

# มหาวิทยาลัยสงขลานครินทร์

## คณะวิศวกรรมศาสตร์

การสอบปลายภาค ประจำภาคการศึกษาที่ 1

สอบวันที่ 10 ตุลาคม 2548

วิชา 220-361,221-361 ตำราจ 2

ปีการศึกษา 2548

เวลา 09:00 – 12:00 น.

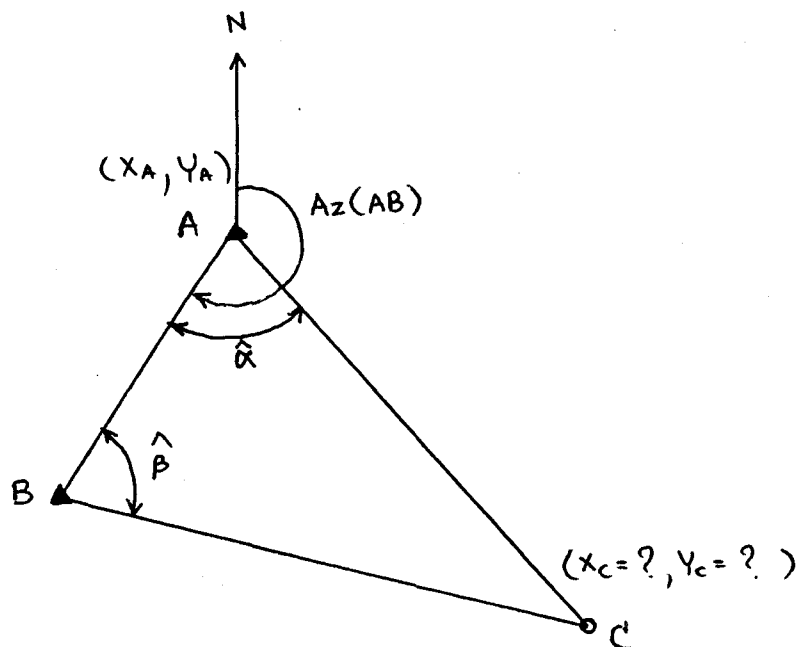
ห้องสอบ A201

### คำสั่ง

- 1) ข้อสอบมีทั้งหมด 5 ข้อ คะแนนรวม 100 คะแนน
- 2) ให้ทำข้อสอบทุกข้อ
- 3) ห้ามนำ ตำรา เล็กเซอร์โน้ต และเอกสารใดๆ เข้าห้องสอบ มิฉะนั้นจะถือว่า “ทุจริตในการสอบ” และจะถูกปรับให้ได้ “E” ทุกกรณี
- 4) อนุญาตให้ใช้ดินสอทำข้อสอบได้ (ควรใช้ชนิด B)
- 5) อนุญาตให้ใช้เครื่องคิดเลขคำนวณได้ทุกชนิด
- 6) อนุญาตให้นักศึกษานำเอาพจนานุกรม เข้าห้องสอบได้

ผู้ออกข้อสอบ นาย รุจ ศุภวิไล

- 1) A 200-m equal tangent parabolic vertical curve is to be placed between the incoming grades of  $g_1 = 1.25\%$ , and  $g_2 = -2.75\%$  intersecting at station  $18 + 000$ , which has an elevation of 270.190 m above mean sea level (MSL) respectively. Please calculate elevations at even 20-m stations on the vertical curve and also determine the station and elevation of the highest point on the vertical curve. (20 points)
- 2) On August 1<sup>st</sup>, the observed altitude of the sun at a given place was  $30^\circ 51' 45''$  at  $7^h 42^m 20^s$  local time. The latitude of the place is  $37^\circ 18' 20''$  N. During the observation, the temperature and the barometric pressure were  $T = 75^\circ$  F and  $P = 29.3''$  Hg respectively. The horizontal angle, measured clockwise from the reference line AB to the sun is  $89^\circ 39' 15''$ . Determine the azimuth of the sun at the time of the observation and what is the azimuth of the line AB? (30 points)  
Hint: GMT = Local Time + 7 h.
- 3) Station C is located by intersection from two control stations A and B. The coordinates of the A are  $X_A = 1,421,231.304$  m and  $Y_A = 521,304.009$  m respectively. The distance AB was measured by using an EDM device and  $AB = 897.859$  m. The azimuth AB is known to be  $235^\circ 20' 32''$ . The measured horizontal angles are  $\hat{\alpha} = \hat{BAC} = 80^\circ 27' 35.8''$  and  $\hat{\beta} = \hat{ABC} = 54^\circ 14' 37.8''$  respectively. What is the unknown coordinates  $X_C$  and  $Y_C$ ? (20 points)



- 4) Name and describe the horizontal curves that are very common in route survey. How many types of the circular arcs that are common in highway design? Also discuss the advantages and disadvantages for each types of the circular arcs. ( 15 points)
- 5) Name the person who perform the 1<sup>st</sup> scientific measurement of the earth circumference. Specify the place, the date and the time of this expedition. Also explain the method used and discuss the quality of the outcome of this historical measurement. ( 15 points)
-



**TABLE 2a**

To correct Table 2. See Examples below.  
**MULTIPLIERS FOR OBSERVED BAROMETRIC PRESSURE OR ELEVATION**

