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ECE Dept.
Exam.
Internal Assessment
Odd Sem(2018-19)

Sem: VII
Date: 12/09/2018

FIRST INTERNAL ASSESSMENT

Sub: Satellite Communication **Sub. Code:15EC755**
Time: 11am -12 noon **Max. Marks:25**

Note: Answer two full questions, draw sketches wherever necessary.

Q. No		Discription of Question	Marks	CO	RBT LEVEL
1	a	Explain Kepler laws of planetary motion with neat sketch and equations.	7	C405a.1	L2
	b	Define the following. i) Apogee ii) Inclination iii) Prograde orbit iv)Ascending Node v)Argument of Perigee vi)Eccentricity	6	C405a.1	L2
		OR			
2	a	The elliptical eccentric orbit of a satellite has its semi-major and semi-minor axes as 25000 km and 18330 km respectively. Determine the apogee and perigee distances.	7	C405a.1	L2
	b	Define the following i) Orbit ii) Trajectoty ii) Sun Synhronous Orbit iv) Newtons 2nd law of motion v) Elevation angle vi) Station Keeping	6	C405a.1	L3
3	a	Explain spin and three axis stabilization of satellite orbit.	6	C405a.1	L3
	b	Explain the types of satellite orbits.	6	C405a.1	L2
		OR			
4	a	A satellite in the Intelsat-VI series is located at 37°W and another belonging to the Intelsat-VII series is located at 74°E (Figure 3.37). If both these satellites are in a circular equatorial geostationary orbit with an orbital radius of 42164 km, determine the intersatellite distance.	6	C405a.1	L3
	b	Write a note on injection velocity.	6	C405a.1	L2

Course Coordinator
(Prof. S B Akkole)

Module Coordinator
(Prof. S B Akkole)

HOD
(Dr. V G Kasabegoudar)

IA - I SCHEME OF EVALUATION

Page. No. 1 /

Sem : VII | Subject : Satellite Communication | Sub Code : 15EC755 | Date : 12/9/2018

Q. No.	Bit	Description	Marks	CO's	RBT LEVEL
1	(a)	Each law with sketches ~~2+2+2+2~~ 2.5+2.5+2	7	CO5a-1	L2
		(i) Path followed by a sat around the earth is ellipse  (2.5M)			
		(ii) Sat covers same area in in same equal orbits equally $\frac{dA}{dt} = \frac{\text{angular momentum of Sat}}{2m}$ m - mass of sat			
		 $A_1 = A_2$ (2.5M)			
		(3) The square of time period of any satellite is proportional to the cube of semimajor axis in elliptical orbit $T^2 \propto a^3$ or $T = \frac{2\pi}{\sqrt{M}} a^{3/2}$ (2M)			
	(b)	Defining each parameter 1+1+1+1+1+1=6	6M.	CO5a-1	L2
2	(a)	$a = 25000$ KM $b = 18330$ KM $\therefore e = \frac{\sqrt{a^2-b^2}}{a} = \frac{\sqrt{(25000)^2-(18330)^2}}{25000}$ $= 0.68$ (2M) $A = a(1+e) = 25000(1.68)$ $= 42000$ KM (2M)	6M	CO5a-1	L3

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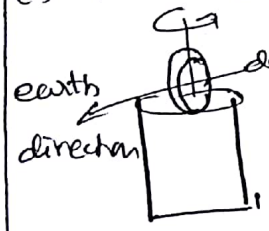
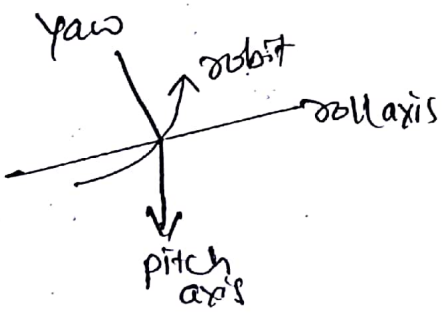
IA - 1 SCHEME OF EVALUATION

Sem : VII | Subject : Satellite communication | Sub Code : 15EC751 | Date : 12/9/2018

Q. No.	Bit	Description	Marks	CO's	RBT LEVEL
2	(a)	$P = a(1-e) = 25000(0.32)$ $= 8000$ km (2M)			
2	(b)	Defining each 1 mares each $1+1+1+1+1 = 6$	6M	CLO2-1	L_2
3	(a)	(i) Spin axis Explanation 2M + 1 figure  Body spins @ 30 to 100 rpm axis ⊥r to orbit plane It maintains the moment of inertia maximum & 10% greater than the spin axis — 3M.	6	CLO3-1	L2
		(ii) Three axis Stabilization.  Is achieved by controlling 3 axis yaw, roll & pitch axis. The reaction & momentum wheels are used. The wheels are speed up or slow down according to satellite direction. In Reaction wheel. reaction force is generated which opposite the			

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IA - I SCHEME OF EVALUATION

Sem : VII	Subject : Satellite Comm	Sub Code : 15EC755	Date : 12/9/2018		
Q. No. / Bit	Description		Marks	CO's	RBT LEVEL
	Satellite is maintained in desired orbit & allow to move in desired orbit; Eg. INSAT 5.				
3 (b)	Explaining any 6 orbits of the satellite 1+1+1+1+1+1 (i) orientation of the orbital plane – Equatorial orbit, polar orbit prograde orbit & retrograde orbit (ii) orbit types – Eccentricity: Elliptical & circular (iii) Distance from the earth – LEO, MEO & GEO		6M.	CO5a-1	L2
4 (a)	$\theta = 37+74 = 111^\circ$ —(1) $D_1 = 42164$ km ; $D_2 = 42164$ km $\therefore$ Inter Sat distance $D = \sqrt{D_1^2+D_2^2-2D_1D_2\cos\theta}$ —(1) $= \sqrt{(42164)^2+(42164)^2-2(42164)^2\cos 111^\circ}$ $D = 69486.27$ km —(4)		6M	CO5a-1	L3
(b)	The horizontal velocity with which a sat is injected into space by the launch vehicle with intension of imparting a specific trajectory to the sat has a direct bearing on the sat trajectory $v_p = \sqrt{\frac{2M}{P} - \frac{2M}{A+P}}$ at perige $A=P$ $\therefore v_1 = v_p = \sqrt{M/P}$		6M.	CO5a-1	L2

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IA - 2 SCHEME OF EVALUATION

Sem : VII	Subject : Satellite Comm	15EC755 Sub Code :	Date : 12/9/2018		
Q. No. / Bit	Description		Marks	CO's	RBT LEVEL

If v_p greater than 1st cosmic velocity then

$$v_p = \sqrt{\frac{2\mu}{p} - \frac{2\mu}{A+p}} = \frac{V_d \cos\gamma}{p}$$

When the injection velocity equals $\sqrt{2\mu/p}$ the apogee distance A becomes infinite & the orbit takes the shape of parabola & e=1 This is second cosmic velocity v_d.

If the injection velocity increased further the sat succeed in escaping the solar system. This is known as Third cosmic velocity

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