



Course Title: Material Specification for Roads and Airports

Course Code: CPW619

Date: June 2016

Allowed Time: 3 hrs

No of Pages: (3)

Remarks: (Answer all the following questions, assume any missing data), (Answers should be supported by sketches)

Questions No. 1 (25%):

a) True or False (10%):

1. Aggregate hardness is determined by Los Angeles Abrasion Test ()
2. California bearing Ratio is performed on asphalt mixtures to determine their strength characteristics ()
3. Rutting of asphalt could be controlled by decreasing complex shear modulus and/or decreasing phase angle of asphalt binder ()
4. Changing the ratio between applied vertical pressure and the transmitted horizontal pressure would affect the resistance value of subgrade ()
5. The increase of moisture content increases resilient modulus values ()
6. The resins is the asphalt component which is responsible for asphalt aging ()
7. The direct tension tester is an indicator of low temperature cracking performance properties ()
8. Stress hardening occurs in fine-grained materials ()
9. The rate of change in material properties due to change in temperature is the same for all asphalt samples penetration 50-60 ()
10. The increase of maximum dry density of materials increases resilient modulus values ()

b) Answer the Following Questions (15 %):

1. (5 %) write short notes about "*Classification of Asphalt Cement*".
2. (4 %) Mention subgrade material characterization tests and relate the test results values to each other (if applicable)?
3. (6 %) What are the three major types of asphalt materials? State how each type achieve viscosity for use in pavement construction? Differentiate between advantages and disadvantages of each type.

Question No.2 (25 %):

a) (10%) Differentiate between the following and explain briefly how to obtain these and what are they used for:

1. Softening point and flash point.
2. Cutback and emulsions.
3. Absolute viscosity and Kinematic viscosity.
4. RTFO and DSR.

b) (12%) The following table shows the grain size distribution of two aggregates A and B and the specification limits:

Sieve Size (mm)	19	12.5	9.5	4.75	2.36	0.6	0.3	0.15	0.075
Specification Limits	100	80-100	70-90	50-70	35-50	18-29	13-23	8-16	4-10
Aggregate A	100	82	52	23	7	3	0	0	0
Aggregate B	100	100	100	92	65	48	37	19	11
Aggregate C	100	97	95	76	55	31	18	11	5

Determine the following:

1. Maximum and NMAS for each of the aggregate gradations specified
2. The blend proportion and gradation required to meet specification Requirements.

c) (3%) For Cairo region in Egypt, if the recorded maximum pavement temperature in 7 consecutive days during the last 20 years were 63, 53, 52, 60, 61, 56 and 59°C while the minimum air temperature was 3 degrees, which binder grade would you recommend:

PG 58-10

PG 64-10

PG 70-10

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Questions No.3 (25%):

a) (3%) Which asphalt is more fluid MC 250 or MC and why?

b) (12%) Explain in details how you would perform the CBR test, draw sketches to clarify your answer. And if the following data is taken during a CBR test. Determine the CBR for this soil.

Load (lb)	0	60	145	240	310	420	490	520
Penetration (in)	0	0.05	0.1	0.15	0.2	0.3	0.4	0.5

c) (10%) Samples of coarse aggregate from a stockpile are brought to the laboratory for determination of specific gravities. The following weights are found:

Mass of moist aggregate sample as brought to the laboratory: 6423 gm. Mass of oven dried aggregate: 6512 gm, Mass of aggregates submerged in water: 4000 gm Mass of SSD aggregate: 6483 gm, Find:

1. aggregate bulk specific gravity
2. apparent specific gravity
3. SSD specific gravity
4. absorption,
5. moisture content of the stockpile aggregate

Questions No.4 (25%):

a) (10%) Use only plots to show the following:

1. Gap graded soil and open graded soil (on one plot and label all axes).
2. Effect of moisture on resilient modulus of materials (label all axes).

3. The six plots for HMA design using Marshall Method (label all axes).

b) (5%) If the VMA of an asphalt mix is 18.5% and V_a is 5%, G_b is 1.05% and G_{mb} is 2.273, Calculate the following:

1. Asphalt content by weight
2. Asphalt content by volume
3. VFA

c) (5%) Define the following (be specific):

1. Deviator Stress
2. Recoverable Strain
3. Pen 60-70
4. AC-2.5
5. Confining pressure

d) (5%) Aggregates from three sources having bulk specific gravities of 2.693, 2.759, and 2.46 were blended at a ratio of 70:20:10 by weight, respectively. What is the bulk specific gravity of the aggregate blend?

مع خالص تمنياتي بالنجاح والتوفيق..... د. رجاء عبد الحكيم ولجنة الممتحنين