Model Question Paper-1 with effect from 2019-20 (CBCS Scheme)

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Fourth Semester B.E. Degree Examination

18AS45 - INTRODUCTION TO SPACE TECHNOLOGY

TIME: 03 Hours **Max. Marks: 100**

Note: 01. Answer any **FIVE** full questions, choosing at least **ONE** question from each **MODULE**.
02.
03.

		Module -1	***Bloom's Taxonomy Level**	**Marks**
Q.01	a	Explain the concept of Aerospace plane.	L1	
	b	Explain in detail about Liquid rocket propulsion with turbo pump feed system neat sketch and its Advantages & Disadvantages.	L1	
	c	Derive Tsiolkovsky rocket equation.	L2	
		OR		
Q.02	a	Derive Sounding Rocket equation	L2	
	b	Consider the single-stage rocket and the double-stage rocket, Both rockets have the same total mass M_{total} = 5000 kg and the same specific impulse Isp = 350 s. Both rockets have the same payload mass ML = 50 kg. The total structural mass of the double-stage rocket is Vs1 + Ms2 = 400 kg + 100 kg = 500 kg, which is the structural mass of the single-stage rocket. The total propellant mass of the double-stage rocket is Mp1 + Mp2 = 3450 + 1000 = 4450 kg, which is the propellant mass of the single-stage rocket. Both rockets are boosting the same payload mass of 50 kg into space. Calculate and compare the burnout velocities for the rockets.	L3	
	c	Write Short notes on: i) Vehicle sizing ii) Trade-off ratios.	L1	
		Module-2		
Q. 03	a	Derive Ballistic Reentry: Vehicle Deceleration, Trajectory Curvature: Small KD & Free-Fall: High KD.	L2	
	b	Derive Double Dip Reentry.	L2	
	c			
		OR		
Q.04	a	Consider a solid mass in shape of sphere entering the earth's atmosphere at 13km/s and at an angle 15 deg below the local horizontal. The sphere diameter is 1m. The drag coefficient of the sphere at hypersonic speeds is approximately 1. The density of the mass is 6963 kg/m3. Calculate i) the altitude at which maximum deceleration occurs. ii) the value of the maximum deceleration.iii) the velocity at which the sphere would impact the earth's surface.	L3	
	b	Explain briefly Aerobraking &Lifting body Reentry	L1	
	c			
		Module-3		
Q. 05	a	Derive Elliptical Orbits and its Assumptions	L2	
	b	At two points on a geocentric orbit, the altitude and true anomaly are z1 =1545 km, θ1= 126_ and z2 =852 km, θ2=58 respectively. Find (a) the	L3	

		eccentricity, (b) the altitude of perigee, (c) the semi major axis, and (d) the period.		
	c	An Earth satellite is in an orbit with a perigee altitude of 400 km and an eccentricity of 0.6. Find (a) the perigee velocity (b) the apogee radius (c) the apogee velocity (d) the orbit period (e) the satellite velocity when its altitude is 3622 km (f) the true anomaly at altitude 3622 km (g) the flight path angle at altitude 3622 k	L3	
		OR		
Q. 06	a	Explain briefly about Bielliptical Transfer & Plane change	L1	
	b	Explain briefly about In-Plane Orbit Changes & Hohmann Transfers	L1	
	c	A two-impulse Earth-orbit transfer where the first impulse occurs after perigee passage on the transfer ellipse. The inner and outer circular orbits have radii r1=2.5RE and r2=6RE, respectivelywhere RE is the radius of the Earth. The transfer orbit has a perigee radius of 1.9RE and an apogee radius of 8.5RE. Determine (a) the magnitude and direction of the first impulse, and (b) the timeof flight on the transfer ellipse.	L3	
		Module-4		
Q. 07	a	Derive the Torque free Axi-symmetric rigid body	L2	
	b	Write short notes on : i. Attitude Control for Spinning Spacecraft,	L1	
	c	Write short notes on Attitude Determination.	L1	
		OR		
Q. 08	a	Derive The Yo-Yo Mechanism,	L2	
	b	Write short notes on i. Gravity – Gradient Satellite	L1	
	c	Write short notes on i. Dual Spin Spacecraft	L1	
		Module-5		
Q. 09	a	Explain mission phases and core operations for team responsibilities.	L1	
	b	Explain Standard operations practices.	L1	
	c			
		OR		
Q. 10	a	Explain high level space mission operations architecture with neat sketch.	L1	
	b	Explain Mission Diversity	L1	
	c			

*Bloom's Taxonomy Level: Indicate as L1, L2, L3, L4, etc. It is also desirable to indicate the COs and POs to be attained by every bit of questions.