.	08	CO5	[K_2]
16.		The following data are given for a certain rocket unit: thrust, 8896 N; propellant consumption, 3.867 kg/sec; velocity of vehicle, 400 m/sec; energy content of propellant, 6.911 MJ/kg. Assume 100% combustion efficiency. Determine (a) the effective velocity; (b) the kinetic jet energy rate per unit flow of propellant; (c) the internal efficiency; (d) the propulsive efficiency; (e) the overall efficiency; (f) the specific impulse; (g) the specific propellant consumption.	16	CO1	[K_4]

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