Kafr El-Sheikh University Faculty Of Engineering Civil Engineering Dep. Year: 4th Civil Academic Number:	HIGH ENGINEERING	Date:3/1/2017 Time Allowed: (3) Hours Full Mark: (100)% Final Exam: 2 Pages 2016/2017

Answer as much as you can .... Any missing data can be assumed.

QUESTION [1] **[15] %**

A. Discuss the two problems on the horizontal alignment?

B. Two tangents intersect at station (10+00) with a deflection angle 60°.It is required to connect them with (spiral-curve-spiral) alignment. If the design speed is 90kph and the rate of super elevation is 8%.Draw the cross section of the highway at a distance of 50m from the beginning of the horizontal alignment station in the case of revolving the pavement around centerline.
Note:-The highway is 2-lane of width 8.0m & normal cross slope is 2%.
- Draw the profile of highway during revolving around C.L. to a suitable scale showing all dimensions on the drawing.

QUESTION [2] **[15] %**

A. Define:- critical length of grade – climbing.

B. A sag curve is to be used under an over-pass to provide the required clearance. The vertical curve is 235m long and connects -4.5% and +6.3% grades. Calculate the elevation of the lowest point on the curve if the station & elevation of the V.I.P are 250+75 and 426.83m respectively. Determine also the maximum safe speed on this curve knowing that the road is lighted.

QUESTION [3] **[15] %**

A. what is meant by the following:-
Right of way – Side walk – traveled lane – median- mountable curbs.

B. What is the difference between normal cross section and fully super elevated section? When we use each one.

C. Draw a typical cross section in Urban & Rural areas?

QUESTION [4] **[15] %**

A-What are the difference between an interchange and grade separation?

B- Two roads(roadA: 14m width & V_A = 100kph, road B: 7m width & V_B=80kph) intersect at 90^0 (deflection angle) , if the design vehicle is (SUT) and the turning speed V_{AB}=15 kph , V_{BA}=10 kph. It is required to design this intersection as :-

a-plain b- flared c- fully channelized

QUESTION [5] **[15] %**

A. Why:
1) Soil classification and compaction are made?
2) One layer theory not gives real values for stress and deflection?
3) Chlorides are used in soil stabilization?

B. Classify the following soils according to AASHTO classification.

Soil number	Sieve analysis					Atterberg limits	
	3/8"	NO.4	NO.10	NO.40	NO.200	LL	PL
Soil 1	100	99	.95	82	58	48	36
Soil 2	100	88	80	62	10	NP	NP

C. The following data taken during a C.B.R test on subgrade soil :

Load (lbs)	30	120	243	390	450	480
Penetration (in)	0.05	0.1	0.2	0.3	0.4	0.5

It is required to determine the C.B.R for the subgrade soil and surcharge weight required for a C.B.R test if the estimated pavement thickness will be 20 inches. The pavement will have a unit weight of 137 pcf.

QUESTION [6] **[25] %**

A. With neat sketches answer the following

1) Which one has a bad impact on the pavement wheels of hand driver or rubber tires of P.C? Why?
2) What the meaning of edge loading? Give two solutions to face the failure caused by edge loading?
3) Mention factors affecting the pavement thickness.
4) Differentiate between flexible pavement and rigid pavement.

B. Determine the equivalent single wheel load for a dual-tandem gear carrying 150000 lbs. with contact pressure 120 psi, and spaced 20*40 inches if the pavement thickness 15 inch as shown in fig(2).

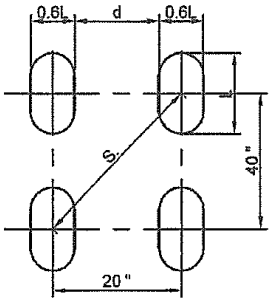

Fig.(2)

C. Which one of the following two sections is more safe under the same loading conditions?. Thenby using one layer theory and conversion theory compute the vertical stress and deflectionat bottom surface of the pavement in section(B) for a wheel load 30000 lbs and tire pressure 150 psi for point A and point B as shown in fig(3).

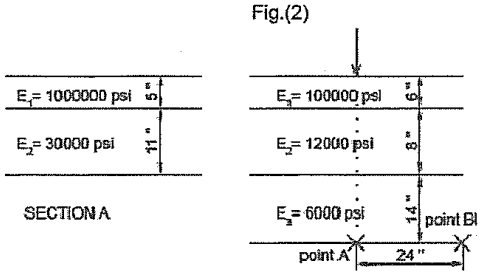

Fig.(3)

D – The traffic on the design lane of a proposed 4 – lane rural interstate highway consists of 40 percent trucks. If the classification studies have shown that the truck factor can be taken as o.45 , design a suitable flexible pavement using the AASHTO procedure if : -

- The AADT on the design lane during first year of operation is 1000
- Pi = 4.2
- Growth rate = 4 %
- Design life = 20 year
- Reliability level = 95%
- Standard deviation=0.45

The pavement structure will be exposed to moisture levels approaching saturation 20 percent of the time, and it will take about 1 week for drainage of water. The CBR value of the sub-grade material is 7%and the CBR of the base and sub-base layers are 70% & 22% respectively. The resilient moduli (Mr) of the asphalt 450000 Ib/in^2

Best Wishes,,, **Dr. Amal Al-Yaat**

b) The perpendicular offsets taken at 10 m intervals from a survey line to an irregular boundary are 2.25, 3.85, 4.50, 6.80, 5.20, 7.35, 8.90 and 5.45 meters. Determine the area enclosed between the survey line, the irregular boundary, the first and last offsets by: Average-ordinates rule, Trapezoidal rule and Simpson's rule.

Question (3) (30%)

a) The following coordinates were calculated in closed traverse

Stations	X-coordinates	Y-coordinates
A	7200.054	7640.842
B	7204.601	8103.036
C	7369.177	8001.383
D	7356.207	7759.292

Compute the area of traverse by two methods.

b) The accompanying longitudinal and cross sections show that the ground level at 2 m interval, is as follows:

distance	0	2	4	6	8	10	12	14
elevation	15	14.59	14.33	13.25	11.96	13.10	13.10	13.10

If the formation level for first point = 14.00 m and gradient of formation line is 1:16 failing, and that the section side slope at 1 unit vertically to 2 units horizontally and 8.0 m wide:

1) Calculate the depth of cut and height of fill for every point?
2) Calculate the volume of cut and fill?

Good Luck

D. Magda Farhan