University Of Technology
Building and Construction Eng.Dept.
Final Exam 2015/2016

Subject : Field Astronomy | **Class: Three**
Branch : Geomatic | **Time : 3 Hours**
Examiner : Dr. Oday Z.Jasim | **Date : 11 / 6 / 2016**

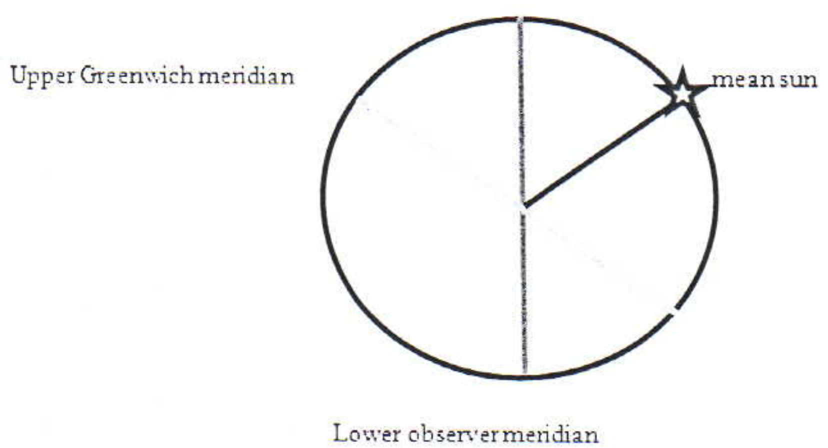
Note: Answer Four questions only

Q1) Write the equations of determining the azimuth for the both cases of determining the azimuth of the true meridian by observation on star at equal altitudes .Draw the figures for the both cases.

(25 marks)

Q2) In the following figure:

a. Define (Local mean time , Greenwich hour angle, Local hour angle)
b. Complete (where are) all the elements in this figure (G.M.T, L.M.T, λ E, G.H.A, L.H.A).
c. Write the equation of the L.M.T with respect of (G.M.T, λ E).
d. What is the G.H.A. at midnight and noon.
e. Write the equation of the G.M.T with respect of (G.H.A).
f. If the hour angle of the mean sun is 195°, what will be the mean time?



(25 marks)

Q3) Answer the following:

a. Define the equation of time.
b. Why the amount of the equation of time variation all the year, due to?
c. Explain with equations and drawing figure, the equation of time due to obliquity of the ecliptic for the year.
d. Show how to get the equation of time due to right ascension of mean sun ,true sun for the period (21/3 till 21/6).
e. When the equation of time will be vanishing?

(25 marks)

Q4A): Fill the blank with the suitable Phrase or word or numbers:

a. The angle of the sun beam at Equator in Autumn equinox is …….., while in Winter solstice is nearly …….

b. The length of daylight at summer solstice in Tropic of Capricorn is ……… hour and ….. minutes.

c. Zone 1 in UTM lies from ……….. to …….. and Zone 60 lies between …… and ………

d. At sun set ,if the declination is south of equator , the magnitude of Azimuth will be …………….., and Hour angle will be …………

Q4B): Show by equations and figure ,how the altitude of the pole is always equal to the latitude of the observer

(25 marks)

Q5A): Calculate the azimuth of a star of declination 73°17' at eastern elongation in a place of latitude of 44° 55' N

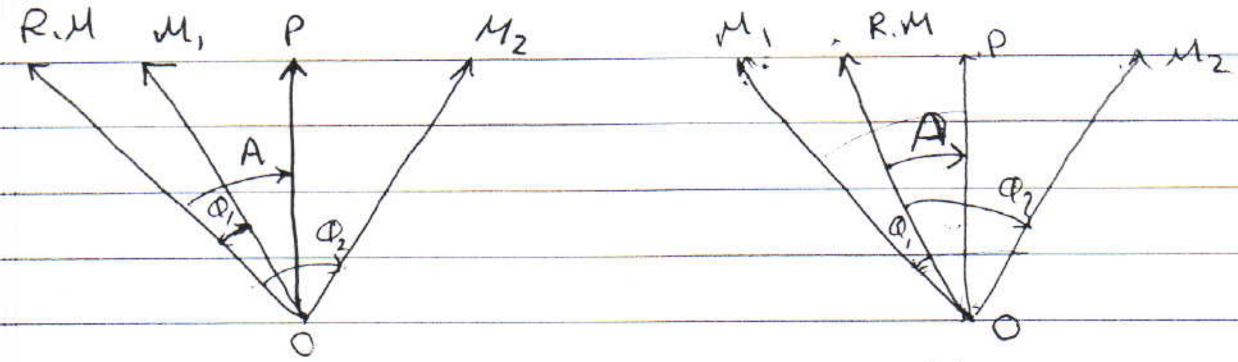
Q5B): What is the hour angle of the Sun at Local Sidereal Time 9^h and the Sun at 21 of September

(25 marks)

Good Luck

حل اسئلة مادة الفلك العملي لطلبة فرع الجيوماتكس
المرحلة الثالثة الدور الاول ٢٠١٥ - ٢٠١٦

