KING FAHD UNIVERSITY OF PETROLEUM & MINERALS
DEPARTMENT OF ELECTRICAL ENGINEERING

EE 672 SATELLITE COMMUNICATIONS
EXAMINATION I

26 March, 2007

NAME :	
I.D. # :	

PROBLEM #	Q. 1	Q.2	Q.3	TOTAL
Marks				
Maximum	36	34	30	100

Q.1 Answer the following questions. (a question may have more than one answer).

1) The ground segment of a satellite communication system of the FSS type consists of:
   a. Earth stations   b. TT&C Ground station
   c. Receiving antennas   d. Regional networks   e. Land mobile

2) The advantages of using low earth orbits (LEO'S) for satellite communications are:
   a. Global coverage area for the LEO satellite.
   b. Better utilization of frequency spectrum through frequency re-use.
   c. Reduction of transmission delay
   d. Availability of direct broadcasting for home reception.

3) The satellite speed at apogee, in an elliptical orbit, compared to its speed at perigee is:
   a. Faster   b. The same   c. Slower.

4) The x axis in the perifocal coordinate system is along:
   a. The vernal equinox.   b. The direction of perigee
   c. The direction from the geo-centre towards the intersection of the equator with longitude 0^{O}.
   d. The direction of apogee.

5) A satellite is located from a fixed point on earth, using:
   a. Geocentric equatorial coordinate system   b. The perifocal coordinate system
   c. Celestial horizon coordinate system.

6) An earth station is located in Saudi Arabia, which is in the northern hemisphere, at a longitude of 45^{o} east. In which part of the sky would you locate a satellite with a sub-satellite point longitude of 7^{o} west.
   a. North   b. North- East   c. East   d. South- East
   e. South   f. South- West   g. West   h. North- West

Q.2 Some orbital measurements for a hypothetical satellite are:

Semi-major axis = 15000 km
Eccentricity = 0.12
Mean anomaly = 35^{o}

Determine:

a. The orbital period in hours, minutes, and seconds.
b. The mean orbital angular velocity in radians per second.
c. The maximum and minimum distances of the satellite from the centre of the earth during each orbital revolution.
d. The time (expressed as a date, hour, minute, and second) of the next perigee passage after 00:00:00 UT on March 26, 1999.

($\mu = 3.9861352 \times 10^5\ km^3/s^2$, earth radius = 6370 *km*) (Hint: *Kepler's third law,* $a^3 = \dfrac{\mu}{\omega^2}$)

Q.3 Calculate the look angles for an earth station at Dhahran, Saudi Arabia to establish communications with NILESAT 102 at 7.0^{o} West. Dhahran location is 26.18^{o} North and 50.08^{o} East. Determine also the range of satellite positions that are visible from Dhahran.