Bar. (Inches)	Elev. (Feet)	Multi-plier	Bar. (Inches)	Elev. (Feet)	Multi-plier
30.5	- 451	1.03	23.9	+ 6194	0.81
30.2	- 181	1.02	23.6	+ 6538	0.80
30.0	00	1.01	23.3	+ 6887	0.79
			23.0	+ 7239	0.78
29.9	+ 91	1.01	22.7	+ 7597	0.77
29.6	366	1.00	22.4	+ 7950	0.76
29.3	643	0.99	22.1	+ 8327	0.75
29.0	924	0.98			
28.7	1207	0.97	21.8	+ 8700	0.74
28.4	1493	0.96	21.5	+ 9077	0.73
28.1	1783	0.95	21.2	+ 9460	0.72
27.8	2075	0.94	20.9	+ 9848	0.71
27.5	2371	0.93	20.6	+ 10242	0.70
27.2	2670	0.92	20.3	+ 10642	0.69
			20.0	+ 11047	0.68
26.9	2972	0.91			
26.6	3277	0.90	19.7	+ 11458	0.67
26.3	3586	0.89	19.4	+ 11875	0.66
26.0	3899	0.88	19.1	+ 12299	0.65
25.7	4215	0.87	18.8	+ 12729	0.64
25.4	4535	0.86	18.5	+ 13165	0.63
25.1	4859	0.85	18.2	+ 13608	0.62
24.8	5186	0.84			
24.5	5515	0.83	17.9	+ 14058	0.61
24.2	5854	0.82			

**MULTIPLIERS FOR TEMPERATURE**

Temp. Deg. F	Multi-plier	Temp. Deg. F	Multi-plier	Temp. Deg. F	Multi-plier
- 20	1.16	+ 30	1.04	+ 80	0.94
- 10	1.13	+ 40	1.02	+ 90	0.92
0	1.11	+ 50	1.00	+ 100	0.91
+ 10	1.08	+ 60	0.98	+ 110	0.90
+ 20	1.06	+ 70	0.96	+ 120	0.88

Example. Sun: Meas. Alt. = 30°; Bar. = 26 in. or Elev. 3900 ft.; Temp. 70° F.  
 Refraction = 1.66' (0.88) (0.96) = 1.40'. Parallax = 0.13'.  
 True Alt. = 30° 00.00' - 1.40' + 0.13' = 29° 58.73'.

Example. Star: Meas. Alt. = 25°; Bar. = 24.5 or Elev. 5518 ft.; Temp. 10° F.  
 Refraction = 2.05' (0.83) (1.08) = 1.84'.  
 True Alt. = 25° 00.00' - 1.84' = 24° 58.16'.

**TABLE 3**

**POLAR DISTANCE OF POLARIS 1984**  
 For 0<sup>h</sup> Universal Time or Greenwich Civil Time

Polar Distance			Polar Distance		
1984	Angle	Cotan	1984	Angle	Cotan
Jan. 1	0 48.24	71.26	July 9	0 48.71	70.57
11	0 48.21	71.30	19	0 48.70	70.59
21	0 48.19	71.33	29	0 48.69	70.60
31	0 48.19	71.33			
Feb. 10	0 48.19	71.33	Aug. 8	0 48.67	70.63
20	0 48.20	71.32	18	0 48.64	70.67
			28	0 48.61	70.72
Mar. 1	0 48.23	71.27	Sep. 7	0 48.56	70.78
11	0 48.26	71.23	17	0 48.52	70.83
21	0 48.30	71.17	27	0 48.46	70.94
31	0 48.35	71.10			
Apr. 10	0 48.40	71.02	Oct. 7	0 48.40	71.02
20	0 48.45	70.95	17	0 48.34	71.11
30	0 48.50	70.88	27	0 48.28	71.20
May 10	0 48.54	70.82	Nov. 6	0 48.21	71.30
20	0 48.59	70.75	16	0 48.15	71.39
30	0 48.63	70.69	26	0 48.09	71.48
June 9	0 48.66	70.64	Dec. 6	0 48.04	71.56
19	0 48.68	70.61	16	0 47.98	71.64
29	0 48.70	70.59	26	0 47.94	71.70

Declination = 90° - Polar Distance

**TABLE 4**

**THE SUN'S SEMI-DIAMETER 1984**  
 For 0<sup>h</sup> Universal Time or Greenwich Civil Time

Date	Semi-Diam.	Date	Semi-Diam.	Date	Semi-Diam.
1984		1984		1984	
Jan. 1	16.29	May 10	15.86	Sep. 7	15.90
11	16.29	20	15.83	14	15.93
21	16.28	30	15.80	27	15.98
31	16.26				
Feb. 10	16.24	June 9	15.78	Oct. 7	16.03
20	16.20	19	15.76	17	16.08
		29	15.76	27	16.12
Mar. 1	16.17	July 9	15.76	Nov. 6	16.16
11	16.12	19	15.76	16	16.20
21	16.08	29	15.78	26	16.23
31	16.03				
Apr. 10	15.99	Aug. 8	15.80	Dec. 6	16.26
20	15.94	18	15.83	16	16.28
30	15.90	28	15.86	26	16.29