Q1



(a) (b)

Case I: Both positions of the stars to the same side in fig (a)

$\Phi_1 = \measuredangle ROM_1$

$\Phi_2 = \measuredangle ROM_2$

$A = \text{Azimuth} = \measuredangle ROP$ where P is the pole

$$\therefore A = \Phi_1 + \frac{\Phi_2 - \Phi_1}{2} \Rightarrow A = \frac{\Phi_1 + \Phi_2}{2}$$

in case I ⇒ the azimuth of the line is equal to half the sum of the two observed angles

Case II

Both position of the stars are on opposite sides of the line in fig (b)

$$A = \left(\frac{\Phi_1 + \Phi_2}{2}\right) - \Phi_1$$

$$\therefore A = \frac{\Phi_2 - \Phi_1}{2}$$ hence the azimuth of line is equal to half the difference of

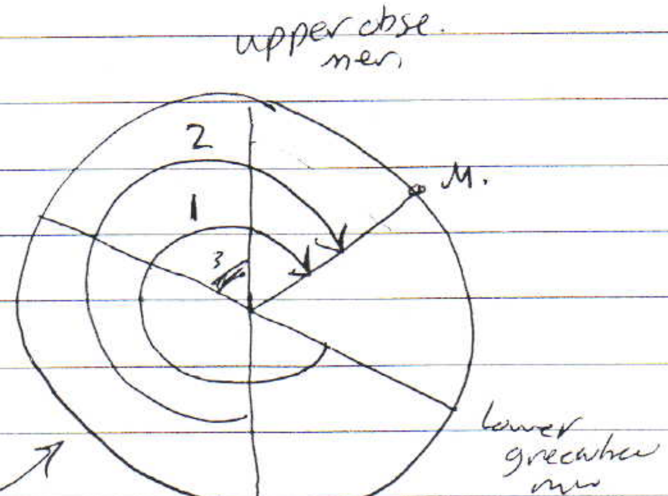
Q2 a.

Local mean time: L.M.T is reckoned from lower observation meridian (midnight) to the mean sun

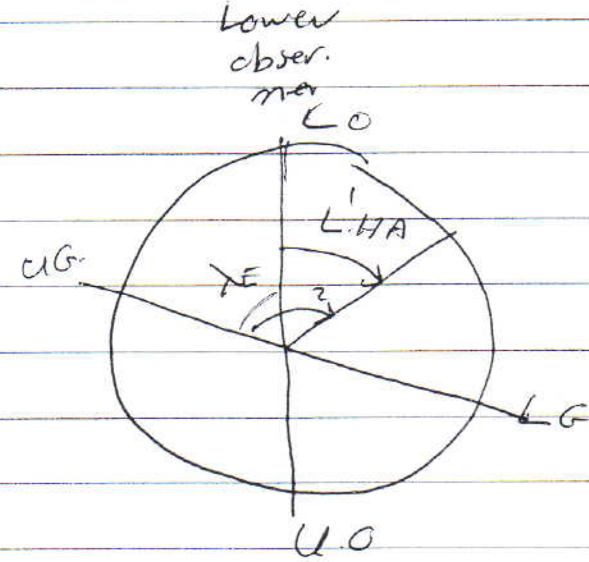
Greenwich hour angle G.H.A is measured clockwise from upper greenwich to the meridian of celestial body

Local hour angle L.H.A is measured from clockwise upper upper observation meridian to the meridian of body

b.



1 = G.M.T
2 = L.M.T
3 = λ_E

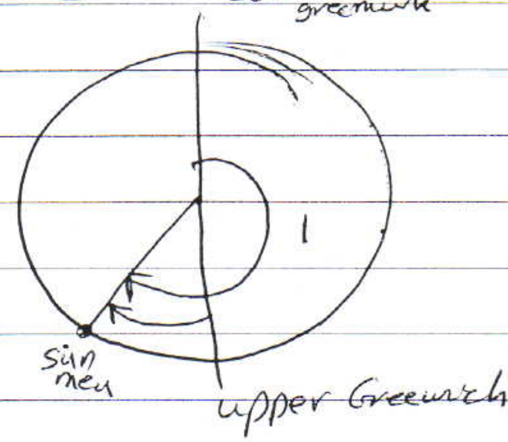


1 = L.H.A
2 = GHA

Q2 c. $L.M.T + \lambda_E = G.M.T$

d.

