

**Question 4**

**(25 marks)**

1. Explain the following Superpave tests of asphalt sample clearing the purpose of each test, sample preparation, and test performing:
  - a. Rolling Thin Film Oven (RTFO)
  - b. Dynamic Shear Rheometer (DSR)
  - c. Binding Beam Rheometer (BBR)
2. Talk about the self-healing asphalt? illustrating the methods of self-healing?
3. What are self-healing materials and its types?
4. The grain size analysis of an aggregate is as the following :

Sieve NO.	4	10	40	60	100	200
% passing	60	56	30	19	13	10

If the previous aggregate used in a surface mixture, determine the approximate value for bitumen content in the mixture?

5. A specimen of asphalt its weight in air and water were 1205 and 691 gm respectively the proportion of the mix as follow:

Material	Specific gravity	% by weight
Asphalt cement	1.03	4
Lime stone aggregate	2.77	20
Sand	2.86	80
Filler	2.92	6

Calculate:

- a) The bulk density of the specimen.
- b) The present of air voids in the specimen.
- c) The present of voids in compacted mineral aggregate.
- d) The present of voids in the aggregate that filled with asphalt.
- e) The theoretical density of the mix.
- f) Find the relative density of a compacted pavement constructed from the above mix if the core taken from the pavement weight 3470 gm in air and 2005 gm in water.

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*With my best wishes*  
*Dr. Ahmed Abu El-Maaty*

This exam measures the following ILOs (Intended Learning Outcomes)

Question No.	ILOs
1	A-1, A-2, B-3, C-2, D-7
2	A-3, B-4, B-5, C-1, C-2, D-3, D-6
3	B-4, B-5, A-4, D-4, C-1
4	A-2, C-3, B-4, D-5, C-2



**Question 1**

**(25 marks)**

1. What are the generally characteristics of bituminous?
2. Explain in details the different types of asphalt? illustrating the different sources of it?
3. What is tar and what is pitch? clarifying which one is more purity?
4. What is the meaning of the following:- (AC 60/70 , SC-200 , RT 4 , MC-70)
5. What are the advantages and disadvantages of traditional methods of mix design (Marshall & Hveem)?
6. Discuss the following tests:
  - a. ductility test
  - b. flash point test
  - c. solubility test
  - d. volatility test
7. Discuss with sketch
  - a. penetration test
  - b. ductility test
  - c. float test
  - d. softening point test

**Question 2**

**(25 marks)**

1. What are the factors affecting the design using Superpave system? illustrating the main three stages of this design?
2. What are the distresses healed after the application of Superpave system?
3. Draw a flow chart showing the family of modifiers & additives?
4. What are the purpose of using the following materials in asphalt mixtures:  
Fillers – Fibers – Oxidant – Antioxidant
5. What are the two mechanisms used to add additives to the mix?
6. Talk about using plastics in the asphalt mixtures?
7. Discuss the using of rubber as additive in asphalt mixtures?
8. Talk about the foamed asphalt?

**Question 3**

**(25 marks)**

1. Discuss the importance of creep test? illustrating its types?
2. What is rutting? discussing it's dangers on pavement structure?
3. What are the factors affecting rutting of asphalt mixtures? illustrating the different devices used in rutting tests?
4. Talk about the fatigue development in pavement? illustrating the factors affecting pavement's ability to withstand?
5. Discuss in details the flexural fatigue test?
6. Illustrates the primary performance-based tests and the temperatures at which they are used?
7. Compare between short-term aging and long-term aging?
8. Show by sketch the difference between elastic & viscoelastic & viscous materials?