UNIVERSITY OF RUHUNA

Faculty of Engineering

End-Semester 5 Examination in Engineering: August 2015

Module Number: CE5255 **Module Name: Remote Sensing and GIS**

[Three Hours]

[Answer all questions. Each question carries **TWELVE** marks]
All Standard Notations denote their regular meanings

Q1. Seven Grama Niladari (GN) divisions situated along the Badulla and Monaragala districts have been selected for a multi faced development project. For the planning stage of this project data is needed on many aspects from land-use, mineral deposits, etc. Unfortunately, there are no data available with GNs or local governments. In this backdrop, as the first step in data gathering, vertical aerial photos are to be used.

a) Vertical aerial photos are needed at a scale of 1:10,000 or larger if the vertical aerial photos are to be taken from a camera having a focal length of 100 mm mounted on aeroplane. Assuming that the average ground elevation of the terrain as 140 m AMSL determine the flying height of the aero plane above the average ground elevation.

[2.0 Marks]

b) On a vertical photo taken [as described in Q1. (a)], an image of a tall tree appears. Top of the tree is located 98 mm from the plumb point while bottom of the tree is located 94 mm from the plumb point. Determine the height of the tree.

[2.0 Marks]

c) In the same aerial photo session the plane had to alter the flying height due to unavoidable situation. However the flying height was not recorded. In such a vertical photograph, images "a" and "b" of ground points "A" and "B" have photographic coordinates as given in Table Q1-1. The horizontal distance between A and B is later measured to be as 3250 m, and the elevations of A and B above datum are 145 m and 160 m, respectively. Determine the flying height above the datum.

[4.0 Marks]

d) If the positive side of the x axis has WCB of 97 degrees, determine the whole circle bearing of the line AB

[4.0 Marks]

Q2. During ground survey of an area, it was found that soil was magnetic and compasses are useless. The survey team decided to use Sun observations to determine the bearing of the starting line of a traverse. Latitude of the place is 7° 29 ' 19" N and other observations are tabulated in Table Q2-1. Declination of the Sun is 12° 25' 6" N at 12h UT and decreasing at 59" per hour. Determine the following:

a) Mean observed altitude of the Sun

[1.0 Marks]

b) Refraction and parallax corrections for this observation.

[2.0 Marks]

c) Corrected altitude of the Sun.

[1.0 Marks]

d) Mean UT of observation.

[1.0 Marks]

e) Declination of the Sun.

[1.0 Marks]

f) Bearing of the Sun.

[4.0 Marks]

g) Mean horizontal angle between RO and the Sun.

[1.0 Marks]

h) Whole circle bearing of RO.

[1.0 Marks]

Q3. Two stations A and B have latitudes of 52 °20' 10" N and 52 °24' 20" N respectively and longitudes of 02° 14' 10" W and 02° 23' 40" W respectively. Using the data given in Table Q3-1 determine the following.

a) Mean latitude.

[2.0 Marks]

b) Length of 1" of longitude and length of 1" of latitude at the mean latitude.

[2.0 Marks]

c) Correction due to the convergence of the meridians.

[4.0 Marks]

d) Distance between stations A and B.

[4.0 Marks]

Q4. a) Compare and contrast the geoid and the ellipsoid.

[2.0 Marks]

b) The Clarke, 1866 ellipsoid has Semi-axis "a" and Semi-axis "b" 6,378,206.4 m and 6,356,583.8 m, respectively. Determine the flatness of the ellipsoid.

[3.0 Marks]

c) For the Clarke, 1866 ellipsoid, determine the first eccentricity, e, and the second eccentricity e'.

[2.0 Marks]

d) Briefly describe the three segments of Global Navigations Satellite Systems (eg. GPS)

[3.0 Marks]

e) Briefly explain the GNSS Static Survey Method

[2.0 Marks]

Q5. a) With the aid of sketches, show all relevant parts of an active remote sensing system.

[4.0 Marks]

b) State the Stefan-Boltzmann law and define all terms.

[2.0 Marks]

c) Define the following terms with respect to remote sensing

i. Rayleigh scattering
ii. Mie scattering
iii. Non-selective scattering
iv. Atmospheric windows

[4.0 Marks]

d) One of the main problems faced by the local government is that there are no details of types of crops grown, their health and their extent for the tax purposes. Explain how remote sensing can be applied to solve this problem.

[2.0 Marks]

Equations, Figures and Tables

Table Q1-1

Point	x mm	y mm
a	35	68
b	-40	75

Table Q2-1

Object	Face	Horizontal Circle	Altitude	UT
RO	R	60° 00' 00"		
Sun ☌	R	191° 38' 00"	22°56'30"	15 hr 12 min
Sun ☾	L	12° 39' 30"	22°13 '00"	15 hr 14 min
RO	L	240° 00' 00"		

Table Q3-1

Latitude	Length of 1" of longitude	Length of 1" of latitude
52°20'	18.9364 m	30.9022 m
52°25'	18.9008 m	30.9107 m