G.H.A at midnight $= 12^h$
G.H.A at noon $= 0^h$



e

1 = G.M.T
2. G.H.A
∴ $GMT = GHA + 12^h$

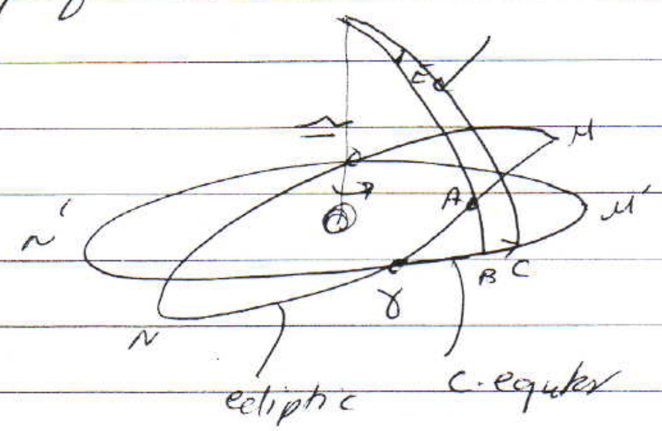
f $mt = h.H._{sun} + 12^h$

$= (195^\circ)\ 13^h + 12^h$
$= 25^h$
= 1 o clock mean time after midnight (next day)

Q3 a// The difference betwee the mean time sun and the apparent solar time at any instat is Eqution of Time

b// The amount of equation of time variation due to
1- obliquty of the ecliptic
2. elliptcity of the orbit

c//



A = true sun
C = mean sun

$$E = MT - TT$$

d// $Eq.T = R_{ms} - R_{Ts}$

$Eq.T = \gamma_c - \gamma_B$

e// Eq.T vanishes at equinoxes ♎, γ
" " solstices
mid of April and June
Beginning of september and end of December

(4) A

a. 90° , 66.5°

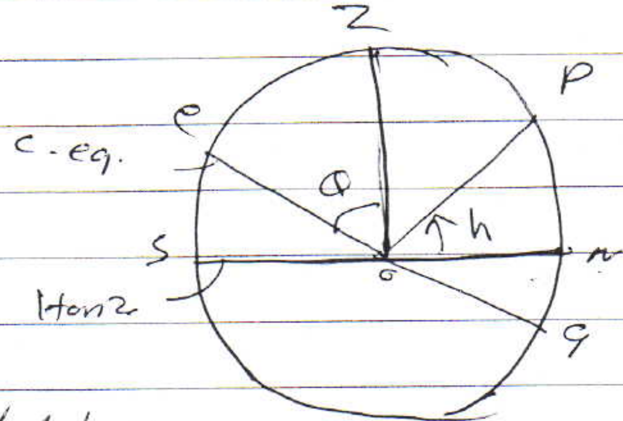
b. $10^h\ 33^m$,

c. 180W to 174W , 174E, 180 E/W

d. A = $90 \leq A \leq 180$

H = $0 < H \leq 90$

B

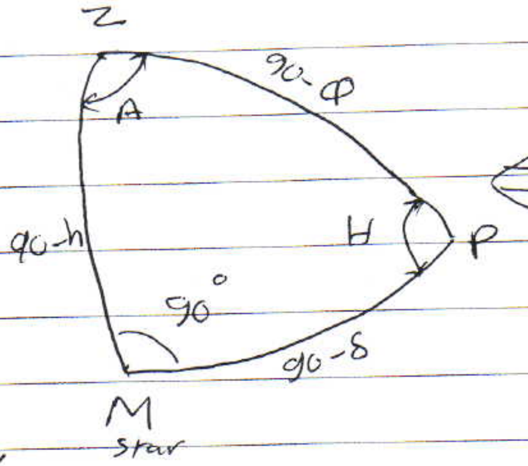


eq = c. equator
SN = horizon
O = center of earth
ZO
∢ EOZ = Φ latitude of observer
PON = h = altitude of pole
EOP = 90 = ZOP + ZOE
90 = Φ + ZOP ——(1)

NOZ = 90 = NOP + ZOP
90 = h + ZOP ——(2)
∴ Φ + ~~ZOP~~ = h + ~~ZOP~~
∴ Φ = h

Q5

A)



المثلث الفلكي

$\phi = 44^\circ 55' N$

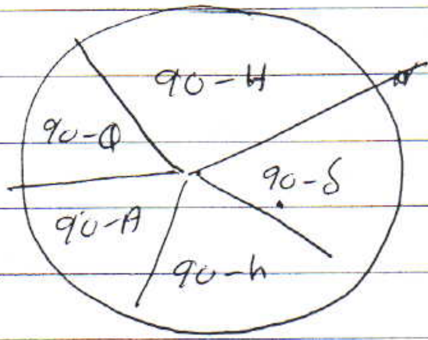
$\therefore 90 - \phi = 45.083^\circ$

$\delta = 73^\circ 17'$

$\therefore 90 - \delta = 16.716^\circ$

لانه هناك مثلث قائم الزاوية

∴ ينطبق عليه مثلث نابير



$\sin(90-\delta) = \cos\delta$ الملاصقات

$= \sin A$

$\cos\delta = \cos(90-A)\cos(90-\phi)$

$\cos\delta = \sin A \sin\phi$

$\sin A = \dfrac{\cos\delta}{\sin\phi} \Rightarrow A = 24.040^\circ$

1·Q5

B

∴ $L.S.T = 9^h$

at 21/6

Right ascension $= 6^h$

$L.S.T = H + R_a$

$9 = H + 6$

$\therefore H = 9 - 6$

$= 3^h$

∴ hourangle of the sun $= 3^h$